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Subject: Re: Full-Disk Orthographic to Cylindrical Projection  
Posted by [David Fanning](#) on Mon, 11 Mar 2013 18:07:08 GMT  
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Tyler Behm writes:

>  
> I have full-disk ground-based solar images. They can be thought of as satellite-projection maps of the Sun. I am trying to work my way up to projecting these images to cylindrical by starting with the easier case of full-disk Earth orthographic projections.

>  
> I have been using IDL's `map_set` to produce orthographic images of the Earth. When I use `map_proj_init` or `poly_warp` to transform this orthographic Earth image into a cylindrical projection, it is definitely not correct. I think that IDL is also warping the corners of the orthographic image which are outside the mapping. How can I transform only the circular disk of the Earth (or Sun)?

>  
> `window, 0, xsize=600, ysize=600`  
> `map_set, /orthographic, /grid, /conti, /hori, xmar=0, ymar=0, /iso`  
> `ortho=tvrd()`  
> `omap=!map`  
> `cmap=map_proj('Cylindrical')`  
> `cylin=map_proj_image(ortho, omap.uv_box, image_str=omap, map_str=cmap)`  
> `tvsl, cylin`  
>  
> Thank you in advance.

Humm. Well, you are doing this all wrong. :-)

There are two ways to do map projections in IDL. With the ancient `Map_Set` routines, or with the newer (but still old) `Map_Proj_***` routines. You can't mix and match them the way you are doing here, unfortunately.

In particular, the map structures produced by `Map_Set` and `Map_Proj_Init` are completely different and can't be interchanged.

I don't have time to go into it all today, but I would say its probably crazy to convert an orthographic projection to a cylindrical projection, but if you REALLY have to do it, I would stick to doing it in the `Map_Proj_***` routines. You will have better luck, probably. Here is an article that describes the process using `Map_Proj_Image`:

[http://www.idlcoyote.com/map\\_tips/warpimage.html](http://www.idlcoyote.com/map_tips/warpimage.html)

Cheers,

David

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David Fanning, Ph.D.  
Fanning Software Consulting, Inc.  
Coyote's Guide to IDL Programming: <http://www.idlcoyote.com/>  
Sepore ma de ni thue. ("Perhaps thou speakest truth.")

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Subject: Re: Full-Disk Orthographic to Cylindrical Projection  
Posted by [Craig Markwardt](#) on Mon, 11 Mar 2013 19:14:16 GMT  
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On Monday, March 11, 2013 1:48:55 PM UTC-4, Tyler Behm wrote:

> I have full-disk ground-based solar images. They can be thought of as satellite-projection maps of the Sun. I am trying to work my way up to projecting these images to cylindrical by starting with the easier case of full-disk Earth orthographic projections.

Do you start with astronomical FITS images with world coordinates? The IDL Astronomy Library provides truly excellent routines for remapping images with FITS world coordinates.

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Subject: Re: Full-Disk Orthographic to Cylindrical Projection  
Posted by [Tyler Behm](#) on Mon, 11 Mar 2013 21:20:13 GMT  
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Edit to OP: `cmap=map_proj('Cylindrical')` should be `cmap=map_proj_init('Cylindrical')`

David. Although I have read that article and many others of yours, I still need to read them more. They have been very helpful.

On Monday, March 11, 2013 1:14:16 PM UTC-6, Craig Markwardt wrote:

Do you start with astronomical FITS images with world coordinates? The IDL Astronomy Library provides truly excellent routines for remapping images with FITS world coordinates.

Craig, I am familiar with the Astronomical Library's good coordinate transform routines like `wcssph2xy.pro`. Unfortunately, these FITS do not have world coordinates.

The solar images can be found at [ftp://diglib.nso.edu/Evans\\_spectroheliograms/CaK/1988/](ftp://diglib.nso.edu/Evans_spectroheliograms/CaK/1988/)

Most of the header is just info about the viewing geometry. I used `"print, headfits('880110.1555c.fits')` and got:

```
SIMPLE =          T / FITS STANDARD /  
BITPIX =         16 / FITS BITS/PIXEL /  
NAXIS  =          2 / NUMBER OF AXES /
```

```
NAXIS1 =      1952 /
NAXIS2 =      1896 /
BSCALE =  1.0 / REAL = TAPE*BSCALE + BZERO /
BZERO =   0.0 /
BZERO =   0.0 /
ORIGIN = 880110.1555c.fit /
DATE_OBS = 1988/01/10 /
TIME_OBS = 15:55 /
SOLP = -71.80 /
SOLB = -4.10 /
CRPIX1 = 891 /
CRPIX2 = 1044 /
R_SUN = 785 /
SOLR = 785 /
CENTER_X = 891 /
CENTER_Y = 1044 /
DATE_OBS = '1988-01-10T15:55' /
SOLAR_P = -71.80 /
CDELTA = 0 /
TEL_P_ang = 251.59 /
DEL_RX = 0.00 /
DEL_RY = 0.00 /
Scatt1 = 35540.30 0.35 /
Scatt2 = 34133.02 0.36 /
Kf_Scatt = 0.92 /
Kf_lin = 0.00 /
Kf_exrtr = 0.00 /
END
```

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Subject: Re: Full-Disk Orthographic to Cylindrical Projection  
Posted by [Craig Markwardt](#) on Tue, 12 Mar 2013 00:34:49 GMT  
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On Monday, March 11, 2013 5:20:13 PM UTC-4, Tyler Behm wrote:

>  
> On Monday, March 11, 2013 1:14:16 PM UTC-6, Craig Markwardt wrote:  
>  
> Do you start with astronomical FITS images with world coordinates? The IDL Astronomy Library provides truly excellent routines for remapping images with FITS world coordinates.  
>  
> Craig, I am familiar with the Astronomical Library's good coordinate transform routines like wcssph2xy.pro. Unfortunately, these FITS do not have world coordinates.  
>  
> The solar images can be found at [ftp://diglib.nso.edu/Evans\\_spectroheliograms/CaK/1988/](ftp://diglib.nso.edu/Evans_spectroheliograms/CaK/1988/)

The files you posted are from 1988, which is before there was a standard for FITS world coordinates, so people just rolled their own. That's kind of unfortunate. In fact, the headers of

those FITS files you linked are only barely FITS headers; there are many nonconformances which might trip up reader software.

On the other hand, it does look like there is a lot of useful information in the header, perhaps enough to construct appropriate world coordinates. It would take some reverse engineering. Unfortunately the README provides next to no information. Not even the plate scale!

I'm not a solar astronomer, so I'm out of my league here. The obvious choice is the AZP projection, which can handle planetary projections, assuming that's appropriate for your images (Calabretta & Greisen 2002 celestial WCS paper, section 7.4.4).

Wayne Thompson, who is an IDL person, has a paper about solar coordinates and FITS images (Thompson 2006 A&A 449 791). If that paper doesn't help then he might be a good point of information. Also the original provider of the data might need to be consulted.

Craig Markwardt

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