Notes Regarding the PDS3-to-PDS4 Migration of Deep Space Program Science Experiment (Clementine) LWIR Brightness Temperature Data Archived at the PDS Geosciences Node

PDS Geosciences Node

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Notes

All Clementine datasets were originally archived as part of NASA's Planetary Data System (PDS) under the PDS3 standard. These datasets are being migrated to the PDS4 standard. These notes refer to the migration of the Clementine LWIR camera data that were reduced to surface brightness temperature.

The format of these data products was already PDS4-compliant, so there was no need to alter the data files. The PDS3 archive volume remains intact; no files have been removed. The only two changes are (1) the addition of a brief note at the beginning of the aareadme.txt directing the reader to the PDS4 readme file in the bundle root directory and (2) the addition of PDS4 labels and documentation files. In the data directories, the metadata in PDS3 labels have been copied to PDS4 labels, so that each data product now has both a PDS3 and a PDS4 label.

Instead of the archive volumes in PDS3, PDS4 datasets are organized into collections and bundles. A collection is a set of related products, which may be data products, document products, browse products, miscellaneous products, etc. A bundle is a set of related collections. For this brightness temperature dataset, one PDS4 bundle has been defined that corresponds to the PDS3 volume. The bundle has three data collections, two document collection, and a miscellaneous collection. The table below shows the correspondence between the PDS3 volume and PDS4 bundle.

PDS4 Bundle and Corresponding PDS3 Volume and Dataset ID

Archive	PDS4 Bundle LID	PDS3 Volume ID	PDS3 Dataset ID
LWIR Brightness Temperature	urn:nasa:pds:clementine_lwir_bt	CL_7XXX	CLEM1-L-LWIR-3-RDR-V1.0

A bundle is identified by a file named bundle_*.xml (where * is some character sequence) in the root directory of volume; this PDS4 label describes the bundle and lists the collections that belong to it. A collection, in turn, is identified by a PDS4 label named collection_*.xml in a subdirectory. The file collection_*_inventory.csv is found in the same directory as the collection label and lists the products that belong to that collection. Every other product that is part of the bundle also has its own PDS4 label named *.xml.

Every PDS4 product has a Logical Identifier (LID) that is guaranteed to be unique throughout the PDS. The LID is defined in the PDS4 label using the <logical_identifier> tag. For data products, the LID is analogous to PRODUCT_ID in a PDS3 label.

Not every PDS3 component has a PDS4 counterpart. Namely, PDS3 readme (aareadme.txt), volume description (voldesc.cat), catalog info (catinfo.txt), document info (docinfo.cat), and index info (indxinfo.txt) files do not have PDS4 labels. The PDS4 readme (readme_*.txt) file has no separate PDS4 label, but is referenced by the bundle file.

The PDS4 bundle has three data collections: 1) brightness temperature images; 2) flat field images; and 3) bad pixel maps. There are two document collections. The document_catalog contains the original PDS3 catalog files. PDS4 labels have been created for these files, but their content has not changed. The second document collection contains this document and a copy of the documentation from the original PDS3 volume. The final collection contains two PDS3 index files – one for the flat field and bad pixel products, and one for the brightness temperature products.

Errata
The PDS3 labels of the brightness temperature and flat field products contain keywords for values of minimum, maximum, mean, and standard deviation in the products. Due to round off of the values in the PDS3 labels, which were initially copied to the PDS4 labels, the PDS4 validation program flagged cases as errors where actual values in the data were slightly outside the minimum and/or maximum rounded off values. As a result these minimum and maximum attributes have been left out of the PDS4 labels. The mean and standard deviation values have been retained. If the approximate minimum and maximum values are needed, these are retained in the original PDS3 labels.

The PDS3 labels contain latitude and longitude values for the four image reticle points as a string of four values. The documentation in the PDS3 volume defined the pixel locations of these reticle points. However, the documentation is not clear how the order of the four points in the label match up to the reticle point locations. Investigation determined that the latitude and longitude order starts in the upper left point and proceeds clockwise around the corners of the image.

Below are errata notes from the PDS3 dataset:

Several revolutions worth of data were not calibrated to brightness temperature, either because there were no space images taken for that revolution or because the detector saturated. LWIR images have been calibrated from 95% of the revolutions from the first month of lunar mapping and from 77% of the revolutions from the second month of lunar mapping. Thus, a total of 86% of the 266 Clementine systematic mapping revolutions have been reduced.

Below is a table that gives the reason that specific revolutions were not calibrated.

Rev	Reason
032	no space images
033	no space images
035	no space images
111	no data acquired
131	no data acquired
164	no data acquired
201	no data acquired
211-217	bad space images
218-220	cryocooler off

222-223 cryocooler off
225-227 cryocooler off
231   no data acquired
233-243 no space images
261-262 bad data
291   no space images