EED2-170-002

HDF-EOS Library Users Guide for the EOSDIS Evolution and Development-2 (EED-2) Contract Volume 2: Function Reference Guide

Technical Paper

December 2017

Prepared Under Contract #-NNG15HZ39C

RESPONSIBLE ENGINEER

[illegible] 12/27/17

Abe Taaheri, Toolkit Task Lead — Date
EOSDIS Evolution and Development-2 (EED-2) Contract

SUBMITTED BY

[illegible] 12/21/17

Kristene Rodrigues, Task 32 Lead — Date
EOSDIS Evolution and Development-2 (EED-2) Contract

Raytheon Company
Riverdale, Maryland

Preface

This document is a Users Guide for HDF-EOS (Hierarchical Data Format - Earth Observing System) library tools. HDF is the scientific data format standard selected by NASA as the baseline standard for EOS. This Users Guide accompanies Version 4 software, which is available to the user community on the EDHS1 server. The library is aimed at EOS data producers and consumers, who will develop their data into increasingly higher order products. These products range from calibrated Level 1 to Level 4 model data. The primary use of the HDF-EOS library will be to create structures for associating geolocation data with their associated science data. This association is specified by producers through use of the supplied library. Most EOS data products which have been identified, fall into categories of grid, point or swath structures, which are implemented in the current version of the library. Services based on geolocation information will be built on HDF-EOS structures. Producers of products not covered by these structures, e.g. non-geolocated data, can use the standard HDF libraries.

In the ECS (EOS Core System) production system, the HDF-EOS library will be used in conjunction with SDP (Science Data Processing) Toolkit software. The primary tools used in conjunction with HDF-EOS library will be those for metadata handling, process control and status message handling. Metadata tools will be used to write ECS inventory and granule specific metadata into HDF-EOS files, while the process control tools will be used to access physical file handles used by the HDF tools. (*SDP Toolkit Users Guide for the EOSDIS Evolution and Development-2 (EED-2) Contract, December 2017, EED2-333-001).*

HDF-EOS is an extension of NCSA (National Center for Supercomputing Applications) HDF and uses HDF library calls as an underlying basis. Version 4.2.13 of HDF is used. The library tools are written in the C language and a Fortran interface is provided. The current version contains software for creating, accessing and manipulating Grid, Point and Swath structures. This document includes overviews of the interfaces, and code examples. HDFView with HDF-EOS plug-in, the HDF-EOS viewing tool, has been revised to accommodate the current version of the library.

Technical Points of Contact within EOS are:
Abe Taaheri, Abe_Taaheri@Raytheon.com

An email address has been provided for user help:
RVL_PGSTLKIT@raytheon.com

Any questions should be addressed to:

Data Management Office
Raytheon Company
EOSDIS Evolution and Development-2 (EED-2) Contract
5700 Rivertech Court
Riverdale, MD 20737

Abstract

This document will serve as the user's guide to the HDF-EOS file access library. HDF refers to the scientific data format standard selected by NASA as the baseline standard for EOS, and HDF-EOS refers to EOS conventions for using HDF. This document will provide information on the use of the three interfaces included in HDF-EOS - Point, Swath, and Grid - including overviews of the interfaces, and code examples. This document should be suitable for use by data producers and data users alike.

Keywords: HDF-EOS, Metadata, Standard Data Format, Standard Data Product, Disk Format, Point, Grid, Swath, Projection, Array, Browse

This page intentionally left blank

Contents

Preface

Abstract

1. Introduction

1.1 Purpose 1-1

1.2 Organization 1-1

1.3 Point Data 1-1

1.3.1 PT API Routines 1-1

1.3.2 List of PT API Routines 1-1

1.4 Swath Data 1-3

1.4.1 The Swath Data Interface 1-3

1.4.2 List of SW API Routines 1-3

1.5 Grid Data 1-5

1.5.1 The Grid Data Interface 1-5

1.5.2 List of Grid API Routines 1-5

1.6 GCTP Usage 1-6

1.6.1 GCTP Projection Codes 1-7

1.6.2 UTM Zone Codes 1-7

1.6.3 GCTP Spheroid Codes 1-8

1.6.4 GCTP Projection Parameters 1-8

2. Function Reference

2.1 Format 2-1

2.1.1 Point Interface Functions 2-1

2.1.2 Swath Interface Functions 2-40

2.1.3 Grid Interface Functions 2-108

2.1.4 HDF-EOS Utility Routines 2-179

List of Tables

1-1 Summary of the Point Interface 1-2

1-2 Summary of the Swath Interface 1-3

1-3 Summary of the Grid Interface 1-5

1-4 Projection Transformation Package Projection Parameters 1-9

Appendix A. Numbertype Codes

Abbreviations and Acronyms

1. Introduction

1.1 Purpose

HDF-EOS Library Users Guide for the *EOSDIS Evolution and Development-2 (EED-2) Contract,* Volume 2: Function Reference Guide, Contract (NNG15HZ39C).

This software reference guide is intended for use by anyone who wishes to use the HDF-EOS library to create or read EOS data products. Users of this document will include EOS instrument team science software developers and data product designers, DAAC personnel, and end users of EOS data products such as scientists and researchers.

1.2 Organization

This paper is organized as follows:

- Section 1 Introduction - Presents Scope and Purpose of this document
- Section 2 Function Reference
- Abbreviations and Acronyms

1.3 Point Data

The PT (*Point)* interface consists of routines for storing, retrieving, and manipulating data in point data sets. This interface is designed to support data that has associated geolocation information, but is not organized in any well defined spatial or temporal way. See the Users' Guide, Volume 1 that accompanies this document for more information.

1.3.1 PT API Routines

All C routine names in the point data interface have the prefix "PT" and the equivalent FORTRAN routine names are prefixed by "pt." The PT routines are classified into the following categories:

- ***Access routines*** initialize and terminate access to the PT interface and point data sets (including opening and closing files).
- ***Definition*** routines allow the user to set key features of a point data set.
- ***Basic I/O*** routines read and write data and metadata to a point data set.
- ***Index I/O*** routines read and write information which links two tables in a point data set.
- ***Inquiry*** routines return information about data contained in a point data set.
- ***Subset*** routines allow reading of data from a specified geographic region.

1.3.2 List of PT API Routines

The PT function calls are listed below in Table 1-1 and are described in detail in Section 2 of this document. The listing in Section 2 is in alphabetical order.

Table 1-1. Summary of the Point Interface

Category	Routine Name		Description	Page
	C	FORTRAN		Nos.
Access	PTopen	ptopen	creates a new file or opens an existing one	2-28
	PTcreate	ptcreate	creates a new point data set and returns a handle	2-6
	PTattach	ptattach	attaches to an existing point data set	2-2
	PTdetach	ptdetach	releases a point data set and frees memory	2-14
	PTclose	ptclose	closes the HDF-EOS file and deactivates the point interface	2-5
Definition	PTdeflevel	ptdeflev	defines a level within the point data set	2-8
	PTdeflinkage	ptdeflink	defines link field to use between two levels	2-10
	PTdefvrtregion	ptdefvrtreg	defines a vertical subset region	2-12
Basic I/O	PTwritelevel	ptwrlev	writes (appends) full records to a level	2-40
	PTreadlevel	ptrdlev	reads data from the specified fields and records of a level	2-32
	PTupdatelevel	ptuplev	updates the specified fields and records of a level	2-37
	PTwriteattr	ptwrattr	creates or updates an attribute of the point data set	2-39
	PTreadattr	ptrdattr	reads existing attribute of point data set	2-31
Inquiry	PTnlevels	ptnlevs	returns the number of levels in a point data set	2-26
	PTnrecs	ptnrecs	returns the number of records in a level	2-27
	PTnfields	ptnflds	returns number of fields defined in a level	2-25
	PTlevelinfo	ptlevinfo	returns information about a given level	2-24
	PTlevelindx	ptlevidx	returns index number for a named level	2-23
	PTbcklinkinfo	ptblinkinfo	returns link field to previous level	2-4
	PTfwdlinkinfo	ptflinkinfo	returns link field to following level	2-17
	PTgetlevelname	ptgetlevname	returns level name given level number	2-18
	PTsizeof	ptsizeof	returns size in bytes for specified fields in a point	2-36
	PTattrinfo	ptattrinfo	returns information about point attributes	2-3
	PTinqattrs	ptinqattrs	retrieves number and names of attributes defined	2-21
	PTinqpoint	ptinqpoint	retrieves number and names of points in file	2-22
Utility	PTgetrecnums	ptgetrecnums	returns corresponding record numbers in a related level	2-19
Subset	PTdefboxregion	ptdefboxreg	define region of interest by latitude/longitude	2-7
	PTregioninfo	ptreginfo	returns information about defined region	2-34
	PTregionrecs	ptregrecs	returns # of records and record #s within region	2-35
	PTextractregion	ptextreg	read a region of interest from a set of fields in a single level	2-16
	PTdeftimeperiod	ptdeftmeper	define time period of interest	2-11
	PTperiodinfo	ptperinfo	returns information about defined time period	2-29
	PTperiodrecs	ptperrecs	returns # of records and record #s within time period	2-30
	PTextractperiod	ptextper	read a time period from a set of fields in a single level	2-15

1.4 Swath Data

The SW (*Swath*) interface consists of routines for storing, retrieving, and manipulating data in swath data sets. This interface is tailored to support time-ordered data such as satellite swaths (which consist of a time-ordered series of scanlines), or profilers (which consist of a time-ordered series of profiles). See the Users' Guide, Volume 1 that accompanies this document for more information.

1.4.1 The Swath Data Interface

All C routine names in the swath data interface have the prefix "SW" and the equivalent FORTRAN routine names are prefixed by "sw." The SW routines are classified into the following categories:

- ***Access routines*** initialize and terminate access to the SW interface and swath data sets (including opening and closing files).
- ***Definition*** routines allow the user to set key features of a swath data set.
- ***Basic I/O*** routines read and write data and metadata to a swath data set.
- ***Inquiry*** routines return information about data contained in a swath data set.
- ***Subset*** routines allow reading of data from a specified geographic region.

1.4.2 List of SW API Routines

The SW function calls are listed below in Table 1-2 and are described in detail in Section 2 of this document. The listing in Section 2 is in alphabetical order.

Table 1-2. Summary of the Swath Interface (1 of 2)

Category	Routine Name		Description	Page
	C	FORTRAN		Nos.
Access	SWopen	swopen	opens or creates HDF file in order to create, read, or write a swath	2-87
	SWcreate	swcreate	creates a swath within the file	2-45
	SWattach	swattach	attaches to an existing swath within the file	2-41
	SWdetach	swdetach	detaches from swath interface	2-63
	SWclose	swclose	closes file	2-43
Definition	SWdefdim	swdefdim	defines a new dimension within the swath	2-52
	SWdefdimmap	swdefmap	defines the mapping between the geolocation and data dimensions	2-53
	SWdefidxmap	swdefimap	defines a non-regular mapping between the geolocation and data dimension	2-57
	SWdefgeofield	swdefgfld	defines a new geolocation field within the swath	2-55
	SWdefdatafield	swdefdfld	defines a new data field within the swath	2-50
	SWdefcomp	swdefcomp	defines a field compression scheme	2-48
	SWwritegeometa	swwrgmeta	writes field metadata for an existing swath geolocation field	2-108
	SWwritedatameta	swwrdmeta	writes field metadata for an existing swath data field	2-105
	SWwritefield	swwrfld	writes data to a swath field	2-106
	SWreadfield	swrdfld	reads data from a swath field.	2-91

Table 1-2. Summary of the Swath Interface (2 of 2)

Category	Routine Name		Description	Page
	C	**FORTRAN**		**Nos.**
Basic I/O	SWwriteattr	swwrattr	writes/updates attribute in a swath	2-104
	SWreadattr	swrdattr	reads attribute from a swath	2-90
	SWsetfillvalue	swsetfill	sets fill value for the specified field	2-101
	SWgetfillvalue	swgetfill	retrieves fill value for the specified field	2-75
Inquiry	SWinqdims	swinqdims	retrieves information about dimensions defined in swath	2-80
	SWinqmaps	swinqmaps	retrieves information about the geolocation relations defined	2-83
	SWinqidxmaps	swinqimaps	retrieves information about the indexed geolocation/data mappings defined	2-82
	SWinqgeofields	swinqgflds	retrieves information about the geolocation fields defined	2-81
	SWinqdatafields	swinqdflds	retrieves information about the data fields defined	2-79
	SWinqattrs	swinqattrs	retrieves number and names of attributes defined	2-78
	SWnentries	swnentries	returns number of entries and descriptive string buffer size for a specified entity	2-86
	SWdiminfo	swdiminfo	retrieve size of specified dimension	2-64
	SWmapinfo	swmapinfo	retrieve offset and increment of specified geolocation mapping	2-85
	SWidxmapinfo	swimapinfo	retrieve offset and increment of specified geolocation mapping	2-76
	SWindexinfo	swidxinfo	Retrieve the indices information about a subsetted region	2-77
	SWattrinfo	swattrinfo	returns information about swath attributes	2-42
	SWfieldinfo	swfldinfo	retrieve information about a specific geolocation or data field	2-68
	SWcompinfo	swcompinfo	retrieve compression information about a field	2-44
	SWinqswath	swinqswath	retrieves number and names of swaths in file	2-84
	SWregionindex	swregidx	Returns information about the swath region ID	2-93
Subset	SWupdateidxmap	swupimap	update map index for a specified region	2-102
	SWgeomapinfo	swgmapinfo	Retrieve type of dimension mapping for a dimension	2-70
	SWdefboxregion	swdefboxreg	define region of interest by latitude/longitude	2-46
	SWregioninfo	swreginfo	returns information about defined region	2-95
	SWextractregion	swextreg	read a region of interest from a field	2-67
	SWdeftimeperiod	swdeftmeper	define a time period of interest	2-58
	SWperiodinfo	swperinfo	retuns information about a defined time period	2-88
	SWextractperiod	swextper	extract a defined time period	2-66
	SWdefvrtregion	swdefvrtreg	define a region of interest by vertical field	2-60
	SWdupregion	swdupreg	duplicate a region or time period	2-65
	SWsetdimscale	swsetdimscale	sets dimension scale for a given dimension	2-97
Dimension Scale	**SWdefdimscale**	**swdefdimscale**	**sets dimension scale for a given dimension that is used in all fields defined in the swath**	**2-97**
	SWgetdimscale	swgetdimscale	gets dimension scale for a given dimension	2-71
	SWsetdimstrs	swsetdimstrs	sets the label, unit, and format strings for a given dimension	2-99
	SWdefdimstrs	**swdefdimstrs**	**sets the label, unit, and format strings for a given dimension that is used in all fields defined in the swath**	**2-99**
	SWgetdimstrs	swgetdimstrs	gets the label, unit, and format strings for a given dimension	2-73

1.5 Grid Data

The GD (*Grid)* interface consists of routines for storing, retrieving, and manipulating data in grid data sets. This interface is designed to support data that has been stored in a rectilinear array based on a well defined and explicitly supported projection. See the Users' Guide, Volume 1 that accompanies this document for more details.

1.5.1 The Grid Data Interface

All C routine names in the grid data interface have the prefix "GD" and the equivalent FORTRAN routine names are prefixed by "gd." The GD routines are classified into the following categories:

- ***Access routines*** initialize and terminate access to the GD interface and grid data sets (including opening and closing files).
- ***Definition*** routines allow the user to set key features of a grid data set.
- ***Basic I/O*** routines read and write data and metadata to a grid data set.
- ***Inquiry*** routines return information about data contained in a grid data set.
- ***Subset*** routines allow reading of data from a specified geographic region.

1.5.2 List of Grid API Routines

The GD function calls are listed below in Table 1-3 and are described in detail in Section 2 of this document. The listing in Section 2 is in alphabetical order.

Table 1-3. Summary of the Grid Interface (1 of 2)

	Routine Name			**Page**
Category	**C**	**FORTRAN**	**Description**	**Nos.**
Access	GDopen	gdopen	creates a new file or opens an existing one	2-157
	GDcreate	gdcreate	creates a new grid in the file	2-115
	GDattach	gdattach	attaches to a grid	2-109
	GDdetach	gddetach	detaches from grid interface	2-134
	GDclose	gdclose	closes file	2-113
Definition	GDdeforigin	gddeforigin	defines origin of grid pixels	2-124
	GDdefdim	gddefdim	defines dimensions for a grid	2-121
	GDdefproj	gddefproj	defines projection of grid	2-126
	GDdefpixreg	gddefpixreg	defines pixel registration within grid cell	2-125
	GDdeffield	gddeffld	defines data fields to be stored in a grid	2-122
	GDdefcomp	gddefcomp	defines a field compression scheme	2-119
	GDblkSOMoffset	none	This is a special function for SOM MISR data. Write block SOM offset values.	2-111
	GDsettilecomp	none	This routine was added as a fix to a bug in HDF-EOS. The current method of implementation didn't allow the user to have a field with fill values and use tiling and compression. This function allows the user to access all of these features.	2-173
Basic I/O	GDwritefieldmeta	gdwrmeta	writes metadata for field already existing in file	2-178
	GDwritefield	gdwrfld	writes data to a grid field.	2-176
	GDreadfield	gdrdfld	reads data from a grid field	2-162
	GDwriteattr	gdwrattr	writes/updates attribute in a grid.	2-175
	GDreadattr	gdrdattr	reads attribute from a grid	2-161
	GDsetfillvalue	gdsetfill	sets fill value for the specified field	2-171
	GDgetfillvalue	gdgetfill	retrieves fill value for the specified field	2-144

Table 1-3. Summary of the Grid Interface (2 of 2)

Category	**Routine Name**		**Description**	**Page**
	C	**FORTRAN**		**Nos.**
Inquiry	GDinqdims	gdinqdims	retrieves information about dimensions defined in grid	2-151
	GDinqfields	gdinqdflds	retrieves information about the data fields defined in grid	2-152
	GDinqattrs	gdinqattrs	retrieves number and names of attributes defined	2-150
	GDnentries	gdnentries	returns number of entries and descriptive string buffer size for a specified entity	2-156
	GDgridinfo	gdgridinfo	returns dimensions of grid and X-Y coordinates of corners	2-149
	GDprojinfo	gdprojinfo	returns all GCTP projection information	2-160
	GDdiminfo	gddiminfo	retrieves size of specified dimension.	2-135
	GDcompinfo	gdcompinfo	retrieve compression information about a field	2-114
	GDfieldinfo	gdfldinfo	retrieves information about a specific geolocation or data field in the grid	2-138
	GDinqgrid	gdinqgrid	retrieves number and names of grids in file	2-153
	GDattrinfo	gdattrinfo	returns information about grid attributes	2-110
	GDorigininfo	gdorginfo	return information about origin of grid pixels	2-158
	GDpixreginfo	gdpreginfo	return pixel registration information for given grid	2-159
Subset	GDdefboxregion	gddefboxreg	define region of interest by latitude/longitude	2-118
	GDregioninfo	gdreginfo	returns information about a defined region	2-165
	GDextractregion	gdextrreg	read a region of interest from a field	2-137
	GDdeftimeperiod	gddeftmeper	define a time period of interest	2-130
	GDdefvrtregion	gddefvrtreg	define a region of interest by vertical field	2-132
	GDgetpixels	gdgetpix	get row/columns for lon/lat pairs	2-145
	GDgetpixvalues	gdgetpixval	get field values for specified pixels	2-147
	GDinterpolate	gdinterpolate	perform bilinear interpolation on a grid field	2-154
	GDdupregion	gddupreg	duplicate a region or time period	2-136
Tiling	GDdeftile	gddeftle	define a tiling scheme	2-128
	GDtileinfo	gdtleinfo	returns information about tiling for a field	2-174
	GDsettilecache	gdsettleche	set tiling cache parameters	2-172
	GDreadtile	gdrdtle	read data from a single tile	2-164
	GDwritetile	gdwrtile	write data to a single tile	2-179
Utility	GDij2ll	Gdij2ll	convert (i,j) coordinates to (lon,lat) for a grid	2-184
	GDll2ij	Gdll2ij	convert (lon,lat) coordinates to (i,j) for a grid	2-187
	GDrs2ll	gdrs2ll	convert (r,s) coordinates to (lon,lat) for EASE grid	2-190
	GDsetdimscale	gdsetdimscale	sets dimension scale for a given dimension	2-167
Dimension Scale	GDdefdimscale	gddefdimscale	sets dimension scale for a given dimension that is used in all fields defined in the grid	2-167
	GDgetdimscale	gdgetdimscale	gets dimension scale for a given dimension	2-140
	GDsetdimstrs	gdsetdimstrs	sets the label, unit, and format strings for a given dimension	2-169
	GDdefdimstrs	gddefdimstrs	sets the label, unit, and format strings for a given dimension that is used in all fields defined in the grid	2-169
	GDgetdimstrs	gdgetdimstrs	gets the label, unit, and format strings for a given dimension	2-142

1.6 GCTP Usage

The HDF-EOS Grid API uses the U.S. Geological Survey General Cartographic Transformation Package (GCTP) to define and subset grid structures. This section described codes used by the package.

1.6.1 GCTP Projection Codes

The following GCTP projection codes are used in the grid API described in Section 7 below:

```
GCTP_GEO       (0)   Geographic
GCTP_UTM       (1)   Universal Transverse Mercator
GCTP_SPCS      (2)   State Plane Coordinate System
GCTP_ALBERS    (3)   Albers Conical Equal Area
GCTP_LAMCC     (4)   Lambert Conformal Conic
GCTP_MERCAT    (5)   Mercator
GCTP_PS        (6)   Polar Stereographic
GCTP_POLYC     (7)   Polyconic
GCTP_TM        (9)   Transverse Mercator
GCTP_LAMAZ     (11)  Lambert Azimuthal Equal Area
GCTP_SNSOID    (16)  Sinusoidal
GCTP_HOM       (20)  Hotine Oblique Mercator
GCTP_SOM       (22)  Space Oblique Mercator
GCTP_GOOD      (24)  Interrupted Goode Homolosine
GCTP_ISINUS1   (31)  Integerized Sinusoidal Projection*
GCTP_ISINUS    (99)  Intergerized Sinusoidal Projection*
GCTP_CEA       (97)  Cylindrical Equal-Area (for EASE grid with grid corners
                     in meters)**
GCTP_BCEA      (98)  Cylindrical Equal-Area (for EASE grid with grid corners
                     in packed degrees, DMS)**
```

* The Intergerized Sinusoidal Projection is not part of the original GCTP package. It has been added by ECS. See *Level-3 SeaWiFS Data Products: Spatial and Temporal Binning Algorithms*. Additional references are provided in Section 2.

** The Cylindrical Equal-Area Projection was not part of the original GCTP package. It has been added by ECS. See Notes for section 1.6.4.

Note that other projections supported by GCTP will be adapted for HDF-EOS Version 2.20 as new user requirements are surfaced. For further details on the GCTP projection package, please refer to Section 6.3.4 and Appendix G of the *SDP Toolkit Users Guide for the EOSDIS Evolution and Development Contract-2, December 2017 (333-EED2-001, Revision 01).*

1.6.2 UTM Zone Codes

The Universal Transverse Mercator (UTM) Coordinate System uses zone codes instead of specific projection parameters. The table that follows lists UTM zone codes as used by GCTP Projection Transformation Package. C.M. is Central Meridian.

Zone	C.M.	Range	Zone	C.M.	Range
01	177W	180W-174W	31	003E	000E-006E
02	171W	174W-168W	32	009E	006E-012E
03	165W	168W-162W	33	015E	012E-018E
04	159W	162W-156W	34	021E	018E-024E
05	153W	156W-150W	35	027E	024E-030E
06	147W	150W-144W	36	033E	030E-036E
07	141W	144W-138W	37	039E	036E-042E
08	135W	138W-132W	38	045E	042E-048E

09	129W	132W-126W	39	051E	048E-054E
10	123W	126W-120W	40	057E	054E-060E
11	117W	120W-114W	41	063E	060E-066E
12	111W	114W-108W	42	069E	066E-072E
13	105W	108W-102W	43	075E	072E-078E
14	099W	102W-096W	44	081E	078E-084E
15	093W	096W-090W	45	087E	084E-090E
16	087W	090W-084W	46	093E	090E-096E
17	081W	084W-078W	47	099E	096E-102E
18	075W	078W-072W	48	105E	102E-108E
19	069W	072W-066W	49	111E	108E-114E
20	063W	066W-060W	50	117E	114E-120E
21	057W	060W-054W	51	123E	120E-126E
22	051W	054W-048W	52	129E	126E-132E
23	045W	048W-042W	53	135E	132E-138E
24	039W	042W-036W	54	141E	138E-144E
25	033W	036W-030W	55	147E	144E-150E
26	027W	030W-024W	56	153E	150E-156E
27	021W	024W-018W	57	159E	156E-162E
28	015W	018W-012W	58	165E	162E-168E
29	009W	012W-006W	59	171E	168E-174E
30	003W	006W-000E	60	177E	174E-180W

1.6.3 GCTP Spheroid Codes

Clarke 1866 (default)	(0)	Modified Everest	(11)
Clarke 1880	(1)	WGS 84	(12)
Bessel	(2)	Southeast Asia	(13)
International 1967	(3)	Australian National	(14)
International 1909	(4)	Krassovsky	(15)
WGS 72	(5)	Hough	(16)
Everest	(6)	Mercury 1960	(17)
WGS 66	(7)	Modified Mercury 1968	(18)
GRS 1980	(8)	Sphere of Radius 6370997m	(19)
Airy	(9)	Sphere of Radius 6371228m	(20)
Modified Airy	(10)	Sphere of Radius 6371007.181m	(21)

1.6.4 GCTP Projection Parameters

Starting with HDFEOS version 2.19 the Lambert Azimuthal Equal area projection was generalized to support WGS84 ellipsoidal Earth model in addition to the spherical model that was supported before. This generalization was needed to support EASE GRID 2.0 used for SMAP products. Starting with HDFEOS version 2.20 the same change was made for Sinusoidal projection.

Table 1-4. Projection Transformation Package Projection Parameters (1 of 2)

	Array Element							
Code & Projection Id	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
0 Geographic								
1 U T M	Lon/Z	Lat/Z						
2 PGSd_SPCS			Spheroid	Zone				
3 Albers Conical Equal_Area	Smajor	Sminor	STDPR1	STDPR2	CentMer	OriginLat	FE	FN
4 Lambert Conformal C	Smajor	Sminor	STDPR1	STDPR2	CentMer	OriginLat	FE	FN
5 Mercator	Smajor	Sminor			CentMer	TrueScale	FE	FN
6 Polar Stereographic	Smajor	Sminor			LongPol	TrueScale	FE	FN
7 Polyconic	Smajor	Sminor			CentMer	OriginLat	FE	FN
9 Transverse Mercator	Smajor	Sminor	Factor		CentMer	OriginLat	FE	FN
11 Lambert Azimuthal**	Smajor	Sminor			CentLon	CenterLat	FE	FN
Lambert Azimuthal	Sphere				CentLon	CenterLat	FE	FN
16 PGSd_SNSOID**	Smajor	Sminor			CentMer		FE	FN
PGSd_SNSOID	Sphere				CentMer		FE	FN
20 Hotin Oblique Merc A	Smajor	Sminor	Factor			OriginLat	FE	FN
20 Hotin Oblique Merc B	Smajor	Sminor	Factor	AziAng	AzmthPt	OriginLat	FE	FN
22 Space Oblique Merc A	Smajor	Sminor		IncAng	AscLong		FE	FN
22 Space Oblique Merc B	Smajor	Sminor	Satnum	Path			FE	FN
24 Interrupted Goode	Sphere							
97 CEA utilized by EASE grid (see Notes)	Smajor	Sminor			CentMer	TrueScale	FE	FN
98 BCEA utilized by EASE grid (see Notes)	Smajor	Sminor			CentMer	TrueScale	FE	FN

** Lambert Azimuthal and Sinusoidal supports both spherical and WGS84 ellipsoidal Earth model

Table 1-4. Projection Transformation Package Projection Parameters (2 of 2)

	Array Element				
Code & Projection Id	**9**	**10**	**11**	**12**	**13**
0 Geographic					
1 U T M					
2 PGSd_SPCS					
3 Albers Conical Equal_Area					
4 Lambert Conformal C					
5 Mercator					
6 Polar Stereographic					
7 Polyconic					
9 Transverse Mercator					
11 Lambert Azimuthal					
Lambert Azimuthal					
16 PGSd_SNSOID					
PGSd_SNSOID					
20 Hotin Oblique Merc A	Long1	Lat1	Long2	Lat2	zero
20 Hotin Oblique Merc B					one
22 Space Oblique Merc A	PSRev	SRat	PFlag	HDF-EOS Para	zero
22 Space Oblique Merc B				HDF-EOS Para	one
24 Interrupted Goode					
31 & 99 Integerized Sinusoidal	NZone		RFlag		
97 CEA utilized by EASE grid (see Notes)					
98 BCEA utilized by EASE grid (see Notes)					

Where,

Lon/Z	Longitude of any point in the UTM zone or zero. If zero, a zone code must be specified.
Lat/Z	Latitude of any point in the UTM zone or zero. If zero, a zone code must be specified.
Smajor	Semi-major axis of ellipsoid. If zero, Clarke 1866 in meters is assumed. It is recommended that explicit value, rather than zero, is used for Smajor.
Sminor	Eccentricity squared of the ellipsoid if less than one, if zero, a spherical form is assumed, or if greater than one, the semi-minor axis of ellipsoid. It should be noted that a negative sphere code should be used in order to have user specified Smajor and Sminor be accepted by GCTP, otherwise default ellipsoid Smajor and Sminor will be used.

Sphere	Radius of reference sphere. If zero, 6370997 meters is used. It is recommended that explicit value, rather than zero, is used for Sphere.
STDPR1	Latitude of the first standard parallel
STDPR2	Latitude of the second standard parallel
CentMer	Longitude of the central meridian
OriginLat	Latitude of the projection origin
FE	False easting in the same units as the semi-major axis
FN	False northing in the same units as the semi-major axis
TrueScale	Latitude of true scale
LongPol	Longitude down below pole of map
Factor	Scale factor at central meridian (Transverse Mercator) or center of projection (Hotine Oblique Mercator)
CentLon	Longitude of center of projection
CenterLat	Latitude of center of projection
Long1	Longitude of first point on center line (Hotine Oblique Mercator, format A)
Long2	Longitude of second point on center line (Hotine Oblique Mercator, frmt A)
Lat1	Latitude of first point on center line (Hotine Oblique Mercator, format A)
Lat2	Latitude of second point on center line (Hotine Oblique Mercator, format A)
AziAng	Azimuth angle east of north of center line (Hotine Oblique Mercator, frmt B)
AzmthPt	Longitude of point on central meridian where azimuth occurs (Hotine Oblique Mercator, format B)
IncAng	Inclination of orbit at ascending node, counter-clockwise from equator (SOM, format A)
AscLong	Longitude of ascending orbit at equator (SOM, format A)
PSRev	Period of satellite revolution in minutes (SOM, format A)
SRat	Satellite ratio to specify the start and end point of x,y values on earth surface (SOM, format A -- for Landsat use 0.5201613)
PFlag	End of path flag for Landsat: 0 = start of path, 1 = end of path (SOM, frmt A)
Satnum	Landsat Satellite Number (SOM, format B)
Path	Landsat Path Number (Use WRS-1 for Landsat 1, 2 and 3 and WRS-2 for Landsat 4 and 5.) (SOM, format B)
Nzone	Number of equally spaced latitudinal zones (rows); must be two or larger and even
Rflag	Right justify columns flag is used to indicate what to do in zones with an odd number of columns. If it has a value of 0 or 1, it indicates the extra column is on the right (zero) or left (one) of the projection Y-axis. If the flag is set to 2 (two), the number of columns are calculated so there are always an even number of columns in each zone.

Notes:

- Array elements 14 and 15 are set to zero.
- All array elements with blank fields are set to zero.

All angles (latitudes, longitudes, azimuths, etc.) are entered in packed degrees/ minutes/ seconds (DDDMMMSSS.SS) format.

The following notes apply to the Space Oblique Mercator A projection:

- A portion of Landsat rows 1 and 2 may also be seen as parts of rows 246 or 247. To place these locations at rows 246 or 247, set the end of path flag (parameter 11) to 1--end of path. This flag defaults to zero.
- When Landsat-1,2,3 orbits are being used, use the following values for the specified parameters:
  - Parameter 4 099005031.2
  - Parameter 5 128.87 degrees - (360/251 * path number) in packed DMS format
  - Parameter 9 103.2669323
  - Parameter 10 0.5201613
- When Landsat-4,5 orbits are being used, use the following values for the specified parameters:
  - Parameter 4 098012000.0
  - Parameter 5 129.30 degrees - (360/233 * path number) in packed DMS format
  - Parameter 9 98.884119
  - Parameter 10 0.5201613

The following notes apply for **BCEA projection** and **EASE grid**:

HDFEOS 2.7 and 2.8: Behrmann Cylindrical Equal-Area (BCEA) projection was used for 25 km global EASE grid. For this projection the Earth radius is set to 6371228.0m and latitude of true scale is 30 degrees. For 25 km global EASE grid the following apply:

```
Grid Dimensions
      Width 1383
      Height 586Map
Origin:
      Column (r0) 691.0
      Row (S0) 292.5
      Latitude 0.0
      Longitude 0.0
Grid Extent:
      Minimum Latitude 86.72S
      Maximum Latitude 86.72N
      Minimum Longitude 180.00W
      Maximum Longitude 180.00E
      Actual grid cell size 25.067525km
```

Grid coordinates (r,s) start in the upper left corner at cell (0.0), with r increasing to the right and s increasing downward.

HDFEOS 2.8.1 and later: Although the projection code and name kept the same, BCEA projection was generalized to accept Latitude of True Scales other than 30 degrees, Central Meridian other than zero, and ellipsoid earth model besides the spherical one with user supplied radius. This generalization along with the removal of hard coded grid parameters will allow users not only subsetting, but also creating other grids besides the 25 km global EASE grid and having freedom to use different appropriate projection parameters. With the current version one can create the above mentioned 25 km global EASE grid of previous versions using:

```
Grid Dimensions:
      Width 1383
      Height 586
Grid Extent:
      UpLeft Latitude 86.72
      LowRight Latitude -86.72
      UpLeft Longitude -180.00
      LowRight Longitude 180.00
Projection Parameters:
      1) 6371.2280/25.067525 = 254.16263
      2) 6371.2280/25.067525 = 254.16263
      5) 0.0
      6) 30000000.0
      7) 691.0
      8) –292.5
```

Also one may create **12.5 km global EASE grid** using:

```
Grid Dimensions:
      Width 2766
      Height 1171
Grid Extent:
      UpLeft Latitude 85.95
      LowRight Latitude –85.95
      UpLeft Longitude –179.93
      LowRight Longitude 180.07
Projection Parameters:
      1) 6371.2280/(25.067525/2) = 508.325253
      2) 6371.2280/(25.067525/2) = 508.325253
      5) 0.0
      6) 30000000.0
      7) 1382.0
      8) –585.0
```

Any other grids (normalized pixels or not) with generalized BCEA projection can be created using appropriate grid corners, dimension sizes, and projection parameters. Please note that like other projections Semi-major and Semi-minor axes will default to Clarke 1866 values (in meters) if they are set to zero.

HDFEOS 2.10 and later: A new projection CEA (97) was added to GCTP. This projection is the same as the generalized BCEA, except that the EASE grid produced will have its corners in meters rather than packed degrees, which is the case with EASE grid produced by BCEA.

This page intentionally left blank.

2. Function Reference

2.1 Format

This section contains a function-by-function reference for each interface in the HDF-EOS library. Each function has a separate page describing it (in some cases there are multiple pages). Each page contains the following information (in order):

- Function name as used in C
- Function declaration in ANSI C format
- Description of each argument
- Purpose of routine
- Description of returned value
- Description of the operation of the routine
- A short example of how to use the routine in C
- The FORTRAN declaration of the function and arguments
- An equivalent FORTRAN example

2.1.1 Point Interface Functions

This section contains an alphabetical listing of all the functions in the Point interface. The functions are alphabetized based on their C-language names.

Attach to an Existing Point Structure

PTattach

int PTattach(int *fid*, char **pointname*)

fid	*IN:*	*Point file id returned by PTopen*
pointname	*IN:*	*Name of point to be attached*

Purpose *Attaches to an existing point within the file.*

Return value *Returns the point handle (pointID) if successful or FAIL (-1) otherwise. Typical reasons for failure are an improper point file id or point name.*

Description *This routine attaches to the point using the pointname parameter as the identifier.*

Example *In this example, we attach to the previously created point, "ExamplePoint", within the HDF file, PointFile.hdf, referred to by the handle, fid:*

```
pointID = PTattach(fid, "ExamplePoint");
```

The point can then be referenced by subsequent routines using the handle, pointID.

FORTRAN *integer function ptattach(fid,pointname)*

integer	*fid*
character*(*)	*pointname*

The equivalent *FORTRAN* code for the example above is:

```
status = ptattach(fid, "ExamplePoint")
```

Return Information About a Point Attribute

PTattrinfo

int PTattrinfo(int *pointID*, char **attrname*, int * *numbertype*, hsize_t **count*)

pointID	*IN:*	*Point id returned by PTcreate or PTattach*
attrname	*IN:*	*Attribute name*
numbertype	*OUT:*	*Number type of attribute*
count	*OUT:*	*Number of total bytes in attribute*

Purpose — *Returns information about a point attribute*

Return value — *Returns SUCCEED (0) if successful or FAIL (-1) otherwise.*

Description — *This routine returns number type and number of elements (count) of a point attribute. See Appendix A for interpretation of number types.*

Example — *In this example, we return information about the ScalarFloat attribute.*

```
status = PTattrinfo(pointID, "ScalarFloat",&nt,&count);
```

The nt variable will have the value 5 and count will have the value 4.

FORTRAN — *integer function ptattrinfo(pointid, attrname, ntype, count,)*

Integer	*pointid*
character(*)*	*attrname*
integer	*ntype*
integer	*count*

The equivalent FORTRAN code for the first example above is:

```
status = ptattrinfo(pointid, "ScalarFloat",nt,count)
```

Return Linkage Field to Previous Level

PTbcklinkinfo

int PTbcklinkinfo(int *pointID*, int *level*, char **linkfield*)

pointID	*IN:*	*Point id returned by PTcreate or PTattach*
level	*IN:*	*Point level (0-based)*
linkfield	*OUT:*	*Link field*

Purpose *Returns the linkfield to the previous level.*

Return value *Returns SUCCEED (0) if successful or FAIL (-1) otherwise.*

Description *This routine returns the linkfield to the previous level.*

Example *In this example, we return the linkfield connecting the Observations level to the previous Desc-Loc level. (This levels are defined in the PTdeflevel routine.)*

```
status = PTbcklinkinfo(pointID2, 1, linkfield);
```

The linkfield will contain the string: ID.

FORTRAN *integer ptblinkinfo(pointid, level, linkfield)*

integer	*pointid*
integer	*level*
character(*)*	*linkfield*

The equivalent FORTRAN code for the example above is:

status = ptblinkinfo(pointid2, 0, linkfield)

Close an HDF-EOS File

PTclose

intn PTclose(int32 *fid*)

fid	*IN:* *Point file id returned by PTopen*
Purpose	*Closes file.*
Return value	*Returns SUCCEED (0) if successful or FAIL (-1) otherwise.*
Description	*This routine closes the HDF point file.*
Example	

```
status = PTclose(fid);
```

FORTRAN *integer ptclose(fid)*

*integer*4* *fid*

The equivalent FORTRAN code for the example above is:

```
status = ptclose(fid)
```

Create a New Point Structure

PTcreate

int32 PTcreate(int32 *fid*, char **pointname*)

fid	*IN:*	*Point file id returned by PTopen*
pointname	*IN:*	*Name of point to be created*

Purpose *Creates a point within the file.*

Return value *Returns the point handle (pointID) if successful or FAIL (-1) otherwise.*

Description *The point is created as a Vgroup within the HDF file with the name pointname and class POINT.*

Example *In this example, we create a new point structure, ExamplePoint, in the previously created file, PointFile.hdf.*

```
pointID = PTcreate(fid, "ExamplePoint");
```

The point structure is then referenced by subsequent routines using the handle, pointID.

FORTRAN *integer*4 function ptcreate(fid,pointname)*

*integer*4*	*fid*
character*(*)	*pointname*

The equivalent *FORTRAN* code for the example above is:

```
pointid = ptcreate(fid, "ExamplePoint");
```

Define Region of Interest by Latitude/Longitude

PTdefboxregion

int32 PTdefboxregion(int32*pointID*, float64 *cornerlon[]*, float64 *cornerlat[]*)

pointID	*IN:*	*Point id returned by PTcreate or PTattach*
cornerlon	*IN:*	*Longitude in decimal degrees of box corners*
cornerlat	*IN:*	*Latitude in decimal degrees of box corners*

Purpose *Defines a longitude-latitude box region for a point.*

Return value *Returns the point regionID if successful or FAIL (-1) otherwise.*

Description *This routine defines an area of interest for a point. It returns a point region ID which is used by the PTextractregion routine to read the fields from a level for those records within the area of interest. The point structure must have a level with both a Longitude and Latitude (or Colatitude) field defined*

Example *In this example, we define an area of interest with (opposite) corners at -145 degrees longitude, -15 degrees latitude and -135 degrees longitude, -8 degrees latitude.*

```
cornerlon[0] = -145.;
cornerlat[0] = -15.;
cornerlon[1] = -135.;
cornerlat[1] = -8.;
regionID = PTdefboxregion(pointID, cornerlon, cornerlat);
```

FORTRAN *integer*4 function ptdefboxreg(pointid, cornerlon, cornerlat)*

*integer*4*	*pointid*
*real*8*	*cornerlon*
*real*8*	*cornerlat*

The equivalent FORTRAN code for the example above is:

```
cornerlon(1) = -145.
cornerlat(1) = -15.
cornerlon(2) = -135.
cornerlat(2) = -8.
regionid = ptdefboxreg(pointid, cornerlon, cornerlat)
```

Define a New Level Within a Point

PTdeflevel

intn PTdeflevel(int32 pointID, char *levelname, char *fieldlist, int32 fieldtype[], int32 fieldorder[])

pointID	*IN:*	*Point id returned by PTcreate or PTattach*
levelname	*IN:*	*Name of level to be defined*
fieldlist	*IN:*	*List of fields in level*
fieldtype	*IN:*	*Array containing field type of each field within level*
fieldorder	*IN:*	*Array containing order of each field within level*

Purpose *Defines a new level within the point.*

Return value *Returns SUCCEED (0) if successful or FAIL (-1) otherwise.*

Description *This routine defines a level within the point. A simple point consists of a single level. A point where there is common data for a number of records can be more efficiently stored with multiple levels. The order in which the levels are defined determines the (0-based) level index.*

Example *Simple Point*

In this example, we define a simple single level point, with levelname, Sensor. The levelname should not contain any slashes ("/"). It consists of six fields, ID, Time, Longitude, Latitude, Temperature, and Mode defined in the field list. The fieldtype and fieldorder parameters are arrays consisting of the HDF number type codes and field orders, respectively. The Temperature is an array field of dimension 4 and the Mode field a character string of size 4. All other fields are scalars. Note that the order for numerical scalar variables can be either 0 or 1.

```
int32 fieldtype[6] = {DFNT_INT16, DFNT_INT16,
      DFNT_FLOAT32,DFNT_FLOAT32, DFNT_FLOAT32,DFNT_CHAR8};
int32 fieldorder[6] = {0,0,0,0,4,4};
char8 *fldlist =
      "ID,Time,Longitude,Latitude,Temperature,Mode";
status = PTdeflevel(pointID1, "Sensor", fldlist, fieldtype,
      fieldorder);
```

Multi-Level Point

In this example, we define a two-level point that describes data from a network of fixed buoys. The first level contains information about each buoy and includes the name (label) of the buoy, its (fixed) longitude and latitude, its deployment date, and an ID that is used to link it to the following level. (The link field is defined in the PTdeflinkage routine described later.) The entries within this ID field must be unique. The second level contains the actual measurements from the buoys (rainfall and temperature values) plus the observation time and the ID which relates a given measurement to a particular buoy entry in the previous level. There can be many records in this level with the same ID since there can be multiple measurements from a single buoy. It is advantageous, although not mandatory, to store all records for a particular buoy (ID) contiguously.

Level 0

```
int32 fieldtype0[5] = {DFNT_CHAR8, DFNT_FLOAT64,
      DFNT_FLOAT64,DFNT_INT32,DFNT_CHAR8};
int32 fieldorder0[5] = {8,0,0,0,1};
char8 *fldlist0 =  "Label,Longitude,Latitude,DeployDate,ID";
status = PTdeflevel(pointID2, "Desc-Loc", fldlist0, fieldtype0,
fieldorder0);
```

Level 1

```
int32 fieldtype1[4] = {DFNT_FLOAT64, DFNT_FLOAT32,
DFNT_FLOAT32, DFNT_CHAR8};
int32 fieldorder1[4] = {0,0,0,1};
char8 *fldlist1 = "Time,Rainfall,Temperature,ID";
status = PTdeflevel(pointID2, "Observations", fldlist1,
fieldtype1, fieldorder1);
```

FORTRAN *integer function ptdeflev(pointid, levelname, fieldlist, fieldtype, fieldorder)*

*integer*4*	*pointid*
character(*)*	*levelname*
character(*)*	*fieldlist*
*integer*4*	*fieldtype (*)*
*integer*4*	*fieldorder (*)*

The equivalent *FORTRAN* code for the first example above is:

```
status = PTdeflevel(pointID1, "Sensor", fldlist, fieldtype,
fieldorder)
```

Define Linkage Field Between Two Levels

PTdeflinkage

intn PTdeflinkage(int32 pointID, char *parent, char *child, char *linkfield)

pointID	*IN:*	*Point id returned by PTcreate or PTattach*
parent	*IN:*	*Name of parent level*
child	*IN:*	*Name of child level*
linkfield	*IN:*	*Name of (common) linkfield*

Purpose *Defines a linkfield between two (adjacent) levels.*

Return value *Returns SUCCEED (0) if successful or FAIL (-1) otherwise.*

Description *This routine defines the linkfield between two levels. This field must be defined in both levels.*

Example *In this example we define the ID field as the link between the two levels defined previously in the PTdeflevel routine.*

```
status = PTdeflinkage(pointID2, "Desc-Loc", "Observations",
"ID");
```

FORTRAN *integer function ptdeflink(pointid, parent, child ,linkfield)*

*integer*4*	*pointid*
character(*)*	*parent*
character(*)*	*child*
character(*)*	*linkfield*

The equivalent *FORTRAN* code for the example above is:

```
status = ptdeflink(pointid2, "Desc-Loc", “Observations”,       “ID”)
```

Define Time Period of Interest

PTdeftimeperiod

int32 PTdeftimeperiod(int32*pointID*, float64 *starttime,* float64 *stoptime*)

pointID	*IN:*	*Point id returned by PTcreate or PTattach*
starttime	*IN:*	*Start time of period*
stoptime	*IN:*	*Stop time of period*

Purpose — *Defines a time period for a point.*

Return value — *Returns the point periodID if successful or FAIL (-1) otherwise.*

Description — *This routine defines time period for a point. It returns a point period ID which is used by the PTextractperiod routine to read the fields from a level for those records within the time period. The point structure must have a level with theTime field defined*

Example — *In this example, we define a time period with a start time of 35208757.6 and a stop time of 35984639.2*

```
starttime = 35208757.6;
stoptime = 35984639.2;
periodID = PTdeftimeperiod(pointID, starttime, stoptime);
```

FORTRAN — *integer*4 function ptdeftmeper(pointid, starttime,stoptime)*

*integer*4*	*pointid*
*real*8*	*starttime*
*real*8*	*stoptime*

The equivalent FORTRAN code for the example above is:

```
starttime = 35208757.6
stoptime = 35984639.2
periodid = ptdeftmeper(pointid, starttime, stoptime)
```

Note: — *This function determines whether a record in the point data is within the specified time interval by doing a simple boolean comparison of the "Time" value and the "starttime" and "stoptime". This simple boolean comparison does not take into account the precisions of the values being compared. As a result, the first and last records in the subset can be erroneously determined to be outside the interval simply because they are not defined to the maximum precision of a float 64 value. It is the responsibility of the user to subtract a tolerance from the starttime and add it to the stoptime before calling the function.*

Define a Vertical Subset Region

PTdefvrtregion

int32 PTdefvrtregion(int32 *pointID*, int32 *regionID*, char **fieldname*, float64 *range[]*)

pointID	*IN:*	*Point id returned by PTcreate or PTattach*
regionID	*IN:*	*Region (or period) id from previous subset call*
fieldname	*IN:*	*Dimension or field to subset by*
range	*IN:*	*Minimum and maximum range for subset*

Purpose *Selects records within a given range for the given field.*

Return value *Returns the point region ID if successful or FAIL (-1) otherwise.*

Description *This routine allows the user to select those records within a point whose field values are within a given range. (For the current version of this routine, the field must have one of the following number types: INT16, INT32, FLOAT32, FLOAT64.) This routine may be called after PTdefboxregion or PTdeftimeperiod to provide both geographic or time and "vertical" subsetting . In this case the user provides the id from the previous subset call. (This same id is then returned by the function.) This routine may also be called "stand-alone" by setting the input id to HDFE_NOPREVSUB (-1).*

This routine may be called as many times as desired for a single region. In this way a region can be subsetted using a number of field ranges. The PTregioninfo and PTextractregion routines work in the usual manner.

Example *Suppose we wish to find those records within a point whose Rainfall values fall between 1 and 2. We wish to search all the records within the point so we set the input region ID to HDFE_NOPREVSUB (-1).*

```
range[0] = 1.;

range[1] = 2.;

regionID = PTdefvrtregion(pointID, HDFE_NOPREVSUB, "Rainfall",
range);
```

We now wish to subset further using the Temperature field.

```
range[0] = 22.;

range[1] = 24.;

regionID = PTdefvrtregion(pointID, regionID, "Temperature",
range);
```

The subsetted region referred to by regionID will now contain those records whose Rainfall field are between 1 and 2 ***and*** *whose Temperature field are between 22 and 24.:*

FORTRAN *integer*4 function ptdefvrtreg(pointid, regionid, fieldname, range)*

*integer*4*	*pointid*
*integer*4*	*regionid*
character(*)*	*fieldname*
*real*8*	*range*

The equivalent FORTRAN code for the examples above is:

```
parameter (HDFE_NOPREVSUB=-1)
range(1) = 1.
range(2) = 2.
regionid = ptdefvrtreg(pointid, HDFE_NOPREVSUB, ‘Rainfall’,
range)
range(1) = 22.     ! Note 1-based element numbers
range(2) = 24.
regionid = ptdefvrtreg(pointid, regionid, ‘Temperature’, range)
```

Detach from Point Structure

PTdetach

intn PTdetach(int32 *pointID*)

pointID	*IN: Point id returned by PTcreate or PTattach*
Purpose	*Detaches from point data set.*
Return value	*Returns SUCCEED (0) if successful or FAIL (-1) otherwise.*
Description	*This routine should be run before exiting from the point file for every point opened by PTcreate or PTattach.*
Example	*In this example, we detach the point structure, ExamplePoint:*

```
status = PTdetach(pointID);
```

FORTRAN *integer ptdetach(pointid)*

*integer*4* *pointid*

The equivalent FORTRAN code for the example above is:

```
status = ptdetach(pointid)
```

Reads Point Records for a Specified Time Period

PTextractperiod

intn PTextractperiod(int32 *pointID*, int32 *periodID*, int32 *level*, char **fieldlist*, VOIDP *buffer)*

pointID	*IN:*	*Point id*
periodID	*IN:*	*Period id returned by PTdeftimeperiod*
level	*IN:*	*Point level (0-based)*
fieldlist	*IN:*	*List of fields to extract*
buffer	*OUT:*	*Data buffer*

Purpose *Extracts (reads) from subsetted time period.*

Return value *Returns SUCCEED (0) if successful or FAIL (-1) otherwise.*

Description *This routine reads data from the designated level fields into the data buffer from the subsetted time period.*

Example *In this example, we read data within the subsetted time period defined in Ptdeftimeperiod from theTime field.*

```
/* Read subsetted data into buffer */
status = PTextractperiod(pointID, periodID, 0, "Time",
datbuf);
```

FORTRAN *integer function ptextper(pointid,periodid,level,fieldlist,buffer)*

*integer*4*	*pointid*
*integer*4*	*periodid*
*integer*4*	*level*
character(*)*	*fieldlist*
<valid type>	*buffer(*)*

The equivalent FORTRAN code for the example above is:

```
status = ptextper(pointid,periodid,0,”Time”,datbuf)
```

Reads Point Records for a Specified Geographic Region

PTextractregion

intn PTextractregion(int32 *pointID*, int32 *regionID*, int32 *level*, char **fieldlist*,
VOIDP *buffer)*

pointID	*IN:*	*Point id*
regionID	*IN:*	*Region id returned by PTdefboxregion*
level	*IN:*	*Point level (0-based)*
fieldlist	*IN:*	*List of fields to extract*
buffer	*OUT:*	*Data buffer*

Purpose — *Extracts (reads) from subsetted area of interest.*

Return value — *Returns SUCCEED (0) if successful or FAIL (-1) otherwise.*

Description — *This routine reads data from the designated level fields into the data buffer from the subsetted area of interest.*

Example — *In this example, we read data within the subsetted area of interest defined in PTdefboxregion from the Longitude and Latitude fields.*

```
/* Read subsetted data into buffer */
status = PTextractregion(pointID, regionID, 0,
"Longitude,Latitude",datbuf);
```

FORTRAN — *integer function ptextreg(pointid,regionid,level,fieldlist,buffer)*

*integer*4*	*pointid*
*integer*4*	*regionid*
*integer*4*	*level*
character(*)*	*fieldlist*
<valid type>	*buffer(*)*

The equivalent FORTRAN code for the example above is:

```
status = ptextreg(pointid,regionid,0,”Longitude,Latitude”,datbuf)
```

Return Linkage Field to Following Level

PTfwdlinkinfo

intn PTfwdlinkinfo(int32 *pointID*, int32 *level*, char **linkfield*)

pointID	*IN:*	*Point id returned by PTcreate or PTattach*
level	*IN:*	*Point level (0-based)*
linkfield	*OUT:*	*Link field*

Purpose *Returns the linkfield to the following level.*

Return value *Returns SUCCEED (0) if successful or FAIL (-1) otherwise.*

Description *This routine returns the linkfield to the following level.*

Example *In this example, we return the linkfield connecting the Desc-Loc level to the following Observations level. (These levels are defined in the PTdeflevel routine.)*

```
status = PTfwdlinkinfo(pointID2, 1, linkfield);
```

The linkfield will contain the string: ID.

FORTRAN *integer ptflinkinfo(pointid, level, linkfield)*

*integer*4*	*pointid*
*integer*4*	*level*
character(*)*	*linkfield*

The equivalent FORTRAN code for the example above is:

```
status = ptflinkinfo(pointid2, 1, linkfield)
```

Return Level Name

PTgetlevelname

intn PTgetlevelname(int32 *pointID*,int32 *level*, char **levelname*, int32 **strbufsize*)

pointID	*IN:*	*Point id returned by PTcreate or PTattach*
level	*IN:*	*Point level (0-based)*
levelname	*OUT:*	*Level name*
strbufsize	*OUT:*	*String length of level name*

Purpose *Returns the name of a level given the level number.*

Return value *Returns SUCCEED (0) if successful or FAIL (-1) otherwise.*

Description *This routine returns the name of a level given the level number (0-based). If the user passes NULL for the levelname, the routine will return just the string length of the level name (not counting the null terminator).*

Example *In this example, we return the level name of the 0th level of the second point defined in the PTdeflevel section:*

```
status = PTgetlevelname(pointID2, 0, levelname, &strbufsize);
```

The levelname will contain the string: Desc-Loc and the strbufsize variable will be set to 8.

FORTRAN *integer ptgetlevname(pointid, level, levelname,strbufsize)*

*integer*4*	*pointid*
*integer*4*	*level*
character(*)*	*levelname*
*integer*4*	*strbufsize*

The equivalent FORTRAN code for the example above is:

```
status = ptgetlevname(pointid2, 0, levelname, strbufsize)
```

Return Record Numbers Related to Level

PTgetrecnums

intn PTgetrecnums(int32 *pointID*, int32 *inlevel*, int32 *outlevel*, int32 *inNrec*, int32 *inRecs[]*, int32 **outNrec*, int32 *outRecs[]*)

pointID	*IN:*	*Point id returned by PTcreate or PTattach*
inlevel	*IN:*	*Level number of input records(0-based)*
outlevel	*IN:*	*Level number of output records(0-based)*
inNrec	*IN:*	*Number of records in the inRecs array*
inRecs	*IN:*	*Array containing the input record numbers.*
outNrec	*OUT:*	*Number of records in the outRecs array*
outRecs	*OUT*	*Array containing the output record numbers.*

Purpose *Returns the record numbers in one level corresponding to a group of records in a different level.*

Return value *Returns SUCCEED (0) if successful or FAIL (-1) otherwise.*

Description *The records in one level are related to those in another through the link field. These in turn are related to the next. In this way each record in any level is related to others in all the levels of the point structure. The purpose of PTgetrecnums is to return the record numbers in one level that are connected to a given set of records in a different level. Note that the two levels need not be adjacent.*

Example *In this example, we get the record number in the second level that are related to the first record in the first level.*

```
nrec = 1;
recs[0] = 0;
inLevel = 0;
outLevel = 1;
status = PTgetrecnums(pointID2, inLevel, outLevel, nrec, recs,
&outNrec, outRecs);
```

FORTRAN	*integer ptgetrecnum(pointID,inlevel,outlevel,innrec,inrecs,outnrec,outrecs)*	
	*integer*4*	*pointid*
	*integer*4*	*inlevel*
	*integer*4*	*outlevel*
	*integer*4*	*innrec*
	*integer*4*	*inrecs*
	*integer*4*	*outnrec*
	*integer*4*	*outnrecs*

The equivalent FORTRAN code for the example above is:

```
status=ptgetrecnums(pointid2,inlevel,outlevel,nrec,recs,outn
rec,outrecs)
```

Retrieve Information About Point Attributes

PTinqattrs

int32 PTinqattrs(int32 *pointID*, char **attrlist*, int32 **strbufsize)*

pointID	*IN:*	*Point id returned by PTcreate or PTattach*
attrlist	*OUT:*	*Attribute list (entries separated by commas)*
strbufsize	*OUT:*	*String length of attribute list*

Purpose *Retrieve information about attributes defined in point.*

Return value *Number of attributes found if successful or FAIL (-1) otherwise.*

Description *The attribute list is returned as a string with each attribute name separated by commas. If attrlist is set to NULL, then the routine will return just the string buffer size, strbufsize. This variable does not count the null string terminator.*

Example *In this example, we retrieve information about the attributes defined in a point structure. We assume that there are two attributes stored, attrOne and attr_2:*

```
nattr = PTinqattrs(pointID, NULL, strbufsize);
```

The parameter, nattr, will have the value 2 and strbufsize will have value 14.

```
nattr = PTinqattrs(pointID, attrlist, strbufsize);
```

The variable, attrlist, will be set to:

"*attrOne,attr_2*".

FORTRAN *integer*4 function ptinqattrs(pointid,attrlist,strbufsize)*

*integer*4*	*pointid*
character(*)*	*attrlist*
*integer*4*	*strbufsize*

The equivalent FORTRAN code for the example above is:

```
nattr = ptinqattrs(pointid, attrlist, strbufsize)
```

Retrieve Point Structures Defined in HDF-EOS File

PTinqpoint

int32 PTinqpoint(char * filename, char *pointlist, int32 *strbufsize)

filename	*IN:*	*HDF-EOS filename*
pointlist	*OUT:*	*Point list (entries separated by commas)*
strbufsize	*OUT:*	*String length of point list*

Purpose — *Retrieves number and names of points defined in HDF-EOS file.*

Return value — *Number of points found if successful or FAIL (-1) otherwise.*

Description — *The point list is returned as a string with each point name separated by commas. If pointlist is set to NULL, then the routine will return just the string buffer size, strbufsize. If strbufsize is also set to NULL, the routine returns just the number of points. Note that strbufsize does not count the null string terminator.*

Example — *In this example, we retrieve information about the points defined in an HDF-EOS file, HDFEOS.hdf. We assume that there are two points stored, PointOne and Point_2:*

```
npoint = PTinqpoint(“HDFEOS.hdf”, NULL, strbufsize);
```

The parameter, npoint, will have the value 2 and strbufsize will have value 16.

```
npoint = PTinqpoint(“HDFEOS.hdf”, pointlist, strbufsize);
```

The variable, pointlist, will be set to:

“*PointOne,Point_2*”.

FORTRAN — *integer*4 function ptinqpoint(filename,pointlist,strbufsize)*

character(*)* *filename*

character(*)* *pointlist*

*integer*4* *strbufsize*

The equivalent FORTRAN code for the example above is:

```
npoint = ptinqpoint(“HDFEOS.hdf”, pointlist, strbufsize)
```

Return Index Number of a Named Level

PTlevelindx

int32 PTlevelindx(int32 *pointID*, char **levelname)*

pointID	*IN:*	*Point id returned by PTcreate or PTattach*
levelname	*IN:*	*Level Name*

Purpose — *Returns the level index (0-based) for a given (named) level.*

Return value — *Returns the level index if successful or FAIL (-1) otherwise.*

Description — *This routine returns the level index for a give level specified by name.*

Example — *In this example, we return the level index of the Observations level in the multilevel point structure defined in PTdeflevel.*

```
levindx = PTlevelindex(pointID2, “Observations”);
```

The levindx variable will have the value 1.

FORTRAN — *integer*4 ptlevidx (pointid) levelname)*

*integer*4*	*pointid*
character(*)*	*levelname*

The equivalent FORTRAN code for the example above is:

```
levindx = ptlevidx(pointid2, “Observations”)
```

Return Information on Fields in a Given Level

PTlevelinfo

int32 PTlevelinfo(int32 pointID, int32 level, char *fieldlist, int32 fldtype[], int32 fldorder[])

pointID	*IN:*	*Point id returned by PTcreate or PTattach*
level	*IN:*	*Point level (0-based)*
fieldlist	*OUT:*	*Field names in level*
fldtype	*OUT:*	*Number type of each field*
fldorder	*OUT:*	*Order of each field*

Purpose *Returns information on fields in a given level.*

Return value *Returns number of fields if successful or FAIL (-1) otherwise. Typical reasons for failure are an improper point id or level number.*

Description *This routine returns information about the fields in a given level.*

Example *In this example we return information about the Desc-Loc (1st) level defined previously.*

```
nflds = PTlevelinfo(pointID2, 0, fldlist, fldtype, fldorder);
```

The fldlist variable will be set to:

"Time,Longitude,Latitude,Channel,Value".

The nflds= 5, the fldtype array = {22,5,5,22,5}, the fldorder array = {0,0,0,0,0}.

FORTRAN integer*4 function ptlevinfo(pointID, level, fieldlist, fldtype, fldorder)

*integer*4*	*pointid*
*integer*4*	*level*
character(*)*	*fieldlist*
*integer*4*	*fldtype (*)*
*integer*4*	*fldorder (*)*

The equivalent FORTRAN code for the example above is:

```
nflds = ptlevinfo(pointid2, 0, fldlist, fldtype, fldorder)
```

Unlike the C language example, all output parameters must be supplied in the call.

Return Number of Fields Defined in a Level

PTnfields

int32 PTnfields(int32 *pointID,* int32 *level,* int32 *strbufsize)

pointID	*IN:*	*Point id returned by PTcreate or PTattach*
level	*IN:*	*Level number (0-based)*
strbufsize	*OUT:*	*Size in bytes of fieldlist for level*

Purpose *Returns number of fields in a level and the size of the fieldlist.*

Return value *Returns number of fields if successful or FAIL (-1) otherwise.*

Description *This routine returns the number of fields in a level and the size of the comma-separated fieldlist. This value does NOT count the null character at the end of the string.*

Example *In this example we retrieve the number of levels in the 2nd point defined previously:*

```
nflds = PTnfields(pointID2, 0, strbufsize);
```

The nfldsvariable will be 5 and the strbufsize variable equal to 38.

FORTRAN *integer*4 function ptnflds(pointid), level, strbufsize*

*integer*4*	*pointid*
*integer*4*	*level*
*integer*4*	*strbufsize*

The equivalent FORTRAN code for the example above is:

```
nflds = ptnflds(pointid2, 0, strbufsize)
```

Return Number of Levels in a Point Structure

PTnlevels

int32 PTnlevels(int32 *pointID)*

pointID	*IN: Point id returned by PTcreate or PTattach*
Purpose	*Returns number of levels in a point.*
Return value	*Returns number of levels if successful or FAIL (-1) otherwise. Typical reasons for failure are an improper point id.*
Description	*This routine returns the number of levels in a point.*
Example	*In this example we retrieve the number of levels in the 2nd point defined previously:*

```
nlevels = PTnlevels(pointID2);
```

The nlevels variable will be 2.

FORTRAN *integer*4 function ptnlevs(pointid)*

*integer*4 pointid*

The equivalent FORTRAN code for the example above is:

```
nlevels = ptnlevs(pointid2)
```

Return Number of Records in a Given Level

PTnrecs

int32 PTnrecs(int32 *pointID*, int32 *level)*

pointID	*IN:*	*Point id returned by PTcreate or PTattach*
level	*IN:*	*Level number (0-based)*

Purpose *Returns number of records in a given level.*

Return value *Returns number of records in a given level if successful or FAIL (-1) otherwise. Typical reasons for failure are an improper point id or level number.*

Description *This routine returns the number of records in a given level.*

Example *In this example we retrieve the number of records in the first level of the 2nd point defined previously:*

```
nrecs = PTnrecs(pointID2, 0);
```

FORTRAN *integer*4 function ptnrecs(pointid,level)*

*integer*4*	*pointid*
*integer*4*	*level*

The equivalent FORTRAN code for the example above is:

```
nrecs = ptnrecs(pointid2, 0)
```

Open HDF-EOS File

PTopen

int32 PTopen(char **filename*, intn *access*)

filename	*IN:*	*Complete path and filename for the file to be opened*
access	*IN:*	*DFACC_READ, DFACC_RDWR or DFACC_CREATE*

Purpose *Opens or creates HDF file in order to create, read, or write a point.*

Return value *Returns the point file id handle (fid) if successful or FAIL (-1) otherwise.*

Description *This routine creates a new file or opens an existing one, depending on the access parameter.*

Access codes:

DFACC_READ	*Open for read only. If file does not exist, error*
DFACC_RDWR	*Open for read/write. If file does not exist, create it*
DFACC_CREATE	*If file exist, delete it, then open a new file for read/write*

Example *In this example, we create a new point file named, PointFile.hdf. It returns the file handle, fid.*

```
fid = PTopen("PointFile.hdf", DFACC_CREATE);
```

FORTRAN *integer*4 function ptopen(filename, access)*

character(*)*	*filename*
integer	*access*

The access codes should be defined as parameters:

parameter (DFACC_READ=1)

parameter (DFACC_RDWR=3)

parameter (DFACC_CREATE=4)

The equivalent *FORTRAN* code for the example above is:

```
fid = ptopen("PointFile.hdf", DFACC_CREATE)
```

Note to users of the SDP Toolkit: Please refer to the *SDP Toolkit Users Guide for the EOSDIS Evolution and Development-2 Contract, December, 2017, 333-EED2-001, Revision 01,* Section 6.2.1.2, for information on how to obtain a file name (referred to as a "physical file handle") from within a PGE. See also Section 9 of this document for code examples.

Returns Information About a Time Period

PTperiodinfo

intn PTperiodinfo(int32 *pointID*, int32 *periodID*, int32 *level*, char **fieldlist*, int32 **size*)

pointID	*IN:*	*Point id*
periodID	*IN:*	*Period id returned by PTdeftimeperiod*
level	*IN:*	*Point level (0-based)*
fieldlist	*IN:*	*List of fields to extract*
size	*OUT:*	*Size in bytes of subset period*

Purpose *Retrieves information about the subsetted period.*

Return value *Returns SUCCEED (0) if successful or FAIL (-1) otherwise.*

Description *This routine returns information about a subsetted time period for a particular fieldlist. It is useful when allocating space for a data buffer for the subset.*

Example *In this example, we get the size of the subsetted time period defined in PTdeftimeperiod for the Time field.*

```
status = PTperiodinto(pointID, periodID, 0, "Time", &size);
```

FORTRAN *integer function ptperinfo(pointid,periodid,level,fieldlist,size)*

*integer*4*	*pointid*
*integer*4*	*periodid*
*integer*4*	*level*
character(*)*	*fieldlist*
*integer*4*	*size*

The equivalent FORTRAN code for the example above is:

```
status = ptperinfo(pointid,periodid,0,"Time",size)
```

Returns Record Numbers within a Time Period

PTperiodrecs

intn PTperiodrecs(int32 *pointID*, int32 *periodID*, int32 *level*, int32 **nrec*, int32 *recs[]*)

pointID	*IN:*	*Point id*
periodID	*IN:*	*Period id returned by PTdeftimeperiod*
level	*IN:*	*Point level (0-based)*
nrec	*OUT:*	*Number of records within time period in level*
recs	*OUT:*	*Record numbers of subsetted records in level*

Purpose *Retrieves record numbers within time period.*

Return value *Returns SUCCEED (0) if successful or FAIL (-1) otherwise.*

Description *This routine returns the record numbers within a subsetted time period for a particular level. If the recs array is set to NULL, then the routine simply returns the number of records.*

Example *In this example, we get the number of records and record numbers within the subsetted area of interest defined in PTdeftimeperiod for the 0th level.*

```
status = PTperiodrecs(pointID, periodID, 0, &nrec, recs);
```

FORTRAN *integer function ptperrecs(pointid,periodid,level,nrec,recs)*

*integer*4*	*pointid*
*integer*4*	*periodid*
*integer*4*	*level*
*integer*4*	*nrec*
*integer*4*	*recs(*)*

The equivalent FORTRAN code for the example above is:

```
status = ptperrecs(pointid,periodid,0,nrec,recs)
```

Read Point Attribute

PTreadattr

intn PTreadattr(int32 *pointID*, char **attrname*, VOIDP *datbuf)*

pointID	*IN:*	*Point id returned by PTcreate or PTattach*
attrname	*IN:*	*Attribute name*
datbuf	*IN:*	*Buffer allocated to hold attribute values*

Purpose — *Reads attribute from a point.*

Return value — *Returns SUCCEED (0) if successful or FAIL (-1) otherwise. Typical reasons for failure are an improper point id or number type or incorrect attribute name.*

Description — *The attribute is passed by reference rather than value in order that a single routine suffice for all numerical types.*

Example — *In this example, we read a single precision (32 bit) floating point attribute with the name "ScalarFloat":*

```
status = PTreadattr(pointID, "ScalarFloat", &f32);
```

FORTRAN — *integer function ptrdattr(pointid, attrname, datbuf)*

*integer*4*	*pointid*
character(*)*	*attrname*
<valid type>	*datbuf(*)*

The equivalent FORTRAN code for the example above is:

```
status = ptrdattr(pointid, "ScalarFloat", f32)
```

Read Records From a Point Level

PTreadlevel

intn PTreadlevel(int32 *pointID,* int32 *level,* char *fieldlist*, int32 *nrec*, int32 *recs[]*, VOIDP *buffer)*

pointID	*IN:*	*Point id returned by PTcreate or PTattach*
level	*IN:*	*Level to read (0-based)*
fieldlist	*IN:*	*List of fields to read*
nrec	*IN:*	*Number of records to read*
recs	*IN:*	*Record number of records to read (0 - based)*
buffer	*OUT:*	*Buffer to store data*

Purpose *Reads data from a point level.*

Return value *Returns SUCCEED (0) if successful or FAIL (-1) otherwise. Typical reasons for failure are an improper point id or unknown fieldname.*

Description *This routine reads data from the specified fields and records of a single level in a point. Sufficient space in the read buffer must be allocated by the user.*

Example *In this example we read records 0, 2, and 3 from the Temperature and Mode fields in the first level in the point referred to by the point id, pointID1.*

```
int32 recs[3] = {0,2,3};
status = PTreadlevel(pointID1, 0, "Temperature,Mode", 3,  recs,
buffer);
```

FORTRAN *integer function*

ptrdlev(pointid,level,fieldlist,nrec,recs,buffer)

*integer*4*	*pointid*
*integer*4*	*level*
character(*)*	*fieldlist*
*integer*4*	*nrec*
*integer*4*	*recs(*)*
<valid type>	*buffer(*)*

The equivalent *FORTRAN* code for the example above is:

```
integer*4 recs(10)
recs(1) = 0
recs(2) = 2
recs(3) = 3
status = ptrdlev(pointid1, 1, "Temperature,Mode",  3, recs,
       buffer)
```

Returns Information About a Geographic Region

PTregioninfo

intn PTregioninfo(int32 *pointID*, int32 *regionID*, int32 *level*, char **fieldlist*,
int32 **size*)

pointID	*IN:*	*Point id returned by Ptcreate or PTattach*
regionID	*IN:*	*Region id returned by PTdefboxregion*
level	*IN:*	*Point level (0-based)*
fieldlist	*IN:*	*List of fields to extract*
size	*OUT:*	*Size in bytes of subset region*

Purpose *Retrieves information about the subsetted region.*

Return value *Returns SUCCEED (0) if successful or FAIL (-1) otherwise.*

Description *This routine returns information about a subsetted area of interest for a particular fieldlist. It is useful when allocating space for a data buffer for the subset.*

Example *In this example, we get the size of the subsetted area of interest defined in PTdefboxregion from the Longitude and Latitude fields.*

```
status = PTregioninfo(pointID, regionID, 0,
"Longitude,Latitude",&size);
```

FORTRAN *integer function ptreginfo(pointid,regionid,level,fieldlist,size)*

*integer*4*	*pointid*
*integer*4*	*regionid*
*integer*4*	*level*
character(*)*	*fieldlist*
*integer*4*	*size*

The equivalent FORTRAN code for the example above is:

```
status = ptreginfo(pointid,regionid,0,”Longitude,Latitude”,size)
```

Returns Record Numbers within a Geographic Region

PTregionrecs

intn PTregionrecs(int32 *pointID*, int32 *regionID*, int32 *level*, int32 **nrec*, int32 *recs[]*)

pointID	*IN:*	*Point id returned by PTcreate or PTattach*
regionID	*IN:*	*Region id returned by PTdefboxregion*
level	*IN:*	*Point level (0-based)*
nrec	*OUT:*	*Number of records within geographic region in level*
recs	*OUT:*	*Record numbers of subsetted records in level*

Purpose — *Retrieves record numbers within geographic region.*

Return value — *Returns SUCCEED (0) if successful or FAIL (-1) otherwise.*

Description — *This routine returns the record numbers within a subsetted geographic region for a particular level. If the recs array is set to NULL, then the routine simply returns the number of records.*

Example — *In this example, we get the number of records and record numbers within the subsetted area of interest defined in PTdefboxregion for the 0th level.*

```
status = PTregionrecs(pointID, regionID, 0, &nrec, recs);
```

FORTRAN — *integer function ptregrecs(pointid,regionid,level,nrec,recs)*

*integer*4*	*pointid*
*integer*4*	*regionid*
*integer*4*	*level*
*integer*4*	*nrec*
*integer*4*	*recs(*)*

The equivalent FORTRAN code for the example above is:

```
status = ptregrecs(pointid,regionid,0,nrec,recs)
```

Return Information About Fields in a Point

PTsizeof

int32 PTsizeof(int32 pointID, char *fieldlist, int32 fldlevel[])

pointID	*IN:*	*Point id returned by PTcreate or PTattach*
fieldlist	*IN:*	*Field names*
fldlevel	*OUT:*	*Level number of each field*

Purpose *Returns information on specified fields in point.*

Return value *Returns size in bytes of specified fields if successful or FAIL (-1) otherwise. Typical reasons for failure are an improper point id or field names.*

Description *This routine returns information about specified fields in a point regardless of level.*

Example *In this example we return the size in bytes of the Label and Rainfall fields in the 2nd point defined in the PTdeflevel routine.*

```
size = PTsizeof(pointID2, "Label,Rainfall", fldlevel);
```

The size variable will be 8 and the fldlevel = {1,2}.

FORTRAN integer*4 function ptsizeof(*pointID, fieldlist, fldlevel)*

*integer*4*	*pointid*
character(*)*	*fieldlist*
*integer*4*	*fldlevel (*)*

The equivalent FORTRAN code for the example above is:

```
size = ptsizeof(pointid2, "Label,Rainfall", fldlevel)
```

Update Records in a Point Structure

PTupdatelevel

intn PTupdatelevel(int32 *pointID*, int32 *level*, char *fieldlist*, int32 *nrec*, int32 *recs[]*, VOIDP data*)*

pointID	*IN:*	*Point id returned by PTcreate or PTattach*
level	*IN:*	*Level to update (0-based)*
fieldlist	*IN:*	*List of fields to update*
nrec	*IN:*	*Number of records to update*
recs	*IN:*	*Record number of records to update (0 - based)*
data	*IN:*	*Values to be written to the fields*

Purpose *Updates (corrects) data to a point level.*

Return value *Returns SUCCEED (0) if successful or FAIL (-1) otherwise. Typical reasons for failure are an improper point id or unknown fieldname.*

Description *This routine updates the specified fields and records of a single level.*

Example *In this example we update records 0, 2, and 3 in the Temperature and Mode fields in the first level in the point referred to by the point id, pointID1.*

```
int32 recs[3] = {0,2,3};
/* Fill Data Buffer */
status = PTupdatelevel(pointID1, 0, "Temperature,Mode", 3,
       recs, datbuf);
```

The user may update a single record or all records in precisely the same manner as that used in the PTreadlevel examples.

FORTRAN *integer function*

ptuplev(pointid,level,fieldlist,nrec,recs,buffer)

*integer*4*	*pointid*
*integer*4*	*level*
character(*)*	*fieldlist*
*integer*4*	*nrec*
*integer*4*	*recs(*)*
<valid type>	*buffer(*)*

The equivalent *FORTRAN* code for the example above is:

```
integer*4 recs(10)
recs(1) = 0
recs(2) = 2
recs(3) = 3
status = ptuplev(pointid1, 1, "Temperature,Mode", 3, recs,
       datbuf)
```

Write/Update Point Attribute

PTwriteattr

intn PTwriteattr(int32 *pointID*, char **attrname*, int32 *ntype*, int32 *count*, VOIDP *datbuf)*

pointID	*IN:*	*Point id returned by PTcreate or PTattach*
attrname	*IN:*	*Attribute name*
ntype	*IN:*	*Number type of attribute*
count	*IN:*	*Number of values to store in attribute*
datbuf	*IN:*	*Attribute values*

Purpose *Writes/Updates attribute in a point.*

Return value *Returns SUCCEED (0) if successful or FAIL (-1) otherwise. Typical reasons for failure are an improper point id or number type.*

Description *If the attribute does not exist, it is created. If it does exist, then the value(s) is (are) updated. The attribute is passed by reference rather than value in order that a single routine suffice for all numerical types. Because of this a literal numerical expression should not be used in the call.*

Example *In this example, we write a single precision (32 bit) floating point number with the name "ScalarFloat" and the value 3.14:*

```
f32 = 3.14;
status = PTwriteattr(pointid, "ScalarFloat", DFNT_FLOAT32,
        1, &f32);
```

We can update this value by simply calling the routine again with the new value:

```
f32 = 3.14159;
status =
PTwriteattr(pointid,"ScalarFloat",DFNT_FLOAT32,1,&f32);
```

FORTRAN *integer function ptwrattr(pointid, attrname, ntype, count, datbuf)*

*integer*4*	*pointid*
character(*)*	*attrname*
*integer*4*	*ntype*
*integer*4*	*count*
<valid type>	*datbuf(*)*

The equivalent FORTRAN code for the first example above is:

```
parameter (DFNT_FLOAT32=5)
f32 = 3.14
status = ptwrattr(pointid,"ScalarFloat",DFNT_FLOAT32, 1, f32)
```

Write New Records to a Point Level

PTwritelevel

intn PTwritelevel(int32 *pointID*, int32 *level*, int32 *nrec*, VOIDP *data)*

pointID	*IN:*	*Point id returned by PTcreate or PTattach*
level	*IN:*	*Level to write (0-based)*
nrec	*IN:*	*Number of records to write*
data	*IN:*	*Values to be written to the field*

Purpose *Writes (appends) new records to a point level.*

Return value *Returns SUCCEED (0) if successful or FAIL (-1) otherwise. Typical reasons for failure are an improper point id or level number.*

Description *This routine writes (appends) full records to a level. The data in each record must be packed. Please refer to the section on Vdatas in the HDF documentation. The input data buffer must be sufficient to fill the number of records designated.*

Example *In this example we write 5 records to the first level in the point refered to by the point id, pointID1.*

```
/* Fill Data Buffer */
status = PTwritelevel(pointID1, 0, 5, datbuf);
```

FORTRAN *integer function*

ptwrlev(pointid,level,nrec,data)

*integer*4*	*pointid*
*integer*4*	*level*
*integer*4*	*nrec*
<valid type>	*data(*)*

The equivalent *FORTRAN* code for the example above is:

```
status = ptwrlev(pointid1, 0, 5, datbuf)
```

2.1.2 Swath Interface Functions

This section contains an alphabetical listing of all the functions in the Swath interface. The functions are alphabetized based on their C-language names.

Attach to an Existing Swath Structure

SWattach

int32 SWattach(int32 *fid*, char **swathname*)

fid	*IN:*	*Swath file id returned by SWopen*
swathname	*IN:*	*Name of swath to be attached*

Purpose *Attaches to an existing swath within the file.*

Return value *Returns the swath handle (swathID) if successful or FAIL (-1) otherwise. Typical reasons for failure are an improper swath file id or swath name.*

Description *This routine attaches to the swath using the swathname parameter as the identifier.*

Example *In this example, we attach to the previously created swath, "ExampleSwath", within the HDF file, SwathFile.hdf, referred to by the handle, fid:*

```
swathID = SWattach(fid, "ExampleSwath");
```

The swath can then be referenced by subsequent routines using the handle, swathID.

FORTRAN *integer*4 function swattach(fid,swathname)*

*integer*4*	*fid*
character*(*)	*swathname*

The equivalent *FORTRAN* code for the example above is:

```
swathid = swattach(fid, "ExampleSwath")
```

`Note:` If unlike the above example user defines a swathname string and then copies the actual name into that string, then it is suggested that user initialize every single character in the swathname string in their code to "'\0'", before copying swathname into this string [before passing the string into SWattach()]. If user is getting the swath name from another call, then user must initialize the swathname string before that call. Failing to do this may result in having some random characters in the swathname and, therefore, failing of SWattach().

Return Information About a Swath Attribute

SWattrinfo

intn SWattrinfo(int32*swathID*, char **attrname*, int32 * *numbertype*, int32 **count*)

swathID	*IN:*	*Swath id returned by SWcreate or SWattach*
attrname	*IN:*	*Attribute name*
numbertype	*OUT:*	*Number type of attribute. See Appendix A for interpretation of number types.*
count	*OUT:*	*Number of total bytes in attribute*

Purpose *Returns information about a swath attribute*

Return value *Returns SUCCEED (0) if successful or FAIL (-1) otherwise.*

Description *This routine returns number type and number of elements (count) of a swath attribute.*

Example *In this example, we return information about the ScalarFloat attribute.*

```
status = SWattrinfo(swathID, "ScalarFloat",&nt,&count);
```

The nt variable will have the value 5 and count will have the value 4.

FORTRAN *integer function swattrinfo(swathid, attrname, ntype, count,)*

*integer*4*	*swathid*
character(*)*	*attrname*
*integer*4*	*ntype*
*integer*4*	*count*

The equivalent FORTRAN code for the first example above is:

```
status = swattrinfo(swathid, "ScalarFloat",nt,count)
```

Close an HDF-EOS File

SWclose

intn SWclose(int32 *fid*)

fid	*IN: Swath file id returned by SWopen*
Purpose	*Closes file.*
Return value	*Returns SUCCEED (0) if successful or FAIL (-1) otherwise.*
Description	*This routine closes the HDF swath file.*

Example

```
status = swclose(fid);
```

FORTRAN *integer function swclose(fid)*

*integer*4 fid*

The equivalent FORTRAN code for the example above is:

```
status = swclose(fid)
```

Retrieve Compression Information for Field

SWcompinfo

intn SWcompinfo(int32 *swathID*, char **fieldname*, int32 **compcode*, intn *compparm[]*)

swathID	*IN:*	*Swath id returned by SWcreate or SWattach*
fieldname	*IN:*	*Fieldname*
compcode	*OUT:*	*HDF compression code*
compparm	*OUT:*	*Compression parameters*

Purpose *Retrieves compression information about a field.*

Return value *Returns SUCCEED(0) if successful or FAIL(-1) otherwise.*

Description *This routine returns the compression code and compression parameters for a given field. If the field is not compressed compression code returned will be HDFE_COMP_NONE.*

Example *To retrieve the compression information about the Opacity field defined in the SWdefcomp section:*

```
status = SWcompinfo(swathID, “Opacity”, &compcode, compparm);
```

The compcode parameter will be set to 4 and compparm[0] to 5.

FORTRAN *integer function swcompinfo(gridid,fieldname compcode, compparm)*

*integer*4* *swathid*

character(*)* *fieldname*

*integer*4* *compcode*

integer *compparm*

The equivalent FORTRAN code for the example above is:

```
status = swcompinfo(swathid, ‘Opacity’, compcode, compparm)
```

The compcode parameter will be set to 4 and compparm(1) to 5.

Note for SZIP compression:

compcode: HDFE_COMP_SZIP = 5

compparm[0]: an even number between 2 and 32 indicating pixels per block

compparm[1]: SZ_EC = 4 (Entropy Coding (EC) Method)

SZ_NN = 32 (Nearest Neighbour + Entropy Coding (EC) Method)

Create a New Swath Structure

SWcreate

int32 SWcreate(int32 *fid*, char **swathname*)

fid	*IN:*	*Swath file id returned by SWopen*
swathname	*IN:*	*Name of swath to be created*

Purpose *Creates a swath within the file.*

Return value *Returns the swath handle (swathID) if successful or FAIL (-1) otherwise.*

Description *The swath is created as a Vgroup within the HDF file with the name swathname and class SWATH.*

Example *In this example, we create a new swath structure, ExampleSwath, in the previously created file, SwathFile.hdf.*

```
swathID = SWcreate(fid, "ExampleSwath");
```

The swath structure is referenced by subsequent routines using the handle, swathID.

FORTRAN *integer*4 function swcreate(fid,swathname)*

*integer*4*	*fid*
character*(*)	*swathname*

The equivalent *FORTRAN* code for the example above is:

```
swathid = swcreate(fid, "ExampleSwath")
```

Define a Longitude-Latitude Box Region for a Swath

SWdefboxregion

int32 SWdefboxregion(int32 *swathID*, float64 *cornerlon[]*, float64 *cornerlat[]*, int32 *mode*)

swathID	*IN:*	*Swath id returned by SWcreate or SWattach*
cornerlon	*IN:*	*Longitude in decimal degrees of box corners*
cornerlat	*IN:*	*Latitude in decimal degrees of box corners*
mode	*IN:*	*Cross Track inclusion mode*

Purpose — *Defines a longitude-latitude box region for a swath.*

Return value — *Returns the swath region ID if successful or FAIL (-1) otherwise.*

Description — *This routine defines a longitude-latitude box region for a swath. It returns a swath region ID which is used by the SWextractregion routine to read all the entries of a data field within the region. A cross track is within a region if 1) its midpoint is within the longitude-latitude "box" (HDFE_MIDPOINT), or 2) either of its endpoints is within the longitude-latitude "box" (HDFE_ENDPOINT), or 3) any point of the cross track is within the longitude-latitude "box" (HDFE_ANYPOINT), depending on the inclusion mode designated by the user. All elements within an included cross track are considered to be within the region even though a particular element of the cross track might be outside the region. The swath structure must have both Longitude and Latitude (or Colatitude) fields defined*

Note: Users who are defining subset regions involving scenes with overlaps should add a call to the routine in SWupdatescene after calling this routine in order to get correctly defined region.

Example — *In this example, we define a region bounded by the 3 degrees longitude, 5 degrees latitude and 7 degrees longitude, 12 degrees latitude. We will consider a cross track to be within the region if its midpoint is within the region.*

```
cornerlon[0] = 3.;
cornerlat[0] = 5.;
cornerlon[1] = 7.;
cornerlat[1] = 12.;
regionID = SWdefboxregion(swathID, cornerlon, cornerlat,
       HDFE_MIDPOINT);
```

FORTRAN — *integer*4 function swdefboxreg(swathid, cornerlon, cornerlat, mode)*

*integer*4*	*swathid*
*real*8*	*cornerlon*
*real*8*	*cornerlat*
*integer*4*	*mode*

The equivalent FORTRAN code for the example above is:

```
parameter (HDFE_MIDPOINT=0)
cornerlon(1) = 3.
cornerlat(1) = 5.
cornerlon(2) = 7.
cornerlat(2) = 12.
regionid = swdefboxreg(swathid, cornerlon, cornerlat,
      HDFE_MIDPOINT)
```

Set Swath Field Compression

SWdefcomp

intn SWdefcomp(int32 *swathID*, int32 *compcode*, intn *compparm[]*)

swathID	*IN:*	*Swath id returned by SWcreate or SWattach*
compcode	*IN:*	*HDF compression code*
compparm	*IN:*	*Compression parameters (if applicable)*

Purpose *Sets the field compression for all subsequent field definitions.*

Return value *Returns SUCCEED(0) if successful or FAIL(-1) otherwise.*

Description *This routine sets the HDF field compression for subsequent swath field definitions. The compression does not apply to one-dimensional fields. The compression schemes currently supported are: run length encoding (HDFE_COMP_RLE = 1) , skipping Huffman (HDFE_COMP_SKPHUFF = 3), deflate (gzip) (HDFE_COMP_DEFLATE=4) , (szip) (HDFE_COMP_SZIP =5) and no compression (HDFE_COMP_NONE = 0, the default). Deflate compression requires a single integer compression parameter in the range of one to nine with higher values corresponding to greater compression. Compressed fields are written using the standard SWwritefield routine, however, the entire field must be written in a single call. Any portion of a compressed field can then be accessed with the SWreadfield routine. Compression takes precedence over merging so that multi-dimensional fields that are compressed are not merged. The user should refer to the HDF Reference Manual for a fuller explanation of the compression schemes and parameters.*

Note for SZIP compression:

compcode: HDFE_COMP_SZIP = 5

compparm[0]: an even number between 2 and 32 indicating pixels per block

compparm[1]: SZ_EC = 4 (Entropy Coding (EC) Method)

SZ_NN = 32 (Nearest Neighbour + Entropy Coding (EC) Method)

Example *Suppose we wish to compress the Pressure using run length encoding, the Opacity field using deflate compression, the Spectra field with skipping Huffman compression, and use no compression for the Temperature field.*

```
status = SWdefcomp(swathID, HDFE_COMP_RLE, NULL);
status = SWdefdatafield(swathID, "Pressure", "Track,Xtrack",
DFNT_FLOAT32, HDFE_NOMERGE);
compparm[0] = 5;
status = SWdefcomp(swathID, HDFE_COMP_DEFLATE, compparm);
status = SWdefdatafield(swathID, "Opacity", "Track,Xtrack",
DFNT_FLOAT32, HDFE_NOMERGE);
status = SWdefcomp(swathID, HDFE_COMP_SKPHUFF, NULL);
status = SWdefdatafield(swathID, "Spectra",
"Bands,Track,Xtrack", DFNT_FLOAT32, HDFE_NOMERGE);
status = SWdefcomp(swathID, HDFE_COMP_NONE, NULL);
status = SWdefdatafield(swathID, "Temperature", "Track,Xtrack",
DFNT_FLOAT32, HDFE_AUTOMERGE);
```

Note that the HDFE_AUTOMERGE parameter will be ignored in the Temperature field definition.

FORTRAN *integer function swdefcomp(swathid, compcode, compparm)*

*integer*4* *swathid*

integer *compcode*

integer *compparm*

The equivalent FORTRAN code for the example above is:

```
parameter (HDFE_COMP_NONE=0)
parameter (HDFE_COMP_RLE=1)
parameter (HDFE_COMP_SKPHUFF=3)
parameter (HDFE_COMP_DEFLATE=4)
parameter (HDFE_COMP_SZIP=5)
integer    compparm(5)
status = swdefcomp(swathid, HDFE_COMP_RLE, compparm)
status = swdefdfld(swathid, "Pressure", "Track,Xtrack",
DFNT_FLOAT32, HDFE_NOMERGE)
compparm(1) = 5
status = swdefcomp(swathid, HDFE_COMP_DEFLATE, compparm)
status = swdefdfld(swathid, "Opacity", "Track,Xtrack",
DFNT_FLOAT32, HDFE_NOMERGE)
status = swdefcomp(swathid, HDFE_COMP_SKPHUFF, compparm)
status = swdefdfld(swathid, "Spectra", "Bands,Track,Xtrack",
DFNT_FLOAT32, HDFE_NOMERGE)
status = swdefcomp(swathid, HDFE_COMP_NONE, compparm)
status = swdefdfld(swathid, "Temperature", "Track,Xtrack",
DFNT_FLOAT32, HDFE_AUTOMERGE)
```

Define a New Data Field Within a Swath

SWdefdatafield

intn SWdefdatafield(int32 *swathID*, char **fieldname*, char **dimlist*, int32 *numbertype*, int32 *merge*)

swathID	*IN:*	*Swath id returned by SWcreate or SWattach*
fieldname	*IN:*	*Name of field to be defined*
dimlist	*IN:*	*The list of data dimensions defining the field*
numbertype	*IN:*	*The number type of the data stored in the field. See Appendix A for number types.*
merge	*IN:*	*Merge code (HDFE_NOMERGE (0) - no merge, HDFE_AUTOMERGE (1) -merge)*

Note: *Illegal characters are: "/" ";" "," ":"*

Purpose *Defines a new data field within the swath.*

Return value *Returns SUCCEED (0) if successful or FAIL (-1) otherwise. Typical reason for failure is unknown dimension in the dimension list.*

Description *This routine defines data fields to be stored in the swath. The dimensions are entered as a string consisting of data dimensions separated by commas. They are entered in C order, that is, the last dimension is incremented first. The API will attempt to merge into a single object those fields that share dimensions and in case of multidimensional fields, numbertype. Two and three dimensional fields will be merged into a single three-dimensional object if the last two dimensions (in C order) are equal. If the merge code for a field is set to HDF_NOMERGE (0) , the API will not attempt to merge it with other fields. Because merging breaks the one-to-one correspondence between HDF-EOS fields and HDF SDS arrays, it should not be set if the user wishes to access the HDF-EOS field directly using HDF routines or, for example, to create an HDF attribute corresponding to the field.*

Example *In this example, we define a three dimensional data field named Spectra with dimensions Bands, DataTrack, and DataXtrack:*

```
status = SWdefdatafield(swathID, "Spectra",
       "Bands,DataTrack,DataXtrack", DFNT_FLOAT32,
       HDFE_AUTOMERGE);
```

Note: To assure that the fields defined by SWdefdatafield are properly established in the file, the swath should be detached (and then reattached) before writing to any fields.

FORTRAN *integer function swdefdfld(swathid, fieldname, dimlist, numbertype,merge)*

*integer*4*	*swathid*
character(*)*	*fieldname*

character(*)*	*dimlist*
*integer*4*	*numbertype*
*integer*4*	*merge*

The equivalent FORTRAN code for the example above is:

```
parameter (DFNT_FLOAT32=5)
parameter (HDFE_AUTOMERGE=1)
status = swdefdfld(swathid, "Spectra",
       "DataXtrack,DataTrack,Bands", DFNT_FLOAT32,
       HDFE_AUTOMERGE)
```

Define a New Dimension Within a Swath

SWdefdim

intn SWdefdim(int32 *swathID*, char **fieldname*, int32 *dim)*

swathID	*IN:*	*swath returned by SWcreate or SWattach*
fieldname	*IN:*	*Name of dimension to be defined*
dim	*IN:*	*The size of the dimension*

Purpose *Defines a new dimension within the swath.*

Return value *Returns SUCCEED (0) if successful or FAIL (-1) otherwise. Typical reason for failure is an improper swath id.*

Note: *Illegal characters are: "/" ";" "," ":"*

Description *This routine defines dimensions that are used by the field definition routines (described subsequently) to establish the size of the field.*

Example *In this example, we define a track geolocation dimension, GeoTrack, of size 2000, a cross track dimension, GeoXtrack, of size 1000 and two corresponding data dimensions with twice the resolution of the geolocation dimensions:*

```
status = SWdefdim(swathID, "GeoTrack", 2000);
status = SWdefdim(swathID, "GeoXtrack", 1000);
status = SWdefdim(swathID, "DataTrack", 4000);
status = SWdefdim(swathID, "DataXtrack", 2000);
status = SWdefdim(swathID, "Bands", 5);
```

To specify an unlimited dimension which can be used to define an appendable array, the dimension value should be set to zero or equivalently, SD_UNLIMITED:

```
status = SWdefdim(swathID, "Unlim", SD_UNLIMITED);
```

FORTRAN *integer function swdefdim(swathid,fieldname,dim)*

*integer*4*	*swathid, dim*
character(*)*	*fieldname*

The equivalent *FORTRAN* code for the first example above is:

```
status = swdefdim(swathid, "GeoTrack", 2000)
```

The equivalent FORTRAN code for the unlimited dimension example above is:

```
parameter (SD_UNLIMITED=0)
status = swdefdim(swathid, "Unlim", SD_UNLIMITED)
```

Define Mapping Between Geolocation and Data Dimensions

SWdefdimmap

intn SWdefdimmap(int32 *swathID,* char **geodim*, char **datadim*, int32 *offset*, int32 *increment*)

swathID	*IN:*	*Swath id returned by SWcreate or SWattach*
geodim	*IN:*	*Geolocation dimension name*
datadim	*IN:*	*Data dimension name*
offset	*IN:*	*The offset of the geolocation dimension with respect to the data dimension*
increment	*IN:*	*The increment of the geolocation dimension with respect to the data dimension*

Purpose — *Defines monotonic mapping between the geolocation and data dimensions.*

Return value — *Returns SUCCEED (0) if successful or FAIL (-1) otherwise. Typical reason for failure is incorrect geolocation or data dimension name.*

Description — *Typically the geolocation and data dimensions are of different size (resolution). This routine established the relation between the two where the offset gives the index of the data element (0-based) corresponding to the first geolocation element and the increment gives the number of data elements to skip for each geolocation element. If the geolocation dimension begins "before" the data dimension, then the offset is negative. Similarly, if the geolocation dimension has higher resolution than the data dimension, then the increment is negative.*

Example — *In this example, we establish that (1) the first element of the GeoTrack dimension corresponds to the first element of the DataTrack dimension and the data dimension has twice the resolution as the geolocation dimension, and (2) the first element of the GeoXtrack dimension corresponds to the second element of the DataTrack dimension and the data dimension has twice the resolution as the geolocation dimension:*

```
status = SWdefdimmap(swathID, "GeoTrack",  "DataTrack", 0,
       2);
status = SWdefdimmap(swathID, "GeoXtrack", "DataXtrack", 1,
       2);
```

FORTRAN	*integer function*	
	swdefmap(swathid,geodim,datadim,offset,increment)	
*integer*4*	*swathid*	
	character(*)*	*geodim*
	character(*)*	*datadim*
	*integer*4*	*offset*
	*integer*4*	*increment*

The equivalent *FORTRAN* code for the second example above is:

```
status = swdefmap(swathid, "GeoTrack", "DataTrack", 0, 2)
status = swdefmap(swathid, "GeoXtrack", "DataXtrack", 1, 2)
```

Define a New Geolocation Field Within a Swath

SWdefgeofield

intn SWdefgeofield(int32 *swathID,* char **fieldname,* char **dimlist,* int32 *numbertype,* int32 *merge*)

swathID	*IN:*	*Swath id returned by SWcreate or SWattach*
fieldname	*IN:*	*Name of field to be defined*
dimlist	*IN:*	*The list of geolocation dimensions defining the field*
numbertype	*IN:*	*The number type of the data stored in the field. See Appendix A for number types.*
merge	*IN:*	*Merge code (HDFE_NOMERGE (0) - no merge, HDFE_AUTOMERGE (1) -merge)*

Purpose *Defines a new geolocation field within the swath.*

Return value *Returns SUCCEED (0) if successful or FAIL (-1) otherwise. Typical reason for failure is unknown dimension in the dimension list.*

Description *This routine defines geolocation fields to be stored in the swath. The dimensions are entered as a string consisting of geolocation dimensions separated by commas. They are entered in C order, that is, the last dimension is incremented first. The API will attempt to merge into a single object those fields that share dimensions and in case of multidimensional fields, numbertype. Two and three dimensional fields will be merged into a single three-dimensional object if the last two dimensions (in C order are equal). If the merge code for a field is set to 0, the API will not attempt to merge it with other fields. Fields using the unlimited dimension will not be merged. Because merging breaks the one-to-one correspondence between HDF-EOS fields and HDF SDS arrays, it should not be set if the user wishes to access the HDF-EOS field directly using HDF routines or, for example, to create an HDF attribute corresponding to the field.*

Example *In this example, we define the geolocation fields, Longitude and Latitude with dimensions GeoTrack and GeoXtrack and containing 4 byte floating point numbers. We allow these fields to be merged into a single object:*

```
status = SWdefgeofield(swathID, "Longitude",
       "GeoTrack,GeoXtrack", DFNT_FLOAT32, HDFE_AUTOMERGE);
status = SWdefgeofield(swathID, "Latitude",
       "GeoTrack,GeoXtrack", DFNT_FLOAT32, HDFE_AUTOMERGE);
```

Note: To assure that the fields defined by SWdefgeofield are properly established in the file, the swath should be detached (and then reattached) before writing to any fields.

FORTRAN *integer function swdefgfld(swathid, fieldname, dimlist, numbertype, merge)*

*integer*4*	*swathid*	
	character(*)*	*fieldname*
	character(*)*	*dimlist*
	*integer*4*	*numbertype*
	*integer*4*	*merge*

The equivalent FORTRAN code for the first example above is:

```
parameter (DFNT_FLOAT32=5)
parameter (HDFE_AUTOMERGE=1)
status = SWdefgeofield(swathID, "Longitude",
      "Geotrack,GeoXtrack", DFNT_FLOAT32, HDFE_AUTOMERGE)
```

The dimensions are entered in FORTRAN order with the first dimension incremented first.

Define Indexed Mapping Between Geolocation and Data Dimension

SWdefidxmap

intn SWdefidxmap(int32 *swathID*, char **geodim*, char **datadim*, int32 *index[])*,

swathID	*IN:*	*Swath id returned by SWcreate or SWattach*
geodim	*IN:*	*Geolocation dimension name*
datadim	*IN:*	*Data dimension name*
index	*IN:*	*The array containing the indices of the data dimension to which each geolocation element corresponds.*

Purpose — *Defines a non-regular mapping between the geolocation and data dimension.*

Return value — *Returns SUCCEED (0) if successful or FAIL (-1) otherwise. Typical reason for failure is incorrect geolocation or data dimension name.*

Description — *If there does not exist a regular (linear) mapping between a geolocation and data dimension, then the mapping must be made explicit. Each element of the index array, whose dimension is given by the geolocation size, contains the element number (0-based) of the corresponding data dimension.*

Example — *In this example, we consider the (simple) case of a geolocation dimension, IdxGeo of size 5 and a data dimension IdxData of size 8.*

```
int32 index[5] = {0,2,3,6,7};
status = SWdefidxmap(swathID, "IdxGeo", "IdxData", index);
```

In this case the 0th element of IdxGeo will correspond to the 0th element of IdxData, the 1st element of IdxGeo to the 2nd element of IdxData, etc.

FORTRAN — *integer function swdefimap(swathid, geodim, datadim, index)*

*integer*4*	*swathid*
character(*)*	*geodim*
character(*)*	*datadim*
*integer*4*	*index (*)*

The equivalent *FORTRAN* code for the example above is:

```
int32 index[5] = {0,2,3,6,7};
status = swidefmap(swathid, "IdxGeo", "IdxData", index)
```

Note: The index array should be 0-based.

Define a Time Period of Interest

SWdeftimeperiod

int32 SWdeftimeperiod(int32*swathID*, float64 *starttime* , float64 *stoptime*
int32 *mode*)

swathID	*IN:*	*Swath id returned by SWcreate or SWattach*
starttime	*IN:*	*Start time of period*
stoptime	*IN:*	*Stop time of period*
mode	*IN:*	*Cross Track inclusion mode*

Purpose *Defines a time period for a swath.*

Return value *Returns the swath period ID if successful or FAIL (-1) otherwise.*

Description *This routine defines a time period for a swath. It returns a swath period ID which is used by the SWextractperiod routine to read all the entries of a data field within the time period. A cross track is within a time period if 1) its midpoint is within the time period "box", or 2) either of its endpoints is within the time period "box", or 3) any point of the cross track is within the time period "box", depending on the inclusion mode designated by the user. All elements within an included cross track are considered to be within the time period even though a particular element of the cross track might be outside the time period. The swath structure must have the Time field defined*

Example *In this example, we define a time period with a start time of 35232487.2 and a stop time of 36609898.1.We will consider a cross track to be within the time period if either one of the time values at the endpoints of a cross track are within the time period.*

```
starttime = 35232487.2;
stoptime = 36609898.1;
periodID = SWdeftimeperiod(swathID, starttime, stoptime,
       HDFE_ENDPOINT);
```

FORTRAN	*integer*4 function swdeftmeper(swathid, starttime, stoptime, mode)*	
	*integer*4*	*swathid*
	*real*8*	*starttime*
	*real*8*	*stoptime*
	*integer*4*	*mode*

The equivalent FORTRAN code for the example above is:

```
parameter (HDFE_ENDPOINT=1)
starttime = 35232487.2
stoptime = 36609898.1
```

periodID = swdeftmeper(swathID, starttime, stoptime,   HDFE_ENDPOINT)

Define a Vertical Subset Region

SWdefvrtregion

int32 SWdefvrtregion(int32 *swathID*, int32 *regionID*, char **vertObj*, float64 *range[]*)

swathID	*IN:*	*Swath id returned by SWcreate or SWattach*
regionID	*IN:*	*Region (or period) id from previous subset call*
vertObj	*IN:*	*Dimension or field to subset by*
range	*IN:*	*Minimum and maximum range for subset*

Purpose *Subsets on a* ***monotonic*** *field or contiguous elements of a dimension.*

Return value *Returns the swath region ID if successful or FAIL (-1) otherwise.*

Description *Whereas the SWdefboxregion and SWdeftimeperiod routines perform subsetting along the "Track" dimension, this routine allows the user to subset along any dimension. The region is specified by a set of minimum and maximum values and can represent either a dimension index (case 1) or field value range(case 2) . In the second case, the field must be one-dimensional and the values must be* ***monotonic*** *(strictly increasing or decreasing) in order that the resulting dimension index range be contiguous. (For the current version of this routine, the second option is restricted to fields with number type: INT16, INT32, FLOAT32, FLOAT64.) This routine may be called after SWdefboxregion or SWdeftimeperiod to provide both geographic or time and "vertical" subsetting . In this case the user provides the id from the previous subset call. (This same id is then returned by the function.) This routine may also be called "stand-alone" by setting the region ID to HDFE_NOPREVSUB (-1).*

This routine may be called up to eight times with the same region ID. It this way a region can be subsetted along a number of dimensions.

The SWregioninfo and SWextractregion routines work as before, however because there is no mapping performed between geolocation dimensions and data dimensions the field to be subsetted, (the field specified in the call to SWregioninfo and SWextractregion) must contain the dimension used explicitly in the call to SWdefvrtregion (case 1) or the dimension of the one-dimensional field (case 2).

Example *Suppose we have a field called Pressure of dimension Height (= 10) whose values increase from 100 to1000. If we desire all the elements with values between 500 and 800, we make the call:*

```
range[0] = 500.;
range[1] = 800.;
regionID = SWdefvrtregion(swathID, HDFE_NOPREVSUB, ‘‘Pressure’’,
range);
```

The routine determines the elements in the Height dimension which correspond to the values of the Pressure field between 500 and 800.

If we wish to specify the subset as elements 2 through 5 (0 - based) of the Height dimension, the call would be:

```
range[0] = 2;
range[1] = 5;
regionID = SWdefvrtregion(swathID, HDFE_NOPREVSUB, “DIM:Height”,
range);
```

The “DIM:” prefix tells the routine that the range corresponds to elements of a dimension rather than values of a field.

In this example, any field to be subsetted must contain the Height dimension.

If a previous subset region or period was defined with id, subsetID, that we wish to refine further with the vertical subsetting defined above we make the call:

```
regionID = SWdefvrtregion(swathID, subsetID, “Pressure”, range);
```

The return value, regionID is set equal to subsetID. That is, the subset region is modified rather than a new one created.

We can further refine the subset region with another call to the routine:

```
freq[0] = 1540.3;
freq[1] = 1652.8;
 regionID = SWdefvrtregion(swathID, regionID, “FreqRange”, freq);
```

FORTRAN *integer*4 function swdefvrtreg(swathid, regionid, vertobj, range)*

*integer*4*	*swathid*
*integer*4*	*regionid*
character(*)*	*vertobj*
*real*8*	*range*

The equivalent FORTRAN code for the examples above is:

```
parameter (HDFE_NOPREVSUB=-1)
range(1) = 500.
range(2) = 800.
regionid = swdefvrtreg(swathid, HDFE_NOPREVSUB, “Pressure”, range)
range(1) = 3 ! Note 1-based element numbers
range(2) = 6
```

```
regionid = swdefvrtreg(swathid, HDFE_NOPREVSUB, “DIM:Height”,
range)
```

regionid = swdefvrtreg(swathid, subsetid, “Pressure”, range)

regionid = swdefvrtreg(swathid, regionid, “FreqRange”, freq)

Detach from a Swath Structure

SWdetach

intn SWdetach(int32 *swathID*)

swathID	*IN: Swath id returned by SWcreate or SWattach*
Purpose	*Detaches from swath interface.*
Return value	*Returns SUCCEED (0) if successful or FAIL (-1) otherwise.*
Description	*This routine should be run before exiting from the swath file for every swath opened by SWcreate or SWattach.*
Example	*In this example, we detach the swath structure, ExampleSwath:*

```
status = SWdetach(swathID);
```

FORTRAN *integer function swdetach(swathid)*

*integer*4 swathid*

The equivalent FORTRAN code for the example above is:

```
status = swdetach(swathid)
```

Retrieve Size of Specified Dimension

SWdiminfo

int32 SWdiminfo(int32 *swathID*, char **dimname)*

swathID	*IN:*	*Swath id returned by SWcreate or SWattach*
dimname	*IN:*	*Dimension name*

Purpose *Retrieve size of specified dimension.*

Return value *Size of dimension if successful or FAIL (-1) otherwise. If -1, could signify an improper swath id or dimension name.*

Description *This routine retrieves the size of specified dimension.*

Example *In this example, we retrieve information about the dimension, "GeoTrack":*

```
dimsize = SWdiminfo(swathID, "GeoTrack");
```

The return value, dimsize, will be equal to 2000.

FORTRAN *integer*4 function swdiminfo(swathid,dimname)*

*integer*4*	*swathid*
character(*)*	*dimname*

The equivalent FORTRAN code for the example above is:

```
dimsize = swdiminfo(swathid, "GeoTrack")
```

Duplicate a Region or Period

SWdupregion

int32 SWdupregion(int32 *regionID*)

regionID	*IN: Region or period id returned by SWdefboxregion, SWdeftimeperiod, or SWdefvrtregion.*
Purpose	*Duplicates a region.*
Return value	*Returns new region or period ID if successful or FAIL (-1) otherwise.*
Description	*This routine copies the information stored in a current region or period to a new region or period and generates a new id. It is usefully when the user wishes to further subset a region (period) in multiple ways.*
Example	*In this example, we first subset a swath with SWdefboxregion, duplicate the region creating a new region ID, regionID2, and then perform two different vertical subsets of these (identical) geographic subset regions:*

```
regionID = SWdefboxregion(swathID, cornerlon, cornerlat,
       HDFE_MIDPOINT);
regionID2 = SWdupregion(regionID);
regionID = SWdefvrtregion(swathID, regionID, “Pressure”,
rangePres);
regionID2 = SWdefvrtregion(swathID, regionID2, “Temperature”,
rangeTemp);
```

FORTRAN *integer*4 swdupreg(regionid)*

*integer*4 regionid*

The equivalent FORTRAN code for the example above is:

```
parameter (HDFE_MIDPOINT=0)
regionid = swdefboxreg(swathid, cornerlon, cornerlat,
       HDFE_MIDPOINT)
regionid2 = swdupreg(regionid)
regionid = swdefvrtreg(swathid, regionid, ‘Pressure’,
rangePres)
regionid2 = swdefvrtreg(swathid, regionid2, ‘Temperature’,
rangeTemp)
```

Read Data from a Defined Time Period

SWextractperiod

intn SWextractperiod(int32 *swathID*, int32 *periodID*, char * *fieldname*, int32 *external_mode*, VOIDP *buffer)*

swathID	*IN:*	*Swath id returned by SWcreate or SWattach*
periodID	*IN:*	*Period id returned by SWdeftimeperiod*
fieldname	*IN:*	*Field to subset*
external_mode	*IN:*	*External geolocation mode*
buffer	*OUT:*	*Data buffer*

Purpose *Extracts (reads) from subsetted time period.*

Return value *Returns SUCCEED (0) if successful or FAIL (-1) otherwise.*

Description *This routine reads data into the data buffer from the subsetted time period. Only complete crosstracks are extracted. If the external_mode flag is set to HDFE_EXTERNAL (1) then the geolocation fields and the data field can be in different swaths. If set to HDFE_INTERNAL (0), then these fields must be in the same swath structure.*

Example *In this example, we read data within the subsetted time period defined in SWdeftimeperiod from the Spectra field. Both the geoloction fields and the Spectra data field are in the same swath.*

```
status = SWextractperiod(SWid, periodID, "Spectra",
      HDFE_INTERNAL, datbuf);
```

FORTRAN *integer function swextper(periodid, fieldname, external_mode, buffer)*

*integer*4*	*periodid*
character(*)*	*fieldname*
*integer*4*	*external_mode*
<valid type>	*buffer(*)*

The equivalent FORTRAN code for the example above is:

```
parameter (HDFE_INTERNAL=0)
status = swextper(periodid, "Spectra", HDFE_INTERNAL, datbuf)
```

Read Data from a Geographic Region

SWextractregion

intn SWextractregion(int32 *swathID*, int32 *regionID*, char * *fieldname*, int32 *external_mode,* VOIDP *buffer)*

swathID	*IN:*	*Swath id returned by SWcreate or SWattach*
regionID	*IN:*	*Region id returned by SWdefboxregion*
fieldname	*IN:*	*Field to subset*
external_mode	*IN:*	*External geolocation mode*
buffer	*OUT:*	*Data buffer*

Purpose *Extracts (reads) from subsetted region.*

Return value *Returns SUCCEED (0) if successful or FAIL (-1) otherwise.*

Description *This routine reads data into the data buffer from the subsetted region. Only complete crosstracks are extracted. If the external_mode flag is set to HDFE_EXTERNAL (1) then the geolocation fields and the data field can be in different swaths. If set to HDFE_INTERNAL (0), then these fields must be in the same swath structure.*

Example *In this example, we read data within the subsetted region defined in SWdefboxregion from the Spectra field. Both the geoloction fields and the Spectra data field are in the same swath.*

```
status = SWextractregion(SWid, regionID, "Spectra",
      HDFE_INTERNAL, datbuf);
```

FORTRAN *integer function swextreg(swathid, regionid, fieldname, external_mode, buffer)*

*integer*4*	*swathid*
*integer*4*	*regionid*
character(*)*	*fieldname*
*integer*4*	*external_mode*
<valid type>	*buffer(*)*

The equivalent FORTRAN code for the example above is:

```
parameter (HDFE_INTERNAL=0)
status = swextreg(swathid, regionid, "Spectra",
HDFE_INTERNAL, datbuf)
```

Retrieve Information About a Swath Field

SWfieldinfo

intn SWfieldinfo(int32 *swathID*, char **fieldname*, int32 **rank*, int32 *dims[]*, int32 **numbertype*, char **dimlist*)

swathID	*IN:*	*Swath id returned by SWcreate or SWattach*
fieldlname	*IN:*	*Fieldname*
rank	*OUT:*	*Rank of field*
dims	*OUT:*	*Array containing the dimension sizes of the field*
numbertype	*OUT:*	*Pointer to the numbertype of the field. See Appendix A for interpretation of number types.*
dimlist	*OUT:*	*List of dimensions in field*

Purpose — *Retrieve information about a specific geolocation or data field in the swath.*

Return value — *Returns SUCCEED (0) if successful or FAIL (-1) othwerwise. A typical reason for failure is the specified field does not exist.*

Description — *This routine retrieves information on a specific data field.*

Example — *In this example, we retrieve information about the Spectra data fields:*

```
dimlist = (char *) calloc(UTLSTR_MAX_SIZE, sizeof(char));

status = SWfieldinfo(swathID, "Spectra", &rank, dims,
       numbertype, dimlist);
```

The return parameters will have the following values:

rank=3, numbertype=5, dims[3]={5,4000,2000} and dimlist=”Bands, DataTrack, DataXtrack”

If one of the dimensions in the field is appendable, then the current value for that dimension will be returned in the dims array.

Note: Instead of dynamic memory allocations for dimlist, one can statically allocate memory as “char dimlist[520]. This is because the max number of dimensions in a field is 8, each dimension has maximum length of 64 characters, the dimension names are separated with no more than 7 commas, and there is 1 null character in dimlist.

FORTRAN	*integer function swfldinfo(swathid, fieldname, rank, dims, numbertype, dimlist)*	
	*integer*4*	*swathid*
	character(*)*	*fieldname*
	*integer*4*	*rank*
	integer*4	*dims(*)*
	integer*4	*numbertype*
	character*(*)	*dimlist*

The equivalent FORTRAN code for the example above is:

```
status = swfldinfo(swathid, "Spectra", rank, dims, numbertype,
dimlist)
```

The return parameters will have the following values:

rank=3, numbertype=5, dims[3]={2000,4000,5} and dimlist=”DataXtrack, DataTrack,Bands"

```
      Note that the dimensions array and dimension list are
in FORTRAN order.
```

Retrieve Type of Dimension Mapping when First Dimension is geodim

SWgeomapinfo

intn SWgeomapinfo(int32 *swathID*, char **geodim)*

swathID	*IN:*	*Swath id returned by SWcreate or SWattach*
geodim	*IN:*	*Dimension name*

Purpose — *Retrieve type of dimension mapping for a dimension.*

Return value — *Returns (2) for indexed mapping, (1) for regular mapping, (0) if dimension is not mapped, or FAIL (-1) otherwise.*

Description — *This routine checks the type of mapping (regular or indexed).*

Example — *In this example, we retrieve information about the type of mapping between the "IdxGeo" and "IdxData" dimensions, defined by Swdefidxmap.*

```
Regmap = SWgeomapinfo(swathID, geodim);
```

We will have regmap = 2 for indexed mapping between the "IdxGeo" and "IdxData" dimensions.

NOTE: If the dimension has been mapped regular and indexed, the function will return a value of 3.

FORTRAN — *integer function swgmapinfo(swathid,geodim)*

*integer*4*	*swathid*
character(*)*	*geodim*

The equivalent FORTRAN code for the example above is:

```
status = swgmapinfo(swathid, geodim)
```

Get Dimension Scale for a Dimension of a Field within a Swath

SWgetdimscale

intn SWgetdimscale(int32 *swathID*, char **fieldname*, char **dimname*, int32 **dimsize*, int32 **numbertype*, VOIDP *data*)

swathID	*IN:*	*Swath id returned by SWcreate or SWattach*
fieldname	*IN:*	*Name of the field whose* ***dimname*** *dimension scale is read*
dimname	*IN:*	*The dimension for which scale values are read*
dimsize	*OUT:*	*The size of the dimension to be read*
numbertype	*OUT:*	*The number type of the data stored in the scale. See Appendix A for number types.*
data	*OUT:*	*Values to be read for the dimension scale*

Purpose *Gets dimension scale for a field dimension within the swath.*

Return value *Returns data buffer size if successful or FAIL (-1) otherwise. Typical reason for failure is unknown dimension in the dimension list or none-existing field.*

Description *This routine gets dimension scale for a field dimension within the swath. The dimension scales attributes label, unit, and format can be read using SWgetdimstrs().*

Example *In this example, we get dimension scale for the Bands dimension in the Spectra field, defined using SWsetdimscale() or SWdefdimscale():*

```
intn buffsize;
int32 nbands, ntype;
int32 *bands;

/* First call, with NULL for data buffer, returns */
/* buffersize needed for the data buffer */

buffsize = SWgetdimscale(swathID, "Spectra", "Bands",
                         &nbands, &ntype, NULL);

/* allocate enough buffer for the data */
bands = (int32 *)malloc(buffsize);

buffsize = SWgetdimscale(swathID, "Spectra", "Bands",
                      &nbands, &ntype, (void *)bands);
```

FORTRAN *integer function swgetdimscale(swathid, fieldname, dimname, dimsize, numbertype, data)*

*integer*4*	*swathid*
character(*)*	*fieldname*
character(*)*	*dimname*

*integer*4*	*dimsize*
*integer*4*	*numbertype*
<valid type>	*data(*)*

The equivalent FORTRAN code for the example above is:

```
integer*4     bands(5)
integer*4     nbands, ntype, buffsize

buffsize = swgetdimscale(swathid, "Spectra", "Bands",
                         nbands, ntype, bands);
```

Get Dimension Scale label, unit, and format for a Dimension of a Field within a Swath

SWgetdimstrs

intn SWgetdimstrs(int32 *swathID,* char **fieldname,* char **dimname,* char **label,*

char **unit*, char **format, intn len*)

swathID	*IN:*	*Swath id returned by SWcreate or SWattach*
fieldname	*IN:*	*Name of the field whose* **dimname** *dimension's scale label, unit, and format is set*
dimname	*IN:*	*The dimension for which scale label, unit, and format is set*
label	*OUT:*	*Label that describes this dimension*
unit	*OUT:*	*Unit used with this dimension*
format	*OUT:*	*Format used to display scale*
len	*IN:*	*Maximum string length it is safe to return*

Purpose — *Gets the label, unit, and format strings for a given field dimension within the swath.*

Return value — *Returns SUCCEED (0) if successful or FAIL (-1) otherwise. Typical reason for failure is unknown dimension in the dimension list, or none-existing field.*

Description — *This routine gets the label, unit, and format strings for a given field dimension scale within the swath. It will return empty strings if any has not been set by SWsetdimstrs() or SWdefdimstrs().*

Example — *In this example, we get dimension label, unit, and format for the Bands dimension in the Spectra field:*

char label[15], unit[15], format[15]

intn len = 10

```
status = SWgetdimstrs(swathID, "Spectra", "Bands",
                      label, unit, format, len);
```

FORTRAN — *integer function swgetdimstrs(swathid, fieldname, dimname, label, unit, format)*

*integer*4*	*swathid*	
	character(*)*	*fieldname*
	character(*)*	*dimname*
	character(*)*	*label*
	character(*)*	*unit*

character(*)   format*

The equivalent FORTRAN code for the example above is:

*character*15 label, unit, format*

```
integer len
len = 10
label = ''
unit = ''
format = ''
status = swgetdimstrs(swathid, "Spectra", "Bands",
                      label, unit, format, len);
```

Get Fill Value for a Specified Field

SWgetfillvalue

intn SWgetfillvalue(int32 *swathID*, char **fieldname,* VOIDP *fillvalue)*

swathID	*IN:*	*Swath id returned by SWcreate or SWattach*
fieldname	*IN:*	*Fieldname*
fillvalue	*OUT:*	*Space allocated to store the fill value*

Purpose *Retrieves fill value for the specified field.*

Return value *Returns SUCCEED (0) if successful or FAIL (-1) otherwise. Typical reasons for failure are an improper swath id or number type.*

Description *It is assumed the number type of the fill value is the same as the field.*

Example *In this example, we get the fill value for the "Temperature" field:*

```
status = SWgetfillvalue(swathID, "Temperature", &tempfill);
```

FORTRAN *integer function*

swgetfill(swathid,fieldname,fillvalue)

*integer*4*	*swathid*
character(*)*	*fieldname*
<valid type>	*fillvalue(*)*

The equivalent FORTRAN code for the example above is:

```
status = swgetfill(swathid, "Temperature", tempfill)
```

Retrieve Indexed Geolocation Mapping

SWidxmapinfo

int32 SWidxmapinfo(int32 swathID, char *geodim, char *datadim, int32 index[])

swathID	*IN:*	*Swath id returned by SWcreate or SWattach*
geodim	*IN:*	*Indexed Geolocation dimension name*
datadim	*IN:*	*Indexed Data dimension name*
index	*OUT:*	*Index mapping array*

Purpose *Retrieve indexed array of specified geolocation mapping.*

Return value *Returns size of indexed array if successful or FAIL (-1) otherwise. A typical reason for failure is the specified mapping does not exist.*

Description *This routine retrieves the size of the indexed array and the array of indexed elements of the specified geolocation mapping.*

Example *In this example, we retrieve information about the indexed mapping between the "IdxGeo" and "IdxData" dimensions:*

```
idxsz = SWidxmapinfo(swathID, "IdxGeo", "IdxData", index);
```

The variable, idxsz, will be equal to 5 and index[5] = {0,2,3,6,7}.

FORTRAN *integer*4 function swimapinfo(swathid, geodim, datadim, index)*

*integer*4*	*swathid*
character(*)*	*geodim*
character(*)*	*datadim*
*integer*4*	*index(*)*

The equivalent FORTRAN code for the example above is:

```
status = swimapinfo(swathid, "IdxGeo", "IdxData", index)
```

Retrieve the Indices of a Subsetted Region

SWindexinfo

int32 SWindexinfo(int32 *regionID*, char **object*, int32 **rank*, char **dimlist*, int32 **indices[])*

regionID	*IN:*	*Region ID returned by SWdefboxregion and/or SWdefvrtregion*
object	*IN:*	*Name of field upon which to define indices*
rank	*IN:*	*Rank of field*
dimlist	*IN:*	*The list of data dimensions in field*
indices	*OUT:*	*The array (0-based) containing the indices for start and stop of the region*

Purpose *Retrieve the indices information about a subsetted region*

Return value *Returns SUCCEED (0) if successful or FAIL (-1) otherwise.*

Description *This routine returns the indices information about a subsetted region for a particular field. It retrieves the indices for start and stop of region.*

Example *In this example, we retrieve the indices information about the Longitude field defined by SWdefboxregion:*

```
status = SWindexinfo(regionID, “Longitude”, &rank, dimlist,
      indices);
```

The return parameters will have the following values:

Rank=2, dimlist=”DataTrack, DataXtrack”, and indices[0][0]=4,

indices[0][1]=11, indices[1][0]=0, indices[1][1]=10

FORTRAN *integer*4 function swidxinfo*(regionid, object, rank, dimlist, indices)

*integer*4*	regionid
integer	rank
character(72)*	dimlist
*integer*4*	indices

The equivalent FORTRAN *code for the example above is*

status = swidxinfo(regionid, “Longitude”, rank, dimlist, indices)

The return parameters will have the following values:

rank=2, dimlist=”DataXtrack,DataTrack", and indices(1,1)=0, indices(1,2)=10, indices(2,1)=4, indices(2,2)=11

Note that the indices array and dimension list are in FORTRAN order.

Retrieve Information Swath Attributes

SWinqattrs

int32 SWinqattrs(int32 *swathID*, char **attrlist*, int32 **strbufsize)*

swathID	*IN:*	*Swath id returned by SWcreate or SWattach*
attrlist	*OUT:*	*Attribute list (entries separated by commas)*
strbufsize	*OUT:*	*String length of attribute list*

Purpose *Retrieve information about attributes defined in swath.*

Return value *Number of attributes found if successful or FAIL (-1) otherwise.*

Description *The attribute list is returned as a string with each attribute name separated by commas. If attrlist is set to NULL, then the routine will return just the string buffer size, strbufsize. This variable does not count the null string terminator.*

Example *In this example, we retrieve information about the attributes defined in a swath structure. We assume that there are two attributes stored, attrOne and attr_2:*

```
nattr = SWinqattrs(swathID, NULL, &strbufsize);
```

The parameter, nattr, will have the value 2 and strbufsize will have value 14.

```
nattr = SWinqattrs(swathID, attrlist, &strbufsize);
```

The variable, attrlist, will be set to:

"*attrOne,attr_2*".

FORTRAN *integer*4 function swinqattrs(swathid,attrlist,strbufsize)*

*integer*4*	*swathid*
character(*)*	*attrlist*
*integer*4*	*strbufsize*

The equivalent FORTRAN code for the example above is:

```
nattr = SWinqattrs(swathID, attrlist, strbufsize)
```

Retrieve Information About Data Fields Defined in Swath

SWinqdatafields

int32 SWinqdatafields(int32 *swathID*, char **fieldlist*, int32 *rank[]*, int32 *numbertype[])*

swathID	*IN:*	*Swath id returned by SWcreate or SWattach*
fieldlist	*OUT:*	*Listing of data fields (entries separated by commas)*
rank	*OUT:*	*Array containing the rank of each data field*
numbertype	*OUT:*	*Array containing the numbertype of each data field. See Appendix A for interpretation of number types.*

Purpose *Retrieve information about all of the data fields defined in swath.*

Return value *Number of data fields found if successful or FAIL (-1) otherwise. A typical reason for failure is an improper swath id.*

Description *The field list is returned as a string with each data field separated by commas. The rank and numbertype arrays will have an entry for each field. Output parameters set to NULL will not be returned.*

Example *In this example we retrieve information about the data fields:*

```
nflds = SWinqdatafields(swathID, fieldlist, rank,  numbertype);
```

The parameter, fieldlist, will have the value:

"Spectra" with ndim = 1, rank[1]={3}, numbertype[1]={5}

FORTRAN *integer*4 function swinqdflds(swathid, fieldlist, rank, numbertype)*

*integer*4*	*swathid*
character(*)*	*fieldlist*
*integer*4*	*rank(*)*
integer*4	*numbertype(*)*

The equivalent FORTRAN code for the example above is:

```
nflds = swinqdflds(swathid, fieldlist, rank, numbertype)
```

Retrieve Information About Dimensions Defined in Swath

SWinqdims

int32 SWinqdims(int32 *swathID*, char **dimname*, int32 *dims[])*

swathID	*IN:*	*Swath id returned by SWcreate or SWattach*
dimname	*OUT:*	*Dimension list (entries separated by commas)*
dims	*OUT:*	*Array containing size of each dimension*

Purpose *Retrieve information about all of the dimensions defined in swath.*

Return value *Number of dimension entries found if successful or FAIL (-1) otherwise. A typical reason for failure is an improper swath id.*

Description *The dimension list is returned as a string with each dimension name separated by commas. Output parameters set to NULL will not be returned.*

Example *In this example, we retrieve information about the dimensions defined in the ExampleSwath structure:*

```
ndims = SWinqdims(swathID, dimname, dims);
```

The parameter, *dimname*, will have the value:
"*GeoTrack,GeoXtrack,DataTrack,DataXtrack,Bands,Unlim*"

with ndims = 5, dims[5]={2000,1000,4000,2000,5,0}

FORTRAN *integer*4 function swinqdims(swathid,dimname,dims)*

*integer*4*	*swathid*
character(*)*	*dimname*
*integer*4*	*dims(*)*

The equivalent FORTRAN code for the example above is:

```
ndims = swinqdims(swathid, dimname, dims)
```

Retrieve Information About Geolocation Fields Defined in Swath

SWinqgeofields

int32 SWinqgeofields(int32 *swathID*, char **fieldlist*, int32 *rank[]*, int32 *numbertype[])*

swathID	*IN:*	*Swath id returned by SWcreate or SWattach*
fieldlist	*OUT:*	*Listing of geolocation fields (entries separated by commas)*
rank	*OUT:*	*Array containing the rank of each geolocation field*
numbertype	*OUT:*	*Array containing the numbertype of each geolocation field. See Appendix A for interpretation of number types.*

Purpose *Retrieve information about all of the geolocation fields defined in swath.*

Return value *Number of geolocation fields found if successful or FAIL (-1) otherwise. A typical reason for failure is an improper swath id.*

Description *The field list is returned as a string with each geolocation field separated by commas. The rank and numbertype arrays will have an entry for each field. Output parameters set to NULL will not be returned.*

Example *In this example, we retrieve information about the geolocation fields:*

```
nflds = SWinqgeofields(swathID, fieldlist, rank,   numbertype);
```

The parameter, fieldlist, will have the value: "Longitude,Latitude"with nflds = 2, rank[2]={2,2}, numbertype[2]={5,5}

FORTRAN *integer*4 function swinqgflds(swathid, fieldlist, rank, numbertype)*

*integer*4*	*swathid*
character(*)*	*fieldlist*
*integer*4*	*rank(*)*
integer*4	*numbertype(*)*

The equivalent FORTRAN code for the example above is:

```
nflds = swinqgflds(swathid, fieldlist, rank, numbertype)
```

Retrieve Information About Indexed Mappings Defined in Swath

SWinqidxmaps

int32 SWinqidxmaps(int32 swathID, char *idxmap, int32 idxsizes[])

swathID	*IN:*	*Swath id returned by SWcreate or SWattach*
idxmap	*OUT:*	*Indexed Dimension mapping list (entries separated by commas)*
idxsizes	*OUT:*	*Array containing the sizes of the corresponding index arrays.*

Purpose *Retrieve information about all of the indexed geolocation/data mappings defined in swath.*

Return value *Number of indexed mapping relations found if successful or FAIL (-1) otherwise. A typical reason for failure is an improper swath id.*

Description *The dimension mapping list is returned as a string with each mapping separated by commas. The two dimensions in each mapping are separated by a slash (/). Output parameters set to NULL, will not be returned.*

Example *In this example. we retrieve information about the indexed dimension mappings:*

```
nidxmaps = SWinqidxmaps(swathID, idxmap, idxsizes);
```

The variable, idxmap, will contain the string:

"IdxGeo/IdxData" with nidxmaps = 1 and idxsizes[1]={5}.

FORTRAN *integer*4 function*

swinqimaps(swathid,dimmap,idxsizes)

*integer*4*	*swathid*
character(*)*	*dimmap*
*integer*4*	*idxsizes(*)*

The equivalent FORTRAN code for the example above is:

```
nidxmaps = swinqimaps(swathid, dimmap, idxsizes)
```

Retrieve Information About Dimension Mappings Defined in Swath

SWinqmaps

int32 SWinqmaps(int32 swathID, char *dimmap, int32 offset[], int32 increment[])

swathID	*IN:*	*Swath id returned by SWcreate or SWattach*
dimmap	*OUT:*	*Dimension mapping list (entries separated by commas)*
offset	*OUT:*	*Array containing the offset of each geolocation relation*
increment	*OUT:*	*Array containing the increment of each geolocation relation*

Purpose *Retrieve information about all of the (non-indexed) geolocation relations defined in swath.*

Return value *Number of geolocation relation entries found if successful or FAIL (-1) otherwise. A typical reason for failure is an improper swath id.*

Description *The dimension mapping list is returned as a string with each mapping separated by commas. The two dimensions in each mapping are separated by a slash (/). Output parameters set to NULL will not be returned.*

Example *In this example, we retrieve information about the dimension mappings in the ExampleSwath structure:*

```
nmaps = SWinqmaps(swathID, dimmap, offset, increment);
```

The variable, dimmap, will contain the string: "GeoTrack/DataTrack,GeoXtrack/DataXtrack" with nmaps = 2, offset[2]={0,1} and increment[2]={2,2}.

FORTRAN *integer*4 function*

swinqmaps(swathid,dimmap,offset,increment)

*integer*4*	*swathid*
character(*)*	*dimmap*
*integer*4*	*offset(*)*
*integer*4*	*increment(*)*

The equivalent FORTRAN code for the example above is:

```
nmaps = swinqmaps(swathid, dimmap, offset,  increment)
```

Retrieve Swath Structures Defined in HDF-EOS File

SWinqswath

int32 SWinqswath(char * filename, char *swathlist, int32 *strbufsize)

filename	*IN:*	*HDF-EOS filename*
swathlist	*OUT:*	*Swath list (entries separated by commas)*
strbufsize	*OUT:*	*String length of swath list*

Purpose *Retrieves number and names of swaths defined in HDF-EOS file.*

Return value *Number of swaths found if successful or FAIL (-1) otherwise.*

Description *The swath list is returned as a string with each swath name separated by commas. If swathlist is set to NULL, then the routine will return just the string buffer size, strbufsize. If strbufsize is also set to NULL, the routine returns just the number of swaths. Note that strbufsize does not count the null string terminator.*

Example *In this example, we retrieve information about the swaths defined in an HDF-EOS file, HDFEOS.hdf. We assume that there are two swaths stored, SwathOne and Swath_2:*

```
nswath = SWinqswath(“HDFEOS.hdf”, NULL, &strbufsize);
```

The parameter, nswath, will have the value 2 and strbufsize will have value 16.

```
nswath = SWinqswath(“HDFEOS.hdf”, swathlist, &strbufsize);
```

The variable, swathlist, will be set to:

“SwathOne,Swath_2”.

FORTRAN *integer*4 function swinqswath(filename,swathlist,strbufsize)*

character(*) filename*

character(*) swathlist*

*integer*4* *strbufsize*

The equivalent FORTRAN code for the example above is:

```
nswath = SWinqswath(“HDFEOS.hdf”, swathlist, strbufsize)
```

Retrieve Offset and Increment of Specific Dimension Mapping

SWmapinfo

intn SWmapinfo(int32 swathID, char *geodim, char *datadim, int32 offset,   int32 increment))

swathID	*IN:*	*Swath id returned by SWcreate or SWattach*
geodim	*IN:*	*Geolocation dimension name*
datadim	*IN:*	*Data dimension name*
offset	*OUT:*	*Mapping offset*
increment	*OUT:*	*Mapping increment*

Purpose — *Retrieve offset and increment of specific monotonic geolocation mapping.*

Return value — *Returns SUCCEED (0) if successful or FAIL (-1) otherwise. A typical reason for failure is the specified mapping does not exist.*

Description — *This routine retrieves offset and increment of the specified geolocation mapping.*

Example — *In this example, we retrieve information about the mapping between the GeoTrack and DataTrack dimensions:*

```
status = SWmapinfo(swathID, "GeoTrack", "DataTrack",
      &offset, &increment);
```

The variable offset will be 0 and increment 2.

FORTRAN — *integer function swmapinfo(swathid, geodim, datadim, offset, increment)*

*integer*4*	*swathid*
character(*)*	*geodim*
character(*)*	*datadim*
*integer*4*	*offset*
*integer*4*	*increment*

The equivalent FORTRAN code for the example above is:

```
status = swmapinfo(swathid, "GeoTrack",  "DataTrack",
      offset, increment)
```

Return Number of Specified Objects in a Swath

SWnentries

int32 SWnentries(int32 *swathID*, int32 *entrycode*, int32 **strbufsize)*

swathID	*IN:*	*Swath id returned by SWcreate or SWattach*
entrycode	*IN:*	*Entrycode*
strbufsize	*OUT:*	*String buffer size*

Purpose *Returns number of entries and descriptive string buffer size for a specified entity.*

Return value *Number of entries if successful or FAIL (-1) otherwise. A typical reason for failure is an improper swath id or entry code.*

Description *This routine can be called before an inquiry routines in order to determine the sizes of the output arrays and descriptive strings. The string length does not include the NULL terminator.*

The entry codes are:

HDFE_NENTDIM (0) - Dimensions

HDFE_NENTMAP (1) - Dimension Mappings

HDFE_NENTIMAP (2) - Indexed Dimension Mappings

HDFE_NENTGFLD (3) - Geolocation Fields

HDFE_NENTDFLD (4) - Data Fields

Example *In this example, we determine the number of dimension mapping entries and the size of the map list string.*

```
nmaps = SWnentries(swathID, HDFE_NENTMAP, &bufsz);
```

The return value, nmaps, will be equal to 2 and bufsz = 39

FORTRAN *integer*4 function swnentries(swathid, entrycode, bufsize)*

*integer*4*	*swathid*
*integer*4*	*entrycode*
*integer*4*	*bufsize*

The equivalent FORTRAN code for the example above is:

```
parameter (HDFE_NENTMAP=1)
nmaps = swnentries(swathid, HDFE_NENTMAP, bufsz)
```

Open HDF-EOS File

SWopen

int32 SWopen(char **filename*, intn *access*)

filename	*IN:*	*Complete path and filename for the file to be opened*
access	*IN:*	*DFACC_READ, DFACC_RDWR or DFACC_CREATE*

Purpose *Opens or creates HDF file in order to create, read, or write a swath.*

Return value *Returns the swath file id handle (fid) if successful or FAIL (-1) otherwise.*

Description *This routine creates a new file or opens an existing one, depending on the access parameter.*

Access codes:

DFACC_READ	*Open for read only. If file does not exist, error*
DFACC_RDWR	*Open for read/write. If file does not exist, create it*
DFACC_CREATE	*If file exist, delete it, then open a new file for read/write*

Example *In this example, we create a new swath file named, SwathFile.hdf. It returns the file handle, fid.*

```
fid = SWopen("SwathFile.hdf", DFACC_CREATE);
```

FORTRAN *integer*4 function swopen(filename, access)*

character(*)   filename*

integer access

The access codes should be defined as parameters:

```
parameter (DFACC_READ=1)

parameter (DFACC_RDWR=3)

parameter (DFACC_CREATE=4)
```

The equivalent *FORTRAN* code for the example above is:

```
fid = swopen("SwathFile.hdf", DFACC_CREATE)
```

Note to users of the SDP Toolkit: Please refer to the *SDP Toolkit Users Guide for the EOSDIS Evolution and Development-2 Contract, December, 2017, 333-EED2-001, Revision 01,* Section 6.2.1.2, for information on how to obtain a file name (referred to as a “physical file handle”) from within a PGE. See also Section 9 of this document for code examples.

Return Information About a Defined Time Period

SWperiodinfo

intn SWperiodinfo(int32 *swathID*, int32 *periodID*, char * *fieldname*, int32 **ntype*, int32 **rank*, int32 *dims[]*, int32 **size*)

swathID	*IN:*	*Swath id returned by SWcreate or SWattach*
periodID	*IN:*	*Period id returned by SWdeftimeperiod*
fieldname	*IN:*	*Field to subset*
ntype	*OUT:*	*Number type of field*
rank	*OUT:*	*Rank of field*
dims	*OUT:*	*Dimensions of subset period*
size	*OUT:*	*Size in bytes of subset period*

Purpose *Retrieves information about the subsetted period.*

Return value *Returns SUCCEED (0) if successful or FAIL (-1) otherwise.*

Description *This routine returns information about a subsetted time period for a particular field. It is useful when allocating space for a data buffer for the subset. Because of differences in number type and geolocation mapping, a given time period will give different values for the dimensions and size for various fields.*

Example *In this example, we retrieve information about the time period defined in SWdeftimeperiodfor the Spectra field. We use this to allocate space for data in the subsetted time period.*

```
/* Get size in bytes of time period for "Spectra" field*/
status = SWperiodinfo(SWid, periodID, "Spectra", &ntype, &rank,
dims, &size);
/* Allocate space */
datbuf = (float64 *) malloc(size);
```

FORTRAN *integer function swperinfo(swathid, periodid, fieldname, ntype, rank, dims, size)*

*integer*4*	*swathid*
*integer*4*	*periodid*
character(*)*	*fieldname*
*integer*4*	*ntype*
*integer*4*	*rank*
*integer*4*	*dims(*)*
*integer*4*	*size*

The equivalent FORTRAN code for the example above is:

```
status = swperinfo(swid, periodid, "Spectra", ntype, rank, dims, size)
```

Read Swath Attribute

SWreadattr

intn SWreadattr(int32 *swathID*, char **attrname*, VOIDP *datbuf)*

swathID	*IN:*	*Swath id returned by SWcreate or SWattach*
attrname	*IN:*	*Attribute name*
datbuf	*OUT:*	*Buffer allocated to hold attribute values*

Purpose *Reads attribute from a swath.*

Return value *Returns SUCCEED (0) if successful or FAIL (-1) otherwise. Typical reasons for failure are an improper swath id or number type or incorrect attribute name.*

Description *The attribute is passed by reference rather than value in order that a single routine suffice for all numerical types.*

Example *In this example, we read a single precision (32 bit) floating point attribute with the name "ScalarFloat":*

```
status = SWreadattr(swathID, "ScalarFloat", &f32);
```

FORTRAN *integer function swrdattr(swathid,attrname,datbuf)*

*integer*4*	*swathid*
character(*)*	*attrname*
<valid type>	*datbuf(*)*

The equivalent FORTRAN code for the example above is:

```
parameter (DFNT_FLOAT32=5)
status = swrdattr(swathid, "ScalarFloat", f32)
```

Read Data From a Swath Field

SWreadfield

intn SWreadfield(int32 *swathID*, char **fieldname*, int32 *start[]*, int32 *stride[]*, int32 *edge[]*, VOIDP *buffer)*

swathID	*IN:*	*Swath id returned by SWcreate or SWattach*
fieldname	*IN:*	*Name of field to read*
start	*IN:*	*Array specifying the starting location within each dimension*
stride	*IN:*	*Array specifying the number of values to skip along each dimension*
edge	*IN:*	*Array specifying the number of values to read along each dimension*
buffer	*OUT:*	*Buffer to store the data read from the field*

Purpose *Reads data from a swath field.*

Return value *Returns SUCCEED (0) if successful or FAIL (-1) otherwise. Typical reasons for failure are improper swath id or unknown fieldname.*

Description *The values within start, stride, and edge arrays refer to the swath field (input) dimensions. The output data in buffer is written to contiguously. The default values for start and stride are 0 and 1 respectively and are used if these parameters are set to NULL. The default values for edge are (dim - start) / stride where dim refers is the size of the dimension.*

Example *In this example, we read data from the 10th track (0-based) of the Longitude field.*

```
float32 track[1000];
int32 start[2]={10,1}, edge[2]={1,1000};
status = SWreadfield(swathID, "Longitude", start, NULL,  edge,
track);
```

FORTRAN	*integer function*	
	swrdfld(swathid, fieldname, start, stride, edge,buffer)	
	*integer*4*	*swathid*
	character(*)*	*fieldname*
	*integer*4*	*start(*)*
	*integer*4*	*stride(*)*
	*integer*4*	*edge(*)*
	<valid type>	*buffer(*)*

The *start*, *stride*, and *edge* arrays must be defined explicitly, with the *start* array being 0-based.

The equivalent FORTRAN code for the example above is:

```
real*4 track(1000)
integer*4 start(2), stride(2), edge(2)
start(1) = 0
start(2) = 10
stride(1) = 1
stride(2) = 1
edge(1) = 1000
edge(2) = 1
status = swrdfld(swathid, "Longitude", start, stride, edge,
      track)
```

Define a Longitude-Latitude Box Region for a Swath

SWregionindex

int32 SWregionindex(int32 *swathID*, float64 *cornerlon[]*, float64 *cornerlat[]*,

int32 *mode*, char **geodim*, int32 *idxrange[]*)

swathID	*IN:*	*Swath id returned by SWcreate or SWattach*
cornerlon	*IN:*	*Longitude in decimal degrees of box corners*
cornerlat	*IN:*	*Latitude in decimal degrees of box corners*
mode	*IN:*	*Cross Track inclusion mode*
geodim	*OUT:*	*Geolocation track dimension*
idxrange	*OUT:*	*The indices of the region in the geolocation track dimension.*

Purpose *Defines a longitude-latitude box region for a swath.*

Return value *Returns the swath region ID if successful or FAIL (-1) otherwise.*

Description *The difference between this routine and SWdefboxregion is the geolocation track dimension name and the range of that dimension are returned in addition to a regionID. Other than that difference they are the same function and this function is used just like SWdefboxregion. This routine defines a longitude-latitude box region for a swath. It returns a swath region ID which is used by the SWextractregion routine to read all the entries of a data field within the region. A cross track is within a region if 1) its midpoint is within the longitude-latitude "box" (HDFE_MIDPOINT), or 2) either of its endpoints is within the longitude-latitude "box" (HDFE_ENDPOINT), or 3) any point of the cross track is within the longitude-latitude "box" (HDFE_ANYPOINT), depending on the inclusion mode designated by the user. All elements within an included cross track are considered to be within the region even though a particular element of the cross track might be outside the region. The swath structure must have both Longitude and Latitude (or Colatitude) fields defined*

Example *In this example, we define a region bounded by the 3 degrees longitude, 5 degrees latitude and 7 degrees longitude, 12 degrees latitude. We will consider a cross track to be within the region if its midpoint is within the region.*

```
cornerlon[0] = 3.;
cornerlat[0] = 5.;
cornerlon[1] = 7.;
cornerlat[1] = 12.;
regionID = SWregionindex(swathID, cornerlon, cornerlat,
      HDFE_MIDPOINT, geodim, idxrange);
```

FORTRAN *integer*4 function swregidx(swathid, cornerlon, cornerlat, mode, geodim, idxrange)*

*integer*4*	*swathid*
*real*8*	*cornerlon*
*real*8*	*cornerlat*
*integer*4*	*mode*
character(*)*	*geodim*
*integer*4*	*idxrange*

The equivalent FORTRAN code for the example above is:

```
parameter (HDFE_MIDPOINT=0)
cornerlon(1) = 3.
cornerlat(1) = 5.
cornerlon(2) = 7.
cornerlat(2) = 12.
regionid = swregidx(swathid, cornerlon, cornerlat,
      HDFE_MIDPOINT, geodim, idxrange)
```

Return Information About a Defined Region

SWregioninfo

intn SWregioninfo(int32 *swathID*, int32 *regionID*, char * *fieldname*, int32 **ntype*, int32 **rank*, int32 *dims[]*, int32 **size*)

swathID	*IN:*	*Swath id returned by SWcreate or SWattach*
regionID	*IN:*	*Region id returned by SWdefboxregion*
fieldname	*IN:*	*Field to subset*
ntype	*OUT:*	*Number type of field*
rank	*OUT:*	*Rank of field*
dims	*OUT:*	*Dimensions of subset region*
size	*OUT:*	*Size in bytes of subset region*

Purpose *Retrieves information about the subsetted region.*

Return value *Returns SUCCEED (0) if successful or FAIL (-1) otherwise.*

Description *This routine returns information about a subsetted region for a particular field. It is useful when allocating space for a data buffer for the region. Because of differences in number type and geolocation mapping, a given region will give different values for the dimensions and size for various fields.*

Example *In this example, we retrieve information about the region defined in SWdefboxregion for the Spectra field. We use this to allocate space for data in the subsetted region.*

```
/* Get size in bytes of region for "Spectra" field*/
status = SWregioninfo(SWid, regionID, "Spectra", &ntype, &rank,
dims, &size);
/* Allocate space */
datbuf = (float64 *) malloc(size);
```

FORTRAN *integer function swreginfo(swathid, regionid, fieldname, ntype, rank, dims, size)*

*integer*4*	*swathid*
*integer*4*	*regionid*
character(*)*	*fieldname*
*integer*4*	*ntype*
*integer*4*	*rank*
*integer*4*	*dims(*)*
*integer*4*	*size*

The equivalent FORTRAN code for the example above is:

```
status = swreginfo(swid, regionid, "Spectra", ntype, rank,
      dims, size)
```

Set Dimension Scale for a Dimension of a Field or Fields within a Swath

SWsetdimscale

intn SWsetdimscale(int32 *swathID,* char **fieldname,* char **dimname,* int32 *dimsize,*
int32 *numbertype,* VOIDP *data*)

SWdefdimscale

intn SWdefdimscale(int32 *swathID,* char **dimname,* int32 *dimsize,*
int32 *numbertype*, VOIDP *data*)

swathID	*IN:*	*Swath id returned by SWcreate or SWattach*
fieldname	*IN:*	*Name of the field whose* **dimname** *dimension scale is set*
dimname	*IN:*	*The dimension for which scale is set in the field*
dimsize	*IN:*	*The size of the dimension for which dimension is set*
numbertype	*IN:*	*The number type of the data stored in the scale. See Appendix A for number types.*
data	*IN:*	*Values to be written to the dimension scale*

Purpose *SWsetdimscale() sets dimension scale for a field dimension within the swath. SWdefdimscale() sets dimension scale for a dimension of all fields within the swath.*

Sets dimension scale for a field dimension within the swath.

Return value *Returns SUCCEED (0) if successful or FAIL (-1) otherwise. Typical reason for failure is unknown dimension in the dimension list, none-existing field, or having the same dimension set before.*

Description *These routines set dimension scale for a field dimension within the swath. Once the dimension scale is set user can write label, unit, and format attributes to it using SWsetdimstrs() or SWdefdimstrs(). Please note that in hdf-eos2 both routines have similar end results for defining dimension scale for a dimension. The SWsetdimscale() should run faster, but requires user's knowledge of at least one field name that has used the specified dimension.*

Example 1 *In this example, we set dimension scale for the "Bands" dimension in the Spectra field, defined by:*

```
status = SWdefdatafield(swathID, "Spectra",
"Bands,DataTrack,DataXtrack", DFNT_FLOAT32, HDFE_AUTOMERGE);

int32 bands[5] = {1,3,6,7,8};
int32 nbands = 5;
status = SWsetdimscale(swathID, "Spectra", "Bands",
                        nbands, DFNT_INT32, bands);
```

FORTRAN *integer function swsetdimscale(swathid, fieldname, dimname, dimsize, numbertype, data)*

*integer*4*	*swathid*
character(*)*	*fieldname*
character(*)*	*dimname*
*integer*4*	*dimsize*
*integer*4*	*numbertype*
<valid type>	*data(*)*

The equivalent FORTRAN code for the example above is:

```
integer*4     bands(5)
integer*4     nbands
integer       DFNT_INT32
parameter    (DFNT_INT32 = 24)
nbands = 5
bands(1) = 1
bands(2) = 3
bands(3) = 6
bands(4) = 7
bands(5) = 8
status = swsetdimscale( swathid, "Spectra", "Bands",
                        nbands, DFNT_INT32, bands);
```

Example 2 *In this example, we set dimension scale for the "Bands" dimension in all fields, defined by* `SWdefdatafield() in the swath:`

```
int32 bands[5] = {1,3,6,7,8};
int32 nbands = 5;
status = SWdefdimscale(swathID, "Bands",
                       nbands, DFNT_INT32, bands);
```

FORTRAN *integer function swdefdimscale(swathid, dimname, dimsize, numbertype, data)*

*integer*4*	*swathid*
character(*)*	*dimname*
*integer*4*	*dimsize*
*integer*4*	*numbertype*
<valid type>	*data(*)*

The equivalent FORTRAN code for the example above is:

```
integer*4   bands(5)
integer*4   nbands
integer     DFNT_INT32
parameter   (DFNT_INT32 = 24)
nbands = 5
bands(1) = 1
bands(2) = 3
bands(3) = 6
bands(4) = 7
bands(5) = 8
status = swdefdimscale( swathid, "Bands",
                        nbands, DFNT_INT32, bands);
```

Set Dimension Scale label, unit, and format for a Dimension of a Field or Fields within a Swath

SWsetdimstrs

intn SWsetdimstrs(int32 *swathID,* char **fieldname,* char **dimname,*

char **label,* char **unit,* char **format*)

SWdefdimstrs

intn SWdefdimstrs(int32 *swathID,* char **dimname,* char **label,* char **unit,* char **format*)

swathID	*IN:*	*Swath id returned by SWcreate or SWattach*
fieldname	*IN:*	*Name of the field whose* **dimname** *dimension's scale label, unit, and format is set*
dimname	*IN:*	*The dimension for which scale label, unit, and format is set*
label	*IN:*	*Label that describes this dimension*
unit	*IN:*	*Unit to be used with this dimension*
format	*IN:*	*Format to be used to display scale*

Purpose *SWsetdimstrs() sets the label, unit, and format strings for a given field dimension within the swath.*

SWdefdimstrs() sets the label, unit, and format strings for a given dimension in for all fields within the swath.

Return value *Returns SUCCEED (0) if successful or FAIL (-1) otherwise. Typical reason for failure is unknown dimension in the dimension list, or none-existing field.*

Description *These routines set the label, unit, and format strings for a given dimension scale of a field or fields within the swath. They are called after setting the dimension scale using SWsetdimscale() or SWdefdimscale().*

Example 1 *In this example, we set dimension label, unit, and format for the "Bands" dimension in the Spectra field:*

```
status = SWsetdimstrs(swathID, "Spectra", "Bands",
                              "Bands Dim", "None", "I2");
```

FORTRAN *integer function swsetdimstrs(swathid, fieldname, dimname, label, unit, format)*

*integer*4*	*swathid*
character(*)*	*fieldname*
character(*)*	*dimname*
character(*)*	*label*
character(*)*	*unit*

character(*)   format*

The equivalent FORTRAN code for the example above is:

```
status = swsetdimstrs(swathid, "Spectra", "Bands",
                      “Bands Dim”, “None”, “I2”);
```

Example 2   *In this example, we set dimension label, unit, and format for the “Bands” dimension for all fields in the swath:*

```
status = SWdefdimstrs(swathID, "Bands",
                      “Bands Dim”, “None”, “I2”);
```

FORTRAN   *integer function swdefdimstrs(swathid, dimname, label, unit, format)*

*integer*4 swathid*

character(*) dimname*

character(*) label*

character(*) unit*

character(*) format*

The equivalent FORTRAN code for the example above is:

```
status = swdefdimstrs(swathid, "Bands",
                     ‘‘Bands Dim’’, ‘‘None’’, ‘‘I2’’);
```

***Note:** There are no specific values for "format" string. It depends on the range or type of the dimension scale values. For example if the dimension scale values are 5 digit integers, one may use I5, or if they are floating numbers with 2 digit after decimal point one may use something like F6.2*

The HDF4 Users Guide quote on "format" :

"Formats describe the form numeric values will be printed and/or displayed. The recommended convention is to use standard Fortran-77 notation for describing the data format. For example,"F7.2" means to display seven digits with two digits to the right of the decimal point"

Set Fill Value for a Specified Field

SWsetfillvalue

intn SWsetfillvalue(int32 *swathID*, char **fieldname*, VOIDP *fillvalue)*

swathID	*IN:*	*Swath id returned by SWcreate or SWattach*
fieldname	*IN:*	*Fieldname*
fillvalue	*IN:*	*Pointer to the fill value to be used*

Purpose *Sets fill value for the specified field.*

Return value *Returns SUCCEED (0) if successful or FAIL (-1) otherwise. Typical reasons for failure are an improper swath id or number type.*

Description *The fill value is placed in all elements of the field which have not been explicitly defined. The field must have 2 or more dimensions.*

Example *In this example, we set a fill value for the "Temperature" field:*

```
tempfill = -999.0;
status = SWsetfillvalue(swathID, "Temperature", &tempfill);
```

FORTRAN *integer function*

swsetfill(swathid,fieldname,fillvalue)

*integer*4*	*swathid*
character(*)*	*fieldname*
<valid type>	*fillvalue(*)*

The equivalent FORTRAN code for the example above is:

```
tempfill = -999.0;
status = swsetfill(swathid, "Temperature", -999.0)
```

Update Map Index for a Specified Region

SWupdateidxmap

int32 SWupdateidxmap(int32 swathID, int32 regionID, int32 indexin[], int32 indexout[], int32 indices[z])

swathID	*IN:*	*Swath id returned by SWcreate or SWattach.*
regionID	*IN:*	*Region id returned by Swdefboxregion.*
indexin	*IN:*	*The array containing the indices of the data dimension to which each geolocation element corresponds.*
indexout	*OUT:*	*The array containing the indices of the data dimension to which each geolocation corresponds in the subsetted region. The indexout set to NULL, will not be returned.*
indices	*OUT:*	*The array containing the indices for start and stop of region.*

Purpose *Retrieve indexed array of specified geolocation mapping for a specified region.*

Return value *Returns size of updated indexed array if successful or FAIL (-1) otherwise. A typical reason for failure is the specified mapping does not exist.*

Description *This routine retrieves the size of the indexed array and the array of indexed elements of the specified geolocation mapping for the specified region.*

Example *In this example, we retrieve information about the indexed mapping between the “IdxGeo” and “IdxData” dimensions, defined by Swdefboxregion:*

```
/* Get size of index_region array */
idxsz = SWupdateidxmap(swathID, regionID, index, NULL, indices);
/* Allocate memory for index_region */
index_region = (int32*)malloc(sizeof(int32) * idxsz);
/* Get the array index_region */
idxsz = Swupdateidxmap(swathID, regionID, index, index_region, indices);
```

FORTRAN

```
integer*4 function swupimap(swathid, regionid, indexin, indexout)
integer*4 swathid
integer*4 regionid
integer*4 indexin(*)
integer*4 indexout(*)
integer*4 indices(2)
```

The equivalent FORTRAN code for the example above is:
status = swupdateidxmap(swathid, regionid, index, index_region, indices)

Note: The indexed arrays should be 0-based.

Write/Update Swath Attribute

SWwriteattr

intn SWwriteattr(int32 *swathID*, char **attrname*, int32 *ntype*, int32 *count*, VOIDP *datbuf)*

swathID	*IN:*	*Swath id returned by SWcreate or SWattach*
attrname	*IN:*	*Attribute name*
ntype	*IN:*	*Number type of attribute*
count	*IN:*	*Number of values to store in attribute*
datbuf	*IN:*	*Attribute values*

Purpose — *Writes/Updates attribute in a swath.*

Return value — *Returns SUCCEED (0) if successful or FAIL (-1) otherwise. Typical reasons for failure are an improper swath id or number type.*

Description — *If the attribute does not exist, it is created. If it does exist, then the value(s) is (are) updated. The attribute is passed by reference rather than value in order that a single routine suffice for all numerical types. Because of this a literal numerical expression should not be used in the call.*

Example — *In this example, we write a single precision (32 bit) floating point number with the name "ScalarFloat" and the value 3.14:*

```
f32 = 3.14;
status = SWwriteattr(swathid, "ScalarFloat", DFNT_FLOAT32,
      1, &f32);
```

We can update this value by simply calling the routine again with the new value:

```
f32 = 3.14159;
status = SWwriteattr(swathid, "ScalarFloat", DFNT_FLOAT32,
      1, &f32);
```

FORTRAN — *integer function swwrattr(swathid, attrname, ntype, count, datbuf)*

*integer*4*	*swathid*
character(*)*	*attrname*
*integer*4*	*ntype*
*integer*4*	*count*
<valid type>	*datbuf(*)*

The equivalent FORTRAN code for the first example above is:

```
parameter (DFNT_FLOAT32=5)
f32 = 3.14
status = swwrattr(swathid, "ScalarFloat", DFNT_FLOAT32, 1, f32)
```

Write Field Metadata for an Existing Swath Data Field

SWwritedatameta

intn SWwritedatameta(int32 *swathID*, char **fieldname*, char **dimlist*, int32 *numbertype*)

swathID	*IN:*	*Swath id returned by SWcreate or SWattach*
fieldname	*IN:*	*Name of field*
dimlist	*IN:*	*The list of data dimensions defining the field*
numbertype	*IN:*	*The number type of the data stored in the field. See Appendix A for number types.*

Purpose *Writes field metadata for an existing swath data field.*

Return value *Returns SUCCEED (0) if successful or FAIL (-1) otherwise. Typical reason for failure is unknown dimension in the dimension list.*

Description *This routine writes field metadata for an existing data field. This is useful when the data field was defined without using the swath API. Note that any entries in the dimension list must be defined through the SWdefdim routine before this routine is called.*

Example *In this example we write the metadata for the "Band_1" data field used in the swath.*

```
status = SWwritedatameta(swathID, "Band_1", "GeoTrack,
      GeoXtrack", DFNT_FLOAT32);
```

FORTRAN *integer function*

swwrdmeta(swathid,fieldname,dimlist,numbertype)

*integer*4*	*swathid*
character(*)*	*fieldname*
character(*)*	*dimlist*
*integer*4*	*numbertype*

The equivalent FORTRAN code for the example above is:

```
status = swwrdmeta(swathID, "Band_1", "GeoXtrack, GeoTrack",
      DFNT_FLOAT32)
```

The dimensions are entered in FORTRAN order with the first dimension being incremented first.

Write Data to a Swath Field

SWwritefield

intn SWwritefield(int32 *swathID*, char **fieldname*, int32 *start[]*, int32 *stride[]*, int32 *edge[]*, VOIDP *data)*

swathID	*IN:*	*Swath id returned by SWcreate or SWattach*
fieldname	*IN:*	*Name of field to write*
start	*IN:*	*Array specifying the starting location within each dimension (0-based)*
stride	*IN:*	*Array specifying the number of values to skip along each dimension*
edge	*IN:*	*Array specifying the number of values to write along each dimension*
data	*IN:*	*Values to be written to the field*

Purpose *Writes data to a swath field.*

Return value *Returns SUCCEED (0) if successful or FAIL (-1) otherwise. Typical reasons for failure are an improper swath id or unknown fieldname.*

Description *The values within start, stride, and edge arrays refer to the swath field (output) dimensions. The input data in the data buffer is read from contiguously. The default values for start and stride are 0 and 1 respectively and are used if these parameters are set to NULL. The default values for edge are (dim - start) / stride where dim refers is the size of the dimension. It is the users responsibility to make sure the data buffer contains sufficient entries to write to the field. Note that the data buffer for a compressed field must be the size of the entire field as incremental writes are not supported by the underlying HDF routines.*

Example *In this example, we write data to the Longitude field.*

```
float32 longitude [2000][1000];
/* Define elements of longitude array */
status = SWwritefield(swathID, "Longitude", NULL, NULL,  NULL,
longitude);
```

We now update Track 10 (0 - based) in this field:

```
float32 newtrack[1000];
int32 start[2]={10,0}, edge[2]={1,1000};
/* Define elements of newtrack array */
status = SWwritefield(swathID, "Longitude", start, NULL, edge,
newtrack);
```

FORTRAN	*integer function*
	swwrfld(swathid,fieldname,start,stride,edge,data)

*integer*4*	*swathid*
character(*)*	*fieldname*
*integer*4*	*start(*)*
*integer*4*	*stride(*)*
*integer*4*	*edge(*)*
<valid type>	*data(*)*

The start, stride, and edge arrays must be defined explicitly, with the start array being 0-based.

The equivalent FORTRAN code for the example above is:

```
real*4 longitude(1000,2000)
integer*4 start(2), stride(2), edge(2)
start(1) = 0
start(2) = 10
stride(1) = 1
stride(2) = 1
edge(1) = 1000
edge(2) = 2000
status = swwrfld(swathid, "Longitude", start, stride, edge,
longitude)
```

We now update Track 10 (0 - based) in this field:

```
real*4 newtrack(1000)
integer*4 start(2), stride(2), edge(2)
start(1) = 10
start(2) = 0
stride(1) = 1
stride(2) = 1
edge(1) = 1000
edge(2) = 1
status = swwrfld(swathid, "Longitude", start, stride, edge,
newtrack)
```

Write Field Metadata to an Existing Swath Geolocation Field

SWwritegeometa

intn SWwritegeometa(int32 *swathID*, char **fieldname,* char **dimlist*, int32 *numbertype*)

swathID	*IN:*	*Swath id returned by SWcreate or SWattach*
fieldname	*IN:*	*Name of field*
dimlist	*IN:*	*The list of geolocation dimensions defining the field*
numbertype	*IN:*	*The number type of the data stored in the field. See Appendix A for number types.*

Purpose *Writes field metadata for an existing swath geolocation field.*

Return value *Returns SUCCEED (0) if successful or FAIL (-1) otherwise. Typical reason for failure is unknown dimension in the dimension list.*

Description *This routine writes field metadata for an existing geolocation field. This is useful when the data field was defined without using the swath API. Note that any entries in the dimension list must be defined through the SWdefdim routine before this routine is called.*

Example *In this example we write the metadata for the "Latitude" geolocation field used in the swath.*

```
status = SWwritegeometa(swathID, "Latitude",
       "GeoTrack,GeoXtrack",DFNT_FLOAT32);
```

FORTRAN *integer function*

swwrgmeta(swathid,fieldname,dimlist,numbertype)

*integer*4*	*swathid*
character(*)*	*fieldname*
character(*)*	*dimlist*
*integer*4*	*numbertype*

The equivalent FORTRAN code for the example above is:

```
status = swwrgmeta(swathID, "Latitude",
       "GeoXtrack,GeoTrack",DFNT_FLOAT32)
```

The dimensions are entered in FORTRAN order with the first dimension being incremented first.

2.1.3 Grid Interface Functions

This section contains an alphabetical listing of all the functions in the Grid interface. The functions are alphabetized based on their C-language names.

Attach to an Existing Grid Structure

GDattach

int32 GDattach(int32 *fid*, char **gridname*)

fid	*IN:*	*Grid file id returned by GDopen*
gridname	*IN:*	*Name of grid to be attached*

Purpose *Attaches to an existing grid within the file.*

Return value *Returns the grid handle(gridID) if successful or FAIL(-1) otherwise. Typical reasons for failure are improper grid file id or grid name.*

Description *This routine attaches to the grid using the gridname parameter as the identifier.*

Example *In this example, we attach to the previously created grid, "ExampleGrid", within the HDF file, GridFile.hdf, referred to by the handle, fid:*

```
gridID = GDattach(fid, "ExampleGrid");
```

The grid can then be referenced by subsequent routines using the handle, gridID.

FORTRAN *integer*4 function gdattach(fid, gridname)*

*integer*4*	*fid*
character*(*)	*gridname*

The equivalent *FORTRAN* code for the example above is:

```
gridid = gdattach(fid, "ExampleGrid")
```

`Note:` If unlike the above example user defines a gridname string and then copies the actual name into that string, then it is suggested that user initialize every single character in the gridname string in their code to "'\0'", before copying gridname into this string [before passing the string into GDattach()]. If user is getting the grid name from another call, then user must initialize the gridname string before that call. Failing to do this may result in having some random characters in the gridname and, therefore, failing of GDattach().

Return Information About a Grid Attribute

GDattrinfo

intn GDattrinfo(int32 *gridID*, char **attrname*, int32 * *numbertype*, int32 **count*)

gridID	*IN:*	*Grid id returned by GDcreate or GDattach*
attrname	*IN:*	*Attribute name*
numbertype	*OUT:*	*Number type of attribute. See Appendix A for interpretation of number types.*
count	*OUT:*	*Number of total bytes in attribute*

Purpose *Returns information about a grid attribute*

Return value *Returns SUCCEED (0) if successful or FAIL (-1) otherwise.*

Description *This routine returns number type and number of elements (count) of a grid attribute.*

Example *In this example, we return information about the ScalarFloat attribute.*

```
status = GDattrinfo(pointID, "ScalarFloat",&nt,&count);
```

The nt variable will have the value 5 and count will have the value 4.

FORTRAN *integer function gdattrinfo(gridid, attrname, ntype, count,)*

*integer*4*	*gridid*
character(*)*	*attrname*
*integer*4*	*ntype*
*integer*4*	*count*

The equivalent FORTRAN code for the first example above is:

```
status = gdattrinfo(pointid, "ScalarFloat",nt,count)
```

Write Block SOM Offset

GDblkSOMoffset

intn GDblkSOMoffset(int32 *gridID*, int32 *offset[]*, int32 *count*, char **code)*

gridID	*IN:*	*Grid id returned by GDcreate or GDattach*
offset	*IN:*	*Offset values for SOM Projection data*
count	*IN:*	*Number of offset values to write*
code	*IN:*	*Write/Read code*

Purpose — *Write block SOM offset values.*

Return value — *Returns SUCCEED(0) if successful or FAIL(-1) otherwise.*

Description — *The routine supports structures that contain data which has been written in the Solar Oblique Mercator (SOM) projection. The structure can contain one to many blocks, each with corner points defined by latitude and longitude. The routine can only be used by grids that use the SOM projection. The routine writes the offset values, in pixels, from a standard SOM projection. Their is an offset value for every block in the grid except for the first block. The count parameter is used as a check for the number of offset values. This routine will also return the offset values, but the user must know how large the offset array needs to be before calling the function, in that case the code value would be "r" and the count parameter has to be provided also.*

Example — *In this example, we first show how the SOM projection is defined using GDdefproj, then we show how the SOM projection is modified using GDblkSOMoffset:*

The first parameter is the Grid id, the second is the projection code for the SOM projection, the third is the zone code, not needed for the SOM projection, the fourth is the sphere code, not needed for the SOM projection and the last parameter is the projection parameter array. Each projection supported by the Grid interface has a unique set of variables that are used by the GCTP library and they are passed to the GCTP library through this array. As you can see below, the twelfth parameter is set to a non-zero value, it is set to the size of the number of blocks in the data field. This is required if the function GDblkSOMoffset is going to be called. The GCTP library doesn't use the this parameter for the SOM projection so that is used by the HDF-EOS library only. The GDblkSOMoffset function checks that parameter first before anything else is done.

projparm[0] = 6378137.0;

projparm[1] = 0.006694348;

projparm[3] = EHconvAng(98.161, HDFE_DEG_DMS);

projparm[4] = EHconvAng(87.11516945924, HDFE_DEG_DMS);

*projparm[8] = 0.068585416 * 1440;*

projparm[9] = 0.0;

projparm[11] = 6;

status = GDdefproj(GDid_som, GCTP_SOM, NULL, NULL, projparm);

Now that the projection has been defined, GDblkSOMoffset can be called:

offset[5] = {5, 10, 12, 8, 2};

count = 5;

code = "w";

```
status = GDblkSOMoffset(gridID, offset, count, code);
```

This set the offset for the second block to 5 pixels, the third block to 10 pixels, fourth block to 12 pixels, fifth to 8 pixels and the sixth block to 2 pixels.

NOTE: *This routine is currently implemented in "C" only. If the need arises, a FORTRAN function will be added.*

Interblock subsetting is not currently supported by the ECS Science Data Server, at this time. That is, a response to a request to return data contained within a specified latitude/longitude box, will be in an integral number of blocks.

Related Documents

An Album of Map Projections, USGS Professional Paper 1453, Snyder and Voxland, 1989

Map Projections - A Working Manual, USGS Professional Paper 1395, Snyder, 1987

Close an HDF-EOS File

GDclose

intn GDclose(int32 *fid*)

fid	*IN:*	*Grid file id returned by GDopen*

Purpose *Closes file.*

Return value *Returns SUCCEED(0) if successful or FAIL(-1) otherwise.*

Description *This routine closes the HDF grid file.*

Example

```
status = GDclose(fid);
```

FORTRAN *integer function gdclose(int32 fid)*

*integer*4* *fid*

The equivalent FORTRAN code for the example above is:

```
status = gdclose(fid)
```

Retrieve Compression Information for Field

GDcompinfo

intn GDcompinfo(int32 *gridID*, char **fieldname*, int32 **compcode*, intn *compparm[]*)

gridID	*IN:*	*Grid id returned by GDcreate or GDattach*
fieldname	*IN:*	*Fieldname*
compcode	*OUT:*	*HDF compression code*
compparm	*OUT:*	*Compression parameters*

Purpose *Retrieves compression information about a field.*

Return value *Returns SUCCEED(0) if successful or FAIL(-1) otherwise.*

Description *This routine returns the compression code and compression parameters for a given field. . If the field is not compressed compression code returned will be HDFE_COMP_NONE.*

Example *To retrieve the compression information about the Opacity field defined in the GDdefcomp section:*

```
status = GDcompinfo(gridID, “Opacity”, compcode, compparm);
```

The compcode parameter will be set to 4 and compparm[0] to 5.

FORTRAN *integer function gdcompinfo(gridid,fieldname compcode, compparm)*

*integer*4* *gridid*

character(*)* *fieldname*

*integer*4* *compcode*

integer *compparm*

The equivalent FORTRAN code for the example above is:

```
status = gdcompinfo(gridid, ‘Opacity’, compcode, compparm)
```

The compcode parameter will be set to 4 and compparm(1) to 5.

Note for SZIP compression:

compcode: HDFE_COMP_SZIP = 5

compparm[0]: an even number between 2 and 32 indicating pixels per block

compparm[1]: SZ_EC = 4 (Entropy Coding (EC) Method)

SZ_NN = 32 (Nearest Neighbour + Entropy Coding (EC) Method)

Create a New Grid Structure

GDcreate

int32 GDcreate(int32 *fid*, char **gridname*, int32 *xdimsize*, int32 *ydimsize*, float64 *upleftpt[]*, float64 *lowrightpt[]*)

fid	*IN:*	*Grid file id returned by GDopen*
gridname	*IN:*	*Name of grid to be created*
xdimsize	*IN:*	*Number of columns in grid*
ydimsize	*IN:*	*Number of rows in grid*
upleftpt	*IN:*	*Location, of upper left corner of the upper left pixel*
lowrightpt	*IN:*	*Location, of lower right corner of the lower right pixel*

Purpose *Creates a grid within the file.*

Return value *Returns the grid handle(gridID) or FAIL(-1) otherwise.*

Description *The grid is created as a Vgroup within the HDF file with the name gridname and class GRID. This routine establishes the resolution of the grid, ie, the number of rows and columns, and it's location within the complete global projection through the upleftpt and lowrightpt arrays. These arrays should be in meters for all GCTP projections other than the Geographic Projection and EASE grid, which should be in packed degree format. q.v. below.*

Example *In this example, we create a UTM grid bounded by 54 E to 60 E longitude and 20 N to 30 N latitude. We divide it into 120 bins along the x-axis and 200 bins along the y-axis*

```
uplft[0]=210584.50041;
uplft[1]=3322395.95445;
lowrgt[0]=813931.10959;
lowrgt[1]=2214162.53278;
xdim=120;
ydim=200;
gridID = GDcreate(fid, "UTMGrid", xdim, ydim, uplft, lowrgt);
```

The grid structure is then referenced by subsequent routines using the handle, gridID.

The xdim and ydim values are referenced in the field definition routines by the reserved dimensions: XDim and YDim.

For the Polar Stereographic, Goode Homolosine and Lambert Azimuthal projections, we have established default values in the case of an entire hemisphere for the first projection, the entire globe for the second and the entire polar or equitorial projection for the third. Thus, if we have a Polar Stereographic projection of the Northern Hemisphere then the uplft and lowrgt arrays can be replaced by NULL in the function call.

In the case of the Geographic projection (linear scale in both longitude latitude), and EASE grid (i.e., BCEA projection) the upleftpt and lowrightpt arrays contain the longitude and latitude of these points in packed degree format (DDDMMMSSS.SS).

Note:

upleftpt - *Array that contains the X-Y coordinates of the upper left corner of the upper left pixel of the grid. First and second elements of the array contain the X and Y coordinates respectively. The upper left X coordinate value should be the lowest X value of the grid. The upper left Y coordinate value should be the highest Y value of the grid.*

lowrightpt - *Array that contains the X-Y corrdinates of the lower right corner of the lower right pixel of the grid. First and second elements of the array contain the X and Y coordinates respectively. The lower right X coordinate value should be the highest X value of the grid. The lower right Y coordinate value should be the lowest Y value of the grid.*

If the projection id geographic (i.e., projcode=0) or Behrmann Cylindrical equal Area (i.e., projcode = GCTP_BCEA = 98) then the X-Y coordinates should be specified in degrees/minutes/seconds (DDDMMMSSS.SS) format. The first element of the array holds the longitude and the second element holds the latitude. For geographic latitudes are from -90 to +90 and longitudes are from -180 to +180 (west is negative). For EASE grid latitudes are from –86.72 to +86.72 and longitudes are from –180 to +180.

For all other projection types the X-Y coordinates should be in ***meters*** *in double precision. These coordinates have to be computed using the* ***GCTP*** *software with the same projection parameters that have been specified in the* ***projparm*** *array. For UTM projections use the same zone code and its sign (positive or negative) while computing both upper left and lower right corner X-Y coordinates irrespective of the hemisphere.*

To convert lat/long to x-y coordinates, it is also possible to use SDP Toolkit routines: PGS_GCT_Init() or PGS_GCT_Proj(). More information is contained in the SDP Toolkit Users Guide for the ECS Project

FORTRAN	*integer*4 function gdcreate(fid, gridname, xdimsize, ydimsize, upleftpt, lowrightpt)*	
	*integer*4*	*fid*
	character(*)*	*gridname*
	*integer*4*	*xdimsize*
	*interger*4*	*ydimsize*
	*real*8*	*upleftpt*
	*real*8*	*lowrightpt*

The equivalent *FORTRAN* code for the example above is:

```
gridid = gdcreate(fid, "UTMGrid", xdim, ydim, uplft,
       lowrgt)
```

The default values for the Polar Stereographic and Goode Homolosine can be designated by setting all elements in the uplft and lowrgt arrays to 0.

Define Region of Interest by Latitude/Longitude

GDdefboxregion

int32 GDdefboxregion(int32 gridID, float64 cornerlon[], float64 cornerlat[])

gridID	*IN:*	*Grid id returned by GDcreate or GDattach*
cornerlon	*IN:*	*Longitude in decimal degrees of box corners*
cornerlat	*IN:*	*Latitude in decimal degrees of box corners*

Purpose — *Defines a longitude-latitude box region for a grid.*

Return value — *Returns the grid region ID if successful or FAIL (-1) otherwise.*

Description — *This routine defines a longitude-latitude box region for a grid. It returns a grid region ID which is used by the GDextractregion routine to read all the entries of a data field within the region.*

Example — *In this example, we define the region to be the first quadrant of the Northern hemisphere.*

```
cornerlon[0] = 0.;
cornerlat[0] = 90.;
cornerlon[1] = 90.;
cornerlat[1] = 0.;
regionID = GDdefboxregion(GDid, cornerlon, cornerlat);
```

FORTRAN — *integer*4 function gddefboxreg(gridid, cornerlon, cornerlat)*

*integer*4 gridid*

*real*8 cornerlon*

*real*8 cornerlat*

The equivalent FORTRAN code for the example above is:

```
cornerlon(1) = 0.
cornerlat(1) = 90.
cornerlon(2) = 90.
cornerlat(2) = 0.
regionid = gddefboxreg(gridid, cornerlon,cornerlat)
```

Set Grid Field Compression

GDdefcomp

intn GDdefcomp(int32 *gridID*, int32 *compcode*, intn *compparm[]*)

gridID	*IN:*	*Grid id returned by GDcreate or GDattach*
compcode	*IN:*	*HDF compression code*
compparm	*IN:*	*Compression parameters (if applicable)*

Purpose *Sets the field compression for all subsequent field definitions.*

Return value *Returns SUCCEED(0) if successful or FAIL(-1) otherwise.*

Description *This routine sets the HDF field compression for subsequent grid field definitions. The compression does not apply to one-dimensional fields. The compression schemes currently supported are: run length encoding (HDFE_COMP_RLE = 1) , skipping Huffman (HDFE_COMP_SKPHUFF = 3), deflate (gzip) (HDFE_COMP_DEFLATE=4), (szip) (HDFE_COMP_SZIP = 5) and no compression (HDFE_COMP_NONE = 0, the default). Deflate compression requires a single integer compression parameter in the range of one to nine with higher values corresponding to greater compression. Compressed fields are written using the standard GDwritefield routine, however, the entire field must be written in a single call. If this is not possible, the user should consider tiling. See GDdeftile for further information. Any portion of a compressed field can then be accessed with the GDreadfield routine. Compression takes precedence over merging so that multi-dimensional fields that are compressed are not merged. The user should refer to the HDF Reference Manual for a fuller explanation of the compression schemes and parameters.*

Note for SZIP compression:

compcode: HDFE_COMP_SZIP = 5

compparm[0]: an even number between 2 and 32 indicating pixels per block

compparm[1]: SZ_EC = 4 (Entropy Coding (EC) Method)

SZ_NN = 32 (Nearest Neighbour + Entropy Coding (EC) Method)

Example *Suppose we wish to compress the Pressure using run length encoding, the Opacity field using deflate compression, the Spectra field with skipping Huffman compression, and use no compression for the Temperature field.*

```
status = GDdefcomp(gridID, HDFE_COMP_RLE, NULL);
status = GDdeffield(gridID, "Pressure", "YDim,XDim",
DFNT_FLOAT32, HDFE_NOMERGE);
compparm[0] = 5;
status = GDdefcomp(gridID, HDFE_COMP_DEFLATE, compparm);
status = GDdeffield(gridID, "Opacity", "YDim,XDim",
DFNT_FLOAT32, HDFE_NOMERGE);
status = GDdefcomp(gridID, HDFE_COMP_SKPHUFF, NULL);
status = GDdeffield(gridID, "Spectra", "Bands,YDim,XDim",
DFNT_FLOAT32, HDFE_NOMERGE);
status = GDdefcomp(gridID, HDFE_COMP_NONE, NULL);
status = GDdeffield(gridID, "Temperature", "YDim,XDim",
DFNT_FLOAT32, HDFE_AUTOMERGE);
```

Note that the HDFE_AUTOMERGE parameter will be ignored in the Temperature field definition.

FORTRAN *integer function gddefcomp(gridid, compcode, compparm)*

*integer*4 gridid*

integer compcode

integer compparm

The equivalent FORTRAN code for the example above is:

```
parameter (HDFE_COMP_NONE=0)
parameter (HDFE_COMP_RLE=1)
parameter (HDFE_COMP_SKPHUFF=3)
parameter (HDFE_COMP_DEFLATE=4)
integer    compparm(5)
status = gddefcomp(gridid, HDFE_COMP_RLE, compparm)
status = gddeffld(gridid, "Pressure", "YDim,XDim",
DFNT_FLOAT32, HDFE_NOMERGE)
compparm(1) = 5
status = gddefcomp(gridid, HDFE_COMP_DEFLATE, compparm)
status = gdeffld(gridid, "Opacity", "YDim,XDim", DFNT_FLOAT32,
HDFE_NOMERGE)
status = gddefcomp(gridid, HDFE_COMP_SKPHUFF, compparm)
status = gddeffld(gridid, "Spectra", "Bands,YDim,XDim",
DFNT_FLOAT32, HDFE_NOMERGE)
status = gddefcomp(gridid, HDFE_COMP_NONE, compparm)
status = gddeffld(gridid, "Temperature", "YDim,XDim",
DFNT_FLOAT32, HDFE_AUTOMERGE)
```

Define a New Dimension Within a Grid

GDdefdim

intn GDdefdim(int32 *gridID*, char **dimname*, int32 *dim)*

gridID	*IN:*	*Grid id returned by GDcreate or GDattach*
dimname	*IN:*	*Name of dimension to be defined*
dim	*IN:*	*The size of the dimension*

Purpose — *Defines a new dimension within the grid.*

Return value — *Returns SUCCEED(0) if successful or FAIL(-1) otherwise. Typical reason for failure is an improper grid id.*

Description — *This routine defines dimensions that are used by the field definition routines (described subsequently) to establish the size of the field.*

Example — *In this example, we define a dimension, Band, with size 15.*

```
status = GDdefdim(gridID, "Band", 15)
```

To specify an unlimited dimension which can be used to define an appendable array, the dimension value should be set to zero or equivalently, SD_UNLIMITED:

```
status = GDdefdim(gridID, "Unlim", SD_UNLIMITED);
```

FORTRAN — *integer function gddefdim(gridid, fieldname, dim)*

*integer*4*	*gridid*
character(*)*	*fieldname*
*integer*4*	*dim*

The equivalent *FORTRAN* code for the example above is:

```
parameter (SD_UNLIMITED=0)
status = gddefdim(gridid, "Band", 15)
status = gddefdim(gridid, "Unlim", SD_UNLIMITED)
```

Define a New Data Field Within a Grid

GDdeffield

intn GDdeffield(int32 gridID, char *fieldname, char *dimlist, int32 numbertype, int32 merge)

gridID	*IN:*	*Grid id returned by GDcreate or GDattach*
fieldname	*IN:*	*Name of field to be defined*
dimlist	*IN:*	*The list of data dimensions defining the field*
numbertype	*IN:*	*The number type of the data stored in the field*
merge	*IN:*	*Merge code (HDFE-NOMERGE (0) - no merge, HDFE_AUTOMERGE (1) -merge)*

Purpose *Defines a new data field within the grid.*

Return value *Returns SUCCEED(0) if successful or FAIL(-1) otherwise. Typical reason for failure is an unknown dimension in the dimension list.*

Description *This routine defines data fields to be stored in the grid. The dimensions are entered as a string consisting of geolocation dimensions separated by commas. They are entered in C order, that is, the last dimension is incremented first. The API will attempt to merge into a single object those fields that share dimensions and in case of multidimensional fields, numbertype. Two and three dimensional fields will be merged into a single three-dimensional object if the last two dimensions (in C order are equal). If the merge code for a field is set to 0, the API will not attempt to merge it with other fields. Fields using the unlimited dimension will not be merged. Because merging breaks the one-to-one correspondence between HDF-EOS fields and HDF SDS arrays, it should not be set if the user wishes to access the HDF-EOS field directly using HDF routines or, for example, to create an HDF attribute corresponding to the field.*

Example *In this example, we define a grid field, Temperature with dimensions XDim and YDim (as established by the GDcreate routine) containing 4-byte floating point numbers and a field, Spectra, with dimensions XDim, YDim, and Bands:*

```
status = GDdeffield(gridID, "Temperature", "YDim,XDim",
DFNT_FLOAT32, HDFE_AUTOMERGE);
status = GDdeffield(gridID, "Spectra", "Bands,YDim,XDim",
DFNT_FLOAT32, HDFE_NOMERGE);
```

FORTRAN	*integer function gddeffld(gridid, fieldname, dimlist, numbertype, merge)*	
	*integer*4*	*gridid*
	character(*)*	*fieldname*
	character(*)*	*dimlist*
	*integer*4*	*numbertype*
	*integer*4*	*merge*

The equivalent FORTRAN code for the example above is:

```
parameter (DFNT_FLOAT32=5)
parameter (HDFE_NOMERGE=0)
parameter (HDFE_AUTOMERGE=1)
status = gddeffld(gridid, "Temperature", "XDim,YDim",
DFNT_FLOAT32, DFE_AUTOMERGE)
status = gddeffld(gridid, "Spectra", "XDim,YDim,Bands",
DFNT_FLOAT32, HDFE_NOMERGE)
```

The dimensions are entered in FORTRAN order with the first dimension incremented first.

Define the Origin of Pixels in the Grid Data

GDdeforigin

intn GDdeforigin(int32 *gridID*, int32 *origincode*)

gridID	*IN:*	*Grid id returned by GDcreate or GDattach*
origincode	*IN:*	*Location of the origin of the pixels in grid data*

Purpose *Defines the origin of the pixels in grid data*

Return Value *Returns SUCCEED(0) if successful or FAIL(-1) otherwise*

Description *The routine is used to define the origin of pixels in the grid data. This allows the user to select any corner of the pixel as the origin.*

Origin Codes:

HDFE_GD_UL(Default)(0)	*Upper Left corner of grid*
HDFE_GD_UR(1)	*Upper Right corner of grid*
HDFE_GD_LL(2)	*Lower Left corner of grid*
HDFE_GD_LR(3)	*Lower Right corner of grid*

Example *In this example we define the origin of the grid pixel to be the Lower Right corner:*

```
status = GDdeforigin(gridID, HDFE_GD_LR);
```

FORTRAN *integer function gddeforg(gridid, origincode)*

*integer*4*	*gridid*
*integer*4*	*origincode*

The equivalent FORTRAN code for the above example is :

```
parameter (HDFE_GD_LR=3)
status = gddeforg(gridid, HDFE_GD_LR)
```

Define a Pixel Registration Within a Grid

GDdefpixreg

intn GDdefpixreg(int32 *gridID*, int32 *pixreg*)

gridID	*IN:*	*Grid id returned by GDcreate or GDattach*
pixreg	*IN:*	*Pixel registration*

Purpose *Defines pixel registration within grid cell*

Return Value *Returns SUCCEED(0) if successful or FAIL(-1) otherwise.*

Description *This routine is used to define whether the pixel center or pixel corner (as defined by the GDdeforigin routine) is used when requesting the location (longitude and latitude) of a given pixel.*

Registration Codes:

HDFE_CENTER (0) (Default)	*Center of pixel cell*
HDFE_CORNER (1)	*Corner of a pixel cell*

Example *In this example, we define the pixel registration to be the corner of the pixel cell:*

```
status = GDdefpixreg(gridID, HDFE_CORNER);
```

FORTRAN *integer function gddefpreg(gridid, pixreg)*

*integer*4*	*gridid*
*integer*4*	*pixreg*

The equivalent FORTRAN code for the example above is:

```
parameter (HDFE_CORNER=1)
status = gddefpreg(gridid, HDFE_CORNER)
```

Define Grid Projection

GDdefproj

intn GDdefproj(int32 *gridID*, int32 *projcode*, int32 *zonecode*, int32 *spherecode*, float64 *projparm[]*)

gridID	*IN:*	*Grid id returned by GDcreate or GDattach*
projcode	*IN:*	*GCTP projection code*
zonecode	*IN:*	*GCTP zone code used by UTM projection*
spherecode	*IN:*	*GCTP spheroid code*
projparm	*IN:*	*GCTP projection parameter array*

Purpose *Defines projection of grid*

Return Value *Returns SUCCEED(0) if successful or FAIL(-1) otherwise*

Description *Defines the GCTP projection and projection parameters of the grid.*

Example *In this example, we define a Universal Transverse Mercator (UTM) grid bounded by 54 E - 60 E longitude and 20 N - 30 N latitude – UTM zonecode 40, using default spheroid (Clarke 1866), spherecode = 0*

```
spherecode = 0;
zonecode = 40;
status = GDdefproj(gridID, GCTP_UTM, zonecode, spherecode,
      NULL);
```

In this next example we define a Polar Stereographic projection of the Northern Hemisphere (True scale at 90 N, 0 Longitude below pole) using the International 1967 spheriod.

```
spherecode = 3;
for (i = 0; i < 13; i++) projparm[i] = 0;
/* Set Long below pole & true scale in DDDMMMSSS.SSS form */
projparm[5] = 90000000.00;
status = GDdefproj(gridID, GCTP_PS, NULL, spherecode,
      projparm);
```

Finally we define a Geographic projection. In this case neither the zone code, sphere code or the projection parameters are used.

```
status = GDdefproj(gridID, GCTP_GEO, NULL, NULL, NULL)
```

FORTRAN *integer function gddefproj(gridid, projcode, zonecode, spherecode, projparm)*

*integer*4*	*gridid*
*integer*4*	*projcode*
*integer*4*	*zonecode*
*integer*4*	*spherecode*
*real*8*	*projparm(*)*

The equivalent FORTRAN code for the examples above is:

```
parameter (GCTP_UTM=1)
spherecode = 0
zonecode = 40
status = gddefproj(gridid, GCTP_UTM, zonecode, spherecode,
      dummy)
parameter (GCTP_PS=6)
spherecode = 6
do i=1,13
      projparm(i) = 0
enddo
projparm(6) = 90000000.00
status = gddefproj(gridid, GCTP_PS, dummy, spherecode,
      projparm)
parameter (GCTP_GEO=0)
status = gddefproj(gridid, GCTP_GEO, dummy, dummy, dummy)
```

Note: *projcode, zonecode, spherecode and projection parameter information are listed in Section 1.6, GCTP Usage.*

Define Tiling Parameters

GDdeftile

intn GDdeftile(int32 *gridID*, int32 *tilecode*, int32 *tilerank*, int32 *tiledims[]*)

gridID	*IN:*	*Grid id returned by GDcreate or GDattach*
tilecode	*IN:*	*Tile code: HDF_TILE, HDF_NOTILE (default)*
tilerank	*IN:*	*The number of tile dimensions*
tiledims	*IN:*	*Tile dimensions*

Purpose *Defines tiling dimensions for subsequent field definitions*

Return Value *Returns SUCCEED(0) if successful or FAIL(-1) otherwise*

Description *This routine defines the tiling dimensions for fields defined following this function call, analogous to the procedure for setting the field compression scheme using GDdefcomp. The number of tile dimensions and subsequent field dimensions must be the same and the tile dimensions must be integral divisors of the corresponding field dimensions. A tile dimension set to 0 will be equivalent to 1.*

Example *We will define four fields in a grid, two two-dimensional fields of the same size with the same tiling, a three-dimensional field with a different tiling scheme, and a fourth with no tiling. We assume that XDim is 200 and YDim is 300.*

```
tiledims[0] = 100;
tiledims[1] = 200;
status = GDdeftile(gridID, HDFE_TILE, 2, tiledims);
status = GDdeffield(gridID, "Pressure", "YDim,XDim",
DFNT_INT16, HDFE_NOMERGE);
status = GDdeffield(gridID, "Temperature", "YDim,XDim",
DFNT_FLOAT32, HDFE_NOMERGE);
tiledims[0] = 1;
tiledims[1] = 150;
tiledims[2] = 100;
status = GDdeftile(gridID, HDFE_TILE, 3, tiledims);
status = GDdeffield(gridID, "Spectra", "Bands,YDim,XDim",
DFNT_FLOAT32, HDFE_NOMERGE);
status = GDdeftile(gridID, HDFE_NOTILE, 0, NULL);
status = GDdeffield(gridID, "Communities", "YDim,XDim",
DFNT_INT32, HDFE_AUTOMERGE);
```

FORTRAN *integer function gddeftle(gridid, tilecode,tilerank,tiledims)*

*integer*4* *gridid*

*integer*4* *tilecode*

*integer*4* *tilerank*

*integer*4* *tiledims(*)*

The equivalent FORTRAN code for the example above is:

```
parameter (HDFE_NOTILE=0)
parameter (HDFE_TILE=1)
tiledims(1) = 200
tiledims(2) = 100
status = gddeftle(gridid, HDFE_TILE, 2, tiledims)
status = gddeffld(gridid, ‘Pressure’, ‘XDim,YDim’, DFNT_INT16,
HDFE_NOMERGE)
status = gddefld(gridid, ‘Temperature’, ‘XDim,YDim’,
DFNT_FLOAT32, HDFE_NOMERGE)
tiledims[1] = 100
tiledims[2] = 150
tiledims[3] = 1
status = gddeftle(gridid, HDFE_TILE, 3, tiledims)
status = gddeffld(gridid, ‘Spectra’, ‘XDim,YDim,Bands’,
DFNT_FLOAT32, HDFE_NOMERGE)
status = gddeftle(gridid, HDFE_NOTILE, 0, tiledims);
status = gddeffld(gridid, ‘Communities’, ‘XDim,YDim’,
DFNT_INT32, HDFE_AUTOMERGE)
```

Define a Time Period of Interest

GDdeftimeperiod

int32 GDdeftimeperiod(int32 *gridID*, int32 *periodID*, float64 *starttime*, float64 *stoptime*)

gridID	*IN:*	*Grid id returned by GDcreate or GDattach*
periodID	*IN:*	*Period (or region) id from previous subset call*
starttime	*IN:*	*Start time of period*
stoptime	*IN:*	*Stop time of period*

Purpose *Defines a time period for a grid.*

Return value *Returns the grid period ID if successful or FAIL (-1) otherwise.*

Description *This routine defines a time period for a grid. It returns a grid period ID which is used by the GDextractperiod routine to read all the entries of a data field within the time period.. The grid structure must have the Time field defined. This routine may be called after GDdefboxregion to provide both geographic and time subsetting . In this case the user provides the id from the previous subset call. (This same id is then returned by the function.) Furthermore it can be called before or after GDdefvrtregion to further refine a region. This routine may also be called "stand-alone" by setting the input id to HDFE_NOPREVSUB (-1).*

Example *In this example, we define a time period with a start time of 35232487.2 and a stop time of 36609898.1.*

```
starttime = 35232487.2;
stoptime = 36609898.1;
periodID = GDdeftimeperiod(gridID, HDFE_NOPREVSUB
starttime, stoptime);
```

If we had previously performed a geographic subset with id, regionID, then we could further time subset this region with the call:

```
periodID = GDdeftimeperiod(gridID, regionID, starttime,
stoptime);
```

Note that periodID will have the same value as regionID.

FORTRAN *integer*4 function gddeftmeper(gridid, periodID, starttime, stoptime)*

*integer*4* *gridid*

*integer*4* *periodid*

*real*8* *starttime*

*real*8* *stoptime*

The equivalent FORTRAN code for the examples above are:

```
parameter (HDFE_NOPREVSUB=-1)
starttime = 35232487.2
stoptime = 36609898.1
```

```
periodid = gddeftmeper(gridid, HDFE_NOPREVSUB, starttime,
stoptime)
periodid = gddeftmeper(gridid, regionid, starttime,
stoptime)
```

Define a Vertical Subset Region

GDdefvrtregion

int32 GDdefvrtregion(int32 *gridID*, int32 *regionID*, char **vertObj*, float64 *range[]*)

gridID	*IN:*	*Grid id returned by GDcreate or GDattach*
regionID	*IN:*	*Region (or period) id from previous subset call*
vertObj	*IN:*	*Dimension or field to subset*
range	*IN:*	*Minimum and maximum range for subset*

Purpose — *Subsets on a* ***monotonic*** *field or contiguous elements of a dimension.*

Return value — *Returns the grid region ID if successful or FAIL (-1) otherwise.*

Description — *Whereas the GDdefboxregion routine subsets along the XDim and YDim dimensions, this routine allows the user to subset along any other dimension. The region is specified by a set of minimum and maximum values and can represent either a dimension index (case 1) or field value range(case 2) . In the second case, the field must be one-dimensional and the values must be* ***monotonic*** *(strictly increasing or decreasing) in order that the resulting dimension index range be contiguous. (For the current version of this routine, the second option is restricted to fields with number type: INT16, INT32, FLOAT32, FLOAT64.) This routine may be called after GDdefboxregion to provide both geographic and "vertical" subsetting . In this case the user provides the id from the previous subset call. (This same id is then returned by the function.) This routine may also be called "stand-alone" by setting the input id to HDFE_NOPREVSUB (-1).*

This routine may be called up to eight times with the same region ID. It this way a region can be subsetted along a number of dimensions.

The GDregioninfo and GDextractregion routines work as before, however the field to be subsetted, (the field specified in the call to GDregioninfo and GDextractregion) must contain the dimension used explicitly in the call to GDdefvrtregion (case 1) or the dimension of the one-dimensional field (case 2).

Example — *Suppose we have a field called Pressure of dimension Height (= 10) whose values increase from 100 to1000. If we desire all the elements with values between 500 and 800, we make the call:*

```
range[0] = 500.;

range[1] = 800.;

regionID = GDdefvrtregion(gridID, HDFE_NOPREVSUB, “Pressure”,
range);
```

The routine determines the elements in the Height dimension which correspond to the values of the Pressure field between 500 and 800.

If we wish to specify the subset as elements 2 through 5 (0 - based) of the Height dimension, the call would be:

```
range[0] = 2;
range[1] = 5;
regionID = GDdefvrtregion(gridID, HDFE_NOPREVSUB, “DIM:Height”,
range);
```

The “DIM:” prefix tells the routine that the range corresponds to elements of a dimension rather than values of a field.

If a previous subset region or period was defined with id, subsetID, that we wish to refine further with the vertical subsetting defined above we make the call:

```
regionID = GDdefvrtregion(gridID, subsetID, “Pressure”, range);
```

The return value, regionID is set equal to subsetID. That is, the subset region is modified rather than a new one created.

In this example, any field to be subsetted must contain the Height dimension.

FORTRAN *integer*4 function gddefvrtreg(gridid, regionid, vertobj, range)*

*integer*4*	*gridid*
*integer*4*	*regionid*
character(*)*	*vertobj*
*real*8*	*range*

The equivalent FORTRAN code for the examples above is:

```
parameter (HDFE_NOPREVSUB=-1)
range(1) = 500.
range(2) = 800.
regionid = gddefvrtreg(gridid, HDFE_NOPREVSUB, “Pressure”,
range)
range(1) = 3 ! Note 1-based element numbers
range(2) = 6
regionid = gddefvrtreg(gridid, HDFE_NOPREVSUB, “DIM:Height”,
range)
regionid = gddefvrtreg(gridid, subsetid, “Pressure”, range)
```

Detach from Grid Structure

GDdetach

intn GDdetach(int32 *gridID*)

gridID	*IN:* *Grid id returned by GDcreate or GDattach*
Purpose	*Detaches from grid interface.*
Return value	*Returns SUCCEED(0) if successful or FAIL(-1) otherwise.*
Description	*This routine should be run before exiting from the grid file for every grid opened by GDcreate or GDattach.*
Example	*In this example, we detach the grid structure, ExampleGrid:* `status = GDdetach(gridID);`
FORTRAN	*integer function gddetach(gridid)*
	*integer*4* *gridid*
	The equivalent FORTRAN code for the example above is: `status = gddetach(gridid)`

Retrieve Size of Specified Dimension

GDdiminfo

int32 GDdiminfo(int32 *gridID*, char **dimname)*

gridID	*IN:*	*Grid id returned by GDcreate or GDattach*
dimname	*IN:*	*Dimension name*

Purpose *Retrieve size of specified dimension.*

Return value *Size of dimension if successful or FAIL(-1) otherwise. A typical reason for failure is an improper grid id or dimension name.*

Description *This routine retrieves the size of specified dimension.*

Example *In this example, we retrieve information about the dimension, "Bands":*

```
dimsize = GDdiminfo(gridID, "Bands");
```

The return value, dimsize, will be equal to 15

FORTRAN *integer*4 function gddiminfo(gridid,dimname)*

*integer*4*	*gridid*
character(*)*	*dimname*

The equivalent FORTRAN code for the example above is:

```
dimsize = gddiminfo(gridid, "Bands")
```

Duplicate a Region or Period

GDdupregion

int32 GDdupregion(int32 *regionID*)

regionID	*IN: Region or period id returned by GDdefboxregion, GDdeftimeperiod, or GDdefvrtregion.*
Purpose	*Duplicates a region.*
Return value	*Returns new region or period ID if successful or FAIL (-1) otherwise.*
Description	*This routine copies the information stored in a current region or period to a new region or period and generates a new id. It is usefully when the user wishes to further subset a region (period) in multiple ways.*
Example	*In this example, we first subset a grid with GDdefboxregion, duplicate the region creating a new region ID, regionID2, and then perform two different vertical subsets of these (identical) geographic subset regions:*

```
regionID = GDdefboxregion(gridID, cornerlon, cornerlat);
regionID2 = GDdupregion(regionID);
regionID = GDdefvrtregion(gridID, regionID, “Pressure”,
rangePres);
regionID2 = GDdefvrtregion(gridID, regionID2, “Temperature”,
rangeTemp);
```

FORTRAN *integer*4 function gddupreg(regionid)*

*integer*4 regionid*

The equivalent FORTRAN code for the example above is:

```
regionid = gddefboxreg(gridid, cornerlon, cornerlat)
regionid2 = gddupreg(regionid)
regionid = gddefvrtreg(gridid, regionid, ‘Pressure’,
rangePres)
regionid2 = gddefvrtreg(gridid, regionid2, ‘Temperature’,
rangeTemp)
```

Read a Region of Interest from a Field

GDextractregion

intn GDextractregion(int32 *gridID*, int32 *regionID*, char **fieldname*, *VOIDP buffer*)

gridID	*IN:*	*Grid id returned by GDcreate or GDattach*
regionID	*IN:*	*Region (period) id returned by GDdefboxregion (GDdeftimeperiod)*
fieldname	*IN:*	*Field to subset*
buffer	*OUT:*	*Data Buffer*

Purpose — *Extracts (reads) from subsetted region.*

Return value — *Returns SUCCEED (0) if successful or FAIL (-1) otherwise.*

Description — *This routine reads data into the data buffer from a subsetted region as defined by GDdefboxregion.*

Example — *In this example, we extract data from the "Temperature" field from the region defined in GDdefboxregion. We first allocate space for the data buffer. The size of the subsetted region for the field is given by the Gdregioninfo routine.*

```
datbuf = (float32) calloc(size, 4);
status = GDextractregion(GDid, regionID, "Temperature",
datbuf32);
```

FORTRAN — *integer*4 function gdextreg(gridid, regionid, fieldname, datbuf)*

*integer*4*	*gridid*
*integer*4*	*regionid*
character(*)*	*fieldname*
<valid type>	*buffer(*)*

The equivalent FORTRAN code for the example above is:

```
status = gdextreg(gridid, regionid, "Temperature", datbuf)
```

Retrieve Information About Data Field in a Grid

GDfieldinfo

intn GDfieldinfo(int32 gridID, char *fieldname, int32 rank, int32 dims[], int32 *numbertype, char *dimlist)

gridID	*IN:*	*Grid id returned by GDcreate or GDattach*
fieldlname	*IN:*	*Fieldname*
rank	*OUT:*	*Pointer to rank of the field*
dims	*OUT:*	*Array containing the dimension sizes of the field*
numbertype	*OUT:*	*Pointer to the numbertype of the field. See Appendix A for interpretation of number types.*
dimlist	*OUT:*	*Dimension list*

Purpose *Retrieve information about a specific geolocation or data field in the grid.*

Return value *Returns SUCCEED(0) if successful or FAIL(-1) otherwise. A typical reason for failure is the specified field does not exist.*

Description *This routine retrieves information on a specific data field.*

Example *In this example, we retrieve information about the Spectra data fields:*

```
status = GDfieldinfo(gridID, "Spectra", &rank, dims,
      &numbertype, dimlist);
```

The return parameters will have the following values:

rank=3, numbertype=5, dims[3]={15,200,120} and

dimlist="Bands,YDim,XDim"

FORTRAN *integer function gdfldinfo (gridid, fieldname, rank, dims, numbertype, dimlist)*

*integer*4*	*gridid*
character(*)*	*fieldname*
*integer*32*	*rank*
integer*4	*dims(*)*
integer*4	*numbertype*
character(*)*	*dimlist*

The equivalent FORTRAN code for the example above is:

```
status = gdfldinfo(gridid, "Spectra", dims, rank, numbertype,
dimlist)
```

The return parameters will have the following values:

rank=3, numbertype=5, dims[3]={120,200,15} and

dimlist="XDim,YDim,Bands"

Note that the dimensions array and the dimension list are in FORTRAN order.

Get Dimension Scale for a Dimension of a Field within a Grid

GDgetdimscale

intn GDgetdimscale(int32 *gridID*, char **fieldname,* char **dimname*, int32 **dimsize,*

int32 **numbertype,* VOIDP *data*)

gridID	*IN:*	*Grid id returned by GDcreate or GDattach*
fieldname	*IN:*	*Name of the field whose* **dimname** *dimension scale is read*
dimname	*IN:*	*The dimension for which scale values are read*
dimsize	*OUT:*	*The size of the dimension to be read*
numbertype	*OUT:*	*The number type of the data stored in the scale. See Appendix A for number types.*
data	*OUT:*	*Values to be read for the dimension scale*

Purpose *Gets dimension scale for a field dimension within the grid.*

Return value *Returns data buffer size if successful or FAIL (-1) otherwise. Typical reason for failure is unknown dimension in the dimension list or none-existing field.*

Description *This routine gets dimension scale for a field dimension within the grid. The dimension scales attributes label, unit, and format can be read using GDgetdimstrs().*

Example *In this example, we get dimension scale for the Bands dimension in the Spectra field, defined using GDsetdimscale() or GDdefdimscale():*

```
intn buffsize;
int32 nbands, ntype;
int32 *bands;

/* First call, with NULL for data buffer, returns */
/* buffersize needed for the data buffer */

buffsize = GDgetdimscale(gridID, "Spectra", "Bands",
                         &nbands, &ntype, NULL);

/* allocate enough buffer for the data */
bands = (int32 *)malloc(buffsize);

buffsize = GDgetdimscale(gridID, "Spectra", "Bands",
                         &nbands,&ntype,(void *)bands);
```

FORTRAN *integer function gdgetdimscale(gridid, fieldname, dimname, dimsize, numbertype, data)*

*integer*4* *gridid*

character(*) fieldname*

character(*)*	*dimname*
*integer*4*	*dimsize*
*integer*4*	*numbertype*
<valid type>	*data(*)*

The equivalent FORTRAN code for the example above is:

```
integer*4     bands(15)
integer*4     nbands, ntype, buffsize

buffsize = gdgetdimscale(gridid, "Spectra", "Bands",
                              nbands, ntype, bands);
```

Get Dimension Scale label, unit, and format for a Dimension of a Field within a Grid

GDgetdimstrs

intn GDgetdimstrs(int32 *gridID,* char **fieldname,* char **dimname,* char **label,*

char **unit*, char **format, intn len*)

gridID	*IN:*	*Grid id returned by GDcreate or GDattach*
fieldname	*IN:*	*Name of the field whose* ***dimname*** *dimension's scale label, unit, and format is set*
dimname	*IN:*	*The dimension for which scale label, unit, and format is set*
label	*OUT:*	*Label that describes this dimension*
unit	*OUT:*	*Unit used with this dimension*
format	*OUT:*	*Format used to display scale*
len	*IN:*	*Maximum string length it is safe to return*

Purpose *Gets the label, unit, and format strings for a given field dimension within the grid.*

Return value *Returns SUCCEED (0) if successful or FAIL (-1) otherwise. Typical reason for failure is unknown dimension in the dimension list, or none-existing field.*

Description *This routine gets the label, unit, and format strings for a given field dimension scale within the grid. It will return empty strings if any have not been set by GDsetdimstrs() or GDdefdimstrs().*

Example *In this example, we get dimension label, unit, and format for the Bands dimension in the Spectra field:*

char label[15], unit[15], format[15]

intn len = 10

```
status = GDgetdimstrs(gridID, "Spectra", "Bands",
                      label, unit, format, len);
```

FORTRAN *integer function gdgetdimstrs(gridid, fieldname, dimname, label, unit, format)*

*integer*4*	*gridid*	
	character(*)*	*fieldname*
	character(*)*	*dimname*
	character(*)*	*label*
	character(*)*	*unit*

character(*)   format*

The equivalent FORTRAN code for the example above is:

*character*15 label, unit, format*

```
integer len
len = 10
label = ''
unit = ''
format = ''
status = gdgetdimstrs(gridid, "Spectra", "Bands", label,
                      unit, format, len);
```

Get Fill Value for Specified Field

GDgetfillvalue

intn GDgetfillvalue(int32 *gridID*, char **fieldname*, VOIDP *fillvalue)*

gridID	*IN:*	*Grid id returned by GDcreate or GDattach*
fieldname	*IN:*	*Fieldname*
fillvalue	*OUT:*	*Space allocated to store the fill value*

Purpose — *Retrieves fill value for the specified field.*

Return value — *Returns SUCCEED(0) if successful or FAIL(-1) otherwise. Typical reasons for failure are an improper grid id or number type or incorrect fill value.*

Description — *It is assumed the number type of the fill value is the same as the field.*

Example — *In this example, we get the fill value for the "Temperature" field:*

```
status = GDgetfillvalue(gridID, "Temperature", &tempfill);
```

FORTRAN — *integer function gdgetfill(gridid,fieldname,fillvalue)*

*integer*4*	*gridid*
character(*)*	*fieldname*
<valid type>	*fillvalue(*)*

The equivalent FORTRAN code for the example above is:

```
status = gdgetfill(gridid, "Temperature", tempfill)
```

Get Row/Columns for Specified Longitude/Latitude Pairs

GDgetpixels

intn GDgetpixels(int32 *gridID*, int32 *nLonLat*, float64 *lonVal[]*, float64 *latVal[]*, int32 *pixRow[]*, int32 *pixCol[]*)

gridID	*IN:*	*Grid id returned by GDcreate or GDattach*
nLonLat	*IN:*	*Number of longitude/latitude pairs*
lonVal	*IN:*	*Longitude values in degrees*
latVal	*IN:*	*Latitude values in degrees*
pixRow	*OUT:*	*Pixel Rows*
pixCol	*OUT:*	*Pixel Columns*

Purpose *Returns the pixel rows and columns for specified longitude/latitude pairs.*

Return value *Returns SUCCEED(0) if successful or FAIL(-1) otherwise.*

Description *This routine converts longitude/latitude pairs into (0 - based) pixel rows and columns. The origin is the upper left-hand corner of the grid pixel. This routine is the pixel subsetting equivalent of GDdefboxregion.*

Example *To convert two pairs of longitude/latitude values to rows and columns, make the following call:*

```
lonArr[0] = 134.2;

latArr[0] = -20.8;

lonArr[1] = 15.8;

latArr[1] = 84.6;

status = GDgetpixels(gridID, 2, lonArr, latArr, rowArr,
colArr);
```

The row and column of the two pairs will be returned in the *rowArr* and *colArr* arrays.

FORTRAN	*integer function gdgetpix(gridid, nlonlat, lonval, latval, pixrow, pixcol)*
	*integer*4* *gridid*
	*integer*4* *nlonlat*
*real*8*	*lonval*
*real*8*	*latval*
*integer*4*	*pixrow*
*integer*4*	*pixcol*

The equivalent FORTRAN code for the example above is:

```
lonarr(1) = 134.2
latarr(1) = -20.8
lonarr(2) = 15.8
latarr(2) = 84.6
status = gdgetpix(gridid, 2, lonarr, latarr, rowarr, colarr)
```

Note that the row and columns values will be 1 - based.

Get Field Values for Specified Row/Columns

GDgetpixvalues

int32 GDgetpixvalues(int32 *gridID*, int32 *nPixels*, int32 *pixRow[]*, int32 *pixCol[]*, char **fieldname*, VOIDP *buffer*)

gridID	*IN:*	*Grid id returned by GDcreate or GDattach*
nPixels	*IN:*	*Number of pixels*
pixRow	*IN:*	*Pixel Rows*
pixCol	*IN:*	*Pixel Columns*
fieldname	*IN:*	*Field from which to extract data values*
buffer	*OUT:*	*Buffer for data values*

Purpose *Read field data values for specified pixels.*

Return value *Returns size of data buffer if successful or FAIL(-1) otherwise.*

Description *This routine reads data from a data field for the specified pixels. It is the pixel subsetting equivalent of GDextractregion. All entries along the non-geographic dimensions (ie, NOT XDim and YDim) are returned. If the buffer is set to NULL, no data is returned but the data buffer size can be determined from the function return value.*

Example *To read values from the Spectra field with dimensions, Bands, YDim, and XDim, make the following call:*

```
float64      *datbuf;

bufsiz = GDgetpixvalues(gridID, 2, rowArr, colArr, "Spectra",
NULL);

/* bufsiz will be equal to  2 * NBANDS * 8 where NBANDS is
the value for the Bands dimension */

datbuf = (float64 *) malloc(bufsiz);

bufsiz = GDgetpixvalues(gridID, 2, rowArr, colArr, "Spectra",
datbuf);
```

FORTRAN	*integer*4 function gdgetpixval(gridid, npixels, pixrow, pixcol, fieldname, buffer)*	
	*integer*4*	*gridid*
	*integer*4*	*nlonlat*
	*integer*4*	*pixrow*
	*integer*4*	*pixcol*
	character(*)*	*fieldname*
	<valid type>	*buffer(*)*

The equivalent FORTRAN code for the example above is:

```
real*8 datbuf(2,NBANDS)
```

```
bufsiz = gdgetpixval(gridid, 2, rowarr, colarr, "Spectra",
datbuf)
```

Return Information About a Grid Structure

GDgridinfo

intn GDgridinfo(int32 *gridID*, int32 **xdimsize*, int32 **ydimsize*, float64 *upleft[z]*, float64 *lowright[z]*)

gridID	*IN:*	*Grid id returned by GDcreate or GDattach*
xdimsize	*OUT:*	*Number of columns in grid*
ydimsize	*OUT:*	*Number of rows in grid*
upleft	*OUT:*	*Location, in meters, of upper left corner*
lowright	*OUT:*	*Location, in meters, of lower right corner*

Purpose *Returns position and size of grid*

Return value *Returns SUCCEED(0) if successful or FAIL(-1) otherwise*

Description *This routine returns the number of rows, columns and the location of the upper left and lower right corners of the grid image. For all projections the unit for upleft and lowright coordinates will be in meters, except for the Geographic Projection, where the units will be in DMS degrees.*

Example *In this example, we retrieve information from a previously created grid with a call to GDattach:*

```
status = GDgridinfo(gridID, &xdimsize, &ydimsize, upleft,
       lowrgt);
```

FORTRAN *integer function gdgridinfo(gridid, xdimsize, ydimsize, upleft, lowright)*

*integer*4*	*gridid*
*integer*4*	*xdimsize*
*integer*4*	*ydimsize*
*real*8*	*upleft(z)*
*real*8*	*lowright(z)*

The equivalent FORTRAN code for the example above is:

```
status = gdgridinfo(gridid, xdimsize, ydimsize, upleft,
       lowrgt);
```

Retrieve Information About Grid Attributes

GDinqattrs

int32 GDinqattrs(int32 *gridID*, char **attrlist*, int32 **strbufsize)*

gridID	*IN:*	*Grid id returned by GDcreate or GDattach*
attrlist	*OUT:*	*Attribute list (entries separated by commas)*
strbufsize	*OUT:*	*String length of attribute list*

Purpose — *Retrieve information about attributes defined in grid.*

Return value — *Number of attributes found if successful or FAIL (-1) otherwise.*

Description — *The attribute list is returned as a string with each attribute name separated by commas. If attrlist is set to NULL, then the routine will return just the string buffer size, strbufsize. This variable does not count the null string terminator.*

Example — *In this example, we retrieve information about the attributes defined in a grid structure. We assume that there are two attributes stored, attrOne and attr_2:*

```
nattr = GDinqattrs(gridID, NULL, strbufsize);
```

The parameter, nattr, will have the value 2 and strbufsize will have value 14.

```
nattr = GDinqattrs(gridID, attrlist, strbufsize);
```

The variable, attrlist, will be set to:

"*attrOne,attr_2*".

FORTRAN — *integer*4 function gdinqattrs(gridid,attrlist,strbufsize)*

*integer*4*	*gridid*
character(*)*	*attrlist*
*integer*4*	*strbufsize*

The equivalent FORTRAN code for the example above is:

```
nattr = gdinqattrs(gridid, attrlist, strbufsize)
```

Retrieve Information About Dimensions Defined in Grid

GDinqdims

int32 GDinqdims(int32 *gridID*, char **dimname*, int32 *dims[])*

gridID	*IN:*	*Grid id returned by GDcreate or GDattach*
dimname	*OUT:*	*Dimension list (entries separated by commas)*
dims	*OUT:*	*Array containing size of each dimension*

Purpose *Retrieve information about dimensions defined in grid.*

Return value *Number of dimension entries found if successful or FAIL(-1) otherwise. A typical reason for failure is an improper grid id.*

Description *The dimension list is returned as a string with each dimension name separated by commas. Output parameters set to NULL will not be returned.*

Example *To retrieve information about the dimensions, use the following statement:*

```
ndim = GDinqdims(gridID, dimname, dims);
```

The parameter, *dimname*, will have the value: "*Xgrid,Ygrid,Bands"*

with dims[3]={120,200,15}

FORTRAN *integer*4 function gdinqdims(gridid,dimname,dims)*

*integer*4*	*gridid*
character(*)*	*dimname*
*integer*4*	*dims(*)*

The equivalent FORTRAN code for the example above is:

```
ndim = gdinqdims(gridid, dimname, dims)
```

Retrieve Information About Data Fields Defined in Grid

GDinqfields

int32 GDinqfields(int32 gridID, char *fieldlist, int32 rank[], int32 numbertype[])

gridID	*IN:*	*Grid id returned by GDcreate or GDattach*
fieldlist	*OUT:*	*Listing of data fields (entries separated by commas)*
rank	*OUT:*	*Array containing the rank of each data field*
numbertype	*OUT:*	*Array containing the numbertype of each data field. See Appendix A for interpretation of number types.*

Purpose — *Retrieve information about the data fields defined in grid.*

Return value — *Number of data fields found if successful or FAIL(-1) otherwise. A typical reason is an improper grid id.*

Description — *The field list is returned as a string with each data field separated by commas. The rank and numbertype arrays will have an entry for each field. Output parameters set to NULL will not be returned.*

Example — *To retrieve information about the data fields, use the following statement:*

```
nfld = GDinqfields(gridID, fieldlist, rank, numbertype);
```

The parameter, *fieldlist,* will have the value: "*Temperature,Spectra"*

with rank[2]={2,3}, numbertype[2]={5,5}

FORTRAN — *integer*4 function gdinqdflds(gridid, fieldlist, rank, numbertype)*

*integer*4*	*gridid*
character(*)*	*fieldlist*
*integer*4*	*rank(*)*
integer*4	*numbertype(*)*

The equivalent FORTRAN code for the example above is:

```
nfld = gdinqflds(gridID, fieldlist, rank, numbertype)
```

The parameter, *fieldlist,* will have the value: "Spectra,*Temperature"*

with rank[2]={3,2}, numbertype[2]={5,5}

Retrieve Grid Structures Defined in HDF-EOS File

GDinqgrid

int32 GDinqgrid(char * filename, char *gridlist, int32 *strbufsize)

filename	*IN:*	*HDF-EOS filename*
gridlist	*OUT:*	*Grid list (entries separated by commas)*
strbufsize	*OUT:*	*String length of grid list*

Purpose — *Retrieves number and names of grids defined in HDF-EOS file.*

Return value — *Number of grids found of successful or FAIL (-1) otherwise.*

Description — *The grid list is returned as a string with each grid name separated by commas. If gridlist is set to NULL, then the routine will return just the string buffer size, strbufsize. If strbufsize is also set to NULL, the routine returns just the number of grids. Note that strbufsize does not count the null string terminator.*

Example — *In this example, we retrieve information about the grids defined in an HDF-EOS file, HDFEOS.hdf. We assume that there are two grids stored, GridOne and Grid_2:*

```
ngrid = GDinqgrid(“HDFEOS.hdf”, NULL, strbufsize);
```

The parameter, ngrid, will have the value 2 and strbufsize will have value 16.

```
ngrid = GDinqgrid(“HDFEOS.hdf”, gridlist, strbufsize);
```

The variable, gridlist, will be set to:

“*GridOne,Grid_2*”.

FORTRAN — *integer*4 function gdinqgrid(filename,gridlist,strbufsize)*

character(*)*	*filename*
character(*)*	*gridlist*
*integer*4*	*strbufsize*

The equivalent FORTRAN code for the example above is:

```
ngrid = gdinqgrid(‘HDFEOS.hdf’, gridlist, strbufsize)
```

Perform Bilinear Interpolation on Grid Field

GDinterpolate

int32 GDinterpolate(int32 *gridID*, int32 *nInterp*, float64 *lonVal[]*, float64 *latVal[]*, char **fieldname*, float64 *interpVal[]*)

gridID	*IN:*	*Grid id returned by GDcreate or GDattach*
nInterp	*IN:*	*Number of interpolation points*
lonVal	*IN:*	*Longitude of interpolation points*
latVal	*IN:*	*Latitude of interpolation points*
fieldname	*OUT:*	*Field from which to interpolate data values*
interpVal	*OUT:*	*Buffer for interpolated data values*

Purpose — *Performs bilinear interpolation on a grid field.*

Return value — *Returns size in bytes of interpolated data values if successful or FAIL(-1) otherwise.*

Description — *This routine performs bilinear interpolation on a grid field. It assumes that the pixel data values are uniformly spaced which is strictly true only for an infinitesimally small region of the globe but is a good approximation for a sufficiently small region. The default position of the pixel value is pixel center, however if the pixel registration has been set to HDFE_CORNER (with the GDdefpixreg routine) then the value is located at one of the four corners (HDFE_GD_UL, _UR, _LL, _LR) specified by the GDdeforigin routine. All entries along the non-geographic dimensions (ie, NOT XDim and YDim) are interpolated and all interpolated values are returned as FLOAT64. The data buffer size can be determined by setting the interpVal parameter to NULL. The reference for the interpolation algorithm is Numerical Recipes in C (2nd ed). (Note for the current version of this routine, the number type of the field to be interpolated is restricted to INT16, INT32, FLOAT32, FLOAT64.)*

Example — *To interpolate the Spectra field at two geographic data points:*

```
lonVal[0] = 134.2;

latVal[0] = -20.8;

lonVal[1] = 15.8;

latVal[1] = 84.6;

float64      *interVal;

bufsiz = GDinterpolate(gridID, 2, lonVal, latVal, "Spectra",
NULL);

/* bufsiz will be equal to  2 * NBANDS * 8 where NBANDS is the
value for the Bands dimension */
```

```
interpVal = (float64 *) malloc(bufsiz);

bufsiz = GDinterpolate(gridID, 2, lonVal, latVal, "Spectra",
interpVal);
```

FORTRAN *integer*4 function gdinterpolate(gridid, ninterp, lonval, latval, fieldname, interpval)*

*integer*4*	*gridid*
*integer*4*	*ninterp*
*real*8*	*lonval*
*real*8*	*latval*
character(*)*	*fieldname*
*real*8*	*interpval*

The equivalent FORTRAN code for the example above is:

```
real*8       interpval(NBANDS, 2)
bufsiz = gdinterpolate(gridid, 2, lonval, latval, "Spectra",
interpval)
```

Return Number of Specified Objects in a Grid

GDnentries

int32 GDnentries(int32 *gridID*, int32 *entrycode*, int32 **strbufsize)*

gridID	*IN:*	*Grid id returned by GDcreate or GDattach*
entrycode	*IN:*	*Entrycode*
strbufsize	*OUT:*	*String buffer size*

Purpose *Returns number of entries and descriptive string buffer size for a specified entity.*

Return value *Number of entries if successful or FAIL(-1) otherwise. A typical reason for failure is an improper grid id or entry code.*

Description *This routine can be called before using the inquiry routines in order to determine the sizes of the output arrays and descriptive strings. The string length does not include the NULL terminator.*

The entry codes are: *HDFE_NENTDIM (0) - Dimensions*

HDFE_NENTDFLD (4) - Data Fields

Example *In this example, we determine the number of data field entries and the size of the field list string.*

```
ndims = GDnentries(gridID, HDFE_NENTDFLD, &bufsz);
```

FORTRAN *integer*4 function gdnentries(gridid,enyrtcode, bufsize)*

*integer*4*	*gridid*
*integer*4*	*entrycode*
*integer*4*	*bufsize*

The equivalent FORTRAN code for the example above is:

```
ndims = gdnentries(gridid, 4, bufsz)
```

Open HDF-EOS File

GDopen

int32 GDopen(char **filename,* intn *access*)

filename	*IN:*	*Complete path and filename for the file to be opened*
access	*IN:*	*DFACC_READ, DFACC_RDWR or DFACC_CREATE*

Purpose *Opens or creates HDF file in order to create, read, or write a grid.*

Return value *Returns the grid file id handle(fid) if successful or FAIL(-1) otherwise.*

Description *This routine creates a new file or opens an existing one, depending on the access parameter.*

Access codes:

DFACC_READ	*Open for read only. If file does not exist, error*
DFACC_RDWR	*Open for read/write. If file does not exist, create it*
DFACC_CREATE	*If file exist, delete it, then open a new file for read/write*

Example *In this example, we create a new grid file named, GridFile.hdf. It returns the file handle, fid.*

```
fid = GDopen("GridFile.hdf", DFACC_CREATE);
```

FORTRAN *integer*4 function gdopen(filename, access)*

character(*) filename*

integer access

The access codes should be defined as parameters:

parameter (DFACC_READ=1)

parameter (DFACC_RDWR=3)

parameter (DFACC_CREATE=4)

The equivalent *FORTRAN* code for the example above is:

```
fid = gdopen("GridFile.hdf", DFACC_CREATE)
```

Note to users of the SDP Toolkit: Please refer to the *SDP Toolkit Users Guide for the EOSDIS Evolution and Development-2 Contract, December, 2017, 333-EED2-001, Revision 01,* Section 6.2.1.2 for information on how to obtain a file name (referred to as a ”physical file handle”) from within a PGE. See also Section 9 of this document for code examples.

Return Grid Pixel Origin Information

GDorigininfo

intn GDorigininfo(int32 *gridID*, int32 **origincode)*

gridID	*IN:*	*Grid id returned by GDcreate or GDattach*
origincode	*IN:*	*Origin code*

Purpose *Retrieve origin code.*

Return value *Returns SUCCEED(0) if successful or FAIL (-1) otherwise.*

It will also return default value (0) for Origin code if the value was not found in the Structure Metdata.

Description *This routine retrieves the origin code.*

Example *In this example, we retrieve the origin code defined in GDdeforigin.*

```
status = GDorigininfo(gridID, &origincode);
```

The return value, origincode, will be equal to 3

FORTRAN *integer function gdorginfo(gridid,origincode)*

*integer*4*	*gridid*
*integer*4*	*origincode*

The equivalent FORTRAN code for the above example is :

```
status = gdorginfo(gridid, origincode)
```

Return Pixel Registration Information

GDpixreginfo

intn GDpixreginfo(int32 *gridID*, int32 **pixregcode)*

gridID	*IN:*	*Grid id returned by GDcreate or GDattach*
pixregcode	*IN:*	*Pixel registration code*

Purpose *Retrieve pixel registration code.*

Return value *Returns SUCCEED(0) if successful or FAIL (-1) otherwise.*

It will also return default value (0) for pixregcode if the value was not found in the Structure Metdata.

Description *This routine retrieves the pixel registration code.*

Example *In this example, we retrieve the pixel registration code defined in GDdefpixreg.*

```
status = GDpixreginfo(gridID, &pixregcode);
```

The return value, pixregcode, will be equal to 1

FORTRAN *integer function gdpreginfo(gridid,pixregcode)*

*integer*4*	*gridid*
*integer*4*	*pixregcode*

The equivalent FORTRAN code for the above example is :

```
status = gdpreginfo(gridid, pixregcode)
```

Retrieve Grid Projection Information

GDprojinfo

intn GDprojinfo(int32 *gridID*, int32 **projcode*, int32 **zonecode*, int32 **spherecode*, float64 *projparm[]*)

gridID	*IN:*	*Grid id returned by GDcreate or GDattach*
projcode	*OUT:*	*GCTP projection code*
zonecode	*OUT:*	*GCTP zone code used by UTM projection*
spherecode	*OUT:*	*GCTP spheroid code*
projparm	*OUT:*	*GCTP projection parameter array*

Purpose *Retrieves projection information of grid*

Return Value *Returns SUCCEED(0) if successful or FAIL(-1) otherwise*

Description *Retrieves the GCTP projection code, zone code, spheroid code and the projection parameters of the grid*

Example *In this example, we are retrieving the projection information from a grid attached to with GDattached:*

```
status = GDprojinfo(gridID, &projcode, &zonecode, &spherecode,
projparm);
```

FORTRAN *integer function gdprojinfo(gridid, projcode, zonecode, spherecode, projparm)*

*integer*4*	*gridid*
*integer*4*	*projcode*
*integer*4*	*zonecode*
*integer*4*	*spherecode*
*real*8*	*projparm(*)*

The equivalent FORTRAN code for the example above is:

```
status = gdprojinfo(gridid, projcode, zonecode, spherecode,
projparm)
```

Read Grid Attribute

GDreadattr

intn GDreadattr(int32 *gridID*, char **attrname*, VOIDP *datbuf*)

gridID	*IN:*	*Grid id returned by GDcreate or GDattach*
attrname	*IN:*	*Attribute name*
datbuf	*OUT:*	*Buffer allocated to hold attribute values*

Purpose *Reads attribute from a grid.*

Return value *Returns SUCCEED(0) if successful or FAIL(-1) otherwise. Typical reasons for failure are an improper grid id or number type or incorrect attribute name.*

Description *The attribute is passed by reference rather than value in order that a single routine suffice for all numerical types.*

Example *In this example, we read a single precision (32 bit) floating point attribute with the name "ScalarFloat":*

```
status = GDreadattr(gridID, "ScalarFloat", &f32);
```

FORTRAN *integer function gdrdattr(gridid, attrname,datbuf)*

*integer*4*	*gridid*
character(*)*	*attrname*
<valid type>	*datbuf(*)*

The equivalent FORTRAN code for the example above is:

```
status = gdrdattr(gridid, "ScalarFloat", f32)
```

Read Data From a Grid Field

GDreadfield

intn GDreadfield(int32 *gridID*, char **fieldname*, int32 *start[]*, int32 *stride[]*, int32 *edge[]*, VOIDP *buffer)*

gridID	*IN:*	*Grid id returned by GDcreate or GDattach*
fieldname	*IN:*	*Name of field to read*
start	*IN:*	*Array specifying the starting location within each dimension*
stride	*IN:*	*Array specifying the number of values to skip along each dimension*
edge	*IN:*	*Array specifying the number of values to read along each dimension*
buffer	*IN:*	*Buffer to store the data read from the field*

Purpose *Reads data from a grid field.*

Return value *Returns SUCCEED(0) if successful or FAIL(-1) otherwise. Typical reasons for failure are improper grid id of unknown fieldname.*

Description *The values within start, stride, and edge arrays refer to the grid field (input) dimensions. The output data in buffer is written to contiguously. The default values for start and stride are 0 and 1 respectively and are used if these parameters are set to NULL. The default values for edge are (dim - start) / stride where dim refers to the size of the dimension.*

Example *In this example, we read data from the 10th row (0-based) of the Temperature field.*

```
float32 row[120];
int32 start[2]={9,0}, edge[2]={1,120};
status = GDreadfield(gridID, "Temperature", start, NULL, edge,
row);
```

FORTRAN	*integer function*	
	gdrdfld(gridid,fieldname,start,stride,edge,buffer)	
	*integer*4*	*gridid*
	character(*)*	*fieldname*
	*integer*4*	*start(*)*
	*integer*4*	*stride(*)*
	*integer*4*	*edge(*)*
	<valid type>	*buffer(*)*

The *start*, *stride*, and *edge* arrays must be defined explicitly, with the *start* array being 0-based.

The equivalent FORTRAN code for the example above is:

```
real*4 row(2000)
integer*4 start(2), stride(2), edge(2)
start(1) = 10
start(2) = 0
stride(1) = 1
stride(2) = 1
edge(1) = 2000
edge(2) = 1
status = gdrdfld(gridid, "Temperature", start, stride, edge,
row)
```

Read from Tile within Field

GDreadtile

intn GDreadtile(int32 gridID, char *fieldname, int32 tilecoords[], VOIDP buffer)

gridID	*IN:*	*Grid id returned by GDcreate or GDattach*
fieldname	*IN:*	*Fieldname*
tilecoords	*IN:*	*Array of tile coordinates*
buffer	*OUT:*	*Data to be written to tile*

Purpose *Reads from tile within field.*

Return value *Returns SUCCEED(0) if successful or FAIL(-1) otherwise.*

Description *This routine reads a single tile of data from a field. If the data is to be read tile by tile, this routine is more efficient than GDreadfield. In all other cases, the later routine should be used. GDreadtile does not work on non-tiled fields. Note that the coordinates in terms of tiles, not data elements.*

Example *In this example. we read one tile from the Temperature field (see GDdeftile example) located at the second column of the first row of tiles. Buffer should contain space for 200 * 100 * 4 = 80000 bytes.*

```
tilecoords[0] = 0;
tilecoords[1] = 1;
status = GDreadtile(gridid, “Temperature”, tilecoords, buffer);
```

FORTRAN *integer function gdrdtle(gridid, fieldname,tilecoords, buffer)*

*integer*4*	*gridid*
character(*)*	*fieldname*
*integer*4*	*tilecoords(*)*
<valid type>	*buffer(*)*

The equivalent FORTRAN code for the first example above is:

```
tilecoords(1) = 1;
tilecoords(2) = 0;
status = gdrdtle(gridid, “Temperature”, tilecoords, buffer)
```

Note that tilecoords for FORTRAN are reversed from the C language example but the values are still 0-based.

Return Information About a Region

GDregioninfo

intn GDregioninfo(int32 *gridID*, int32 *regionID*, char * *fieldname*, int32 **ntype*, int32 **rank*, int32 *dims[]*, int32 **size*, float64 *upleftpt[]*, float64 *lowrightpt[]*)

gridID	*IN:*	*Grid id returned by GDcreate or GDattach*
regionID	*IN:*	*Region (period) id returned by GDdefboxregion (GDdeftimeperiod)*
fieldname	*IN:*	*Field to subset*
ntype	*OUT:*	*Number type of field*
rank	*OUT:*	*Rank of field*
dims	*OUT:*	*Dimensions of subset region*
size	*OUT:*	*Size in bytes of subset region*
upleftpt	*OUT:*	*Upper left point of subset region*
lowrightpt	*OUT:*	*Lower right point of subset region*

Purpose *Retrieves information about the subsetted region.*

Return value *Returns SUCCEED (0) if successful or FAIL (-1) otherwise.*

Description *This routine returns information about a subsetted region for a particular field. It is useful when allocating space for a data buffer for the region. Because of differences in number type and geolocation mapping, a given region will give different values for the dimensions and size for various fields. The upleftpt and lowrightpt arrays can be used when creating a new grid from the subsetted region.*

Example *In this example, we retrieve information about the region defined in GDdefboxregion for theTemperature field. We use this to allocate space for data in the subsetted region.*

```
status = GDregioninfo(GDid, regionID, "Temperature", &ntype,
      &rank, dims, &size, upleft, lowright);
```

FORTRAN	*integer function gdreginfo(gridid, regionid, fieldname, ntype, rank, dims, size, upleftpt, lowrightpt)*	
	*integer*4*	*gridid*
	*integer*4*	*gridid*
	character(*)*	*fieldname*
	*integer*4*	*ntype*
	*integer*4*	*rank*
	*integer*4*	*dims(*)*
	*integer*4*	*size*
	*real*8*	*upleftpt*
	*real*8*	*lowrightpt*

The equivalent FORTRAN code for the example above is:

```
status = gdreginfo(gridid, regid, "Spectra", ntype, rank, dims,
size, upleftpt, lowrightpt)
```

Set Dimension Scale for a Dimension of a Field or Fields within a Grid

GDsetdimscale

intn GDsetdimscale(int32 *gridID,* char **fieldname,* char **dimname,* int32 *dimsize,*

int32 *numbertype,* VOIDP *data*)

GDdefdimscale

intn GDdefdimscale(int32 *gridID,* char **dimname,* int32 *dimsize,*

int32 *numbertype,* VOIDP *data*)

gridID	*IN:*	*Grid id returned by GDcreate or GDattach*
fieldname	*IN:*	*Name of the field whose* **dimname** *dimension scale is set*
dimname	*IN:*	*The dimension for which scale is set in the field*
dimsize	*IN:*	*The size of the dimension for which dimension is set*
numbertype	*IN:*	*The number type of the data stored in the scale. See Appendix A for number types.*
data	*IN:*	*Values to be written to the dimension scale*

Purpose *GDsetdimscale() sets dimension scale for a field dimension within the grid.*

GDdefdimscale() sets dimension scale for a dimension of all fields within the grid.

Return value *Returns SUCCEED (0) if successful or FAIL (-1) otherwise. Typical reason for failure is unknown dimension in the dimension list, none-existing field, or having the same dimension set before.*

Description *These routines set dimension scale for a field* (or fields) *dimension within the grid. Once the dimension scale is set user can write label, unit, and format attributes to it using GDsetdimstrs() or GDdefdimstrs().Please note that in hdf-eos2 both routines have similar end results for defining dimension scale for a dimension. The GDsetdimscale() should run faster, but requires user's knowledge of at least one field name that has used the specified dimension.*

Example 1 *In this example, we set dimension scale for the "Bands" dimension in the Spectra field, defined by:*

```
status = GDdefdatafield( gridID, "Spectra",
               "Bands,YDim,XDim", DFNT_FLOAT32, HDFE_NOMERGE);
int32 bands[15] = {1,3,4,5,6,7,10,11,12,13,14,15,16,17};
int32 nbands = 15;
status = GDsetdimscale(gridID, "Spectra", "Bands",
                         nbands, DFNT_INT32, bands);
```

FORTRAN *integer function gdsetdimscale(gridid, fieldname, dimname, dimsize, numbertype, data)*

*integer*4* *gridid*

character(*)* *fieldname*
character(*)* *dimname*
*integer*4* *dimsize*
*integer*4* *numbertype*
<valid type> *data(*)*

The equivalent FORTRAN code for the example above is:

```
integer*4     bands(15)
integer*4     nbands
nbands = 5
bands(1) = 1
................................
bands(15) = 17
integer       DFNT_INT32
parameter    (DFNT_INT32 = 24)
status = gdsetdimscale(gridid, "Spectra", "Bands",
                        nbands, DFNT_INT32, bands)
```

Example 2 *In this example, we set dimension scale for the "Bands" dimension in all field, defined by* `GDdefdatafield() in the grid:`

```
int32 bands[15] = {1,3,4,5,6,7,10,11,12,13,14,15,16,17};
int32 nbands = 15;
status = GDdefdimscale(gridID, "Bands", nbands, DFNT_INT32,bands);
```

FORTRAN *integer function gddefdimscale(gridid, dimname, dimsize, numbertype, data)*

*integer*4* *gridid*

character(*)* *dimname*

*integer*4* *dimsize*

*integer*4* *numbertype*

<valid type> *data(*)*

The equivalent FORTRAN code for the example above is:

```
integer*4 bands(15)
integer*4 nbands
nbands = 5
bands(1) = 1
................................
bands(15) = 17
integer DFNT_INT32
parameter (DFNT_INT32 = 24)
status = gdsetdimscale(gridid, "Bands", nbands, DFNT_INT32, bands)
```

Note: When setting dimensionscale for XDim or YDim we need to use NULL for data buffer. HDF-EOS will calculate buffer values itself using internal grid corner values and xdim or ydim.

```
xdim = 120;
ydim = 200;
status = GDsetdimscale(GDid1, "Pollution", "XDim", xdim, DFNT_FLOAT64, NULL);
status = GDsetdimscale(GDid2, "Spectra", "YDim", ydim, DFNT_FLOAT64, NULL);
```

In Fortran one needs to declare buffer for XDim and YDim dimension scale buffere values, but they need not be populated before passing to gdsetdimscale()or gddefdimscale().

```
real*8     veg1(120),veg2(200)
xdim = 120;
ydim = 200;
status = gdsetdimscale(gdid, "Vegetation", "XDim", xdim, DFNT_FLOAT64, veg1)
status = gdsetdimscale(gdid, "Vegetation", "YDim", ydim, DFNT_FLOAT64, veg2)
```

Set Dimension Scale label, unit, and format for a Dimension of a Field or Fields within a Grid

GDsetdimstrs

intn GDsetdimstrs(int32 *gridID,* char **fieldname,* char **dimname,* char **label,*
char **unit,* char **format*)

GDdefdimstrs

intn GDdefdimstrs(int32 *gridID,* char **dimname,* char **label,* char **unit,* char **format*)

gridID	*IN:*	*Grid id returned by GDcreate or GDattach*
fieldname	*IN:*	*Name of the field whose* **dimname** *dimension's scale label, unit, and format is set*
dimname	*IN:*	*The dimension for which scale label, unit, and format is set*
label	*IN:*	*Label that describes this dimension*
unit	*IN:*	*Unit to be used with this dimension*
format	*IN:*	*Format to be used to display scale*

Purpose *Sets the label, unit, and format strings for a given field dimension within the grid.*

Return value *Returns SUCCEED (0) if successful or FAIL (-1) otherwise. Typical reason for failure is unknown dimension in the dimension list, or none-existing field.*

Description *These routines set the label, unit, and format strings for a given field (or fields) dimension scale within the grid. They are called after setting the dimension scale using GDsetdimscale() or GDdefdimscale().*

Example 1 *In this example, we set dimension label, unit, and format for the "Bands" dimension in the Spectra field:*

```
status = GDsetdimstrs(gridID, "Spectra", "Bands",
                      “Bands Dim”, “None”, “I2”);
```

FORTRAN *integer function gdsetdimstrs(gridid, fieldname, dimname, label, unit, format)*

*integer*4*	*gridid*
character(*)*	*fieldname*
character(*)*	*dimname*
character(*)*	*label*
character(*)*	*unit*
character(*)*	*format*

The equivalent FORTRAN code for the example above is:

```
status = gdsetdimstrs(gridid, "Spectra", "Bands",
                      “Bands Dim”, “None”, “I2”);
```

Example 2 *In this example, we set dimension label, unit, and format for the “Bands” dimension in the fields within the grid:*

```
status = GDdefdimstrs(gridID, "Bands", “Bands Dim”, “None”,
                      “I2”);
```

FORTRAN *integer function gddefdimstrs(gridid, dimname, label, unit, format)*

*integer*4 gridid*

character(*) dimname*

character(*) label*

character(*) unit*

character(*) format*

The equivalent FORTRAN code for the example above is:

```
status = gddefdimstrs(gridid, "Bands", “Bands Dim”, “None”,
                      “I2”);
```

Note: ***There are no specific values for "format" string. It depends on the range or type of the dimension scale values. For example if the dimension scale values are 5 digit integers, one may use I5, or if they are floating numbers with 2 digit after decimal point one may use something like F6.2***

The HDF4 Users Guide quote on "format" :

"Formats describe the form numeric values will be printed and/or displayed. The recommended convention is to use standard Fortran-77 notation for describing the data format. For example,"F7.2" means to display seven digits with two digits to the right of the decimal point"

Set Fill Value for a Specified Field

GDsetfillvalue

intn GDsetfillvalue(int32 *gridID,* char **fieldname,* VOIDP *fillvalue)*

gridID	*IN:*	*Grid id returned by GDcreate or GDattach*
fieldname	*IN:*	*Fieldname*
fillvalue	*IN:*	*Pointer to the fill value to be used*

Purpose *Sets fill value for the specified field.*

Return value *Returns SUCCEED(0) if successful or FAIL(-1) otherwise. Typical reasons for failure are an improper grid id or number type.*

Description *The fill value is placed in all elements of the field which have not been explicitly defined.*

Example *In this example, we set a fill value for the "Temperature" field:*

```
tempfill = -999.0;
status = GDsetfillvalue(gridID, "Temperature", &tempfill);
```

FORTRAN *integer function*

gdsetfill(gridid,fieldname,fillvalue)

*integer*4*	*gridid*
character(*)*	*fieldname*
<valid type>	*fillvalue(*)*

The equivalent FORTRAN code for the example above is:

```
status = gdsetfill(gridid, "Temperature", -999.0)
```

Set Tile Cache Parameters

GDsettilecache

intn GDsettilecache(int32 *gridID*, char **fieldname*, int32 *maxcache*, int32 *cachecode*)

gridID	*IN:*	*Grid id returned by GDcreate or GDattach*
fieldname	*IN:*	*Fieldname*
maxcache	*IN:*	*Maximum number of tiles to cache in memory*
cachecode	*IN:*	*Currently must be set to 0*

Purpose *Sets tile cache parameters*

Return Value *Returns the maximum number of tiles that can be cached (the value of the parameter maxcache) if successful or FAIL(-1) otherwise*

Description *This routine sets the maximum cache for tiling. If the cache is set for a fewer number of tiles than needed for a particular subset of the field, there can be serious efficiency problems. Therefore it is recommended that this routine not be used unless one is aware for each field, the expected size of a particular subset and it's position relative to the tiles. The maxcache value should be set to the number of tiles which fit along the fastest varying dimension.*

Example *In this example, we set maxcache to 10 tiles. The particular subsetting envisioned for the Spectra field (defined in the GDdeftile example) would never cross more than 10 tiles along the field's fastest varying dimension, ie, XDim..*

```
status = GDsettilecache(gridID, "Spectra", 10, 0);
```

FORTRAN *integer function gdsettleche(gridid, fieldname,maxcache,cachecode)*

*integer*4*	*gridid*
character(*)*	*fieldname*
*integer*4*	*maxcache*
*integer*4*	*cachecode*

The equivalent FORTRAN code for the example above is:

```
status = gdsettleche(gridid, 'Spectra', 10, 0)
```

Set Tiling/Compression Parameters

GDsettilecomp

intn GDsettilecomp(int32 *gridID*, char *fieldname*, int32 *tilerank*, int32 *tiledims*, int32 *compcode*, intn **compparm)*

gridID	*IN:*	*Grid id returned by GDcreate or GDattach*
fieldname	*IN:*	*Field name*
tilerank	*IN:*	*The number of tile dimensions*
tiledims	*IN:*	*Tile dimensions*
compcode	*IN:*	*HDF compression code*
compparm	*IN:*	*Compression parameters(if applicable)*

Purpose — *Set tiling and compression parameters for a field that has fill values.*

Return value — *Returns SUCCEED(0) if successful or FAIL(-1) otherwise.*

Description — *This routine was added as a fix to a bug in HDF-EOS. The current method of implementation didn't allow the user to have a field with fill values and use tiling and compression. This function allows the user to access all of these features. This function must be called in a particular order.*

Example — *This function must be used in a particular sequence with other HDF_EOS Grid functions.*

(1) GDdeffield – Define field

(2) GDsetfillvalue – Set fill value for field

(3) GDsettilecomp – Set tiling(chunking) and compression parameters for field

```
tile_dim[0] = 1;
tile_dim[1] = 128;
tile_dim[2] = 512;
compparm[0] = 5;
status = GDsettilecomp(gridID, “AveSceneElev”, 3, tile_dim,
HDFE_COMP_DEFLATE, compparm);
```

NOTE: This routine is currently implemented in “C” only. If the need arises, a FORTRAN function will be added.

Retrieve Tiling Information for Field

GDtileinfo

intn GDtileinfo(int32 *gridID*, char **fieldname*, int32 **tilecode*, int32 **tilerank*, int32 *tiledims[]*)

gridID	*IN:*	*Grid id returned by GDcreate or GDattach*
fieldname	*IN:*	*Fieldname*
tilecode	*OUT:*	*Tile code: HDF_TILE, HDF_NOTILE*
tilerank	*OUT:*	*The number of tile dimensions*
tiledims	*OUT:*	*Tile dimensions*

Purpose *Retrieves tiling information about a field.*

Return value *Returns SUCCEED(0) if successful or FAIL(-1) otherwise.*

Description *This routine returns the tiling code, tiling rank, and tiling dimensions for a given field.*

Example *To retrieve the tiling information about the Pressure field defined in the GDdeftile section:*

```
status = GDtileinfo(gridID, “Pressure”, &tilecode, &tilerank,
tiledims);
```

The tilecode parameter will be set to 1, the tilerank to 2, and tiledims to {100,200}.

FORTRAN *integer function gdtleinfo(gridid,fieldname tilecode,tilerank,tiledims)*

*integer*4*	*gridid*
character(*)*	*fieldname*
*integer*4*	*tilecode*
*integer*4*	*tilerank*
*integer*4*	*tiledims(*)*

The equivalent FORTRAN code for the example above is:

```
status = gdtileinfo(gridid, ‘Pressure’, tilecode, tilerank,
tiledims)
```

The tilecode parameter will be set to 1, the tilerank to 2, and tiledims to {200,100}.

Write/Update Grid Attribute

GDwriteattr

intn GDwriteattr(int32 gridID, char *attrname, int32 ntype, int32 count, VOIDP datbuf)

gridID	*IN:*	*Grid id returned by GDcreate or GDattach*
attrname	*IN:*	*Attribute name*
ntype	*IN:*	*Number type of attribute*
count	*IN:*	*Number of values to store in attribute*
datbuf	*IN:*	*Attribute values*

Purpose *Writes/Updates attribute in a grid.*

Return value *Returns SUCCEED(0) if successful or FAIL(-1) otherwise. Typical reasons for failure are an improper grid id or number type.*

Description *If the attribute does not exist, it is created. If it does exist, then the value(s) is (are) updated. The attribute is passed by reference rather than value in order that a single routine suffice for all numerical types. Because of this a literal numerical expression should not be used in the call.*

Example *In this example. we write a single precision (32 bit) floating point number with the name "ScalarFloat" and the value 3.14:*

```
f32 = 3.14;
status = GDwriteattr(gridid,"ScalarFloat",DFNT_FLOAT32,1,&f32);
```

We can update this value by simply calling the routine again with the new value:

```
f32 = 3.14159;
status = GDwriteattr(gridid,"ScalarFloat",DFNT_FLOAT32,1,&f32);
```

FORTRAN *integer function gdwrattr(gridid, attrname, ntype, count, datbuf)*

*integer*4*	*gridid*
character(*)*	*attrname*
*integer*4*	*ntype*
*integer*4*	*count*
<valid type>	*datbuf(*)*

The equivalent FORTRAN code for the first example above is:

```
parameter (DFNT_FLOAT32=5)
f32 = 3.14
status = gdwrattr(gridid,"ScalarFloat",DFNT_FLOAT32,1,f32)
```

Write Data to a Grid Field

GDwritefield

intn GDwritefield(int32 *gridID*, char **fieldname*, int32 *start[]*, int32 *stride[]*, int32 *edge[]*, VOIDP *data)*

gridID	*IN:*	*Grid id returned by GDcreate or GDattach*
fieldname	*IN:*	*Name of field to write*
start	*IN:*	*Array specifying the starting location within each dimension (0-based)*
stride	*IN:*	*Array specifying the number of values to skip along each dimension*
edge	*IN:*	*Array specifying the number of values to write along each dimension*
data	*IN:*	*Values to be written to the field*

Purpose *Writes data to a grid field.*

Return value *Returns SUCCEED(0) if successful or FAIL(-1) otherwise.*

Description *The values within start, stride, and edge arrays refer to the grid field (output) dimensions. The input data in the data buffer is read from contiguously. The default values for start and stride are 0 and 1 respectively and are used if these parameters are set to NULL. The default values for edge are (dim - start) / stride where dim refers to the size of the dimension. Note that the data buffer for a compressed field must be the size of the entire field as incremental writes are not supported by the underlying HDF routines. If this is not possible due to, for example, memory limitations, then the user should consider tiling. See GDdeftile for further information.*

Example *In this example, we write data to the Temperature field.*

```
float32 temperature [200][120];
/* Define elements of temperature array */
status = GDwritefield(gridID, "Temperature", NULL, NULL, NULL,
temperature);
```

We now update Row 10 (0 - based) in this field:

```
float32 newrow[2000];
int32 start[2]={0,10}, edge[2]={2000,1};
/* Define elements of newrow array */
status = GDwritefield(gridID, "Temperature", start, NULL,
      edge, newrow);
```

FORTRAN	*integer function*	
	gdwrfld(gridid,fieldname,start,stride,edge,data)	
	*integer*4*	*gridid*
	character(*)*	*fieldname*
	*integer*4*	*start(*)*
	*integer*4*	*stride(*)*
	*integer*4*	*edge(*)*
	<valid type>	*data(*)*

The start, stride, and edge arrays must be defined explicitly, with the start array being 0-based.

The equivalent FORTRAN code for the example above is:

```
real*4 temperature(2000,1000)
integer*4 start(2), stride(2), edge(2)
start(1) = 0
start(2) = 0
stride(1) = 1
stride(2) = 1
edge(1) = 2000
edge(2) = 1000
status = gdwrfld(gridid, "Temperature", start, stride, edge,
      temperature)
```

We now update Row 10 (0 - based) in this field:

```
real*4 newrow(2000)
integer*4 start(2), stride(2), edge(2)
start(1) = 10
start(2) = 0
stride(1) = 1
stride(2) = 1
edge(1) = 2000
edge(2) = 1
status = gdwrfld(gridid, "Temperature", start, stride, edge,
      newrow)
```

Write Field Metadata for an Existing Field Not Defined With the Grid API

GDwritefieldmeta

intn GDwritefieldmeta(int32 *gridID*, char **fieldname*, char **dimlist*, int32 *numbertype*)

gridID	*IN:*	*Grid id returned by GDcreate or GDattach*
fieldname	*IN:*	*Name of field that metadata information is to be written*
dimlist	*IN:*	*Dimension list of field*
numbertype	*IN:*	*Number type of data in field. See Appendix A for interpretation of number types.*

Purpose *Writes field metadata for an existing grid field not defined with the Grid API*

Return Value *Returns SUCCEED(0) if successful or FAIL(-1) otherwise*

Description *This routine writes the field metadata for a grid field not defined by the Grid API*

Example

```
status = GDwritefieldmeta(gridID, "ExternField",
"Ydim,Xdim", DFNT_FLOAT32);
```

FORTRAN *integer function gdwrmeta(gridid, fieldname, dimlist, numbertype)*

*integer*4*	*gridid*
character(*)*	*fieldname*
character(*)*	*dimlist*
*integer*4*	*numbertype*

The equivalent FORTRAN code for the example above is:

```
status = gdwrmeta(gridid, "ExternField, "Xdim,Ydim",
DFNT_FLOAT32)
```

Write to Tile within Field

GDwritetile

intn GDwritetile(int32 *gridID*, char **fieldname*, int32 *tilecoords[]*, VOIDP *data)*

gridID	*IN:*	*Grid id returned by GDcreate or GDattach*
fieldname	*IN:*	*Fieldname*
tilecoords	*IN:*	*Array of tile coordinates*
data	*IN:*	*Data to be written to tile*

Purpose *Writes to tile within field.*

Return value *Returns SUCCEED(0) if successful or FAIL(-1) otherwise. Typical reasons for failure are an improper grid id or number type.*

Description *This routine writes a single tile of data to a field. If the data to be written to a field can be arranged tile by tile, this routine is more efficient than GDwritefield. In all other cases, the later routine should be used. GDwritetile does not work on non-tiled fields. Note that the coordinates in terms of tiles, not data elements.*

Example *In this example. we write one tile to the Temperature field (see GDdeftile example) at the second column of the first row of tiles. Note that there are 200 * 100 * 4 = 80000 bytes in data:*

```
tilecoords[0] = 0;
tilecoords[1] = 1;
status = GDwritetile(gridid, “Temperature”, tilecoords, data);
```

FORTRAN *integer function gdwrtle(gridid, fieldname,tilecoords, data)*

*integer*4*	*gridid*
character(*)*	*fieldname*
*integer*4*	*tilecoords(*)*
<valid type>	*data(*)*

The equivalent FORTRAN code for the first example above is:

```
tilecoords(1) = 1
tilecoords(2) = 0
status = gdwrtle(gridid, “Temperature”, tilecoords, data)
```

Note that tilecoords for FORTRAN are reversed from the C language example but the values are still 0-based.

2.1.4 HDF-EOS Utility Routines

This section contains an alphabetical listing of the HDF-EOS utility routines.

Convert Among Angular Units

EHconvAng

float64 EHconvAng(float64 *inAngle*, intn *code*)

inAngle	*IN:*	*Input angle*
code	*IN:*	*Conversion code*

Purpose *Convert among various angular units.*

Return value *Returns angle in desired units if successful or FAIL (-1) otherwise.*

Description *This routine converts angles between three units, decimal degrees, radians, and packed degrees-minutes-seconds. In the later unit, an angle is expressed as a integral number of degrees and minutes and a float point value of seconds packed as a single float64 number as follows: DDDMMMSSS.SS. The six conversion codes are: HDFE_RAD_DEG (0), HDFE_DEG_RAD (1), HDFE_DMS_DEG (2), HDFE_DEG_DMS (3), HDFE_RAD_DMS (0), and HDFE_DMS_RAD (1), where the first three letter code (RAD - radians, DEG - decimal degrees, DMS - packed degrees-minutes-seconds) corresponds to the input angle and the second to the desired output angular unit.*

Example *To convert 27.5 degrees to packed format:*

```
inAng = 27.5;
outAng = EHconvAng(inAng, HDFE_DEG_DMS);
```

"outAng" will contain the value: 27030000.00.

FORTRAN *real*8 function ehconvang(inangle,code)*

*real*8*	*inangle*
integer	*code*

The equivalent FORTRAN code for the example above is:

```
inangle = 27.5
outangle = ehconvang(inangle,3)
```

Get HDF-EOS Version String

EHgetversion

intn EHgetversion(int32 *fid*, char **version*)

fid	*IN:*	*File id returned by SWopen, GDopen, or PTopen.*
version	*OUT:*	*HDF-EOS version string*

Purpose *Get HDF-EOS version string.*

Return value *Returns SUCCEED(0) if successful or FAIL(-1) otherwise.*

Description *This routine returns the HDF-EOS version string of an HDF-EOS file. This designates the version of HFD-EOS that was used to create the file. This string if of the form: "HDFEOS_Vmaj.min" where maj is the major version and min is the minor version.*

Example *To get the HDF-EOS version (assumed to be 2.7) used to create the HDF-EOS file: "SwathFile.hdf":*

```
char version[16];
fid = SWopen("SwathFile.hdf", DFACC_READ);
status = EHgetversion(fid, version);
```

"version" will contain the string: "HDFEOS_V2.7".

FORTRAN *integer function ehgetver(fid,version)*

*integer*4*	*fid*
character(*)*	*version*

The equivalent FORTRAN code for the example above is:

```
character*16 version
fid = swopen("SwathFile.hdf",1)
status = ehgetver(fid, version)
```

Determine if the Data File is HDF-EOS2 Product

EHHEisHE2

intn EHHEisHE2(char *filename)

filename	*IN:* *Name of the the File.*
Purpose	*Determines if the input data file type is HDF-EOS2*
Return value	Returns *TRUE (1) if file is HDF-EOS2, FALSE (0) if file is not HDF_EOS2, or FAIL (-1) otherwise. Typical reason for failure is failing to open the file.*
Description	*This routine tries to open the file with HDF_EOS2 calls and find at least one of the objects SWATH, GRID, or POINT in the file. If successful, the file is HDF-EOS2, otherwise a different type.*
Example	*In this example, we check the type of HDF file to see if it is HDF-EOS2 type:*

```
intn    fileIsHe2 = -1;
char *  filename  = ”testHDF.hdf”;
fileIsHe2 = EHHEisHE2(filename);
```

FORTRAN *integer function ehheishe2(filename)*

character(*)   filename*

The equivalent FORTRAN code for the example above is:

```
integer fileIsHe2
fileIsHe2 = ehheishe2(filename)
```

Get HDF File ids

EHidinfo

intn EHidinfo(int32 *fid*, int32 **HDFfid*, int32 **sdInterfaceID*)

fid	*IN:*	*File id returned by SWopen, GDopen, or PTopen.*
HDFfid	*OUT:*	*HDF file ID (returned by Hopen)*
sdInterfaceID	*OUT:*	*SD interface ID (returned by SDstart)*

Purpose *Get HDF file IDs.*

Return value *Returns SUCCEED(0) if successful or FAIL(-1) otherwise.*

Description *This routine returns the HDF file ids corresponding to the HDF-EOS file id returned by SWopen, GDopen, or PTopen. These ids can then by used to create or access native HDF structure such as SDS arrays, Vdatas, or HDF attributes within an HDF-EOS file.*

Example *To create a vdata within an existing HDF-EOS file:*

```
char version[16];
fid = SWopen(“SwathFile.hdf”, DFACC_RDWR);
status = EHgetid(fid, &HDFfid, &sdInterfaceID);
vdata_id = VSattach(HDFfid, -1, “w”);
[Define vdata fields]
VSdetach(vdata_id);
SWclose(fid);
```

Note that the file is opened and closed using the HDF-EOS open and close routines.

To access the SDS id of an HDF-EOS (unmerged) grid field:

```
fid = SWopen(“GridFile.hdf”, DFACC_RDWR);
status = EHgetid(fid, &HDFfid, &sdInterfaceID);
idx = SDnametoindex(sdInterfaceID, “GridField”);
sdsID = SDselect(sdInterfaceID, idx);
```

The user can now apply the HDF SD interface directly to the field.

FORTRAN *integer function ehidinfo(fid,hdffid,sdid)*

*integer*4*	*fid*
*integer*4*	*hdffid*
*integer*4*	*sdid*

Convert Grid Coordinates (i,j) to (Longitude, Latitude)

GDij2ll

```
intn GDij2ll(int32 projcode, int32 zonecode, float64 projparm[], int32 spherecode,
             int32 xdimsize, int32 ydimsize, float64 upleft[], float64 lowright[],
             int32 npnts,  int32 row[], int32 col[], float64 longitude[],
             float64 latitude[], int32 pixcen, int32 pixcnr)
```

projcode	*IN:*	*GCTP projection code*
zonecode	*IN:*	*GCTP zone code used by UTM projection*
projparm	*IN:*	*Projection parameters*
spherecode	*IN:*	*GCTP spherecode*
xdimsize	*IN:*	*xdimsize from GDgridinfo( )*
ydimsize	*IN:*	*ydimsize from GDgridinfo( )*
upleft	*IN:*	*Upper left corner of the grid in meter (all projections except Geographic) or DMS degree (Geographic projection), values from GDgridinfo( )*
lowright	*IN:*	*Lower right corner of the grid in meter or DMS degreest, Geographic) or DMS degree (Geographic projection), values from GDgridinfo( )*
npnts	*IN:*	*number of lon-lat points*
row	*IN:*	*row numbers of the pixels (zero based)*
col	*IN:*	*column numbers of the pixels (zero based)*
pixcen	*IN:*	*Code from GDpixreginfo*
pixcnr	*IN:*	*Code from GDorigininfo*
longitude	*OUT:*	*longitude array (decimal degrees)*
latitude	*OUT:*	*latitude array (decimal degrees)*

Purpose — *Converts a grid's (i,j) coordinates to longitude and latritude.*

Return value — *Returns SUCCEED(0) if successful or FAIL(-1) otherwise.*

Description — *This routine converts any grid's (i,j) coordinates to longitude and latiude in decimal degrees.*

Example

```
int32       gridid, npnts = 2;
int32       projcode, origincode, pixregcode, zonecode, spherecode;
float64     upleft[2], lowright[2];
float64     projparm[13];
```

```
int32           cols[2], rows[2] ;
float64          lon[2], lat[2];
int32           xdimsize, ydimsize;
cols[0]= 10;
rows[0]= 14;
cols[1]= 17;
rows[1]= 9;
status = GDprojinfo(gridid, &projcode, &zonecode, &spherecode,
projparm);
status = GDgridinfo(gridid, &xdimsize, &ydimsize, upleft, lowright);
status = GDpixreginfo(gridid, &pixregcode);
status = GDorigininfo(gridid, &origincode);
status = GDij2ll(projcode, zonecode, projparm, spherecode, xdimsize,
ydimsize, upleft, lowright, npnts, rows, cols, lon, lat, pixregcode, origincode);
```

FORTRAN *integer function gdij2ll(projcode, zonecode, projparm, spherecode, xdimsize, ydimsize,upleft, lowright, npnts, rows, cols, longitude, latitude, pixregcode, origincode)*

```
integer*4       projcode, pixregcode, origincode, zonecode, spherecode
real*8          projparm(*)
integer*4       xdimsize, ydimsize, npnts
integer         cols(*), rows(*)
real*8          longitude(*), latitude(*)
real*8          upleft(2), lowright(2)
```

The Equivalent FORTRAN code for the example above is:

```
                npnts = 2
                cols(1)= 10
                rows(1)= 14
                cols(2)= 17
                rows(2)= 9
                status = gdprojinfo(gridid, projcode, zonecode, spherecode, projparm)
                status = gdgridinfo(gridid, xdimsize, ydimsize, upleft, lowright)
                status = gdpreginfo(gridid, pixregcode)
                status = gdorginfo(gridid, origincode)
                status = gdij2ll(projcode, zonecode, projparm, spherecode, xdimsize,
&               ydimsize, upleft, lowright, npnts, rows, cols, longitude, latitude,
&               pixregcode, origincode)
```

Note: ***If the pixel (i,j) is at the poles then this routine will return 90 (north pole) or -90 (south pole) for the latitude. However depending on the floating point accuracy one may get different results for longitude of this pixel from gctp. The returned value for longitude could be any number between -180 and +180.***

Convert Grid Coordinates (Longitude, Latitude) to (i,j)

GDll2ij

```
intn GDll2ij(int32 projcode, int32 zonecode, float64 projparm[], int32 spherecode,
             int32 xdimsize, int32 ydimsize, float64 upleft[], float64 lowright[],
             int32 npnts, float64 longitude[],  float64 latitude[], int32 row[],
             int32 col[], float64 xval[], float64 yval[])
```

projcode	*IN:*	*GCTP projection code*
zonecode	*IN:*	*GCTP zone code used by UTM projection*
projparm	*IN:*	*Projection parameters*
spherecode	*IN:*	*GCTP spherecode*
xdimsize	*IN:*	*xdimsize from GDgridinfo( )*
ydimsize	*IN:*	*ydimsize from GDgridinfo( )*
upleft	*IN:*	*Upper left corner of the grid in meter (all projections except Geographic) or DMS degree (Geographic projection), values from GDgridinfo( )*
lowright	*IN:*	*Lower right corner of the grid in meter or DMS degreest, Geographic) or DMS degree (Geographic projection), values from GDgridinfo( )*
npnts	*IN:*	*number of lon-lat points*
longitude	*IN:*	*longitude array (decimal degrees)*
latitude	*IN:*	*latitude array (decimal degrees)*
row	*OUT:*	*row numbers of the pixels (zero based)*
col	*OUT:*	*column numbers of the pixels (zero based)*
xval	*OUT:*	*x array*
yval	*OUT:*	*y array*

Purpose Converts pixel's longitude and latritude to its (i,j) coordinates

Return value Returns SUCCEED(0) if successful or FAIL(-1) otherwise.

Description This routine converts longitude and latritude pair (in decimal degrees) of any pixel in grid to its (i,j) coordinates. In addition it outputs the x, y position (scaled distances) of the point in the grid.

Example

```
int32        gridid, npnts = 2;
int32        projcode, origincode, pixregcode, zonecode, spherecode ;
```

```
float64         upleft[2], lowright[2];
float64         projparm[13];
int32           xcord[2], ycord[2];
float64         cols[2], rows[2], lon[2], lat[2];
int32           xdimsize, ydimsize;
lat[0]= 48.0;
lon[0]= -120.0;
lat[1]= 34.0;
lon[1]= -110.0;
status = GDprojinfo(gridid, &projcode, &zonecode, &spherecode,
projparm);
status = GDgridinfo(gridid, &xdimsize, &ydimsize, upleft, lowright);
status = GDpixreginfo(gridid, &pixregcode);
status = GDorigininfo(gridid, &origincode);
status = GDll2ij(projcode, zonecode, projparm, spherecode, xdimsize,
ydimsize, upleft, lowright, npnts, lon, lat, , rows, cols, xcord, ycord);
```

FORTRAN

```
integer function gdll2ij( projcode, zonecode, projparm, spherecode, xdimsize,
ydimsize,upleft, lowright, npnts, longitude, latitude, row, col, xcord, ycord )
integer*4       projcode, pixregcode, origincode, zonecode, spherecode
real*8          projparm(*)
integer*4       xdimsize, ydimsize, npnts
integer          row(*), col(*)
real*8          longitude(*), latitude(*), xcord(*), ycord(*)
real*8          upleft(2), lowright(2)
```

The Equivalent FORTRAN code for the example above is:

```
npnts = 2
lat(1)= 48.0
lon(1)= -120.0
lat(2)= 34.0
lon(2)= -110.0
status = gdprojinfo(gridid, projcode, zonecode, spherecode, projparm)
status = gdgridinfo(gridid, xdimsize, ydimsize, upleft, lowright)
status = gdpreginfo(gridid, pixregcode)
status = gdorginfo(gridid, origincode)
```

```
            status = gdll2ij(projcode, zonecode, projparm, spherecode, xdimsize,
&           ydimsize, upleft, lowright, npnts, lon, lat, row, col, xcord, ycord)
```

Convert EASE Grid Coordinates (r,s) to (Longitude, Latitude)

GDrs2ll

intn GDrs2ll(int32 projcode, float64 projparm[], int32 xdimsize, int32 ydimsize, float64 upleft[], float64 lowright[], int32 npnts, float64 r[], float64 s[],float64 longitude[], float64 latitude[], int32 pixcen, int32 pixcnr)

projcode	*IN:*	*GCTP projection code (GCTP_BCEA)*
projparm	*IN:*	*Projection parameters*
xdimsize	*IN:*	*xdimsize from GDgridinfo( )*
ydimsize	*IN:*	*ydimsize from Gdgridinfo( )*
upleft	*IN:*	*Upper left corner lon/lat of the grid in DMS format, values from GDgridinfo( )*
lowright	*IN:*	*Lower right corner lon/lat of the grid in DMS format, values from GDgridinfo( )*
npnts	*IN:*	*number of lon-lat points*
r	*IN:*	*array of EASE grid's r coordinate*
s	*IN:*	*array of EASE grid's s coordinate*
pixcen	*IN:*	*Code from GDpixreginfo*
pixcnr	*IN:*	*Code from GDorigininfo*
longitude	*OUT:*	*longitude array (decimal degrees)*
latitude	*OUT:*	*latitude array (decimal degrees)*

Purpose *Converts EASE grid's (r,s) coordinates to longitude and latritude.*

Return value *Returns SUCCEED(0) if successful or FAIL(-1) otherwise.*

Description *This routine converts EASE grid's (r,s) coordinates to longitude and latiude in decimal degrees.*

Example

```
int32           gridid, npnts = 2;
int32           projcode, origincode, pixregcode;
float64         upleft[2], lowright[2];
                float64         projparm[13];
float64         rcord[2], scord[2], lon[2], lat[2];
int32           xdimsize, ydimsize;
```

```
                    rcord[0]= 0.;
                    scord[0]= 0.;
                    rcord[1]= 691.5;
                    scord[1]= 293.;
                    status = GDprojinfo(gridid, GCTP_BCEA, 0, 0, projparm);
                    status = GDgridinfo(gridid, xdimsize, ydimsize, upleft, lowright);
                    status = GDpixreginfo(gridid, &pixregcode);
                    status = GDorigininfo(gridid, &origincode);
                    status = GDrs2ll(GCTP_BCEA, projparm, xdimsize,ydimsize, upleft,
                    lowright, npnts, rcord, scord, lon, lat, pixregcode, origincode);
```

```
FORTRAN             integer function gdrs2ll( projcode, projparm, xdimsize, ydimsize,upleft,
                    lowright,  npnts, r, s, longitude, latitude, pixregcode, origincode)
                    integer*4        projcode, pixregcode, origincode
                    real*8           projparm(*)
                    integer*4        xdimsize, ydimsize, npnts
                    real*8           r(*), s(*), longitude(*), latitude(*)
                    real*8           upleft(2), lowright(2)
```

The Equivalent FORTRAN code for the example above is:

```
                    parameter (GCTP_BCEA = 98)
                    npnts = 2
                    rcord(1)= 0.
                    scord(1)= 0.
                    rcord(2)= 691.5
                    scord(2)= 293.
                    status = gdprojinfo(gridid, GCTP_BCEA, 0, 0, projparm)
                    status = gdgridinfo(gridid, xdimsize, ydimsize, upleft, lowright)
                    status = gdpreginfo(gridid, pixregcode)
                    status = gdorginfo(gridid, origincode)
                    status = gdrs2ll(GCTP_BCEA, projparm, xdimsize, ydimsize, upleft,
&                   lowright, npnts, rcord, scord, longitude, latitude, pixregcode, origincode)
```

This page intentionally left blank.

Appendix A. Numbertype Codes

The HDF-EOS2 library uses a number of commonly used datatypes with names that are defined in HDF4 (Table A1). These types are shown in Table A1.

Table A1			
DFNT_NONE	0	DFNT_INT8	20
DFNT_QUERY	0	DFNT_UINT8	21
DFNT_VERSION	1	DFNT_INT16	22
DFNT_UCHAR8	3	DFNT_UINT16	23
DFNT_UCHAR	3	DFNT_INT32	24
DFNT_CHAR8	4	DFNT_UINT32	25
DFNT_CHAR	4	DFNT_INT64	26
DFNT_FLOAT32	5	DFNT_UINT64	27
DFNT_FLOAT	5	DFNT_INT128	28
DFNT_FLOAT64	6	DFNT_UINT128	29
DFNT_DOUBLE	6	DFNT_CHAR16	42
DFNT_FLOAT128	7	DFNT_UCHAR16	42

This page intentionally left blank.

Abbreviations and Acronyms

AI&T	Algorithm Integration & Test
AIRS	Atmospheric Infrared Sounder
API	application program interface
ASTER	Advanced Spaceborne Thermal Emission and Reflection Radiometer
CCSDS	Consultative Committee on Space Data Systems
CDRL	Contract Data Requirements List
CDS	CCSDS day segmented time code
CERES	Clouds and Earth Radiant Energy System
CM	configuration management
COTS	commercial off–the–shelf software
CUC	constant and unit conversions
CUC	CCSDS unsegmented time code
DAAC	distributed active archive center
DBMS	database management system
DCE	distributed computing environment
DCW	Digital Chart of the World
DEM	digital elevation model
DTM	digital terrain model
ECR	Earth centered rotating
ECS	EOSDIS Core System
EDC	Earth Resources Observation Systems (EROS) Data Center
EDHS	ECS Data Handling System
EDOS	EOSDIS Data and Operations System
EOS	Earth Observing System
EOSAM	EOS AM Project (morning spacecraft series)
EOSDIS	Earth Observing System Data and Information System
EOSPM	EOS PM Project (afternoon spacecraft series)

ESDIS	Earth Science Data and Information System (GSFC Code 505)
FDF	flight dynamics facility
FOV	field of view
ftp	file transfer protocol
GCT	geo–coordinate transformation
GCTP	general cartographic transformation package
GD	grid
GPS	Global Positioning System
GSFC	Goddard Space Flight Center
HDF	hierarchical data format
HEG	HDF-EOS to GeoTIFF Converter
HITC	Hughes Information Technology Corporation
http	hypertext transport protocol
I&T	integration & test
ICD	interface control document
IDL	interactive data language
IP	Internet protocol
IWG	Investigator Working Group
JPL	Jet Propulsion Laboratory
LaRC	Langley Research Center
LIS	Lightening Imaging Sensor
M&O	maintenance and operations
MCF	metadata configuration file
MET	metadata
MODIS	Moderate–Resolution Imaging Spectroradiometer
MSFC	Marshall Space Flight Center
NASA	National Aeronautics and Space Administration
NCSA	National Center for Supercomputer Applications
netCDF	network common data format
NGDC	National Geophysical Data Center

NMC	National Meteorological Center (NOAA)
ODL	object description language
PC	process control
PCF	process control file
PDPS	planning & data production system
PGE	product generation executive (formerly product generation executable)
POSIX	Portable Operating System Interface for Computer Environments
PT	point
QA	quality assurance
RDBMS	relational data base management system
RPC	remote procedure call
RRDB	recommended requirements database
SCF	Science Computing Facility
SDP	science data production
SDPF	science data processing facility
SGI	Silicon Graphics Incorporated
SMF	status message file
SMAP	Soil Moisture Active Pasive
SMP	Symmetric Multi–Processing
SOM	Space Oblique Mercator
SPSO	Science Processing Support Office
SSM/I	Special Sensor for Microwave/Imaging
SW	swath
TAI	International Atomic Time
TBD	to be determined
TDRSS	Tracking and Data Relay Satellite System
TRMM	Tropical Rainfall Measuring Mission (joint US – Japan)
UARS	Upper Atmosphere Research Satellite
UCAR	University Corporation for Atmospheric Research
URL	universal reference locator

USNO	United States Naval Observatory
UT	universal time
UTC	Coordinated Universal Time
UTCF	universal time correlation factor
UTM	universal transverse mercator
VPF	vector product format
WWW	World Wide Web