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Operations Concept for Digital Elevation Model Data in ECS

White Paper

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Preface

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Abstract

This document is an operations concept for Digital Elevation Model and auxiliary parameter data to be archived and distributed by the Earth Observing System Core System (ECS). The data will be stored in the Hierarchical Data Format (HDF) and will be derived from binary inputs, supplied by the Eros Data Center (EDC). The data will be in both one km. and 100m resolutions and will cover the surface of the earth. Access software to this data will be provided by ECS as part of the Science Data Processing toolkit. Upgrades to the data will be provided periodically by EDC and will be approximately once per year.

Keywords: Digital, Elevation, Model, DEM, Eros, EDC

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Contents

List of Tables

1. Introduction

The NASA Earth Observing System Core System (ECS) will process, archive and distribute science data taken from instruments on EOS-AM1, Landsat-7, EOS-PM1 and other spacecraft in the EOS program. The system is scheduled to be released to archive centers (DAACs) in March, 1999. The system will become operational by July, 1999. DAAC locations include Eros Data Center (EDC), Goddard Space Flight Center (GSFC), National Snow and Ice Data Center (NSIDC), Langely Research Center (LaRC), and others.

ECS has a requirement to supply storage for and access to Digital Elevation Model (DEM) data for instrument data processing and for access by authorized users. The format and content of the data has been specified by the DEM access committee of the Science Working Group, EOS-AM1 Platform (SWAMP). The committee specification was at a high level, giving the data resolution, coverage and data variables to be included.

Raw DEM data is produced by EDC, for NASA. This data is the binary formated representation the content specified by the SWAMP committee. The binary data is reformatted to HDF, the standard data format of ECS. The HDF data is then ingested and stored by ECS at the EDC archive center. ECS has the responsibility for the later two functions. It is expected that occasional updates will be made to the data throughout the lifetime of the EOS program.

The data will be accessed by instrument data processing software, using an interface provided by ECS, and running at EDC and other DAACs. The data will also be accessed as standard ECS products by external users, who have been authorized by NASA.

This document gives an operations concept for ECS handling of the DEM data. We describe the input data format and content (2.); output data (3.); software to be used in data conversion (4.); the plan for testing the conversion (5.); the ingestion process into ECS (6.); storage mechanism (7.); access to the data for science data processing (8.); and access to the data by external users (9.).

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2. Input Data

This section describes the DEM data provided by EDC. The data are provided in 1 km (30arc sec.) and 100m (3 arc sec.) resolution. The former are provided in six files, covering the surface of the earth[1]. The latter are provided in 648, 10^0 x 10^0 files, also covering the earth's surface. The lower resolution files include both elevation data and a land/sea mask. The high resolution files contain elevation data plus several other parameters, listed below. ASCII header files, accompanying each binary file, include information on format, units, projection, number of rows and columns, layout, fill value, datum, spheroid, and statistics. These files were used in constructing the following table.

The Metadata are attributes describing the file content and are contained in an ASCII file and listed in detail in Appendices A and B.

Table 2-1. Input Data Description

Data Set Name	Format	Units	1kmResolution 10^0X10^0 Size[1]	100mResolution 10^0X10^0Size[3]
Elevation	2 byte int.	meter	2.88 MB	288 MB
Land/sea Mask	1 byte int.	codes	1.44 MB	144 MB
Slope[2]	1 – 16 bit int.	degrees	0.18 - 2.88 MB	18 - 288 MB
Aspect	2 byte int.	degrees	2.88 MB	288 MB
Std. Dev. Elevation	2 byte int.	meter	2.88 MB	288 MB
Std. Dev. Slope[2]	1 – 16 bit int.	degrees	0.18 - 2.88 MB	18 - 288 MB
Source	1 byte int.	code	(1^0X1^0 Resolution	0.07 MB)
Horiz. Accuracy	2 byte int.	meter	(1^0X1^0 Resolution	0.13 MB)
Vert. Accuracy	2 byte int.	meter	(1^0X1^0 Resolution	0.13 MB)
Method	1 byte int.	code	(1^0X1^0 Resolution	0.07 MB)
Geoid	2 byte int.	meter	(1^0X1^0 Resolution	0.13 MB)
Metadata	ASCII file			

Note that the data in Table 2-1 represent input supplied by EDC as of Jan. 31, 1999. Additional parameters are expected and placeholders have been left in output data files described in Section 3, Table 3-1.

1. It is expected that the final input data sets for one km. resolution will be in six 90^0 X 120^0 tiles and not in the 648 10^0X10^0 tiles available by Jan. 31, 1999.

2. It is assumed that 1 bit will be the minimum length and that 16 bits will be the maximum length of the slope and standard deviation of the slope, respectively.

3. It is expected that pixel locations within each tile, will be defined at the center points of the pixels, for both resolution data sets. That is, the latitude and longitude of each pixel will be defined at the center points of each pixel.

3. Output Data

This section describes the format of data to be used by ECS. Output data is accessed by the SDP Toolkit which is described in Section 5. There will be 6 X 3 files for the 1km data set (each covering 120^0X90^0 region) and 648 X 2 files for 100m data set (each covering 10^0X10^0 region). The format is HDF. The filenames and volumes are listed in Table 3-1.

Table 3-1. Contents of Output HDF File

Data Set Name	Size	Content
dem30ARC_<upperleftcorner coordinates>.hdf	1.1 GB	Elevation, Land/sea Mask, Slope, Aspect, Source, Method, Horiz. Accuracy, Vert. Accuracy, Geoid, and Metadata
stddev30ARC_<upperleftcorner coordinates>.hdf	630 MB	Std. Dev. Elevation , Std. Dev. Slope, and Metadata
obscshad30ARC_<upperleft corner coordinates>.hdf	2.2 GB	Topo Obscur., Topo shadow, and Metadata
dem3ARC_<upperleftcorner coordinates>.hdf	270 MB	Elevation, Land/sea Mask, Slope, Aspect, Geoid, and Metadata
stddev3ARC_<upperleftcorner coordinates>.hdf	74 MB	Std. Dev. Elevation , Std. Dev. Slope, and Metadata

Note in Table 3-1 the the 1 km data is uncompressed, while the 100m data is compressed using HDF internal compression.

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4. Conversion Software

ECS supplies software for the conversion of the input binary data into output HDF data. The output data have associated ECS compatible metadata. There are four conversion drivers; two for the 100m data set and two for 1km data set.

4.1 Drivers for 1km data set

The first conversion driver converts input binary data for Elevation, Land/sea mask, Slope, and Aspect to HDF format and writes them to a single file. Each input file covers a 120^0X90^0 region, and six files cover the surface of the earth. The conversion is done one at a time for each of the six regions. In addition on each HDF file we write Metadata, Geoid, and Source Accuracy data. The Metadata file for both 1km and 100m resolutions include inventory metadata and archive matadata (see Appendicies A and B).

INPUT: Six binary files generated by EDC for every 120^0X90^0 region.

Elevation

Land/Sea Mask

Slope

Aspect

Metadata (generated by SDP Toolkit)

Geoid data (covers the surface of the earth)

Source, Method, Horiz. Accuracy, and Vert. Accuracy data

Header and Statistic information files for Elevation, Land/Sea Mask, Slope, and Aspect accompanied by each binary file.

OUTPUT: HDF file created for the region specified by the input data.

The second conversion driver converts input binary data for Standard Deviation Elevation and Standard Deviation Slope to HDF format and writes them to a single file. Each input file covers a 120^0X90^0 region, and six cover the surface of the earth. The conversion is done one at a time for each of the six regions. In addition on each HDF file we write Metadata.

INPUT: Binary files generated by EDC for every 120^0X90^0 region.

Standard Deviation Elevation

Standard Deviation Slope

Metadata (generated by SDP Toolkit team using Metadata-Works)

Header and Statistic information files for Standard Deviation Elevation, and Standard Deviation Slope accompanied by each binary file.

OUTPUT: HDF file created for the region specified by the input data.

4.2 Drivers for 100m data set

The first conversion driver converts input binary data for Elevation, Land/sea mask, Slope, and Aspect to HDF format and writes them to a single file. Each input file covers a 10^0X10^0 region, and 648 HDF files cover the whole world. The conversion is done one at a time for each of the 648 regions. In addition on each HDF file we write Metadata, and Geoid data.

INPUT: Binary files generated by EDC for every 10^0X10^0 region.

Elevation

Land/Sea Mask

Slope

Aspect

Metadata (generated by SDP Toolkit using Metadata-Works)

Geoid data (covers the whole world)

Header and Statistic info files for Elevation, Land/Sea Mask, Slope, and Aspect accompanied by each binary file.

OUTPUT: HDF file created for the region specified by the input data.

The second conversion driver converts input binary data for Standard Deviation Elevation and Standard Deviation Slope to HDF format, and writes them to a single file. If each input file covers a 10^0X10^0 region, and 648 HDF files cover the whole world. The conversion is done one at a time for each of the 648 regions. In addition on each HDF file we write Metadata.

INPUT: Binary files generated by EDC for every 10^0X10^0 region.

Standard Deviation Elevation

Standard Deviation Slope

Metadata (generated by SDP Toolkit using Metadata-Works)

Header and Statistic info files for Standard Deviation Elevation, and Standard Deviation Slope accompanied by each binary file.

OUTPUT: HDF file created for the region specified by the input data.

All conversion driver software is written in C language and can be run on SUN and SGI machines. The software can be found in the directory /home/ataaheri/DEM/dem_conversion on machine “green” at Landover site.

5. Test Plan

For each conversion driver, a test driver is available, written in the C language. The test driver opens input binary files and the HDF converted file. It generates N (e.g. 500) random longitude and latitude sets inside the converted region. For each longitude and latitude set the code finds data for every layer (such as Elevation, Land/sea mask, etc.) from both binary files and the HDF file. It then compares the extracted data for inconsistencies.

The test driver software is not part of formally delivered ECS software, but will be available to the DAAC for data quality assurance.

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6. Data Ingest into ECS

The converted data can be inserted into the ECS Data Server by a variety of methods. The recommended method is the static file insertion facility provided by ECS. A program called the Insert Static File is used for inserting a static data granule into the Data Server. The procedure is described below. A summary of the process is given in Table 6-1. Details are found in DID 625, ECS SSI&T Training Manual.

Assumptions:

1. The SSIT Manager is running.
2. The ESDTs have been installed on the Science Data Server.
3. The Target MCF (.met) for this data granule has been created for the Insert.

To Insert the static granule data file to the Science Data Server, execute the steps that follow:

1 From the SSIT Manager, click on the Tools menu, then choose Data Server and then Insert Static. An xterm with title "SSIT: PGE Static Input File Insertion" will be displayed.

2 At the program prompt Configuration filename? (enter for default: ../..EcDpAtInsertStaticFile.CFG) Press **Return.**

3 At the program prompt ECS mode of operations? Type in the <***mode***> and Press **Return**

<***mode***> can either be **OPS** or **TS1.** Use the correct mode and press **Return**.

4 At the program prompt ESDT Short Name for the file(s) to insert? Type ***ESDTShortName***, press **Return**

The ***ESDTShortName*** is the ShortName of the ESDT descriptor file corresponding to this granule to be Inserted. For example, type **MOD02LUT**, press **Return**.

5 At the program prompt ESDT Version for the file(s) insert? type the version number and press **Return.**

6 At the program prompt Science Group for Static file (one of {C, L, D, O} followed by a 3 digit number), type ***ScienceGroupID***, press **Return**

The ***ScienceGroupID*** is an identifier used to define the file type as a coefficient file (C), a lookup table file (L), Metadata Configuration File (MCF) ((D) for Database file), or other type file (O). It distinguishes static granules of different types which share the same ESDT. For instance, for a coefficient file, use **C*n***, where number *n* could be 0, 1, 2…; this number *n* needs to be matched with the number *n* in the PGE_PGEName#Version#profileID.odl file. For example, type **C001**, press **Return**.

The Science Group ID must match what was edited into the PGE metadata ODL file for that PCF entry.

7 At the program prompt Is there more than one data file for this Static (Y = Yes, N = No) (enter for default: N). If there is only one data file, press **Return** and go to next step. If there are more than one data files, type **Y,** press **Return** and go to step 10.

8 At the program prompt Single Static Filename to Insert (including FULL path), type ***pathname/GranuleFileName***, press **Return**

The ***pathname/GranuleFileName*** is the full path name and file name of the static data granule to be Inserted. For example, type **/home/MODIS/PGE10/MOD_PR28/coeff/emissivity.dat**, press **Return**.

9 At the program prompt Associated ASCII Metadata Filename to Insert (including FULL path). Type pathname/GranuleFileName.met)?, press **Return**.

The ***pathname/GranuleFileName.met*** is the full path name and file name of the .met file for the associated static data granule to be Inserted. For example, type **/home/MODIS/PGE10/MOD_PR28/MOD28LUT.met** press **Return**.

10 At the program prompt Directory where all data files and .met file exist (FULL path) Type ***pathname*** press **Return**. where ***pathname*** is the full path of the directory where all data files and .met file exist.

Note for a multifile granule, the data files and .met file should be placed in the same working directory.

11 At the program prompt Name of MFG file (enter to end list)? Type in the ***GranuleFileName,*** one at a time and press **Return.** To end the list press **Return.** where ***GranuleFileName*** is the names of the multifile granules.

12 At the program prompt Associated ASCII Metadata Filename to Insert? Type ***GranuleFileName.met***, press **Return.**

where ***GranuleFileName.met*** is the name of one .met file that is used with all data granules in the even of a multifile granule. The dynamic data granule will be Inserted to the Data Server. For reference, the Data Server Universal Reference (UR) will be printed on the screen.

13 At the program prompt Hit return to run again, 'q <return>' to quit: type **q** and press **Return** to quit or just press **Return** to insert additional dynamic granules. If continuing, repeat steps 2 through 9.

Table 6-1. Inserting Static Data Granules to the Science Data Server - Quick-Step Procedures

Step	What to Enter or Select	Action to Take
1	Tools Data Server I nsert Static	(No action)
2	Configuration FileName	press Return
3	Mode	press Return
4	ESDTShortName	press Return
5	ESDT Version	press Return
6	ScienceGroupID	press Return
7	Is there more than one data file for this Static Granule?	Y = Yes, N = NO if N, press Return go to step 8 if Y, press Return go to step 10
8	pathname/GranuleFileName	press Return
9	pathname/ GranuleFileName.met	press Return
10	pathname	press Return
11	GranuleFileNames	press Return, press Return to end list
12	GranuleFileName.met	press Return
13	q | Return	press Return

It is expected that Digital Elevation Model data will be updated infrequently following initial insertion. ECS provides two methods controlling these updates.

1. The collection will have an Earth Sciences Data Type (ESDT) which specifies the collection. These ESDTs can be versioned upon subsequent updates.

2. Older versions can be copied over.

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7. Data Archival

The DEM data in HDF format will be permanently archived at EDC. The data will be accessible to science data processing software via the ECS Planning and Data Production System (PDPS). Low resolution data will be available on disk, accessable directly by the PDPS. High resolution data will be accessible through the ECS Science Data Server (SDSRV). The high resolution data will be stored on D3 tape in the ECS archives.

It is expected that the DEM data will be updated periodically. One update per year is possible. It is envisioned that any updates to the DEM information would have been previously coordinated and approved through the Mission and Operations (M&O) Configuration Control Board (CCB). Please refer to the M&O Configuration Management Plan, (102-CD-002), available from the ECS document server (http://edhs1.gsfc.nasa.gov), for a description of the configuration control process and CCB.

The DEM will be described in the ECS inventory by Earth Sciences Data Types (ESDTs). Each resolution will be described as a collection by an ESDT. The ESDT contains a descriptor file which has attributes describing the entire data collection. The ESDT also contains an attribute specifying the version of the collection. This version ID will be modified when an update occurs. These procedures are described in detail in the Science Software I&T Operational Procedures for the ECS Project (162-TD-001) and in the Mission Operations Procedures for the ECS Project (611-CD-004)

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8. DEM Access for Instrument Team Processing

8.1 Data access by the ECS Production System.

DEM data, to be used during science data processing, will be provided to the processing software by the ECS Data Production System. As described in Section 7, high resolution (100m) data will be strored in the Archives and will be made available to the production system (PDPS) on request. The low resolution (1 km.) data will be available directly from RAID disk attached to the production system. Typically, a data processing request from the production system will query the ECS Science Data Server for a subset of DEM data specified by a bounding rectangle (corner points of latitude and longitude). If the data is available, one or more tiles, encompassing the requested area, will be returned to the production system. These files are staged to local disk, by PDPS. A Process Control File (PCF) is created that specifies the mapping between logical IDs for DEM data files and the staged physical file names. In this way, science data production code, can access the data through LIDs, and not need to know actual physical file location

As an example, if for the region of interest the upper left corner is (W105, N45) and the lower right corner is (W95, N35), the files that will be staged are: dem3ARC_W100N50.hdf, dem3ARC_W90N50.hdf, dem3ARC_W100N40.hdf, dem3ARC_W90N40.hdf, stddev3ARC_W100N50.hdf, stddev3ARC_W90N50.hdf, stddev3ARC_W100N40.hdf, and stddev3ARC_W90N40.hdf, dem30ARC_W180N90.hdf, and stddev30ARC_W180N90.hdf

The PCF file that is created upon staging the files will have the DEM data file entries:

10650|dem30ARC_W180N90.hdf|<full path>|||dem30ARC__W180N90.hdf|1
10651|stddev30ARC_W180N90.hdf|<full path>|||stddev30ARC__W180N90.hdf|1
10653|dem3ARC_W100N50.hdf|<full path>|||dem3ARC_W100N50.hdf|4
10653|dem3ARC_W100N40.hdf|<full path>|||dem3ARC_W100N40.hdf|3
10653|dem3ARC_W90N50.hdf|<full path>|||dem3ARC_W90N50.hdf|2
10653|dem3ARC_W90N40.hdf|<full path>|||dem3ARC_W90N40.hdf|1
10654|stddev3ARC_ W100N50.hdf|<full path>|||stddev3ARC_ W100N50.hdf|4
10654|stddev3ARC_ W100N40.hdf|<full path>|||stddev3ARC_ W100N40.hdf|3
10654|stddev3ARC_ W90N50.hdf|<full path>|||stddev3ARC_ W90N50.hdf|2
10654|stddev3ARC_ W90N40.hdf|<full path>|||stddev3ARC_ W90N40.hdf|1

Use of the PCF is further described in Section 8.2. The process of access to data by science data production software is specified in detail in the SDP Toolkit Users Guide for the ECS Project. It can be obtained from http://edhs1.gsfc.nasa.gov under Toolkits.

8.2 Data Access by a Science Data Processing Executable (PGE).

Science data processing software, running at the DAAC will access the DEM data, provided through the Production System, through a standard interface, provided by ECS. This is known as

the Science Data Processing Toollkit (SDP Toolkit). The Digital Elevation Model (DEM) access tools described in this section were introduced for the first time in Version 5.2 of the SDP Toolkit. (SDP Toolkit Users Guide for the ECS Project) The text in this section has been excerpted from that Toolkit Users Guide. For more detailed references, please consult that document.

The DEM Toolkit tools are intended for accessing a hierarchy of DEM data sets. In order to utilize these functions, a individual user must install the SDP Toolkit on their machine. Data production software running in the DAAC will have the toolkit available. This hierarchy of data sets will include data from multiple resolutions. The DEM tools accesses this information based on resolution; a user indicates from which resolutions they are interested in query data. Each of these resolutions consists of multiple files. For example, the 3 arc second resolution data set (~100 m postings) is divided into 648 100X100 files. The number and extent of these files are transparent to the user. The user indicates interest in a particular resolution with a resolution tag. This resolution tag is initialized by the tool PGS_DEM_Open. The resolution tags MUST be initialized, either individually or as an array of the resolution tags, BEFORE any of the other DEM tools may access the data set at that resolution. These initialized resolution tags allow access of the underlying files (in the case of the 3 arc second resolution, the 10X10 files), without having to actually specify the particular physical file.

As mentioned above, the DEM tools may be used with a hierarchy of DEM data sets. Most of the DEM tools not only are able to accept a single resolution tag, but they may even accept a list, an array, of resolution tags. The first element of the array is the tag for the preferred resolution of the data (generally this will be the highest resolution data set). Each successive entry in the array will be in descending interest of use: in general, lower spatial resolution. If one inputs an array of resolution tags to a DEM tool, then one may be able to gain information across resolutions. For example, one may enter an array of resolution tags into the tool PGS_DEM_GetRegion. This tool will go to the data set files of the first resolution tag and extract the region of interest. If any of the points in the region of interest is a fill value, then the tool will access the next data set in the input array (for that particular point). It will continue to step through progressively lower resolution data sets (depending on the order of the elements in the inputted array) until it finds "valid", actual, non-fill value, data.

The data sets supported by SDP Toolkit are the 3 arc second (~100 m postings) and 30 arc second (approximately 1km postings) resolution data sets. The layer that will be available in both resolutions are elevation (PGSd_DEM_ELEV), water/land (PGSd_DEM_WATER_LAND), slope (PGSd_DEM_SLOPE), aspect (PGSd_DEM_ASPECT), std. dev. Elevation (PGSd_DEM_STDEV_ELEV), std. dev. Slope (PGSd_DEM_STDEV_SLOPE), and geoid (PGSd_DEM_GEOID). Also other data included in the data files associated with 30 arc second files are data source (PGSd_DEM_SOURCE), quality metric (PGSd_DEM_HORIZONTAL_ACCURACY and PGSd_DEM_VERTICAL_ACCURACY). Both data sets are in HDF-EOS GRID format. The 3 arc second resolution data set is divided into 648 10X10 files. The 30 arc second resolution data set divides the earth's surface into 6 files. Both resolutions are in a Geographic Projection. By geographic, we mean that degrees of latitude and longitude are linearly mapped to row and column pixels, respectively.

To access these data sets, they must be included in the Process Control File (PCF), which specifies all input and output files to be accessed by the toolkit, during a production run. Details of creation and usage of this file can be found in the Toolkit Users Guide. The files which make up the 30 arc second resolution should each have a logical ID equal to 10650. The logical ID of the 3 arc second resolution files should be 10653. For more information on setting up a PCF for DEM access, see both the DEM data set README file and the PCF template which accompanies the Toolkit.

The DEM access tools are:

1. PGS_DEM_Open(): Open the DEM

DESCRIPTION: This tool initializes a list of resolutions tags which correspond to a series of DEM data sets. These initialized resolution tags are used by the DEM tools. A DEM data set includes all the files of a particular resolution. Presently, only two data sets are available: 3 arc second and 30 arc second resolutions which correspond to the tags PGSd_DEM_3ARC and PGSd_DEM_30ARC, respectively. A resolution tag MUST be initialized before it may be used in any of the other PGS_DEM tools. Each layer indicated in the layerList will automatically be initialized across all resolutions in the resolutionList.

2. PGS_DEM_Close(): Close the DEM

DESCRIPTION: This tool closes the session begun by the tool PGS_DEM_Open. One can close multiple data set sessions simultaneously or independently. If one wants to only close one DEM data set, the array resolutionList should only contain an individual resolution tag. Presently, only two data sets are available: 3 arc second and 30 arc second resolutions which correspond to the tags PGSd_DEM_3ARC and PGSd_DEM_30ARC, respectively. Each layer in the layerList will automatically be closed across all the resolutions indicated in the resolutionList.

3. PGS_DEM_DataPresent(): Check for Valid DEM Data Point

DESCRIPTION: This tool checks whether pixel(s), at specified latitude(s) and longitude(s), are data or fill values. In dataPresent, either PGS_TRUE or PGS_FALSE will be returned, corresponding to valid data or fill value, respectively.

4. PGS_DEM_SortModels(): Check for Data in a Specified Region of the DEM

DESCRIPTION: This tool will check the DEM data sets for complete data in a rectangular region defined by the latitude/longitude pair specified (i.e., upper left hand corner, lower right hand corner). If there are fill values at any of the points in the defined region, then the tool will query the next resolution tag in the array for that region. The first DEM data set to have complete data in the region of interest will have its corresponding resolution tag returned in completeDataSet. If none of the data sets in the input array is "complete", then the PGSd_DEM_NO_COMPLETE_DATA will be returned.

5. PGS_DEM_GetPoint(): Return Data at Specified DEM Points

DESCRIPTION: This tool attempts to return the data value(s) of the point(s) defined by latitude and longitude. If the latitude and longitude do not exactly correspond to the center (or corner, depending on the manner in which the DEM map has been constructed) of a pixel , the

value will be interpolated. Presently, there are only two interpolation methods supported: nearest neighbor and bilinear interpolation. If at this point there is a "hole", a fill value, in the data set, then the tool will access the next resolution tag in the input array. It will continue to step through progressively lower resolution data sets (depending on the order of the elements in the inputted array) until it finds actual data for that point. If all of the DEM data sets have a "hole" at this particular location, then the PGSDEM_M_FILLVALUE_INCLUDED will be returned. Even if some of the queried points are not able to be interpolated (i.e. at the lowest resolution that region is fill value), the value, interpolated value or fill value of the point(s) will be returned in interpValues.

6. PGS_DEM_GetRegion(): Return Data from a Specified Region of the DEM

DESCRIPTION: This tool returns the data from a rectangular region of the DEM data set. In addition to returning an array of data, this tool will return the dimension of the region in terms of coordinate degrees, the coordinates of the first element of the dataRegion, and the size of the pixel. If any of the points in the region of interest is a "hole", a fill value, then the tool will access the next DEM data set in the input array. It will continue to step through progressively lower resolution data sets (depending on the order of the resolution tags in the inputted array) until it finds "valid", actual data. If all of the inputted resolutions have a "hole" at these specific locations, then the PGSDEM_M_FILLVALUE_INCLUDED will be returned. Even if some of the queried points are not able to be interpolated (i.e., at the lowest resolution that region is fill value), the data region is still returned. The only consequence is that dataRegion will not consist solely of "valid" and interpolated data but will also contain fill values

7. PGS_DEM_GetMetadata(): Extract Metadata from the DEM

DESCRIPTION: This tool accesses the general metadata that pertains to a single DEM data set. The metadata is for the whole data set, not for isolated geographic sections of the data. Some of the metadata are valid for all the attributes, but other metadata will be mask specific.

8. PGS_DEM_GetQualityData(): Access DEM Quality Data

DESCRIPTION: This tool accesses the quality assurance layer of a particular DEM data set. It takes a latitude and longitude of a point of interest and an attribute mask. It returns information concerning the data source, the region over which the quality assurance information is valid, the quality metric of the aforesaid region, or information on the geoid..

9. PGS_DEM_GetSize(): Return Size of Specified DEM Region

DESCRIPTION: This tool determines the size of a rectangular region defined by the latitudes and longitudes of its upper left and lower right corners. This tool is meant to facilitate the user's ability to allocate appropriate space for the data returned by PGS_DEM_GetRegion and PGS_DEM_GetQualityData. Use of this tool can prevent core dumps and other errors due to improper allocation of memory.

A complete explanation of the tools, including examples, can be found in the SDP Toolkit Users Guide. The toolkit software is available for external users at http://edhs1.gsfc.nasa.gov, look under toolkit . The toolkit is installed at the DAACs as part of ECS.

Note: Before running PGE the environment variable PGS_PC_INFO_FILE will be set to the created PCF file. Upon running the PGE the staged files listed in the PCF will be initialized by a call to PGS_DEM_Open(). The files will remain open until a call to PGS_DEM_Close() is made. Once the files are initialized other DEM calls can be made to extract data and/or metadata. Examples in the SDF Toolkit Users Guide for DEM tools show the calls for extracting data, metadata, etc. If data is desired to be extracted first from 100m resolution and then from 1km resolution (if the 100m data resolution tile does not exist or has fillvalues) then both resolutions must be initialized by the call to PGS_DEM_Open. For example the following C sequence is needed to initialize both resolutions for elevation data:

```
PGSt_integer          numlayers = 1;
PGSt_integer          numResolutions = 2;
PGSt_integer          layerList[1];
PGSt_SMF_status       status;
PGSt_DEM_Tag          resolutionList[2];
resolutionList[0] = PGSd_DEM_3ARC;
resolutionList[1] = PGSd_DEM_30ARC;
layerList[0] = PGSd_DEM_ELEV;

status = PGS_DEM_Open(resolutionList, numResolutions, layerList, numlayers);
```

If this is the case, then points will be extracted first from the 100m data. If there are fillvalues in the data or there are missing tiles, then the real data will be extracted from the 1km data with appropriate warnings sent to the LogStatus file.

On the other hand, if only 100m data resolution is desired, the 100m data set will be searched for the data. If there are any missing tiles, then error will be returned during the initialization or extracting data depending on whether few tiles are missing or there are no staged files for the 100m data.

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9. DEM Access by External Users

DEM data stored at EDC will be used by science processing software at other ECS DAACs. Multiple methods exist to provide the data to the other DAACs. The EDC DAAC may request that the data either be ftp "pushed" to the other DAACs or to make it available for ftp "pull" by the other DAACs. The data may be copied to media for distribution to the other DAACs. After delivery/installation of the ECS 5A Release, the data may be transferred by an automated DAAC-to-DAAC data distribution /ingest interface

The DEM data will not be generally available to individual external users. Usage of the data by other than authorized instrument data processing software at ECS DAACs, will be a matter of NASA policy.

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References

1. SDP Toolkit Users Guide for the ECS Project, 333-CD-100
2. HDF-EOS Library Users Guide for the ECS Project, Vol. 1 and 2, 170-TP-100, 170-TP-101
3. ECS Project Training Material Volume 16: SSI&T, 625-CD-016
4. Mission Operations Procedures for the ECS Project, 611-CD-004

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Appendix A. METADATA for 1km Resolution

```
/*-------------------------------------------------------------------*/
/* ESDTDescriptor: DEM_1KM         */
/*                                 */
/* Metadata Coverage: intermediate */
/*-------------------------------------------------------------------*/
    GROUP = INVENTORYMETADATA
        GROUPTYPE = MASTERGROUP
        GROUP = ECSDataGranule
            OBJECT = SizeMBECSDataGranule
                Data_Location = "DSS"
                NUM_VAL = 1
                TYPE = "DOUBLE"
                Mandatory = "FALSE"
            END_OBJECT = SizeMBECSDataGranule
            OBJECT = ProductionDateTime
                Data_Location = "TK"
                NUM_VAL = 1
                TYPE = "DATETIME"
                Mandatory = "TRUE"
            END_OBJECT = ProductionDateTime
        END_GROUP = ECSDataGranule
        GROUP = CollectionDescriptionClass
            OBJECT = ShortName
                Data_Location = "MCF"
                NUM_VAL = 1
                TYPE = "STRING"
                Mandatory = "TRUE"
                Value = "DEM_1KM"
            END_OBJECT = ShortName
            OBJECT = VersionID
                Data_Location = "MCF"
                NUM_VAL = 1
                TYPE = "STRING"
                Mandatory = "TRUE"
                Value = "1"
            END_OBJECT = VersionID
        END_GROUP = CollectionDescriptionClass
        GROUP = SpatialDomainContainer
            GROUP = HorizontalSpatialDomainContainer
                GROUP = BoundingRectangle
                    OBJECT = WestBoundingCoordinate
                        Data_Location = "PGE"
                        NUM_VAL = 1
                        TYPE = "DOUBLE"
                        Mandatory = "TRUE"
                        VALIDRULE = "Range(-180.0,+180.0)"
                    END_OBJECT = WestBoundingCoordinate
                    OBJECT = NorthBoundingCoordinate
                        Data_Location = "PGE"
                        NUM_VAL = 1
```

```
                    TYPE = "DOUBLE"
                    Mandatory = "TRUE"
                    VALIDRULE = "Range(-90.0,+90.0)"
                END_OBJECT = NorthBoundingCoordinate
                OBJECT = EastBoundingCoordinate
                    Data_Location = "PGE"
                    NUM_VAL = 1
                    TYPE = "DOUBLE"
                    Mandatory = "TRUE"
                    VALIDRULE = "Range(-180.0,+180.0)"
                END_OBJECT = EastBoundingCoordinate
                OBJECT = SouthBoundingCoordinate
                    Data_Location = "PGE"
                    NUM_VAL = 1
                    TYPE = "DOUBLE"
                    Mandatory = "TRUE"
                    VALIDRULE = "Range(-90.0,+90.0)"
                END_OBJECT = SouthBoundingCoordinate
            END_GROUP = BoundingRectangle
        END_GROUP = HorizontalSpatialDomainContainer
    END_GROUP = SpatialDomainContainer
    GROUP = RangeDateTime
        OBJECT = RangeBeginningDate
            Data_Location = "PGE"
            NUM_VAL = 1
            TYPE = "DATE"
            Mandatory = "TRUE"
        END_OBJECT = RangeBeginningDate
        OBJECT = RangeBeginningTime
            Data_Location = "PGE"
            NUM_VAL = 1
            TYPE = "TIME"
            Mandatory = "TRUE"
        END_OBJECT = RangeBeginningTime
        OBJECT = RangeEndingDate
            Data_Location = "PGE"
            NUM_VAL = 1
            TYPE = "DATE"
            Mandatory = "TRUE"
        END_OBJECT = RangeEndingDate
        OBJECT = RangeEndingTime
            Data_Location = "PGE"
            NUM_VAL = 1
            TYPE = "TIME"
            Mandatory = "TRUE"
        END_OBJECT = RangeEndingTime
    END_GROUP = RangeDateTime
END_GROUP = INVENTORYMETADATA

/*Non-searchable metadata*/
/*Basically a dump of metadata that accompanied each DEM binary file. */
/*Some of this is redundant to both the Collection and Core metadata levels.*/
/*But, this is needed by the DEM tools to access metadata through the tool */
/*PGS_DEM_GetMetadata. */

            GROUP = ARCHIVEDMETADATA
            GROUPTYPE = MASTERGROUP
```

```
GROUP = PROJECTION_INFO
    OBJECT = Projection
        Data_Location   = "MCF"
        NUM_VAL         = 1
        Value           = "GEOGRAPHIC"
        Mandatory       = "FALSE"
        Type            = "STRING"
    END_OBJECT = Projection
    OBJECT = Datum
        Data_Location   = "PGE"
        NUM_VAL         = 1
        Mandatory       = "FALSE"
        Type            = "STRING"
    END_OBJECT = Datum
    OBJECT = ZUnits
        Data_Location   = "MCF"
        NUM_VAL         = 1
        Value           = "METERS"
        Mandatory       = "FALSE"
        Type            = "STRING"
    END_OBJECT = ZUNITS
    OBJECT = Units
        Data_Location   = "MCF"
        NUM_VAL         = 1
        Value           = "Decimal Degree (DD)"
        Mandatory       = "FALSE"
        Type            = "STRING"
    END_OBJECT = Units
    OBJECT = Spheroid
        Data_Location   = "PGE"
        NUM_VAL         = 1
        Mandatory       = "FALSE"
        Type            = "STRING"
    END_OBJECT = Spheroid
    OBJECT = Xshift
        Data_Location   = "MCF"
        NUM_VAL         = 1
        Value           = 0.0000000000
        Mandatory       = "FALSE"
        Type            = "DOUBLE"
    END_OBJECT = Xshift
    OBJECT = Yshift
        Data_Location   = "MCF"
        NUM_VAL         = 1
        Value           = 0.0000000000
        Mandatory       = "FALSE"
        Type            = "DOUBLE"
    END_OBJECT = Yshift
        OBJECT = Parameters
        Data_Location   = "MCF"
        NUM_VAL         = 1
        Value           = 0.0000000000
        Mandatory       = "FALSE"
        Type            = "DOUBLE"
    END_OBJECT = Parameters
END_GROUP = PROJECTION_INFO
GROUP = STATISTICS_INFO
```

```
    OBJECT = MinimumValue
        Data_Location   = "PGE"
        NUM_VAL         = 1
        Mandatory       = "FALSE"
        Type            = "INTEGER"
    END_OBJECT = MinimumValue
    OBJECT = MaximumValue
        Data_Location   = "PGE"
        NUM_VAL         = 1
        Mandatory       = "FALSE"
        Type            = "INTEGER"
    END_OBJECT = MaximumValue
    OBJECT = MeanValue
        Data_Location   = "PGE"
        NUM_VAL         = 1
        Mandatory       = "FALSE"
        Type            = "DOUBLE"
    END_OBJECT = MeanValue
    OBJECT              = StandardDeviation
        Data_Location   = "PGE"
        NUM_VAL         = 1
        Mandatory       = "FALSE"
        Type            = "DOUBLE"
    END_OBJECT = StandardDeviation
END_GROUP = STATISTICS_INFO
GROUP = HEADER_INFO
    OBJECT = ByteOrder
        Data_Location   = "MCF"
        NUM_VAL         = 1
        Value           = "Motorola (high order byte first)"
        Mandatory       = "FALSE"
        Type            = "STRING"
    END_OBJECT  = ByteOrder
    OBJECT = BandLayout
        Data_Location   = "MCF"
        NUM_VAL         = 1
        Value           = "Band Interleaved by Line (BIL)"
        Mandatory       = "FALSE"
        Type            = "STRING"
    END_OBJECT = BandLayout
    OBJECT = NumberRows
        Data_Location   = "MCF"
        NUM_VAL         = 1
        Value           = 10800
        Mandatory       = "FALSE"
        Type            = "INTEGER"
    END_OBJECT = NumberRows
    OBJECT = NumberColumns
        Data_Location   = "MCF"
        NUM_VAL         = 1
        Value           = 14400
        Mandatory       = "FALSE"
        Type            = "INTEGER"
    END_OBJECT = NumberColumns
    OBJECT = NumberBands
        Data_Location   = "MCF"
        NUM_VAL         = 1
```

```
    Value           = 1
    Mandatory       = "FALSE"
    Type            = "INTEGER"
END_OBJECT = NumberBands
OBJECT = BitsPerPixel
    Data_Location   = "MCF"
    NUM_VAL         = 1
    Value           = 16
    Mandatory       = "FALSE"
    Type            = "INTEGER"
END_OBJECT = BitsPerPixel
OBJECT = BandRowBytes
    Data_Location   = "MCF"
    NUM_VAL         = 1
    Value           = 28800
    Mandatory       = "FALSE"
    Type            = "INTEGER"
END_OBJECT = BandRowBytes
OBJECT = TotalRowBytes
    Data_Location   = "MCF"
    NUM_VAL         = 1
    Value           = 28800
    Mandatory       = "FALSE"
    Type            = "INTEGER"
END_OBJECT = TotalRowBytes
OBJECT = BandGapBytes
    Data_Location   = "MCF"
    NUM_VAL         = 1
    Value           = 0
    Mandatory       = "FALSE"
    Type            = "INTEGER"
END_OBJECT = BandGapBytes
OBJECT = FillValue
    Data_Location   = "MCF"
    NUM_VAL         = 1
    Value           = -9999.0
    Mandatory       = "FALSE"
    Type            = "DOUBLE"
END_OBJECT = FillValue
OBJECT = Offset
    Data_Location   = "MCF"
    NUM_VAL         = 1
    Value           = 0.0
    Mandatory       = "FALSE"
    Type            = "DOUBLE"
END_OBJECT = Offset
OBJECT = Scaling
    Data_Location   = "MCF"
    NUM_VAL         = 1
    Value           = 1.0
    Mandatory       = "FALSE"
    Type            = "DOUBLE"
END_OBJECT = Scaling
OBJECT = UpperLeftXMap
    Data_Location   = "PGE"
    NUM_VAL         = 1
    Mandatory       = "FALSE"
```

```
                Type            = "DOUBLE"
            END_OBJECT = UpperLeftXMap
            OBJECT = UpperLeftYMap
                Data_Location   = "PGE"
                NUM_VAL         = 1
                Mandatory       = "FALSE"
                Type            = "DOUBLE"
            END_OBJECT = UpperLeftYMap
            OBJECT = XSizePixel
                Data_Location   = "MCF"
                NUM_VAL         = 1
                Value           = .00833333333333
                Mandatory       = "FALSE"
                Type            = "DOUBLE"
            END_OBJECT = XSizePixel
            OBJECT = YSizePixel
                Data_Location   = "MCF"
                NUM_VAL         = 1
                Value           = .00833333333333
                Mandatory       = "FALSE"
                Type            = "DOUBLE"
            END_OBJECT = YSizePixel
        END_GROUP = HEADER_INFO
        END_GROUP = ARCHIVEDMETADATA
END
```

Appendix B. METADATA for 100m Resolution

```
/*--------------------------------------------------------------------------*/
/* ESDTDescriptor: DEM_100M         */
/*                                  */
/*Metadata Coverage: full           */
/*--------------------------------------------------------------------------*/
    GROUP = INVENTORYMETADATA
        GROUPTYPE = MASTERGROUP
        GROUP = ECSDataGranule
            OBJECT = SizeMBECSDataGranule
                Data_Location = "DSS"
                NUM_VAL = 1
                TYPE = "DOUBLE"
                Mandatory = "FALSE"
            END_OBJECT = SizeMBECSDataGranule
            OBJECT = ProductionDateTime
                Data_Location = "TK"
                NUM_VAL = 1
                TYPE = "DATETIME"
                Mandatory = "TRUE"
            END_OBJECT = ProductionDateTime
        END_GROUP = ECSDataGranule
        GROUP = CollectionDescriptionClass
            OBJECT = ShortName
                Data_Location = "MCF"
                NUM_VAL = 1
                TYPE = "STRING"
                Mandatory = "TRUE"
                Value = "DEM_100M"
            END_OBJECT = ShortName
            OBJECT = VersionID
                Data_Location = "MCF"
                NUM_VAL = 1
                TYPE = "STRING"
                Mandatory = "TRUE"
                Value = "1"
            END_OBJECT = VersionID
        END_GROUP = CollectionDescriptionClass
        GROUP = SpatialDomainContainer
            GROUP = HorizontalSpatialDomainContainer
                GROUP = BoundingRectangle
                    OBJECT = WestBoundingCoordinate
                        Data_Location = "PGE"
                        NUM_VAL = 1
                        TYPE = "DOUBLE"
                        Mandatory = "TRUE"
                        VALIDRULE = "Range(-180.0,+180.0)"
                    END_OBJECT = WestBoundingCoordinate
                    OBJECT = NorthBoundingCoordinate
                        Data_Location = "PGE"
                        NUM_VAL = 1
                        TYPE = "DOUBLE"
```

```
                    Mandatory = "TRUE"
                    VALIDRULE = "Range(-90.0,+90.0)"
                END_OBJECT = NorthBoundingCoordinate
                OBJECT = EastBoundingCoordinate
                    Data_Location = "PGE"
                    NUM_VAL = 1
                    TYPE = "DOUBLE"
                    Mandatory = "TRUE"
                    VALIDRULE = "Range(-180.0,+180.0)"
                END_OBJECT = EastBoundingCoordinate
                OBJECT = SouthBoundingCoordinate
                    Data_Location = "PGE"
                    NUM_VAL = 1
                    TYPE = "DOUBLE"
                    Mandatory = "TRUE"
                    VALIDRULE = "Range(-90.0,+90.0)"
                END_OBJECT = SouthBoundingCoordinate
            END_GROUP = BoundingRectangle
        END_GROUP = HorizontalSpatialDomainContainer
    END_GROUP = SpatialDomainContainer
    GROUP = RangeDateTime
        OBJECT = RangeBeginningDate
            Data_Location = "PGE"
            NUM_VAL = 1
            TYPE = "DATE"
            Mandatory = "TRUE"
        END_OBJECT = RangeBeginningDate
        OBJECT = RangeBeginningTime
            Data_Location = "PGE"
            NUM_VAL = 1
            TYPE = "TIME"
            Mandatory = "TRUE"
        END_OBJECT = RangeBeginningTime
        OBJECT = RangeEndingDate
            Data_Location = "PGE"
            NUM_VAL = 1
            TYPE = "DATE"
            Mandatory = "TRUE"
        END_OBJECT = RangeEndingDate
        OBJECT = RangeEndingTime
            Data_Location = "PGE"
            NUM_VAL = 1
            TYPE = "TIME"
            Mandatory = "TRUE"
        END_OBJECT = RangeEndingTime
    END_GROUP = RangeDateTime
END_GROUP = INVENTORYMETADATA

/*Non-searchable metadata*/
/*Basically a dump of metadata that accompanied each DEM binary file. */
/*Some of this is redundant to both the Collection and Core metadata levels.*/
/*But, this is needed by the DEM tools to access metadata through the tool */
/*PGS_DEM_GetMetadata. */
/*presently there are 6 layers: Elevation, LandWater, Slope, Aspect, */
/*StdDevElevation, and StdDevSlope. */
/*The layer LandWater does not have archive metadata. */
/* In the following INFOCONTAINERs */
```

```
/* CLASS 1 is for  Elevation */
/* CLASS 2 is for  Slope */
/* CLASS 3 is for  Aspec */
/* CLASS 4 is for  StdDevElevation */
/* CLASS 5 is for  StdDevSlope */

               GROUP = ARCHIVEDMETADATA
               GROUPTYPE = MASTERGROUP
               GROUP = PROJECTION_INFO
            OBJECT = PROJECTION_INFOCONTAINER1
            CLASS             = "1"
            Data_Location   = "NONE"
            Mandatory       = "FALSE"
                   OBJECT = Projection
                       Data_Location   = "MCF"
                 CLASS             = "1"
                       NUM_VAL         = 1
                       Value           = "GEOGRAPHIC"
                       Mandatory       = "FALSE"
                       Type            = "STRING"
                   END_OBJECT = Projection
                   OBJECT = Datum
                       Data_Location   = "PGE"
                 CLASS             = "1"
                       NUM_VAL         = 1
                       Mandatory       = "FALSE"
                       Type            = "STRING"
                   END_OBJECT = Datum
                   OBJECT = ZUnits
                       Data_Location   = "MCF"
                 CLASS             = "1"
                       NUM_VAL         = 1
                       Value           = "METERS"
                       Mandatory       = "FALSE"
                       Type            = "STRING"
                   END_OBJECT = ZUNITS
                   OBJECT = Units
                       Data_Location   = "MCF"
                 CLASS             = "1"
                       NUM_VAL         = 1
                       Value           = "Decimal Degree (DD)"
                       Mandatory       = "FALSE"
                       Type            = "STRING"
                   END_OBJECT = Units
                   OBJECT = Spheroid
                       Data_Location   = "PGE"
                 CLASS             = "1"
                       NUM_VAL         = 1
                       Mandatory       = "FALSE"
                       Type            = "STRING"
                   END_OBJECT = Spheroid
                   OBJECT = Xshift
                       Data_Location   = "MCF"
                 CLASS             = "1"
                       NUM_VAL         = 1
                       Value           = 0.0000000000
                       Mandatory       = "FALSE"
```

```
            Type            = "DOUBLE"
          END_OBJECT = Xshift
          OBJECT = Yshift
            Data_Location   = "MCF"
        CLASS             = "1"
            NUM_VAL         = 1
            Value           = 0.0000000000
            Mandatory       = "FALSE"
            Type            = "DOUBLE"
          END_OBJECT = Yshift
            OBJECT = Parameters
            Data_Location   = "MCF"
        CLASS             = "1"
            NUM_VAL         = 1
            Value           = 0.0000000000
            Mandatory       = "FALSE"
            Type            = "DOUBLE"
          END_OBJECT = Parameters
END_OBJECT = PROJECTION_INFOCONTAINER1
OBJECT = PROJECTION_INFOCONTAINER2
CLASS             = "2"
Data_Location   = "NONE"
Mandatory       = "FALSE"
          OBJECT = Projection
            Data_Location   = "MCF"
        CLASS             = "2"
            NUM_VAL         = 1
            Value           = "GEOGRAPHIC"
            Mandatory       = "FALSE"
            Type            = "STRING"
          END_OBJECT = Projection
          OBJECT = Datum
            Data_Location   = "PGE"
        CLASS             = "2"
            NUM_VAL         = 1
            Mandatory       = "FALSE"
            Type            = "STRING"
          END_OBJECT = Datum
          OBJECT = ZUnits
            Data_Location   = "MCF"
        CLASS             = "2"
            NUM_VAL         = 1
            Value           = "DEGREES"
            Mandatory       = "FALSE"
            Type            = "STRING"
          END_OBJECT = ZUNITS
          OBJECT = Units
            Data_Location   = "MCF"
        CLASS             = "2"
            NUM_VAL         = 1
            Value           = "Decimal Degree (DD)"
            Mandatory       = "FALSE"
            Type            = "STRING"
          END_OBJECT = Units
          OBJECT = Spheroid
            Data_Location   = "PGE"
        CLASS             = "2"
```

```
            NUM_VAL         = 1
            Mandatory       = "FALSE"
            Type            = "STRING"
          END_OBJECT = Spheroid
          OBJECT = Xshift
            Data_Location   = "MCF"
        CLASS             = "2"
            NUM_VAL         = 1
            Value           = 0.0000000000
            Mandatory       = "FALSE"
            Type            = "DOUBLE"
          END_OBJECT = Xshift
          OBJECT = Yshift
            Data_Location   = "MCF"
        CLASS             = "2"
            NUM_VAL         = 1
            Value           = 0.0000000000
            Mandatory       = "FALSE"
            Type            = "DOUBLE"
          END_OBJECT = Yshift
            OBJECT = Parameters
            Data_Location   = "MCF"
        CLASS             = "2"
            NUM_VAL         = 1
            Value           = 0.0000000000
            Mandatory       = "FALSE"
            Type            = "DOUBLE"
          END_OBJECT = Parameters
END_OBJECT = PROJECTION_INFOCONTAINER2
OBJECT = PROJECTION_INFOCONTAINER3
CLASS             = "3"
Data_Location   = "NONE"
Mandatory       = "FALSE"
          OBJECT = Projection
            Data_Location   = "MCF"
        CLASS             = "3"
            NUM_VAL         = 1
            Value           = "GEOGRAPHIC"
            Mandatory       = "FALSE"
            Type            = "STRING"
          END_OBJECT = Projection
          OBJECT = Datum
            Data_Location   = "PGE"
        CLASS             = "3"
            NUM_VAL         = 1
            Mandatory       = "FALSE"
            Type            = "STRING"
          END_OBJECT = Datum
          OBJECT = ZUnits
            Data_Location   = "MCF"
        CLASS             = "3"
            NUM_VAL         = 1
            Value           = "DEGREES"
            Mandatory       = "FALSE"
            Type            = "STRING"
          END_OBJECT = ZUNITS
          OBJECT = Units
```

```
            Data_Location   = "MCF"
      CLASS             = "3"
            NUM_VAL         = 1
            Value           = "Decimal Degree (DD)"
            Mandatory       = "FALSE"
            Type            = "STRING"
        END_OBJECT = Units
        OBJECT = Spheroid
            Data_Location   = "PGE"
      CLASS             = "3"
            NUM_VAL         = 1
            Mandatory       = "FALSE"
            Type            = "STRING"
        END_OBJECT = Spheroid
        OBJECT = Xshift
            Data_Location   = "MCF"
      CLASS             = "3"
            NUM_VAL         = 1
            Value           = 0.0000000000
            Mandatory       = "FALSE"
            Type            = "DOUBLE"
        END_OBJECT = Xshift
        OBJECT = Yshift
            Data_Location   = "MCF"
      CLASS             = "3"
            NUM_VAL         = 1
            Value           = 0.0000000000
            Mandatory       = "FALSE"
            Type            = "DOUBLE"
        END_OBJECT = Yshift
            OBJECT = Parameters
            Data_Location   = "MCF"
      CLASS             = "3"
            NUM_VAL         = 1
            Value           = 0.0000000000
            Mandatory       = "FALSE"
            Type            = "DOUBLE"
        END_OBJECT = Parameters
END_OBJECT = PROJECTION_INFOCONTAINER3
OBJECT = PROJECTION_INFOCONTAINER4
CLASS             = "4"
Data_Location   = "NONE"
Mandatory       = "FALSE"
        OBJECT = Projection
            Data_Location   = "MCF"
      CLASS             = "4"
            NUM_VAL         = 1
            Value           = "GEOGRAPHIC"
            Mandatory       = "FALSE"
            Type            = "STRING"
        END_OBJECT = Projection
        OBJECT = Datum
            Data_Location   = "PGE"
      CLASS             = "4"
            NUM_VAL         = 1
            Mandatory       = "FALSE"
            Type            = "STRING"
```

```
          END_OBJECT = Datum
          OBJECT = ZUnits
              Data_Location   = "MCF"
        CLASS             = "4"
              NUM_VAL         = 1
              Value           = "METERS"
              Mandatory       = "FALSE"
              Type            = "STRING"
          END_OBJECT = ZUNITS
          OBJECT = Units
              Data_Location   = "MCF"
        CLASS             = "4"
              NUM_VAL         = 1
              Value           = "Decimal Degree (DD)"
              Mandatory       = "FALSE"
              Type            = "STRING"
          END_OBJECT = Units
          OBJECT = Spheroid
              Data_Location   = "PGE"
        CLASS             = "4"
              NUM_VAL         = 1
              Mandatory       = "FALSE"
              Type            = "STRING"
          END_OBJECT = Spheroid
          OBJECT = Xshift
              Data_Location   = "MCF"
        CLASS             = "4"
              NUM_VAL         = 1
              Value           = 0.0000000000
              Mandatory       = "FALSE"
              Type            = "DOUBLE"
          END_OBJECT = Xshift
          OBJECT = Yshift
              Data_Location   = "MCF"
        CLASS             = "4"
              NUM_VAL         = 1
              Value           = 0.0000000000
              Mandatory       = "FALSE"
              Type            = "DOUBLE"
          END_OBJECT = Yshift
              OBJECT = Parameters
              Data_Location   = "MCF"
        CLASS             = "4"
              NUM_VAL         = 1
              Value           = 0.0000000000
              Mandatory       = "FALSE"
              Type            = "DOUBLE"
          END_OBJECT = Parameters
END_OBJECT = PROJECTION_INFOCONTAINER4
OBJECT = PROJECTION_INFOCONTAINER5
CLASS             = "5"
Data_Location   = "NONE"
Mandatory       = "FALSE"
          OBJECT = Projection
              Data_Location   = "MCF"
        CLASS             = "5"
              NUM_VAL         = 1
```

```
      Value           = "GEOGRAPHIC"
      Mandatory       = "FALSE"
      Type            = "STRING"
  END_OBJECT = Projection
  OBJECT = Datum
      Data_Location   = "PGE"
CLASS             = "5"
      NUM_VAL         = 1
      Mandatory       = "FALSE"
      Type            = "STRING"
  END_OBJECT = Datum
  OBJECT = ZUnits
      Data_Location   = "MCF"
CLASS             = "5"
      NUM_VAL         = 1
      Value           = "DEGREES"
      Mandatory       = "FALSE"
      Type            = "STRING"
  END_OBJECT = ZUNITS
  OBJECT = Units
      Data_Location   = "MCF"
CLASS             = "5"
      NUM_VAL         = 1
      Value           = "Decimal Degree (DD)"
      Mandatory       = "FALSE"
      Type            = "STRING"
  END_OBJECT = Units
  OBJECT = Spheroid
      Data_Location   = "PGE"
CLASS             = "5"
      NUM_VAL         = 1
      Mandatory       = "FALSE"
      Type            = "STRING"
  END_OBJECT = Spheroid
  OBJECT = Xshift
      Data_Location   = "MCF"
CLASS             = "5"
      NUM_VAL         = 1
      Value           = 0.0000000000
      Mandatory       = "FALSE"
      Type            = "DOUBLE"
  END_OBJECT = Xshift
  OBJECT = Yshift
      Data_Location   = "MCF"
CLASS             = "5"
      NUM_VAL         = 1
      Value           = 0.0000000000
      Mandatory       = "FALSE"
      Type            = "DOUBLE"
  END_OBJECT = Yshift
      OBJECT = Parameters
      Data_Location   = "MCF"
CLASS             = "5"
      NUM_VAL         = 1
      Value           = 0.0000000000
      Mandatory       = "FALSE"
      Type            = "DOUBLE"
```

```
        END_OBJECT = Parameters
END_OBJECT = PROJECTION_INFOCONTAINER5
    END_GROUP = PROJECTION_INFO
    GROUP = STATISTICS_INFO
OBJECT = STATISTICS_INFOCONTAINER1
CLASS             = "1"
Data_Location   = "NONE"
Mandatory       = "FALSE"
        OBJECT = MinimumValue
            Data_Location   = "PGE"
      CLASS             = "1"
            NUM_VAL         = 1
            Mandatory       = "FALSE"
            Type            = "INTEGER"
        END_OBJECT = MinimumValue
        OBJECT = MaximumValue
            Data_Location   = "PGE"
      CLASS             = "1"
            NUM_VAL         = 1
            Mandatory       = "FALSE"
            Type            = "INTEGER"
        END_OBJECT = MaximumValue
        OBJECT = MeanValue
            Data_Location   = "PGE"
      CLASS             = "1"
            NUM_VAL         = 1
            Mandatory       = "FALSE"
            Type            = "DOUBLE"
        END_OBJECT = MeanValue
        OBJECT              = StandardDeviation
            Data_Location   = "PGE"
      CLASS             = "1"
            NUM_VAL         = 1
            Mandatory       = "FALSE"
            Type            = "DOUBLE"
        END_OBJECT = StandardDeviation
END_OBJECT = STATISTICS_INFOCONTAINER1
OBJECT = STATISTICS_INFOCONTAINER2
CLASS             = "2"
Data_Location   = "NONE"
Mandatory       = "FALSE"
        OBJECT = MinimumValue
            Data_Location   = "PGE"
      CLASS             = "2"
            NUM_VAL         = 1
            Mandatory       = "FALSE"
            Type            = "INTEGER"
        END_OBJECT = MinimumValue
        OBJECT = MaximumValue
            Data_Location   = "PGE"
      CLASS             = "2"
            NUM_VAL         = 1
            Mandatory       = "FALSE"
            Type            = "INTEGER"
        END_OBJECT = MaximumValue
        OBJECT = MeanValue
            Data_Location   = "PGE"
```

```
      CLASS             = "2"
            NUM_VAL         = 1
            Mandatory       = "FALSE"
            Type            = "DOUBLE"
        END_OBJECT = MeanValue
        OBJECT              = StandardDeviation
            Data_Location   = "PGE"
      CLASS             = "2"
            NUM_VAL         = 1
            Mandatory       = "FALSE"
            Type            = "DOUBLE"
        END_OBJECT = StandardDeviation
END_OBJECT = STATISTICS_INFOCONTAINER2
OBJECT = STATISTICS_INFOCONTAINER3
CLASS             = "3"
Data_Location   = "NONE"
Mandatory       = "FALSE"
        OBJECT = MinimumValue
            Data_Location   = "PGE"
      CLASS             = "3"
            NUM_VAL         = 1
            Mandatory       = "FALSE"
            Type            = "INTEGER"
        END_OBJECT = MinimumValue
        OBJECT = MaximumValue
            Data_Location   = "PGE"
      CLASS             = "3"
            NUM_VAL         = 1
            Mandatory       = "FALSE"
            Type            = "INTEGER"
        END_OBJECT = MaximumValue
        OBJECT = MeanValue
            Data_Location   = "PGE"
      CLASS             = "3"
            NUM_VAL         = 1
            Mandatory       = "FALSE"
            Type            = "DOUBLE"
        END_OBJECT = MeanValue
        OBJECT              = StandardDeviation
            Data_Location   = "PGE"
      CLASS             = "3"
            NUM_VAL         = 1
            Mandatory       = "FALSE"
            Type            = "DOUBLE"
        END_OBJECT = StandardDeviation
END_OBJECT = STATISTICS_INFOCONTAINER3
OBJECT = STATISTICS_INFOCONTAINER4
CLASS             = "4"
Data_Location   = "NONE"
Mandatory       = "FALSE"
        OBJECT = MinimumValue
            Data_Location   = "PGE"
      CLASS             = "4"
            NUM_VAL         = 1
            Mandatory       = "FALSE"
            Type            = "INTEGER"
        END_OBJECT = MinimumValue
```

```
        OBJECT = MaximumValue
            Data_Location   = "PGE"
      CLASS             = "4"
            NUM_VAL         = 1
            Mandatory       = "FALSE"
            Type            = "INTEGER"
        END_OBJECT = MaximumValue
        OBJECT = MeanValue
            Data_Location   = "PGE"
      CLASS             = "4"
            NUM_VAL         = 1
            Mandatory       = "FALSE"
            Type            = "DOUBLE"
        END_OBJECT = MeanValue
        OBJECT              = StandardDeviation
            Data_Location   = "PGE"
      CLASS             = "4"
            NUM_VAL         = 1
            Mandatory       = "FALSE"
            Type            = "DOUBLE"
        END_OBJECT = StandardDeviation
END_OBJECT = STATISTICS_INFOCONTAINER4
OBJECT = STATISTICS_INFOCONTAINER5
CLASS             = "5"
Data_Location   = "NONE"
Mandatory       = "FALSE"
        OBJECT = MinimumValue
            Data_Location   = "PGE"
      CLASS             = "5"
            NUM_VAL         = 1
            Mandatory       = "FALSE"
            Type            = "INTEGER"
        END_OBJECT = MinimumValue
        OBJECT = MaximumValue
            Data_Location   = "PGE"
      CLASS             = "5"
            NUM_VAL         = 1
            Mandatory       = "FALSE"
            Type            = "INTEGER"
        END_OBJECT = MaximumValue
        OBJECT = MeanValue
            Data_Location   = "PGE"
      CLASS             = "5"
            NUM_VAL         = 1
            Mandatory       = "FALSE"
            Type            = "DOUBLE"
        END_OBJECT = MeanValue
        OBJECT              = StandardDeviation
            Data_Location   = "PGE"
      CLASS             = "5"
            NUM_VAL         = 1
            Mandatory       = "FALSE"
            Type            = "DOUBLE"
        END_OBJECT = StandardDeviation
END_OBJECT = STATISTICS_INFOCONTAINER5
    END_GROUP = STATISTICS_INFO
    GROUP = HEADER_INFO
```

```
OBJECT = HEADER_INFOCONTAINER1
CLASS            = "1"
Data_Location   = "NONE"
Mandatory       = "FALSE"
        OBJECT = ByteOrder
            Data_Location   = "MCF"
      CLASS             = "1"
            NUM_VAL         = 1
            Value           = "Motorola (high order byte first)"
            Mandatory       = "FALSE"
            Type            = "STRING"
        END_OBJECT  = ByteOrder
        OBJECT = BandLayout
            Data_Location   = "MCF"
      CLASS             = "1"
            NUM_VAL         = 1
            Value           = "Band Interleaved by Line (BIL)"
            Mandatory       = "FALSE"
            Type            = "STRING"
        END_OBJECT = BandLayout
        OBJECT = NumberRows
            Data_Location   = "MCF"
      CLASS             = "1"
            NUM_VAL         = 1
            Value           = 12000
            Mandatory       = "FALSE"
            Type            = "INTEGER"
        END_OBJECT = NumberRows
        OBJECT = NumberColumns
            Data_Location   = "MCF"
      CLASS             = "1"
            NUM_VAL         = 1
            Value           = 12000
            Mandatory       = "FALSE"
            Type            = "INTEGER"
        END_OBJECT = NumberColumns
        OBJECT = NumberBands
            Data_Location   = "MCF"
      CLASS             = "1"
            NUM_VAL         = 1
            Value           = 1
            Mandatory       = "FALSE"
            Type            = "INTEGER"
        END_OBJECT = NumberBands
        OBJECT = BitsPerPixel
            Data_Location   = "MCF"
      CLASS             = "1"
            NUM_VAL         = 1
            Value           = 16
            Mandatory       = "FALSE"
            Type            = "INTEGER"
        END_OBJECT = BitsPerPixel
        OBJECT = BandRowBytes
            Data_Location   = "MCF"
      CLASS             = "1"
            NUM_VAL         = 1
            Value           = 24000
```

```
      Mandatory       = "FALSE"
      Type            = "INTEGER"
  END_OBJECT = BandRowBytes
  OBJECT = TotalRowBytes
      Data_Location   = "MCF"
CLASS             = "1"
      NUM_VAL         = 1
      Value           = 24000
      Mandatory       = "FALSE"
      Type            = "INTEGER"
  END_OBJECT = TotalRowBytes
  OBJECT = BandGapBytes
      Data_Location   = "MCF"
CLASS             = "1"
      NUM_VAL         = 1
      Value           = 0
      Mandatory       = "FALSE"
      Type            = "INTEGER"
  END_OBJECT = BandGapBytes
  OBJECT = FillValue
      Data_Location   = "MCF"
CLASS             = "1"
      NUM_VAL         = 1
      Value           = -9999.0
      Mandatory       = "FALSE"
      Type            = "DOUBLE"
  END_OBJECT = FillValue
  OBJECT = Offset
      Data_Location   = "MCF"
CLASS             = "1"
      NUM_VAL         = 1
      Value           = 0.0
      Mandatory       = "FALSE"
      Type            = "DOUBLE"
  END_OBJECT = Offset
  OBJECT = Scaling
      Data_Location   = "MCF"
CLASS             = "1"
      NUM_VAL         = 1
      Value           = 1.0
      Mandatory       = "FALSE"
      Type            = "DOUBLE"
  END_OBJECT = Scaling
  OBJECT = UpperLeftXMap
      Data_Location   = "PGE"
CLASS             = "1"
      NUM_VAL         = 1
      Mandatory       = "FALSE"
      Type            = "DOUBLE"
  END_OBJECT = UpperLeftXMap
  OBJECT = UpperLeftYMap
      Data_Location   = "PGE"
CLASS             = "1"
      NUM_VAL         = 1
      Mandatory       = "FALSE"
      Type            = "DOUBLE"
  END_OBJECT = UpperLeftYMap
```

```
        OBJECT = XSizePixel
            Data_Location   = "MCF"
      CLASS             = "1"
            NUM_VAL         = 1
            Value           = .000833333333333
            Mandatory       = "FALSE"
            Type            = "DOUBLE"
        END_OBJECT = XSizePixel
        OBJECT = YSizePixel
            Data_Location   = "MCF"
      CLASS             = "1"
            NUM_VAL         = 1
            Value           = .000833333333333
            Mandatory       = "FALSE"
            Type            = "DOUBLE"
        END_OBJECT = YSizePixel
END_OBJECT = HEADER_INFOCONTAINER1
OBJECT = HEADER_INFOCONTAINER2
CLASS             = "2"
Data_Location   = "NONE"
Mandatory       = "FALSE"
        OBJECT = ByteOrder
            Data_Location   = "MCF"
      CLASS             = "2"
            NUM_VAL         = 1
            Value           = "Motorola (high order byte first)"
            Mandatory       = "FALSE"
            Type            = "STRING"
        END_OBJECT  = ByteOrder
        OBJECT = BandLayout
            Data_Location   = "MCF"
      CLASS             = "2"
            NUM_VAL         = 1
            Value           = "Band Interleaved by Line (BIL)"
            Mandatory       = "FALSE"
            Type            = "STRING"
        END_OBJECT = BandLayout
        OBJECT = NumberRows
            Data_Location   = "MCF"
      CLASS             = "2"
            NUM_VAL         = 1
            Value           = 12000
            Mandatory       = "FALSE"
            Type            = "INTEGER"
        END_OBJECT = NumberRows
        OBJECT = NumberColumns
            Data_Location   = "MCF"
      CLASS             = "2"
            NUM_VAL         = 1
            Value           = 12000
            Mandatory       = "FALSE"
            Type            = "INTEGER"
        END_OBJECT = NumberColumns
        OBJECT = NumberBands
            Data_Location   = "MCF"
      CLASS             = "2"
            NUM_VAL         = 1
```

```
      Value           = 1
      Mandatory       = "FALSE"
      Type            = "INTEGER"
  END_OBJECT = NumberBands
  OBJECT = BitsPerPixel
      Data_Location   = "MCF"
CLASS             = "2"
      NUM_VAL         = 1
      Value           = 8
      Mandatory       = "FALSE"
      Type            = "INTEGER"
  END_OBJECT = BitsPerPixel
  OBJECT = BandRowBytes
      Data_Location   = "MCF"
CLASS             = "2"
      NUM_VAL         = 1
      Value           = 12000
      Mandatory       = "FALSE"
      Type            = "INTEGER"
  END_OBJECT = BandRowBytes
  OBJECT = TotalRowBytes
      Data_Location   = "MCF"
CLASS             = "2"
      NUM_VAL         = 1
      Value           = 12000
      Mandatory       = "FALSE"
      Type            = "INTEGER"
  END_OBJECT = TotalRowBytes
  OBJECT = BandGapBytes
      Data_Location   = "MCF"
CLASS             = "2"
      NUM_VAL         = 1
      Value           = 0
      Mandatory       = "FALSE"
      Type            = "INTEGER"
  END_OBJECT = BandGapBytes
  OBJECT = FillValue
      Data_Location   = "MCF"
CLASS             = "2"
      NUM_VAL         = 1
      Value           = -9999.0
      Mandatory       = "FALSE"
      Type            = "DOUBLE"
  END_OBJECT = FillValue
  OBJECT = Offset
      Data_Location   = "MCF"
CLASS             = "2"
      NUM_VAL         = 1
      Value           = 0.0
      Mandatory       = "FALSE"
      Type            = "DOUBLE"
  END_OBJECT = Offset
  OBJECT = Scaling
      Data_Location   = "MCF"
CLASS             = "2"
      NUM_VAL         = 1
      Value           = 1.0
```

```
            Mandatory       = "FALSE"
            Type            = "DOUBLE"
          END_OBJECT = Scaling
          OBJECT = UpperLeftXMap
            Data_Location   = "PGE"
        CLASS               = "2"
            NUM_VAL         = 1
            Mandatory       = "FALSE"
            Type            = "DOUBLE"
          END_OBJECT = UpperLeftXMap
          OBJECT = UpperLeftYMap
            Data_Location   = "PGE"
        CLASS               = "2"
            NUM_VAL         = 1
            Mandatory       = "FALSE"
            Type            = "DOUBLE"
          END_OBJECT = UpperLeftYMap
          OBJECT = XSizePixel
            Data_Location   = "MCF"
        CLASS               = "2"
            NUM_VAL         = 1
            Value           = .000833333333333
            Mandatory       = "FALSE"
            Type            = "DOUBLE"
          END_OBJECT = XSizePixel
          OBJECT = YSizePixel
            Data_Location   = "MCF"
        CLASS               = "2"
            NUM_VAL         = 1
            Value           = .000833333333333
            Mandatory       = "FALSE"
            Type            = "DOUBLE"
          END_OBJECT = YSizePixel
END_OBJECT = HEADER_INFOCONTAINER2
OBJECT = HEADER_INFOCONTAINER3
CLASS               = "3"
Data_Location   = "NONE"
Mandatory       = "FALSE"
          OBJECT = ByteOrder
            Data_Location   = "MCF"
        CLASS               = "3"
            NUM_VAL         = 1
            Value           = "Motorola (high order byte first)"
            Mandatory       = "FALSE"
            Type            = "STRING"
          END_OBJECT  = ByteOrder
          OBJECT = BandLayout
            Data_Location   = "MCF"
        CLASS               = "3"
            NUM_VAL         = 1
            Value           = "Band Interleaved by Line (BIL)"
            Mandatory       = "FALSE"
            Type            = "STRING"
          END_OBJECT = BandLayout
          OBJECT = NumberRows
            Data_Location   = "MCF"
        CLASS               = "3"
```

```
      NUM_VAL         = 1
      Value           = 12000
      Mandatory       = "FALSE"
      Type            = "INTEGER"
  END_OBJECT = NumberRows
  OBJECT = NumberColumns
      Data_Location   = "MCF"
CLASS             = "3"
      NUM_VAL         = 1
      Value           = 12000
      Mandatory       = "FALSE"
      Type            = "INTEGER"
  END_OBJECT = NumberColumns
  OBJECT = NumberBands
      Data_Location   = "MCF"
CLASS             = "3"
      NUM_VAL         = 1
      Value           = 1
      Mandatory       = "FALSE"
      Type            = "INTEGER"
  END_OBJECT = NumberBands
  OBJECT = BitsPerPixel
      Data_Location   = "MCF"
CLASS             = "3"
      NUM_VAL         = 1
      Value           = 16
      Mandatory       = "FALSE"
      Type            = "INTEGER"
  END_OBJECT = BitsPerPixel
  OBJECT = BandRowBytes
      Data_Location   = "MCF"
CLASS             = "3"
      NUM_VAL         = 1
      Value           = 24000
      Mandatory       = "FALSE"
      Type            = "INTEGER"
  END_OBJECT = BandRowBytes
  OBJECT = TotalRowBytes
      Data_Location   = "MCF"
CLASS             = "3"
      NUM_VAL         = 1
      Value           = 24000
      Mandatory       = "FALSE"
      Type            = "INTEGER"
  END_OBJECT = TotalRowBytes
  OBJECT = BandGapBytes
      Data_Location   = "MCF"
CLASS             = "3"
      NUM_VAL         = 1
      Value           = 0
      Mandatory       = "FALSE"
      Type            = "INTEGER"
  END_OBJECT = BandGapBytes
  OBJECT = FillValue
      Data_Location   = "MCF"
CLASS             = "3"
      NUM_VAL         = 1
```

```
            Value           = -9999.0
            Mandatory       = "FALSE"
            Type            = "DOUBLE"
          END_OBJECT = FillValue
          OBJECT = Offset
            Data_Location   = "MCF"
        CLASS             = "3"
            NUM_VAL         = 1
            Value           = 0.0
            Mandatory       = "FALSE"
            Type            = "DOUBLE"
          END_OBJECT = Offset
          OBJECT = Scaling
            Data_Location   = "MCF"
        CLASS             = "3"
            NUM_VAL         = 1
            Value           = 1.0
            Mandatory       = "FALSE"
            Type            = "DOUBLE"
          END_OBJECT = Scaling
          OBJECT = UpperLeftXMap
            Data_Location   = "PGE"
        CLASS             = "3"
            NUM_VAL         = 1
            Mandatory       = "FALSE"
            Type            = "DOUBLE"
          END_OBJECT = UpperLeftXMap
          OBJECT = UpperLeftYMap
            Data_Location   = "PGE"
        CLASS             = "3"
            NUM_VAL         = 1
            Mandatory       = "FALSE"
            Type            = "DOUBLE"
          END_OBJECT = UpperLeftYMap
          OBJECT = XSizePixel
            Data_Location   = "MCF"
        CLASS             = "3"
            NUM_VAL         = 1
            Value           = .000833333333333
            Mandatory       = "FALSE"
            Type            = "DOUBLE"
          END_OBJECT = XSizePixel
          OBJECT = YSizePixel
            Data_Location   = "MCF"
        CLASS             = "3"
            NUM_VAL         = 1
            Value           = .000833333333333
            Mandatory       = "FALSE"
            Type            = "DOUBLE"
          END_OBJECT = YSizePixel
END_OBJECT = HEADER_INFOCONTAINER3
OBJECT = HEADER_INFOCONTAINER4
CLASS             = "4"
Data_Location   = "NONE"
Mandatory       = "FALSE"
        OBJECT = ByteOrder
            Data_Location   = "MCF"
```

```
CLASS             = "4"
      NUM_VAL         = 1
      Value           = "Motorola (high order byte first)"
      Mandatory       = "FALSE"
      Type            = "STRING"
  END_OBJECT  = ByteOrder
  OBJECT = BandLayout
      Data_Location   = "MCF"
CLASS             = "4"
      NUM_VAL         = 1
      Value           = "Band Interleaved by Line (BIL)"
      Mandatory       = "FALSE"
      Type            = "STRING"
  END_OBJECT = BandLayout
  OBJECT = NumberRows
      Data_Location   = "MCF"
CLASS             = "4"
      NUM_VAL         = 1
      Value           = 12000
      Mandatory       = "FALSE"
      Type            = "INTEGER"
  END_OBJECT = NumberRows
  OBJECT = NumberColumns
      Data_Location   = "MCF"
CLASS             = "4"
      NUM_VAL         = 1
      Value           = 12000
      Mandatory       = "FALSE"
      Type            = "INTEGER"
  END_OBJECT = NumberColumns
  OBJECT = NumberBands
      Data_Location   = "MCF"
CLASS             = "4"
      NUM_VAL         = 1
      Value           = 1
      Mandatory       = "FALSE"
      Type            = "INTEGER"
  END_OBJECT = NumberBands
  OBJECT = BitsPerPixel
      Data_Location   = "MCF"
CLASS             = "4"
      NUM_VAL         = 1
      Value           = 16
      Mandatory       = "FALSE"
      Type            = "INTEGER"
  END_OBJECT = BitsPerPixel
  OBJECT = BandRowBytes
      Data_Location   = "MCF"
CLASS             = "4"
      NUM_VAL         = 1
      Value           = 24000
      Mandatory       = "FALSE"
      Type            = "INTEGER"
  END_OBJECT = BandRowBytes
  OBJECT = TotalRowBytes
      Data_Location   = "MCF"
CLASS             = "4"
```

```
      NUM_VAL         = 1
      Value           = 24000
      Mandatory       = "FALSE"
      Type            = "INTEGER"
  END_OBJECT = TotalRowBytes
  OBJECT = BandGapBytes
      Data_Location   = "MCF"
CLASS             = "4"
      NUM_VAL         = 1
      Value           = 0
      Mandatory       = "FALSE"
      Type            = "INTEGER"
  END_OBJECT = BandGapBytes
  OBJECT = FillValue
      Data_Location   = "MCF"
CLASS             = "4"
      NUM_VAL         = 1
      Value           = -9999.0
      Mandatory       = "FALSE"
      Type            = "DOUBLE"
  END_OBJECT = FillValue
  OBJECT = Offset
      Data_Location   = "MCF"
CLASS             = "4"
      NUM_VAL         = 1
      Value           = 0.0
      Mandatory       = "FALSE"
      Type            = "DOUBLE"
  END_OBJECT = Offset
  OBJECT = Scaling
      Data_Location   = "MCF"
CLASS             = "4"
      NUM_VAL         = 1
      Value           = 1.0
      Mandatory       = "FALSE"
      Type            = "DOUBLE"
  END_OBJECT = Scaling
  OBJECT = UpperLeftXMap
      Data_Location   = "PGE"
CLASS             = "4"
      NUM_VAL         = 1
      Mandatory       = "FALSE"
      Type            = "DOUBLE"
  END_OBJECT = UpperLeftXMap
  OBJECT = UpperLeftYMap
      Data_Location   = "PGE"
CLASS             = "4"
      NUM_VAL         = 1
      Mandatory       = "FALSE"
      Type            = "DOUBLE"
  END_OBJECT = UpperLeftYMap
  OBJECT = XSizePixel
      Data_Location   = "MCF"
CLASS             = "4"
      NUM_VAL         = 1
      Value           = .000833333333333
      Mandatory       = "FALSE"
```

```
            Type            = "DOUBLE"
        END_OBJECT = XSizePixel
        OBJECT = YSizePixel
            Data_Location   = "MCF"
      CLASS             = "4"
            NUM_VAL         = 1
            Value           = .000833333333333
            Mandatory       = "FALSE"
            Type            = "DOUBLE"
        END_OBJECT = YSizePixel
END_OBJECT = HEADER_INFOCONTAINER4
OBJECT = HEADER_INFOCONTAINER5
CLASS            = "5"
Data_Location   = "NONE"
Mandatory       = "FALSE"
        OBJECT = ByteOrder
            Data_Location   = "MCF"
      CLASS             = "5"
            NUM_VAL         = 1
            Value           = "Motorola (high order byte first)"
            Mandatory       = "FALSE"
            Type            = "STRING"
        END_OBJECT  = ByteOrder
        OBJECT = BandLayout
            Data_Location   = "MCF"
      CLASS             = "5"
            NUM_VAL         = 1
            Value           = "Band Interleaved by Line (BIL)"
            Mandatory       = "FALSE"
            Type            = "STRING"
        END_OBJECT = BandLayout
        OBJECT = NumberRows
            Data_Location   = "MCF"
      CLASS             = "5"
            NUM_VAL         = 1
            Value           = 12000
            Mandatory       = "FALSE"
            Type            = "INTEGER"
        END_OBJECT = NumberRows
        OBJECT = NumberColumns
            Data_Location   = "MCF"
      CLASS             = "5"
            NUM_VAL         = 1
            Value           = 12000
            Mandatory       = "FALSE"
            Type            = "INTEGER"
        END_OBJECT = NumberColumns
        OBJECT = NumberBands
            Data_Location   = "MCF"
      CLASS             = "5"
            NUM_VAL         = 1
            Value           = 1
            Mandatory       = "FALSE"
            Type            = "INTEGER"
        END_OBJECT = NumberBands
        OBJECT = BitsPerPixel
            Data_Location   = "MCF"
```

```
CLASS             = "5"
      NUM_VAL         = 1
      Value           = 8
      Mandatory       = "FALSE"
      Type            = "INTEGER"
  END_OBJECT = BitsPerPixel
  OBJECT = BandRowBytes
      Data_Location   = "MCF"
CLASS             = "5"
      NUM_VAL         = 1
      Value           = 12000
      Mandatory       = "FALSE"
      Type            = "INTEGER"
  END_OBJECT = BandRowBytes
  OBJECT = TotalRowBytes
      Data_Location   = "MCF"
CLASS             = "5"
      NUM_VAL         = 1
      Value           = 12000
      Mandatory       = "FALSE"
      Type            = "INTEGER"
  END_OBJECT = TotalRowBytes
  OBJECT = BandGapBytes
      Data_Location   = "MCF"
CLASS             = "5"
      NUM_VAL         = 1
      Value           = 0
      Mandatory       = "FALSE"
      Type            = "INTEGER"
  END_OBJECT = BandGapBytes
  OBJECT = FillValue
      Data_Location   = "MCF"
CLASS             = "5"
      NUM_VAL         = 1
      Value           = -9999.0
      Mandatory       = "FALSE"
      Type            = "DOUBLE"
  END_OBJECT = FillValue
  OBJECT = Offset
      Data_Location   = "MCF"
CLASS             = "5"
      NUM_VAL         = 1
      Value           = 0.0
      Mandatory       = "FALSE"
      Type            = "DOUBLE"
  END_OBJECT = Offset
  OBJECT = Scaling
      Data_Location   = "MCF"
CLASS             = "5"
      NUM_VAL         = 1
      Value           = 1.0
      Mandatory       = "FALSE"
      Type            = "DOUBLE"
  END_OBJECT = Scaling
  OBJECT = UpperLeftXMap
      Data_Location   = "PGE"
CLASS             = "5"
```

```
                    NUM_VAL         = 1
                    Mandatory       = "FALSE"
                    Type            = "DOUBLE"
                  END_OBJECT = UpperLeftXMap
                  OBJECT = UpperLeftYMap
                    Data_Location   = "PGE"
                CLASS             = "5"
                    NUM_VAL         = 1
                    Mandatory       = "FALSE"
                    Type            = "DOUBLE"
                  END_OBJECT = UpperLeftYMap
                  OBJECT = XSizePixel
                    Data_Location   = "MCF"
                CLASS             = "5"
                    NUM_VAL         = 1
                    Value           = .000833333333333
                    Mandatory       = "FALSE"
                    Type            = "DOUBLE"
                  END_OBJECT = XSizePixel
                  OBJECT = YSizePixel
                    Data_Location   = "MCF"
                CLASS             = "5"
                    NUM_VAL         = 1
                    Value           = .000833333333333
                    Mandatory       = "FALSE"
                    Type            = "DOUBLE"
                  END_OBJECT = YSizePixel
            END_OBJECT = HEADER_INFOCONTAINER5
              END_GROUP = HEADER_INFO
              END_GROUP = ARCHIVEDMETADATA
END
```

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