Subject: Re: Data format for spherical data
Posted by James Kuyper on Thu, 26 May 2005 03:16:10 GMT
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Wayne Landsman wrote:
> This is not really an IDL question, though I will be using IDL to convert to
> the new data format.
>
> I've only worked only within the provincial field of astronomy, and so I've
> never had to deal with data formats other than FITS. But our data center
> is now being asked to make our all-sky data available in a more popular (but
> still scientific) data format, where suggestions so far for the new format
> have included NetCDF and GeoTIFF. The data will consist of various
> quantities (e.g. flux, error, # of observations) attached to ~60,000
> longitude, latitude points covering the entire sphere.
>
> I suppose the most important criterion for the format is popularity (we only
> want to do this once) although an ability to naturally handle spherical data
> is a plus. Any suggestions?

NetCDF provides no special support for spherical data. You can store such data without any problems, but NetCDF provides no special interpretation of such data.

HDF-EOS is built on HDF, which is implemented in a fashion compatible with NetCDF. HDF-EOS has as a fundamental concept that data fields and geographic fields (latitude, longitude, and altitude) are linked together. It provides three different formats for geographically organized data.

The Point format is for an unorganized collection of individual data points, and associates a latitude and longitude with each of those data points. However, there's nothing in the Point interface which interprets the latitude and longitude fields as latitudes and longitudes. You could fill those field with temperatures and pressures, and it would work the same.

The Swath format organizes the data and geographic fields as 2-dimensional arrays, which might have different resolutions. Typically the dimensions of the data fields will represent image coordinates for data collected from a satellite. It attaches HDF metadata to the file documenting a simple linear mapping relationship between each dimension of the data arrays and the corresponding dimension of the arrays containing latitude and longitude. It's intended that the lower resolution fields be interpolated to match the higher resolution fields using that mapping, but the Swath interface doesn't actually provide a routine for carrying out that interpolation. As a result, just like the

Point interface, the geographic fields don't have to actually contain geographic data.

Only the Grid interface actually provides routines that interpret latitude and longitude as geographic coordinates. HDF-EOS Grids are 2-dimensional arrays of data, arrays represent positions evenly spaced on a rectangular grid in some map projection, and the grid has to be oriented to the U-V coordinates in that projection. Unlike the Point and Swath formats, the Grid format does not store latitude and longitude directly in the file. It only stores information about the map projection used, the position on that map projection of the corners of the rectangular grid, and the number of rows and columns in the grid. The grid interface includes a routine (represented by EOS_GD_INTERPOLATE in the IDL interface) that takes a series of latitude/longitude pairs, interprets them according to the map projection, and interpolates specified data fields in that map projection to those locations. Oddly enough, it doesn't provide routines for calculating latitudes and longitudes that correspond to the data grid points.