ARCGIS (PART 1). BASIC CONVERTING AND COMBINING PLANETARY DATA SETS IN V10

-Trent Hare, Sep. 2011

PDS, ISIS2, ISIS3 SUPPORT IN ARCMAP 10

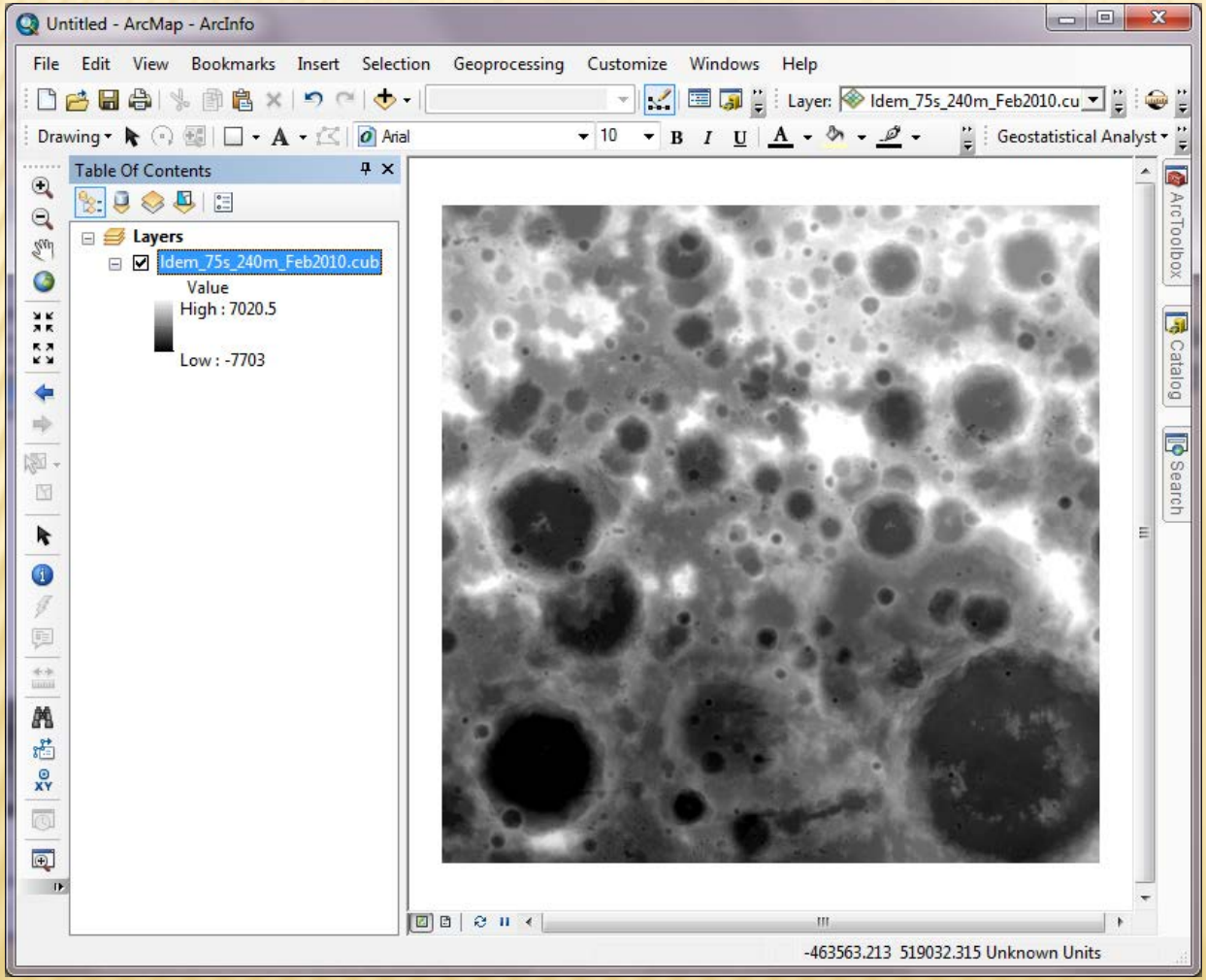
- Recommendation: Use ISIS cubes directly or convert to new format in ArcMap
- The good
  - Attached, detached, tiled or raw
  - Map projections (most).
  - 8, 16, 32 bit
  - Multiple bands
- The bad
  - Only one NULL value. Means no ISIS saturation value support
  - Needs statistics to be build to show 16 and 32bit ranges
  - A couple GDAL bug fixes are not available (e.g. new continuation flag in ISIS3 label). Optional: use “labedit” to remove offender

If ISIS cubes do not work directly, then it is recommended to convert to GeoTiff/GeoJp2 using GDAL

RULES OF THE GIS ROAD

- For ISIS processing
  - Best to set **same** projection and parameters for all
    - Note: optional to set same resolution
  - For visual (thematic) images, best to convert to 8bit
  - For "data" (e.g. DEM, Temperature -- 16,32 bit), set all ISIS Special Pixel Values to NULL (using specpix, stretch, bit2bit)
  - For global
    - If lonsys=360, then set clon=180
    - If lonsys=180, then set clon=0 *(better supported)*
  - Don't use funky projections

DISPLAYING 16, 32 BIT ISIS CUBES

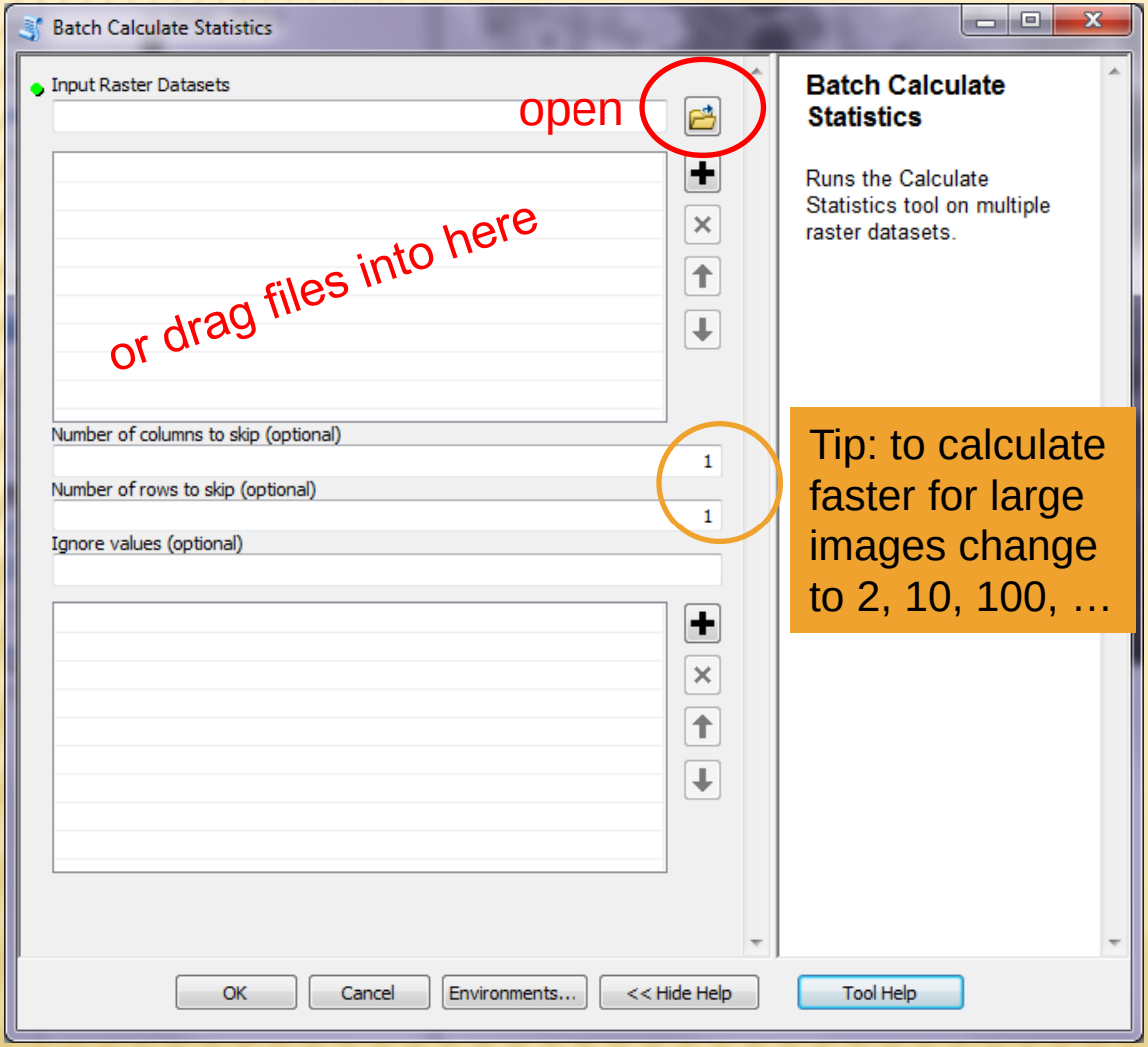


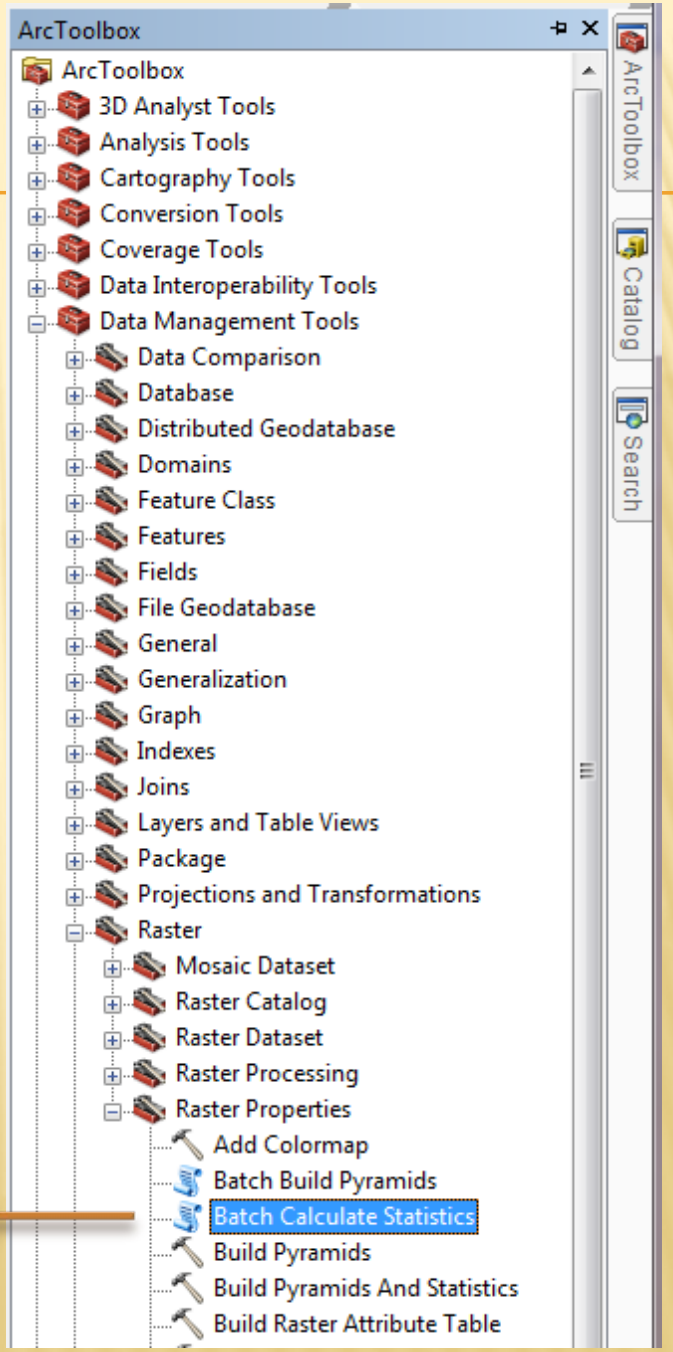
1.) Right click layer,
Select “properties”

2.) Symbology tab, select
stretch: Std Dev.

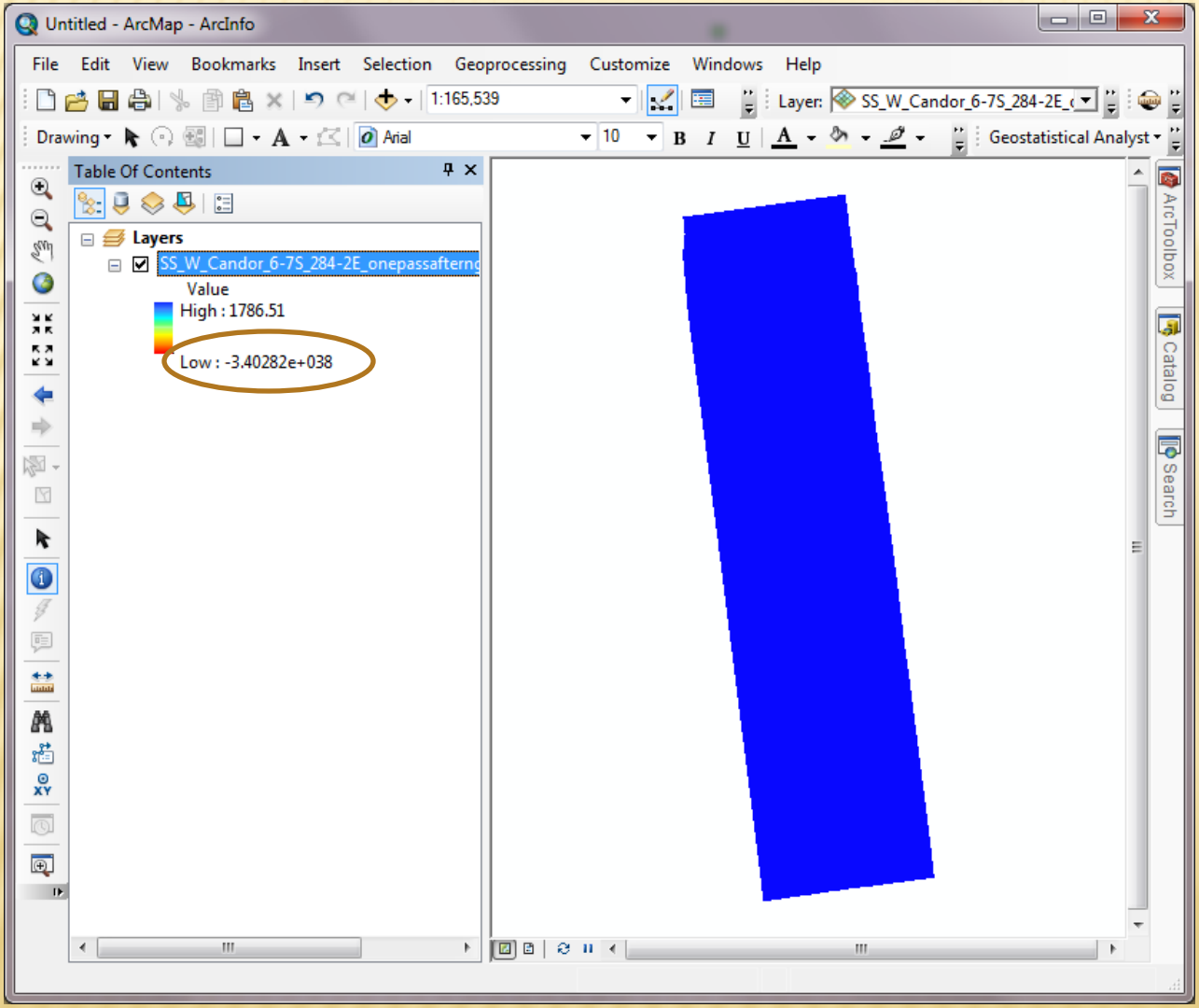
3.) Yes to “calculate stats”,
hit okay

BATCH STATISTICS

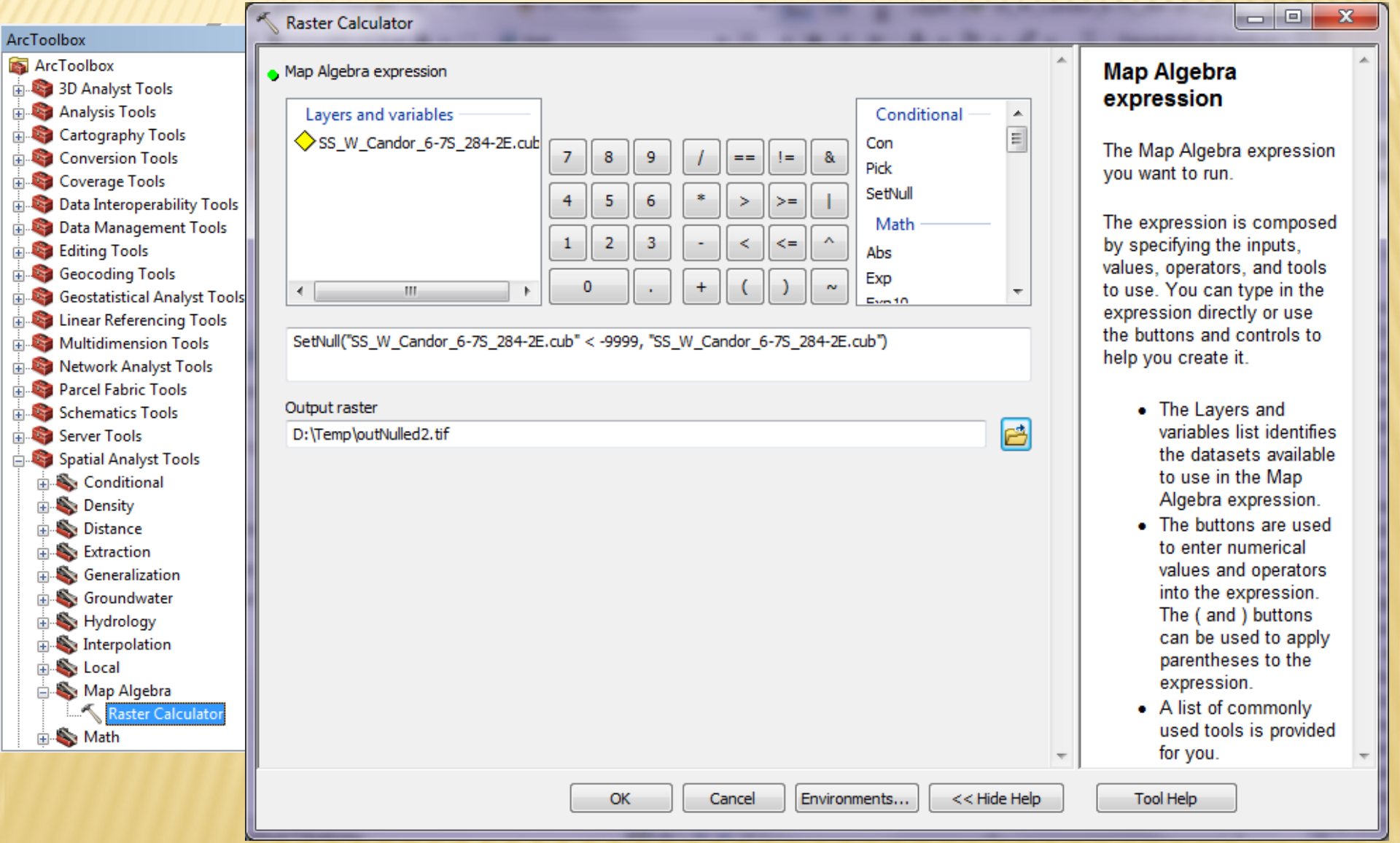




WHEN THE RANGE IS STILL BAD – AFTER STATS



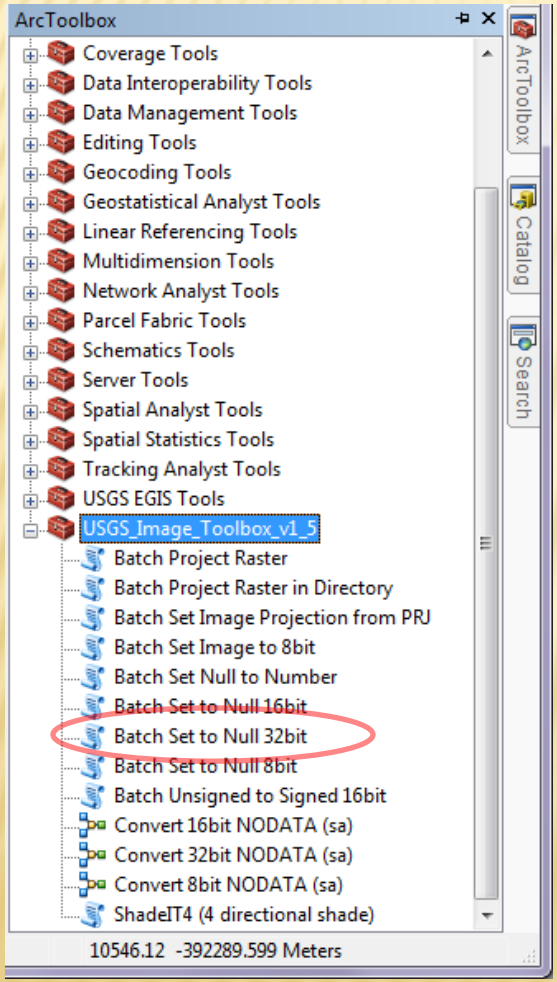
CALCULATE VALID RANGE (SETNULL)

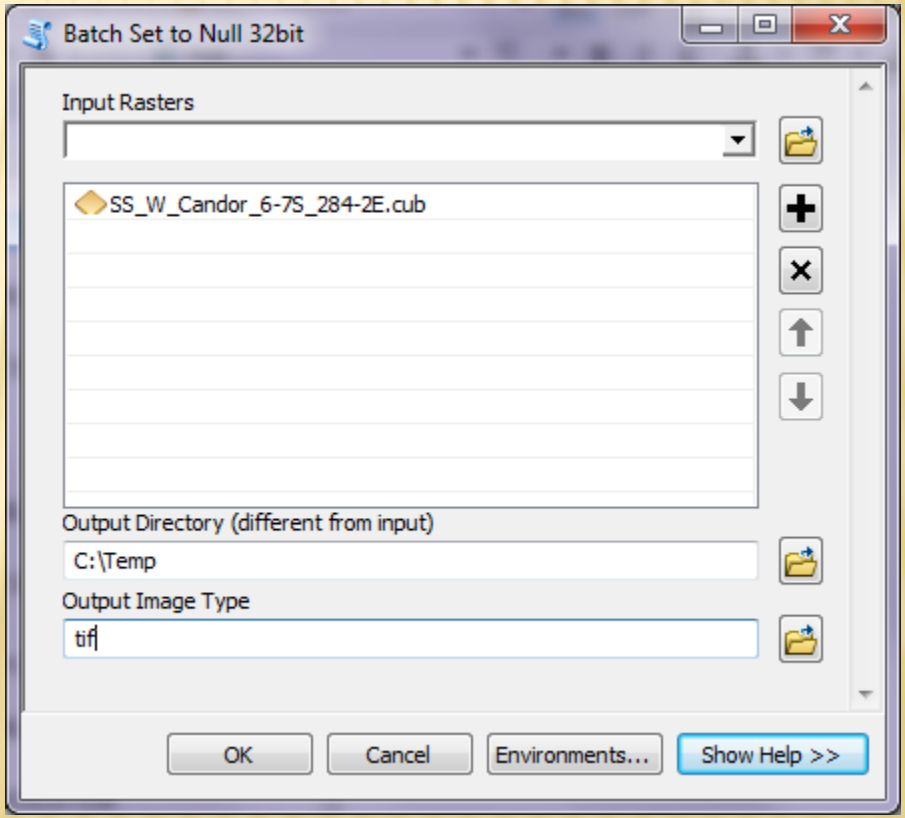


BATCH SET NULL

- USGS Image Toolbox (http://bit.ly/q33Vqa)

written for 9.x but works for 10





NO NEED FOR 16, 32 – CONVERT TO 8BIT

- ISIS
  - Isis2std - easiest but
    - Can not convert files over 2GB (except Jpeg2000)
    - Can only convert to 8bit (except Jpeg2000 - 8 or 16bit)
    - Does not support embedded projection (just worldfile)
  - Bit2bit (new @ ISIS 3.3.0)
    - Reason: convert from 32bit to 16 or 8bit ISIS cube
    - Requires app to still support ISIS format
    - Linear stretches only?

NO NEED FOR 16, 32 – CONVERT TO 8BIT

- GDAL
  - On Astro Machines (more: http://bit.ly/oxIsQ7)

> to8bit_gdal_tif.csh in.cub out.tif

> to8bit_gdal_jp2.csh in.cub out.jp2

> to8bit_gdal_png.csh in.cub out.png

  - Manual method (more: http://bit.ly/pprlMK)

> gdalinfo –mm in.cub (returns min/max, now convert)

> gdal_translate –ot byte –scale min max 1 255 –a_nodata 0 in.cub out.tif

> gdal_translate –of PNG –ot byte –scale min max 1 255 –a_nodata 0 in.cub out.png

> gdal_translate –of JP2KAK –co quality=100 –ot byte –scale min max 1 255 –a_nodata 0 in.cub out.jp2

Also fire up qview to get min/max

TROUBLE WITH ISIS CUBES IN ARCMAP/GDAL?

- Back-up conversion method
  - First run isis2raw or isis2std (on “in.cub”)

  Now run
  - For raw run: isis3world.pl –e –prj in.cub
  - For png run: isis3world.pl –p –prj in.cub
  - For tiff run: isis3world.pl –t –prj in.cub
  - For jpeg: isis3world.pl –j –prj in.cub
  - For jpeg2000: isis3world.pl –J –prj in.cub

  You will then need to assign the created projection to the output file using the new *.prj file. There are batch methods available: USGS Image Toolbox (http://bit.ly/q33Vqa)

GDALDEM – 8BIT HILLSHADES AND SLOPE MAPS

- hillshade

>gdaldem hillshade dem.img out_hillshade.tif -z 2 (z = exaggeration of 2)

- colorize (using color.lut below)

>gdaldem color-relief dem.img color.lut out_color.tif

Merging colorized image and hillshade into a colorshade use: hsv_merge.py:
http://svn.osgeo.org/gdal/trunk/gdal/swig/python/samples/

- merge the two files

>hsv_merge.py out_color.tif out_hillshade.tif out_color-hillshade.tif

---

For color mapping you need a defined mapping. Favorite so far is (rainbow).
nv = NoData Value

File: color.lut

```
nv   0 0 0
0%   purple
20%  blue
40%  aqua
60%  green
80%  yellow
100% red
```

GDALDEM WRAPPERS (@ ASTRO)

- **For LMMP color-defined shades/slopes run**

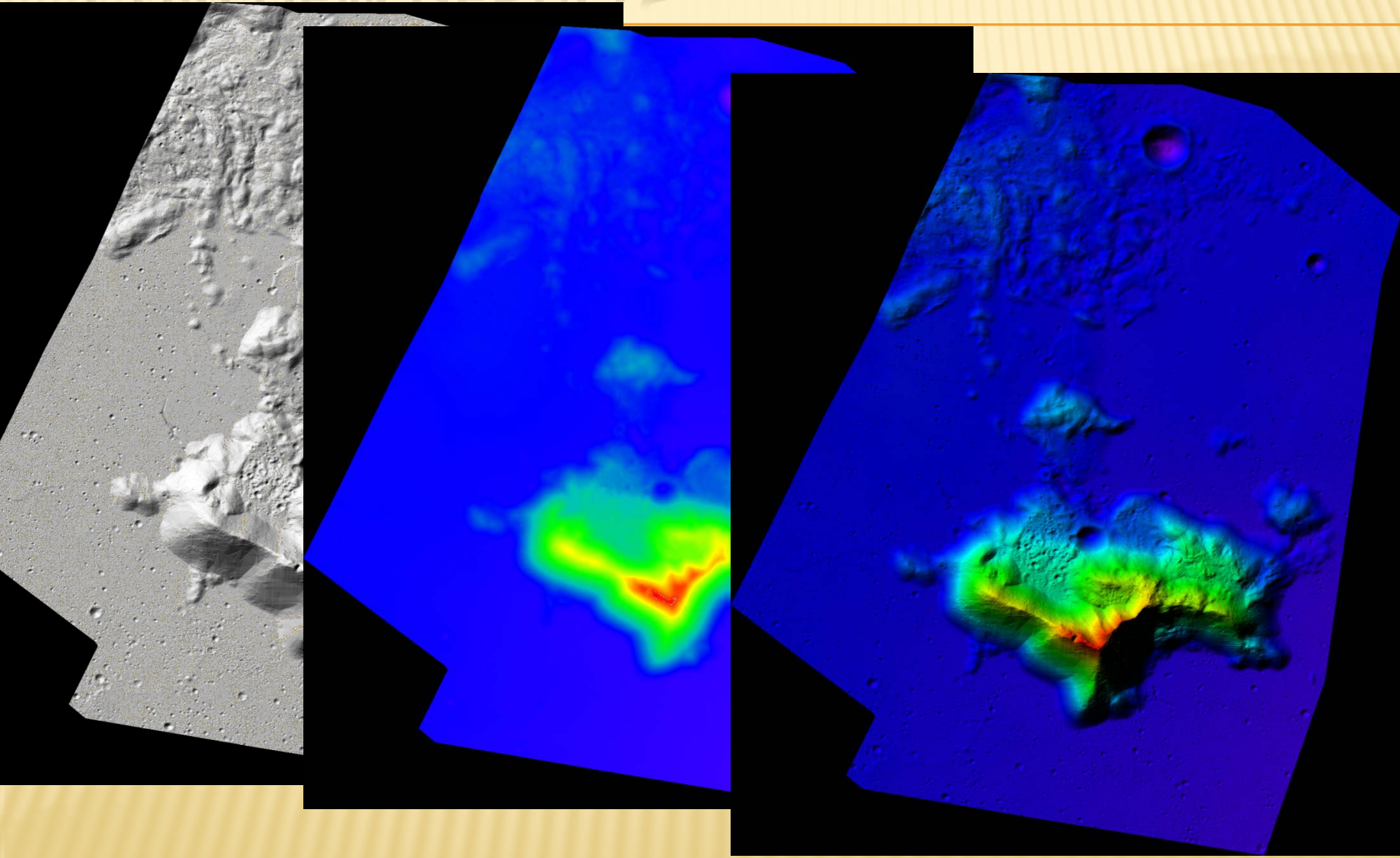
```
> gdal_colorshade_hsv.pl inDEM.cub outClrShade.tif 2
```

  - Where 2 is the exaggeration

```
> gdal_slope_hsv.pl inDEM.cub outSlope.tif 2
```

Color legends will be copied to user's directory but the ColorShade values will still need to be edited in Photoshop or other. Values will be written to screen.

GDALDEM RESULTS



CONVERTING RAW FILES

- ArcMap/GDAL
  - Create ESRI detached header
  - 8,16 bit, use extension *.bil or *.bsq
  - 32 bit file, use extension *.flt
  - Image & header must share filename
- ArcMap
  - Can also use ERDAS detached header
- GDAL
  - Can also use PCI Geomatic detached header

Example header (*.hdr)

```
NCOLS xxx
NROWS xxx
XULCORNER xxx
YULCORNER xxx
CELLSIZE xxx
NBITS 32
NODATA_VALUE xxx
BYTEORDER <MSBFIRST | LSBFIRST>
```

ESRI Help: http://bit.ly/r3kIPJ

GDAL Help: http://www.gdal.org/frmt_various.html#EHdr

http://downloads.esri.com/support/whitepapers/other_/eximgav.pdf

ASCII FILES

- Regularly spaced
  - Add header to stream of “Z”s (filename *.asc)

```
NCOLS 480
NROWS 450
XULCORNER 378922     (or XLL)
YULCORNER 4072345
CELLSIZE 30
NODATA_VALUE -32768
43 2 45 7 3 56 2 5 23 65 34 6 32 54
57 3 2 7 45 23 5 ...
```

ESRI Help: http://bit.ly/r2GNFA

ASCII FILES

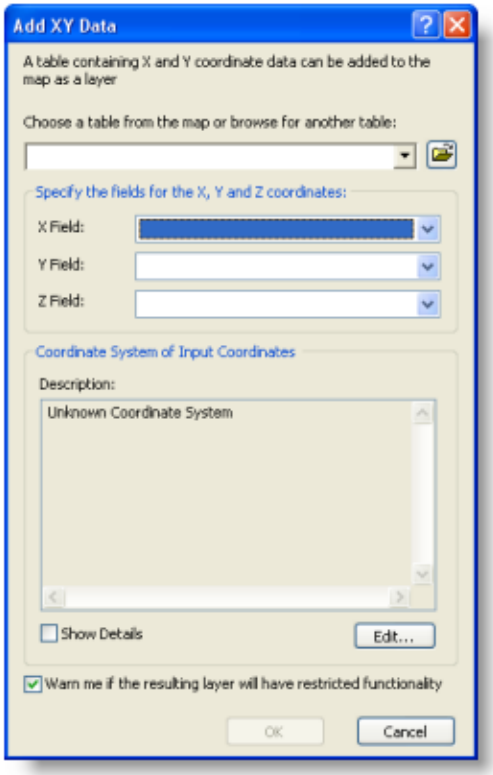
- Irregularly spaced (randomly spaced)
  - Usually from a table (e.g. Lon, Lat, Value)
  - TAB or Comma delimited supported (*.tab, *.csv)
- Once loaded (see next slide), you can then choose one of 10 interpolation methods in ArcMap
  - 3D Analyst, Spatial Analyst
  - GeoStatistical Analyst (interactive interpolation)

ASCII FILES

- Irregularly spaced (must create points prior to interpolation)

Steps for adding x,y data as a layer

1. Click **File** > **Add Data** > **Add XY Data**.



http://bit.ly/psElPz

2. Select the table that contains x,y coordinate data.
3. Identify the columns that hold the x- and y-coordinates (and, optionally, the z-coordinate).
4. Specify the coordinate system.

Astro users – add this to your .cshrc
#GMT for csh or tcsh users:
setenv GMTHOME /work/users/thare/gmt/GMT4.5.7
set path=($path /work/users/thare/gmt/GMT4.5.7/bin)

ASCII FILES

- Irregularly spaced (GMT, GDAL, QGIS, etc)

1.a) GMT Spherical interpolation http://gmt.soest.hawaii.edu/gmt/html/man/sphinterpolate.html

BlockMean or xyz2grd
http://www.soest.hawaii.edu/gmt/gmt/html/man/blockmean.html
#set R=`minmax -I2 ascii.xyz` # Calculate the extent of the points
#blockmean ascii.xyz -I0.01 -bo $R > temp.bm
#
#If known extent set -Rxmin/xmax/ymin/ymax

blockmean vesta_llr.txt -I0.0625 -bo -R0/360/-90/90 -: > temp.bm

where -I resolution, use "-:" for lat,lon order (leave off for lon, lat order)
where -bo means binary output and -bi means binary input (optional but faster)
#
run spherical interpolation (optionally run spherical TIN using sphtriangulate)
Spherical "Q1" = Smooth interpolation with local gradient estimates (more options avail.)

sphinterpolate temp.bm -Q1 -Gvesta_llr_sphInt_Q1.grd -I0.0625 -bo -R0/360/-90/90 -bi -:

#
#now convert to GeoTiff or Raw (for import to ISIS using "raw2isis")
gdal_translate -of ENVI vesta_llr_sphInt_Q1.grd vesta_llr_sphInt_Q1.raw

Astro users – add this to your .cshrc
#GMT for csh or tcsh users:
setenv GMTHOME /work/users/thare/gmt/GMT4.5.7
set path=($path /work/users/thare/gmt/GMT4.5.7/bin)

ASCII FILES

- Irregularly spaced (GMT, GDAL, QGIS, etc)

1.b) GMT Cartesian interpolation (more typical - what MOLA//LOLA Team uses)
http://www.soest.hawaii.edu/gmt/gmt/html/man/surface.html

BlockMean or xyz2grd
http://www.soest.hawaii.edu/gmt/gmt/html/man/blockmean.html
#set R=`minmax -I2 ascii.xyz` # Calculate the extent of the points
#blockmean ascii.xyz -I0.01 -bo $R > temp.bm
#
#If known extent set -Rxmin/xmax/ymin/ymax

blockmean vesta_llr.txt -I0.0625 -bo -R0/360/-90/90 -: > temp.bm

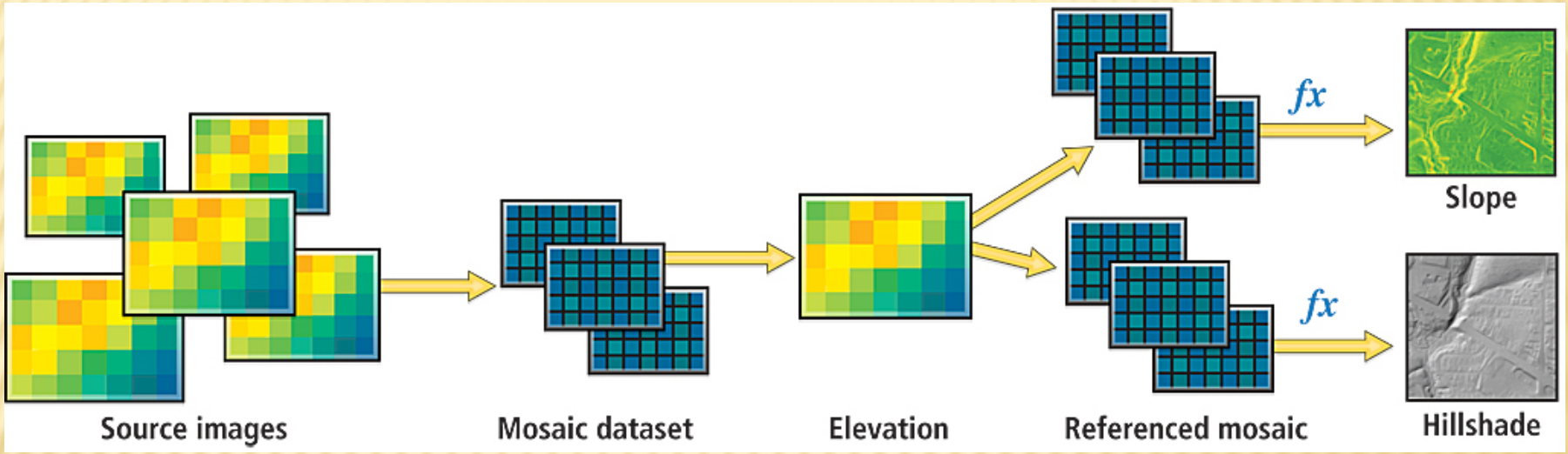
where -I resolution, use "-:" for lat,lon order (leave off for lon, lat order)
where -bo means binary output and -bi means binary input (optional but faster)
#
#run spline interpolation (optionally run TIN using triangulate)

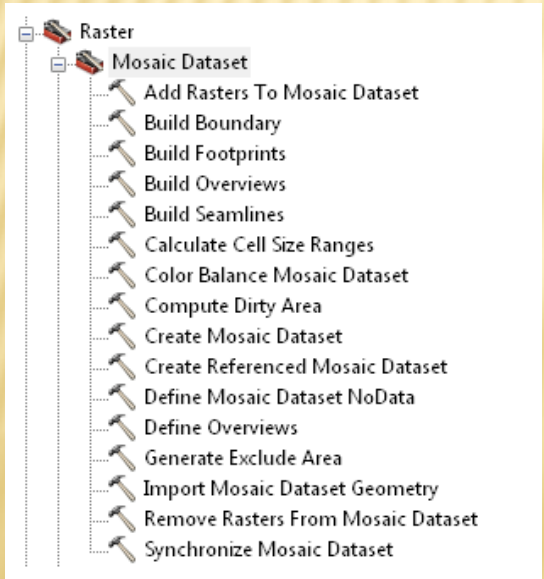
surface temp.bm -Gvesta_llr_surface.grd -I0.0625 -bo -R0/360/-90/90 -bi -:

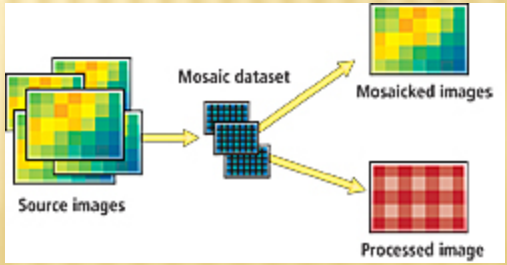
#now convert to GeoTiff or Raw (for import into ISIS using raw2isis):
gdal_translate -of ENVI vesta_llr_surface.grd vesta_llr_surface.raw

MOSAIC RASTER TYPE

A mosaic dataset is a collection of raster datasets (images) stored as a catalog & viewed as a dynamically mosaicked image.



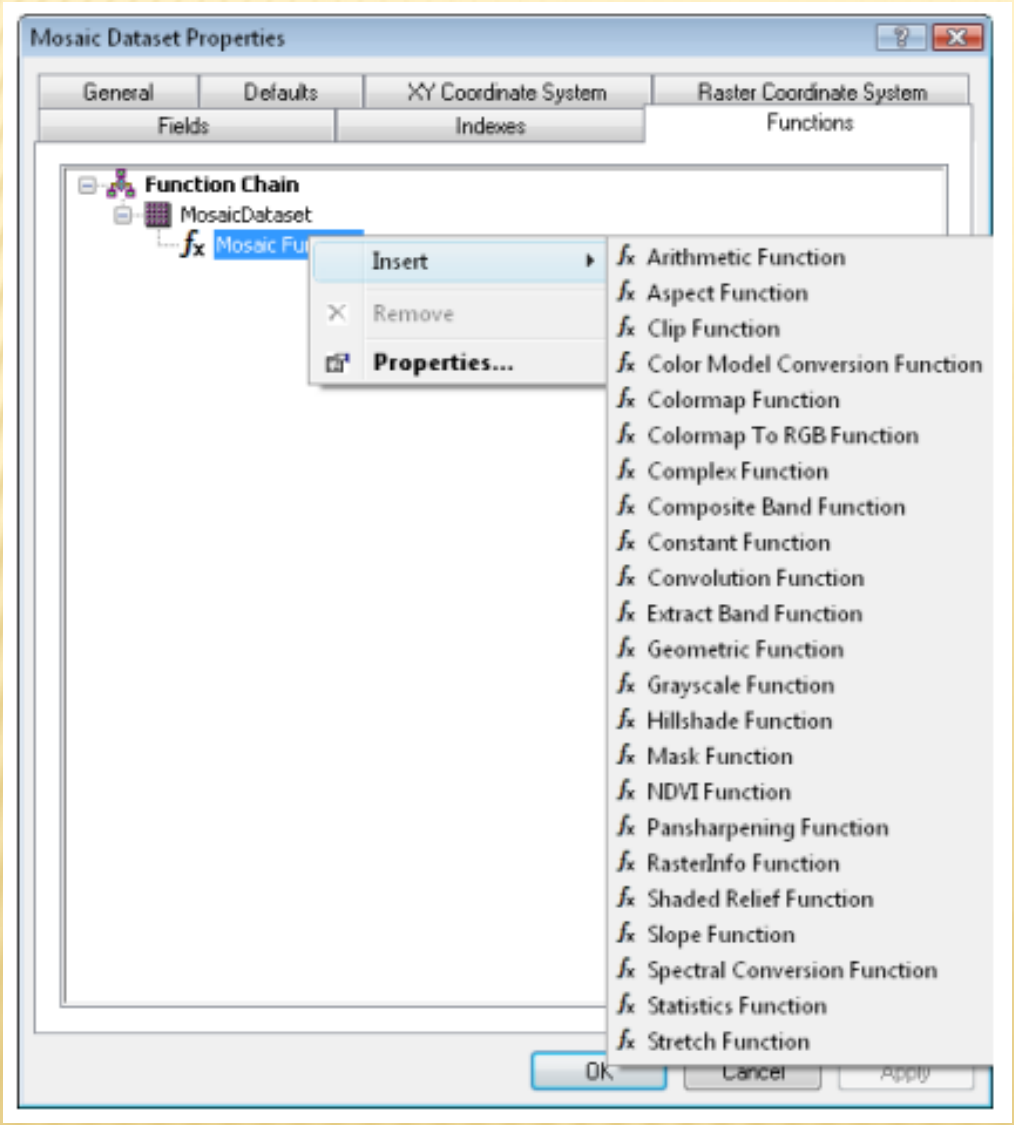




MOSAIC DATA TYPE

- Demo Raster Riser

VIRTUAL IMAGE FUNCTIONS



Demo: Hillshade