Planetary FITS

FITS standard for planetary data?

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FITS standard for planetary data? Why?

- open, well defined, scientific graded standard[1]
- a lot of open source well proven tools to analyse and manipulate it

[1] W. D. Pence, L. Chiappetti, C. G. Page, R. A. Shaw, and E. Stobie. Definition of the Flexible Image Transport System (FITS), version 3.0. *A&A*, 524:A42, December 2010

FITS standard for planetary data? Which data?

First (this presentation)

- High level Imagery: projected surfaces.
- Surface properties maps (Topography, Temperature, ...): projected rasters.

Then

- Spectral cubes
- Tabular data

Maybe

- Raw data

FITS format is not incompatible with metadata PDS archiving: e.g. Hubble Mars images (`http://pds-geosciences.wustl.edu/missions/earthbased/hst_cornell.htm`)

FITS standard for planetary data? Projections. I.

Answers are in the classics:

- J.P. Snyder. *Map Projections: A Working Manual*. Professional paper: United States Geological Survey. U.S. Government Printing Office, 1987
- M. R. Calabretta and E. W. Greisen. Representations of celestial coordinates in FITS. *A&A*, 395:1077–1122, December 2002
- No need for oblique projections definitions: difference is in the projection parameters (projection center or reference point)[2] e.g. Mercator and Transverse Mercator, Simple Cylindrical and Equirectangular.

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[2] M. R. Calabretta and E. W. Greisen. Representations of celestial coordinates in FITS. *A&A*, 395:1077–1122, December 2002

FITS standard for planetary data? Projections. II.

Projection translation from ISIS (`http://isis.astrogeology.usgs.gov/`) to FITS.

- sinusoidal: SFL (spherical and ellipsoidal, Snyder p.243), CRVALi in FITS WCS is the center longitude in ISIS-PDS standard.
- lambertazimuthalequalarea: ZEA (spherical and ellipsoidal, Snyder p.182) CRVALi in FITS WCS is (center longitude,center latitude) (like all zenithal projections)
- lambertconformal: COO (spherical and ellipsoidal, Snyder p.104).
- equirectangular: CAR (only spherical in ISIS, parallels and meridians are straight and orthogonal everywhere)
- mercator: MER (spherical and ellipsoidal, Snyder p.38).

FITS standard for planetary data? Projections. II. Continue.

- orthographic: SIN (spherical and ellipsoidal, Snyder p.145), CRVALi in FITS WCS is the (center longitude, center latitude) in ISIS-PDS standard.
- pointperspective: AZP (spherical and ellipsoidal, Snyder p.169) CRVALi in FITS WCS is (center longitude,center latitude) (like all zenithal projections)
- polarstereographic: STG (spherical and ellipsoidal, Snyder p.154) CRVALi in FITS WCS is (center longitude,center latitude) (like all zenithal projections).

FITS standard for planetary data? Peculiarities.

- ellipsoidal projections: defining planetary RADESYS
- keyword for datum (surface reference): RADESYS containing radius?
- CUNIT : meters and degrees, alternative Coordinate Systems are already described in FITS
- distortions are due to topography not only optics: no polynomial description of distortion in no orthorectified images.

[1] M. R. Calabretta and E. W. Greisen. Representations of celestial coordinates in FITS. *A&A*, 395:1077–1122, December 2002.

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[3] J.P. Snyder. *Map Projections: A Working Manual*. Professional paper: United States Geological Survey. U.S. Government Printing Office, 1987.