CDF-A Specification Version 1.0

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1 Introduction

All NASA missions are required to make their data available to the scientific community. This includes both data users at the time of the mission and those who use the data after the mission has ended. For this reason missions are required to provide the data to an approved archive [1].

This document describes the types of Common Data Format (CDF) [2] data files which meet a minimum set of requirements for data archiving. **A CDF file that meets these requirements is referred to as a "CDF-A" file.**

CDF-A Requirements

A CDF file meets a minimum set of requirements for data archiving when:

- The file contents comply with a released version of the CDF format specification.
- The file includes at least a minimum set of metadata, as defined by the ISTP metadata guidelines with SPDF extensions. [3]
- All data variables which are part of the CDF file are included in the same file.

2 Extensions

Users, missions, organizations and archives may extend the CDF-A requirements to meet the needs of their domain. The extensions must be documented and a unique name chosen to identify the extensions. Typically this

is the name of an organization followed by “CDF-A”. See the Appendix of this document for common extensions.

3 Appendix HPDE

Constraints to allow a CDF-A file to also be archived in the NASA's Heliophysics Data Environment (HPDE).

3.1 Introduction

The metadata documentation standard adopted by NASA's Heliophysics division is the Space Physics Archive Search and Extract (SPASE) Metadata Model [4]. The SPASE standard also has been adopted by other international agencies and organizations. With SPASE a naming authority (usually a designated agency) defines a unique resource identifier (ResourceID) which is assigned to the SPASE resource description. For data resources there are two general types of resources: collections and granules. A collection is a grouping of one or more granules. A granule is a description of a deliverable file which contains data.

This appendix describes how to create a CDF-A file which will be compatible with the HPDE requirements for data products. **A CDF file that meets both CDF-A and HPDE requirements is referred to as a "HPDE/CDF-A" file.**

3.2 Requirements for HPDE Compatible CDF-A files

In the SPASE Metadata Model a set of one or more files that can be delivered to a user is called a "Granule". One or more related Granules which share the same content structure (i.e., same parameters) may grouped into what is called a "collection". In SPASE collections are classified by the type of data. For example numerical data or display (image) data.

To be an HPDE Compatible CDF-A, the file must be part of and connected to a SPASE collection described by a SPASE Resource Description. A file may be connected to its SPASE Resource Description by directly including in the CDF-A file or through otherwise associating with the file
the following CDF global attribute:

- "spase_DatasetResourceID" whose value is the SPASE ResourceID of the collection.

In addition the file may include the following optional CDF global attributes:

- "spase_DatasetResource" whose value is the SPASE XML description of the dataset that corresponds to the SPASE ResourceID assigned to the spase_DatasetResourceID global variable.
- "spase_GranuleResourceID" whose value is the SPASE ResourceID of the Granule.
- "spase_GranuleResource" whose value is the SPASE XML granule description corresponding to the Granule Resource ID assigned to the spase_GranuleResourceID global variable.

4 Appendix PDS

Constraints to allow a CDF-A file to also be archived in the NASA's Planetary Data System (PDS)

4.1 Introduction

The PDS4 standard [5] provides support for multi-dimensional arrays. The same is true for data stored in the Common Data Format (CDF) [2]. If the content of a CDF file meets the CDF-A requirements and the additional requirements listed below it is possible to describe the data portion with a PDS4 label. This allows PDS4 aware tools to access and manipulate data stored in a CDF file without the need for a CDF reader. This appendix describes how to create a CDF-A file which will be compatible with the PDS4 requirements for data products. **A CDF file that meets both CDF-A and PDS requirements is referred to as a "PDS/CDF-A" file.**

4.2 Requirements for PDS4 Compatible CDF-A files

PDS4 metadata can describe data that are stored as contiguous arrays. For a CDF file to meet PDS4 requirements it must adhere to all the CDF-A requirements and must also meet the following conditions:

1. The CDF file must be CDF version 3.4 or later.
2. No compression (file or variable).
3. No unused records. (No superfluous, non-decodable records)
4. No fragmented variables (all data for a variable must be contiguous in the file).
5. No sparse variables. All data values are physical (data for all dimensions in a variable are written)
6. No virtual (calculated) variables.
7. Variables are stored in row majority order.
8. Use only "zVariables" for data.

5 References

[1] Heliophysics Science Data Management Policy (HSDMP version 1.1, 2009 April 12). Appendices D and E, http://hpde.gsfc.nasa.gov/Heliophysics_Data_Policy_2009Apr12.pdf

[2] CDF Internal Format Description; Version 3.4, February 28, 2012; Space Physics Data Facility; NASA / Goddard Space Flight Center. http://cdaweb.gsfc.nasa.gov/pub/software/cdf/doc/cdf34/cdf34ifd.pdf

[3] ISTP/IACG guidelines for CDF, http://spdf.gsfc.nasa.gov/istp_guide/istp_guide.html

[4] SPASE Metadata Model, http://www.spase-group.org/data/

[5] PDS4 Standard documents, http://pds.nasa.gov/pds4/doc/index.shtml

[6] CDF Software, http://cdf.gsfc.nasa.gov/html/sw_and_docs.html

[7] PDS CDF tools, http://release.igpp.ucla.edu/pds/cdf/