

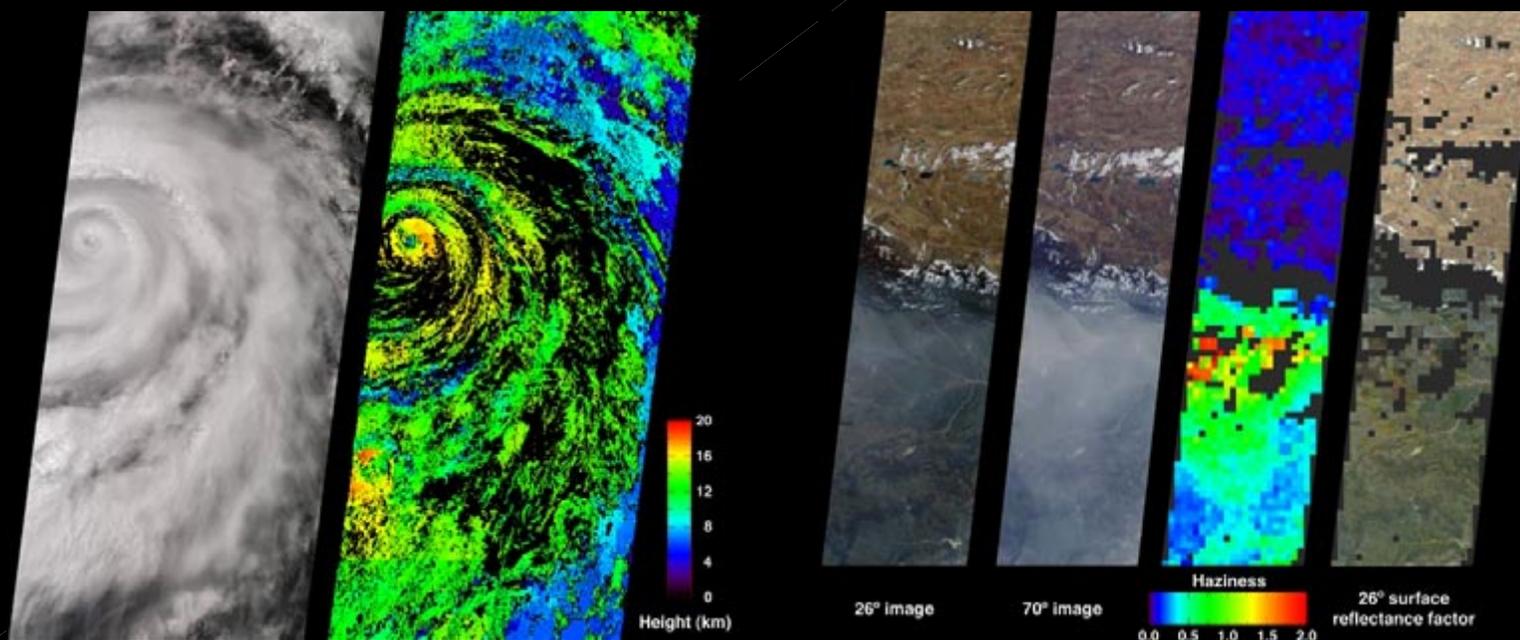


## MISR Products and Tools



“Life of an HDF-EOS Science Data Product.  
A gritty, behind-the-scenes exclusive!”

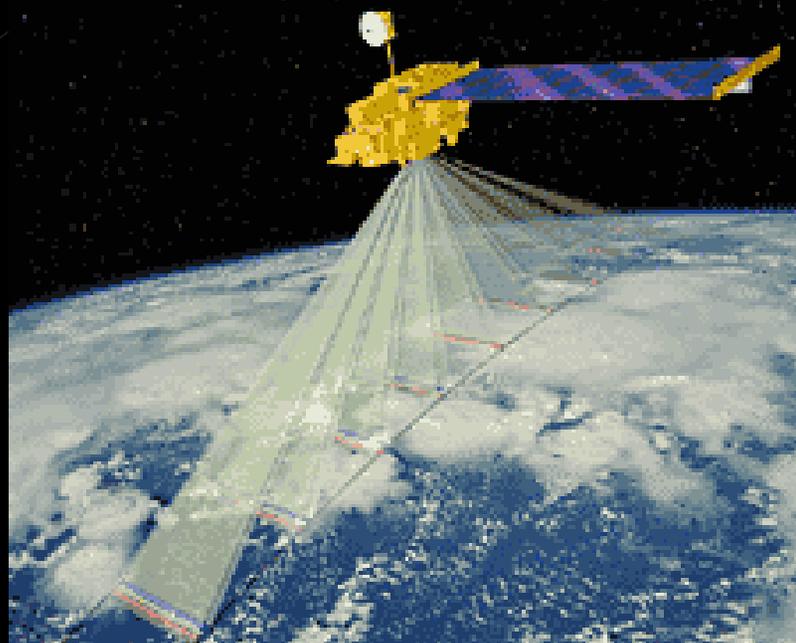
Brian Rheingans and Kyle Miller  
MISR Instrument Team



Science Data Processing Workshop, Greenbelt, MD.  
February 28, 2002

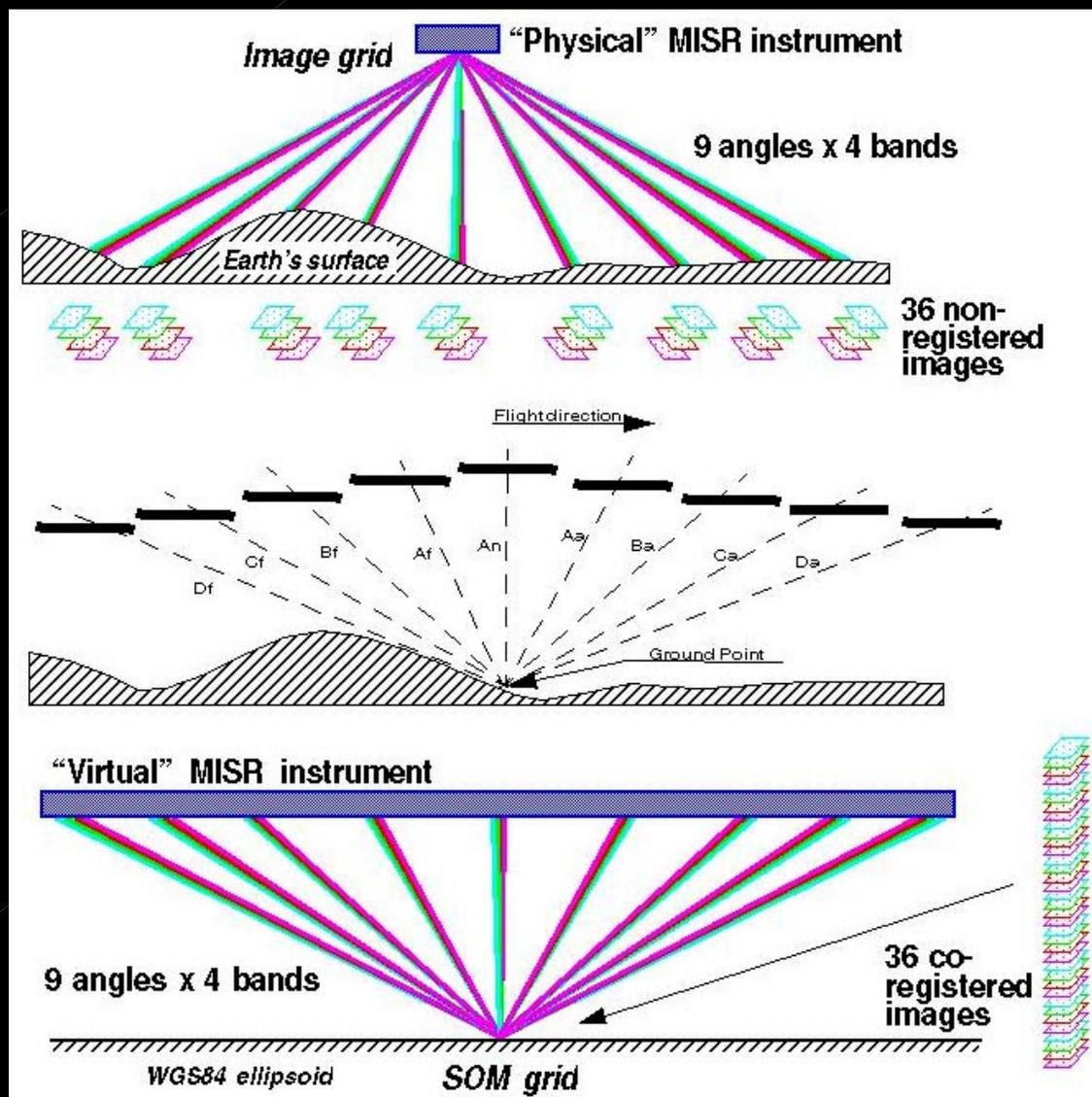
MISR Products and Tools  
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<http://www-misr.jpl.nasa.gov>



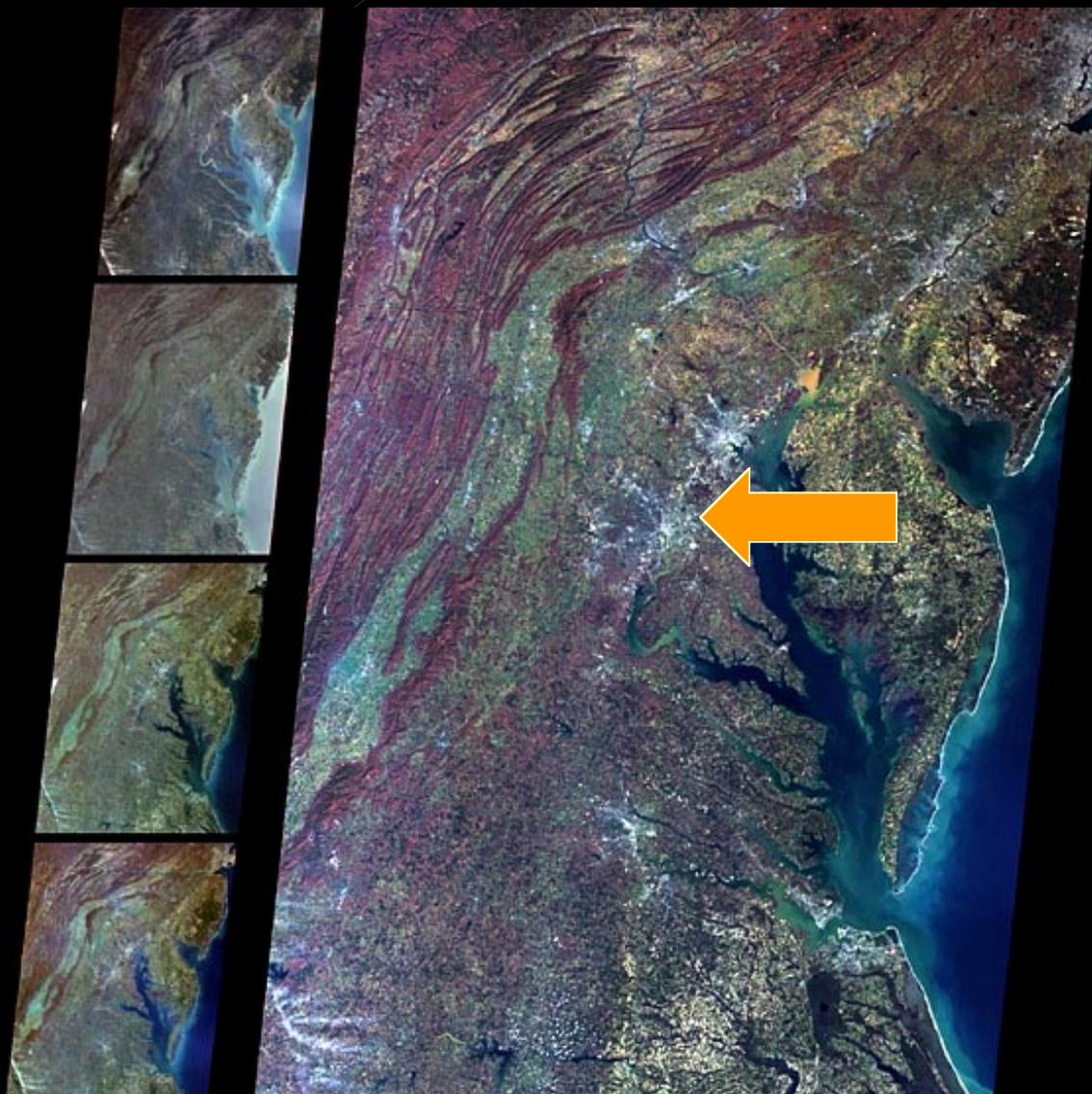
- **Multi-angle Imaging Spectro-Radiometer**
- **9 cameras, 4 spectral channels, pushbroom CCD.**
- **Continuous daylight swath acquisition.**
- **150 TB of HDF at the Langley DAAC.**
- **~50 product types, hundreds of fields.**

# Multi-angle Concept





*You Are Here*

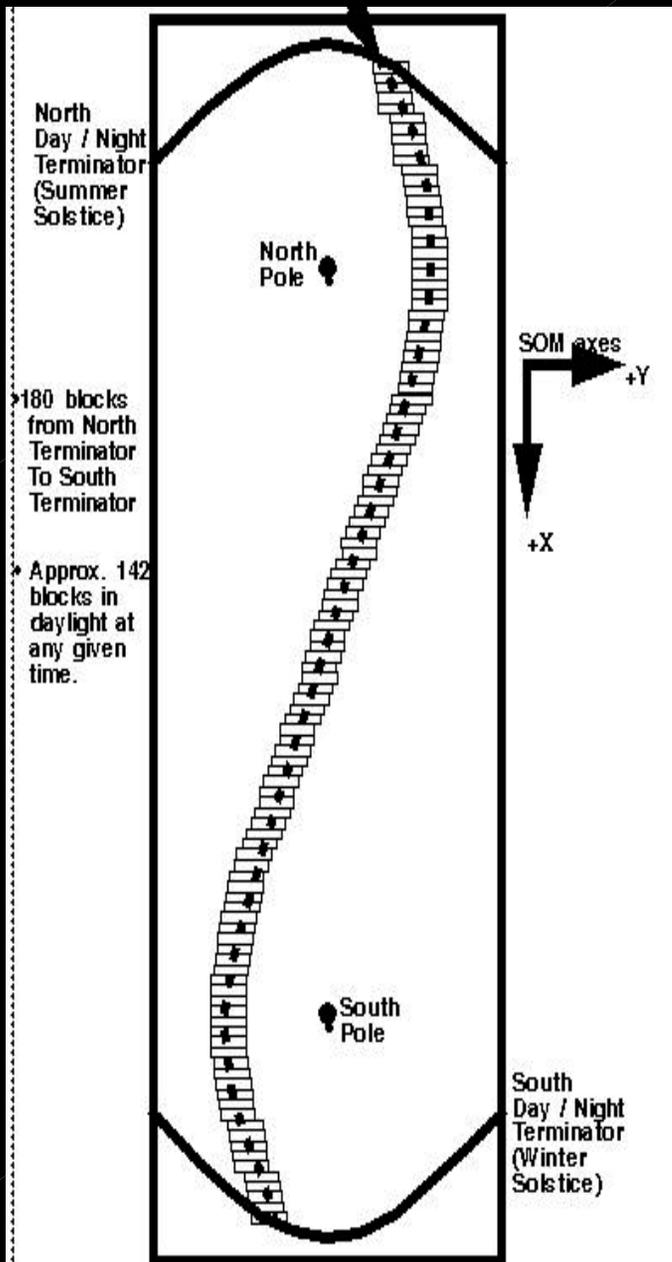


Only  
3% of the  
Length of  
One MISR  
Swath shown



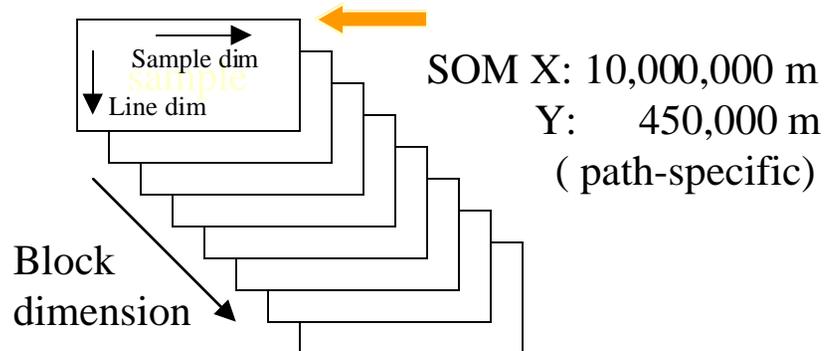
## *MISR Swath*

- 400 km swath width.
- Several product types > 2GB uncompressed.
- HUGE extent of latitude/longitude.
- Stringent science constraints on distortion and geolocation.
- Ambitious algorithms.
- Stringent size, and computing



- 180 blocks per path; fixed locations.
- Same-size, rectangular in SOM.
- Each block is compressed as a separate chunk.
- HDF-EOS Grid meta describes top block.
- Other blocks offset to follow ground track; part of MISR - unique ext. of HDF-EOS.

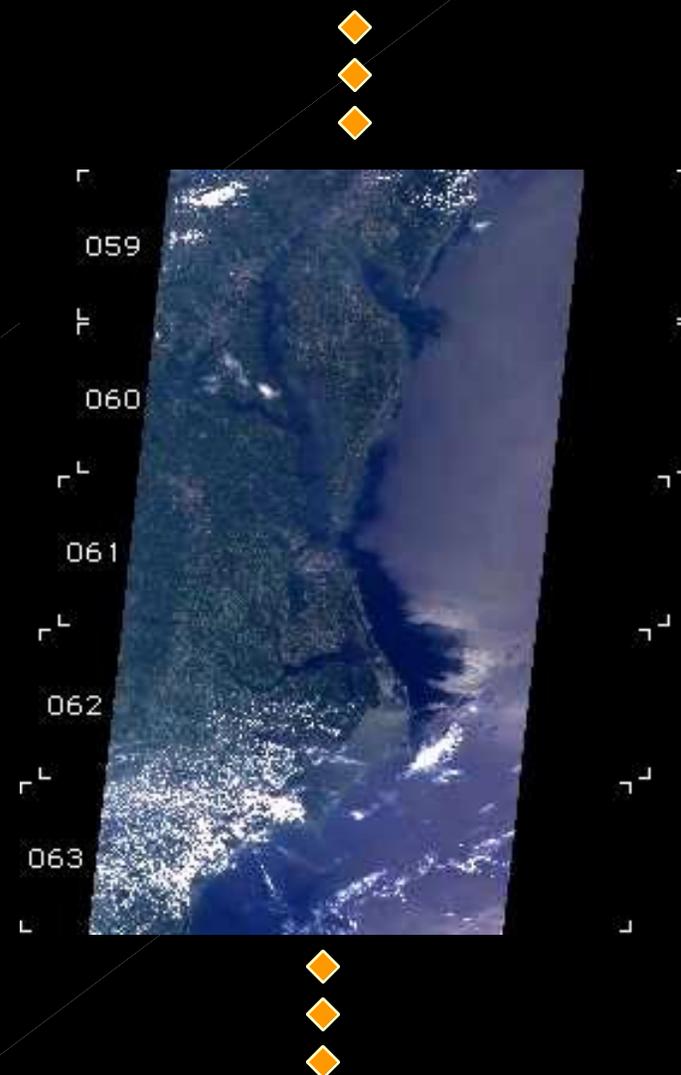
## Red Channel Grid SDS (180 Stacked Blocks)



-SOM coordinates of top-block corners part of Grid metadata.

-Projection and orbital parameters part of Grid Metadata

-Offsets of each block from the one above part of Stacked-block grid extension metadata.





*Where does this pixel belong?*



- Lat/Lon not stored in product.
- In the SDS pixel = (block, line, sample)
  - Conversion  $\leftrightarrow$  SOM  $\leftrightarrow$  Lat/Lon require:
    - Several different metadata reads.
    - Custom code to do some offset arithmetic.
    - HDF-EOS grid api and use of the GCTP map proj. lib.
    - Lots of Patience.
- Described in the MISR Data Product Specification, Appendix A.



## *Mapping Data Users to Tools*



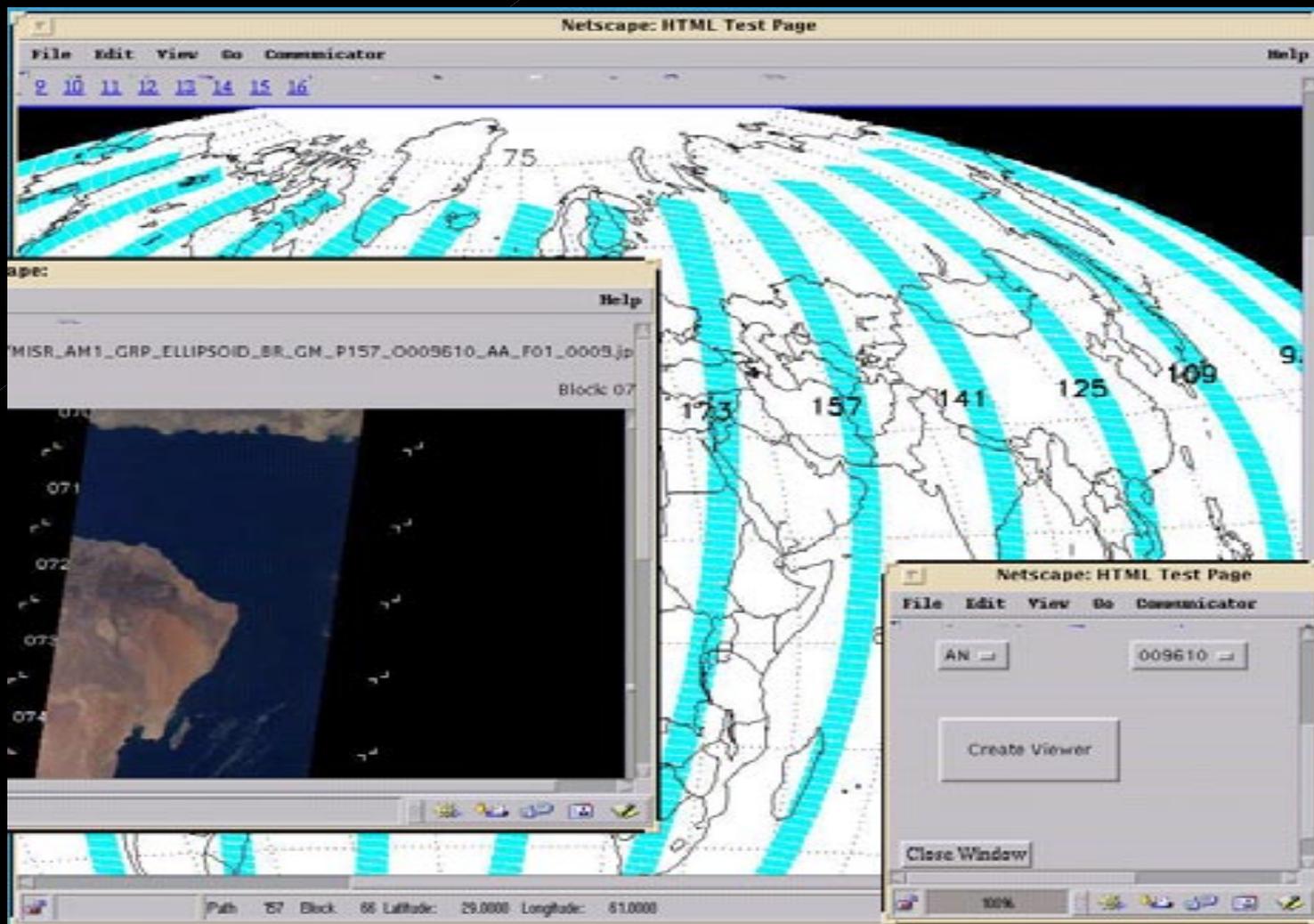
- **Use only MISR-specific GUI tools:**
  - If you are a MISR-centric scientist with nearly zero tolerance for anything digital.
  - If you are a curious individual who want to fiddle with MISR data or learn about MISR file structure.
- **Also use geotiff converters:**
  - If you analyze a lot of MISR data.
  - If you like Photoshop, GIS tools and reprojections.
  - If you want to co-locate MISR images with other data.
- **Also use custom GIS converters:**
  - If you want to do serious data analysis involving MISR science data values (vs images) and other data in a GIS environment.
- **Also use DPS doc and stacked-block grid api**
  - If you must read lots of MISR data into your custom software and you possess some programming savvy
- **If you are a Tool Writer/Vendor.**



# Path/Orbit-based Web Browse Tool



<http://eosweb.larc.nasa.gov>



See images before Ordering them.

Explore path, orbit And geographic Coverage.

Browse images Are jpg and aren't Full resolution.



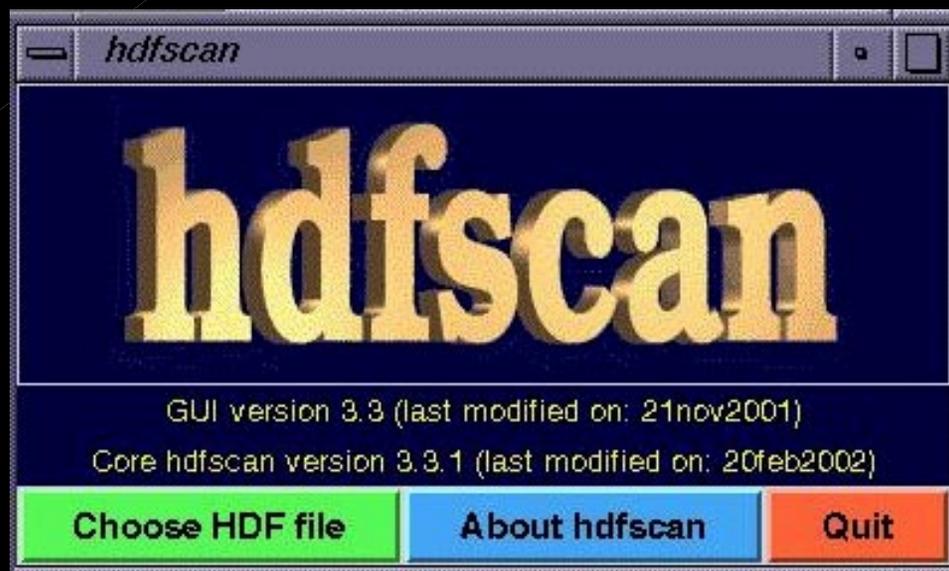
## How can I get at MISR Metadata easily?



### USERS:

Beginner who  
Wants to learn about  
MISR file structure.

Expert when chasing  
A problem.



FORTRAN GUTS  
Tcl-Tk GUI

- Displays HDF-EOS structures and all metadata easily.
- Allows minor editing of the HDF-EOS file.
- Performs some statistics on the data.
- Can only visualize single un-assembled blocks.



# Hdfscan – Main Menu



**Main program options**

Filename /data/imagine/ber/demo/MISR\_AM1\_GRP\_ELLIPSOID\_GM\_P014\_O009703\_AN\_I

grid structures: 4	swath structures: 0	scientific data sets: 4
raster images: 0	vgroups: 14	vdatas: 7
establishing hdf interface as: grid		establishing file type as: MISR L1B2

Show grid data structure	Show annotation text
Display, output, or edit grid data	Show QA data structure
Show file metadata (global attributes)	Display QA data
Show grid metadata (attributes)	Show tabular (vdata) data structure
Show structural metadata	Display tabular (vdata) data
Show core metadata	Display data statistics
Show block metadata structure	Display line data and statistics
Display block metadata	Display line time information
Show projection information	Locate target SOM coordinates

Quit main program options



# Hdfscan Image with Histogram



The screenshot displays the hdfscan software interface with several panels:

- Top Left Panel:** Contains the 'hdfscan' logo, version information (GUI version 3.3, Core hdfscan version 3.3.1), and buttons for 'Choose HDF file', 'About hdfscan', and 'Quit'.
- Image Selection Panel:** Shows 'Number of images available: 1' and details for 'Image number: 1', including structure, field, dimensions, and coordinates.
- Data Display Panel:** Features a table titled 'Table #1: Red Radiance/RDQI' with columns for 'Sample 1', 'Sample 2', and 'Sample 3'. The table lists data for lines 1 through 13, all showing a value of 65515.
- Image #1: Red Radiance/RDQI Panel:** Includes a histogram for image #1 data, a 'Reset display' button, and a 'Show cross-section plots' button. The histogram shows a distribution with a peak at 0 and a maximum value of 333419.
- Data Display or Output Panel:** Allows selecting dimensions and data format (Raw or Interpreted) and provides options to view data as an image, table, or text.
- Bottom Panel:** Shows a status bar with coordinates (Line 375, Sample 249) and a pixel value of 1.472000e+03.

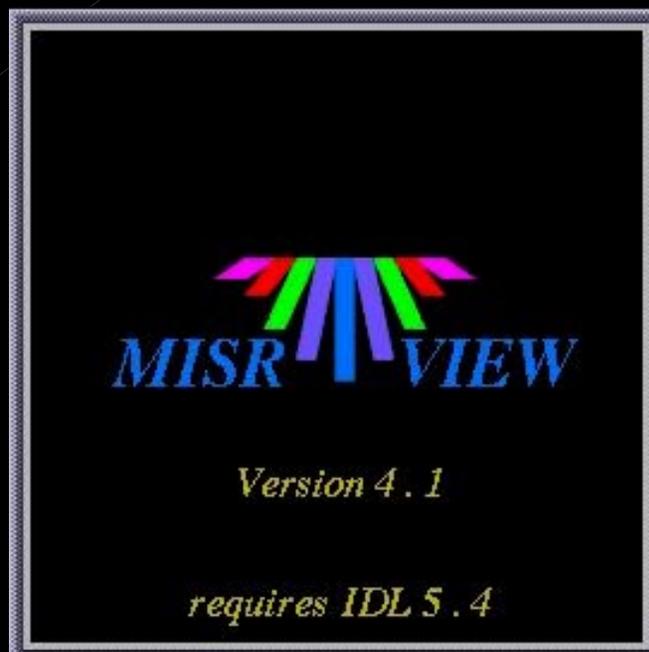


## MISRView



USER:

MISR-CENTRIC  
SCIENCE DATA  
ANALYST



REQUIRES IDL !!!

- Maps path/orbit to time and date
- Assembles multiple MISR blocks
- Reports Lat/Lon via static lookup table.
- Displays true color MISR imagery
- Can reproject MISR imagery
- Perspective tool
- Band slider tool
- Scroll tool
- Vector overlay tool

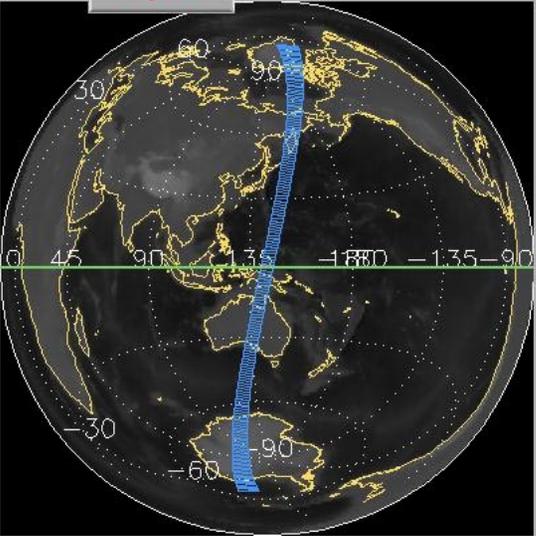


# MISRView – Main Menu



MISRView interface

snapshot



Source Data:  MISR  AirMISR

Choose MISR Orbit  Choose MISR Blocks

Orbit Date:    GMT:

Path:  Orbit:

Start Block:  Center lat,lon: 0.6, 142.3

End Block:  Center lat,lon: 0.6, 142.3

Number of Blocks:  Map Zoom:  In  Out

Cursor lat,lon: 58.3, 00.

Data < None Selected >  1100m  1100m

<input type="button" value="Set Active Plane"/>	<input type="button" value="Clear Active Plane"/>	<input type="button" value="Plane Display Options..."/>
<b>RED PLANE</b> NOT SET	<b>GREEN PLANE</b> NOT SET	<b>BLUE PLANE</b> NOT SET
<b>ANCILLARY 1 PLANE</b> NOT SET	<b>ANCILLARY 2 PLANE</b> NOT SET	<b>ANCILLARY 3 PLANE</b> NOT SET

Data Selection Parameters:   Rotate  Deg.



# MISRView – L1B2 Radiance Data



The screenshot displays the MISRView software interface. At the top left, there is a browser window showing the URL `fjorgyn.jpl.nasa.gov/home/misra1`. Below it is a menu bar with `Controls`, `Quit`, and `Help`. The main window is titled `MISR VIEW 4.1` and contains a `Data Selection Interface`. On the left, a globe shows the satellite's orbit path with a `snapshot` button. The main area displays the following data:

Longitude: 15.2170 degrees  
Latitude: 34.4562 degrees  
RED PLANE (block #, block-y, block-x, data value): 63, 173, 70, 2484  
GREEN PLANE (block #, block-y, block-x, data value): 63, 173, 70, 3464  
BLUE PLANE (block #, block-y, block-x, data value): 63, 173, 70, 7180  
ANCILLARY PLANE #1 (block #, block-y, block-x, data value): 63, 173, 70, 36  
ANCILLARY PLANE #2 (block #, block-y, block-x, data value): 63, 11, 5, 308.27800  
ANCILLARY PLANE #3 (block #, block-y, block-x, data value): 63, 11, 5, 20.931710

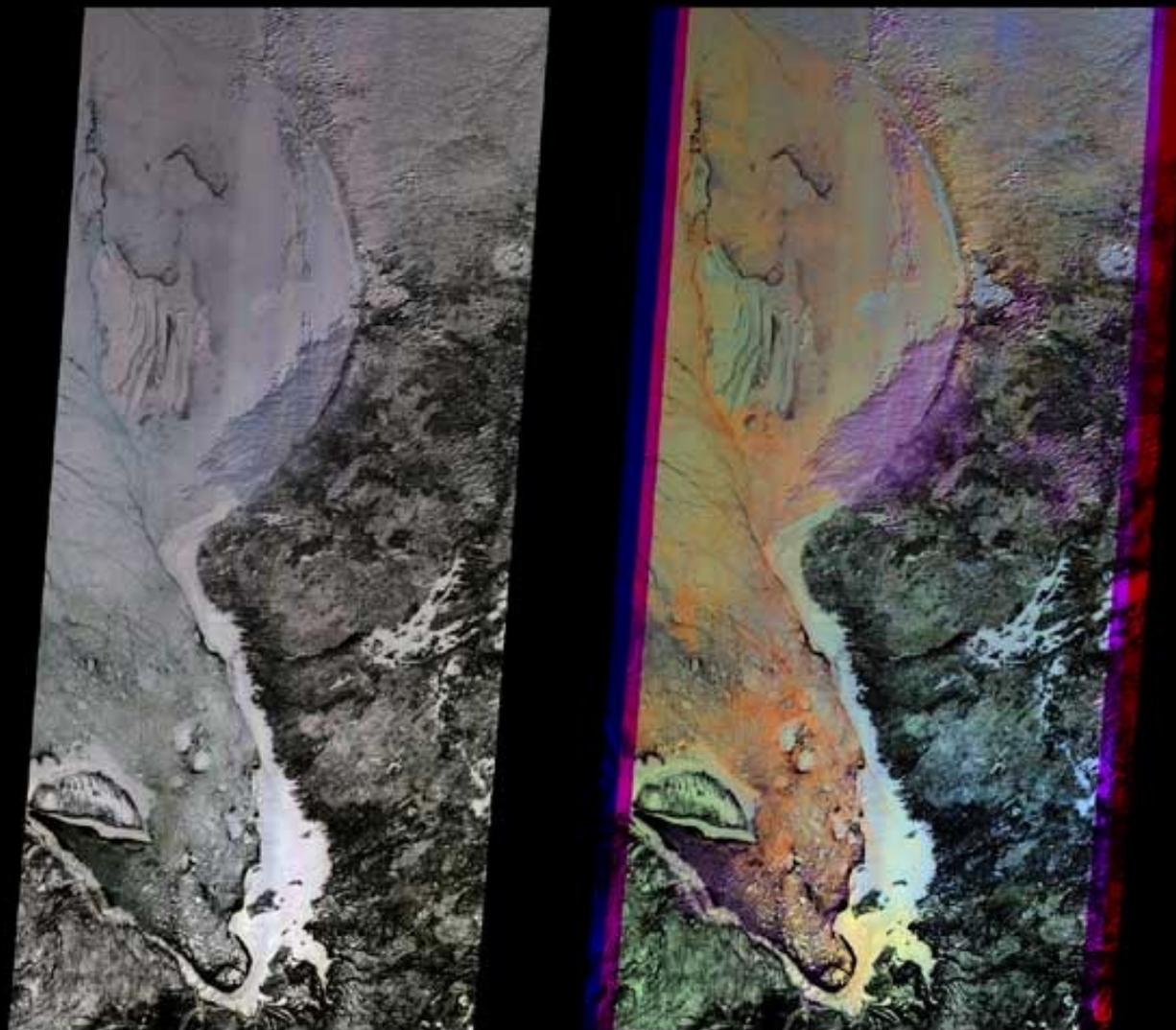
Below this is a control panel with fields for `Orbit Date` (Jul 22 2001), `GMT` (09 22 4), `Path` (187), `Orbit` (8476), `Start Block` (58), `End Block` (67), `Number of Blocks` (10), and `Map Zoom` (In/Out). A `Cursor lat,lon` field shows `1350.0, 23.0`. The interface also includes buttons for `Set Active Plane`, `Clear Active Plane`, and `Plane Display Options`. A table below lists the active planes:

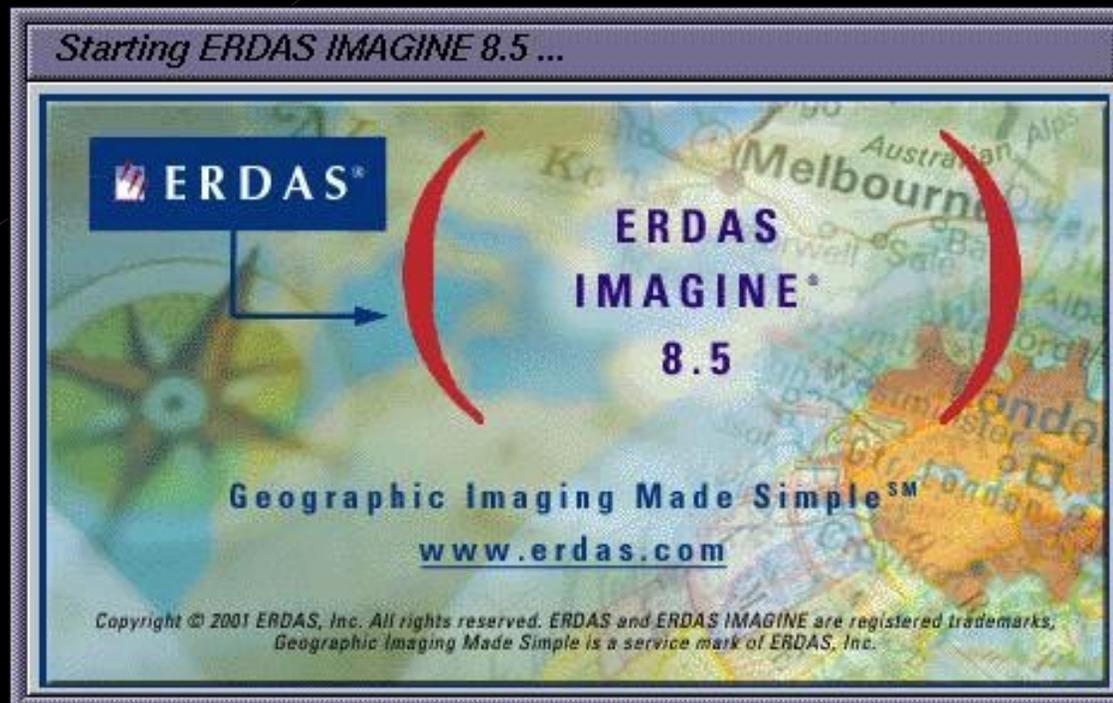
Plane Name	Orbit	Band	Resolution
RED PLANE	ORBIT 8476	RedBand_Red Radiance/RDQI	1100m (cross-track) x 1100m (along-track)
GREEN PLANE	ORBIT 8476	GreenBand_Green Radiance/RDQI	1100m (cross-track) x 1100m (along-track)
BLUE PLANE	ORBIT 8476	BlueBand_Blue Radiance/RDQI	1100m (cross-track) x 1100m (along-track)
ANCILLARY 1 PLANE	ORBIT 8476	Standard_AveSceneElev	1100m (cross-track) x 1100m (along-track)
ANCILLARY 2 PLANE	ORBIT 8476	GeometricParameters_SolarAzimuth	1100m (cross-track) x 1100m (along-track)
ANCILLARY 3 PLANE	ORBIT 8476	GeometricParameters_SolarZenith	1100m (cross-track) x 1100m (along-track)

At the bottom, there are buttons for `Data Selection Parameters`, `Store`, `Recall`, `Rotate` (0.0 Deg), and `Create Viewer`. On the right, a window titled `w-2 p=187 a=8476 b=58.67 z=0.500000 m=` shows a vertical strip of satellite imagery with a `Utilities`, `Tools`, `Modes`, and `Kill` menu.



*MISRView – MISR Vision (R-Ba, G-An, B-Bf)*



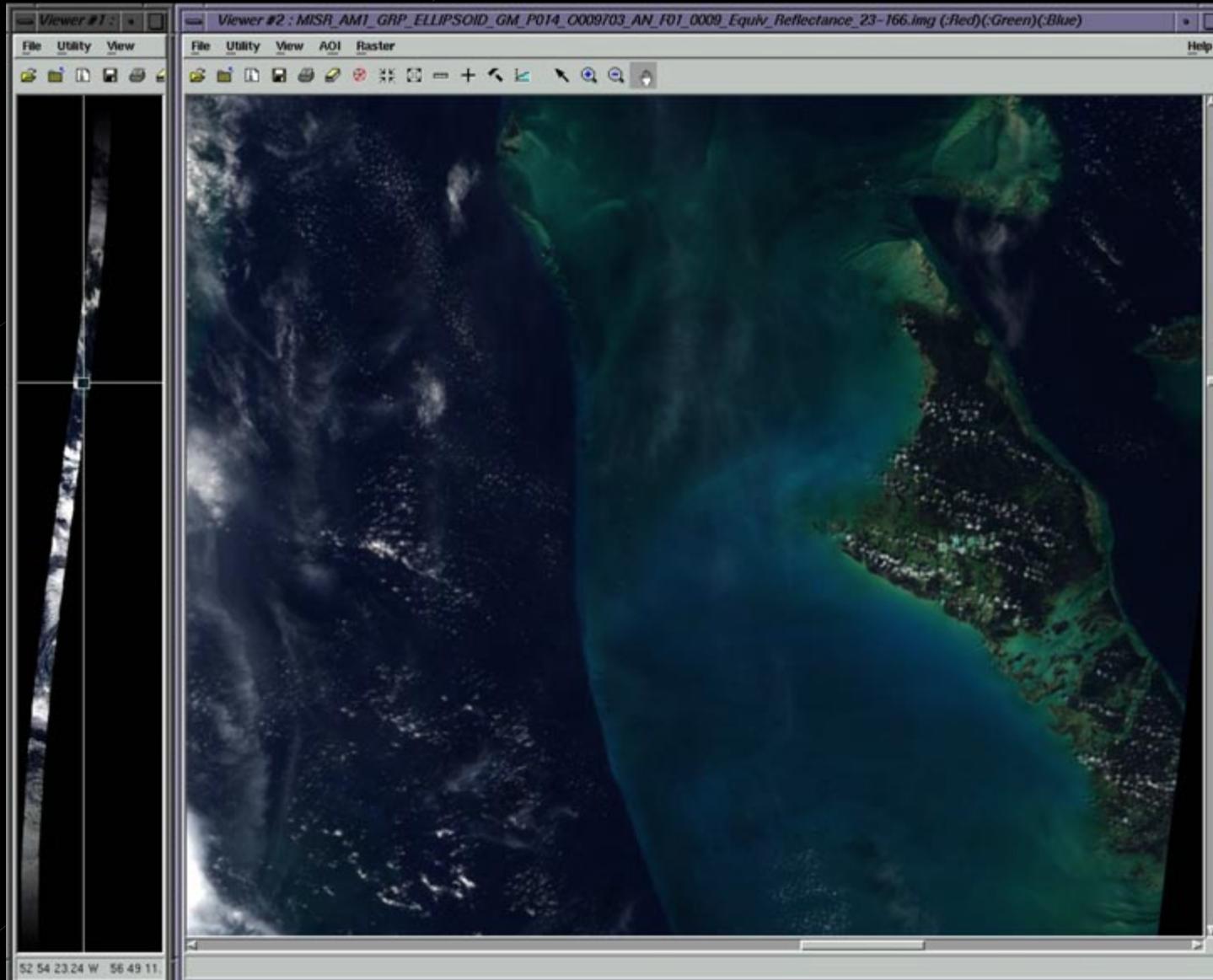


Custom import routines to convert MISR HDF-EOS files into Imagine files preserving geolocation via projection parameters.

SGI Irix utilities for most MISR Grid and some MISR Swath files.



# Imagine – Full Swath/Full Res. Geo-linked

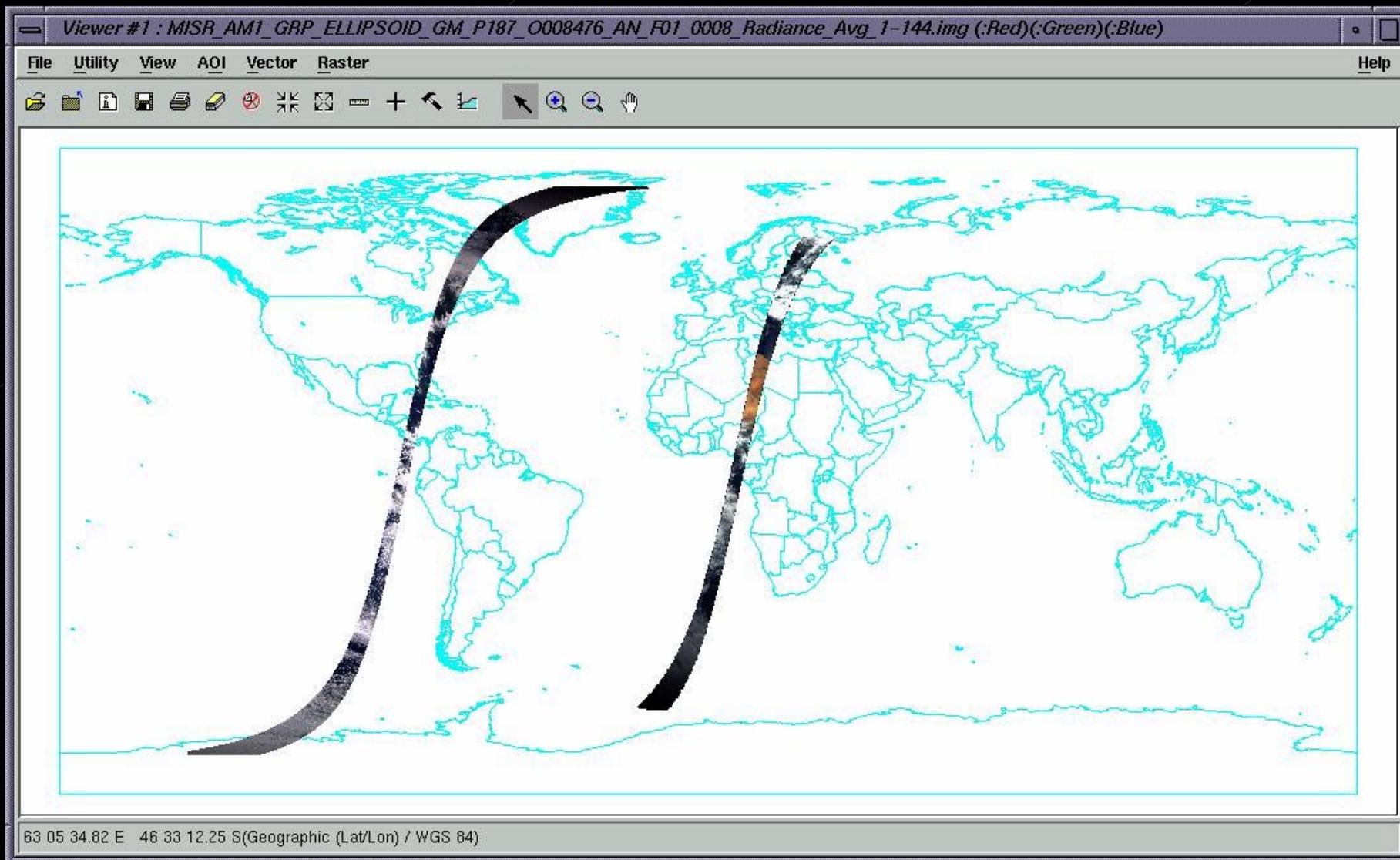


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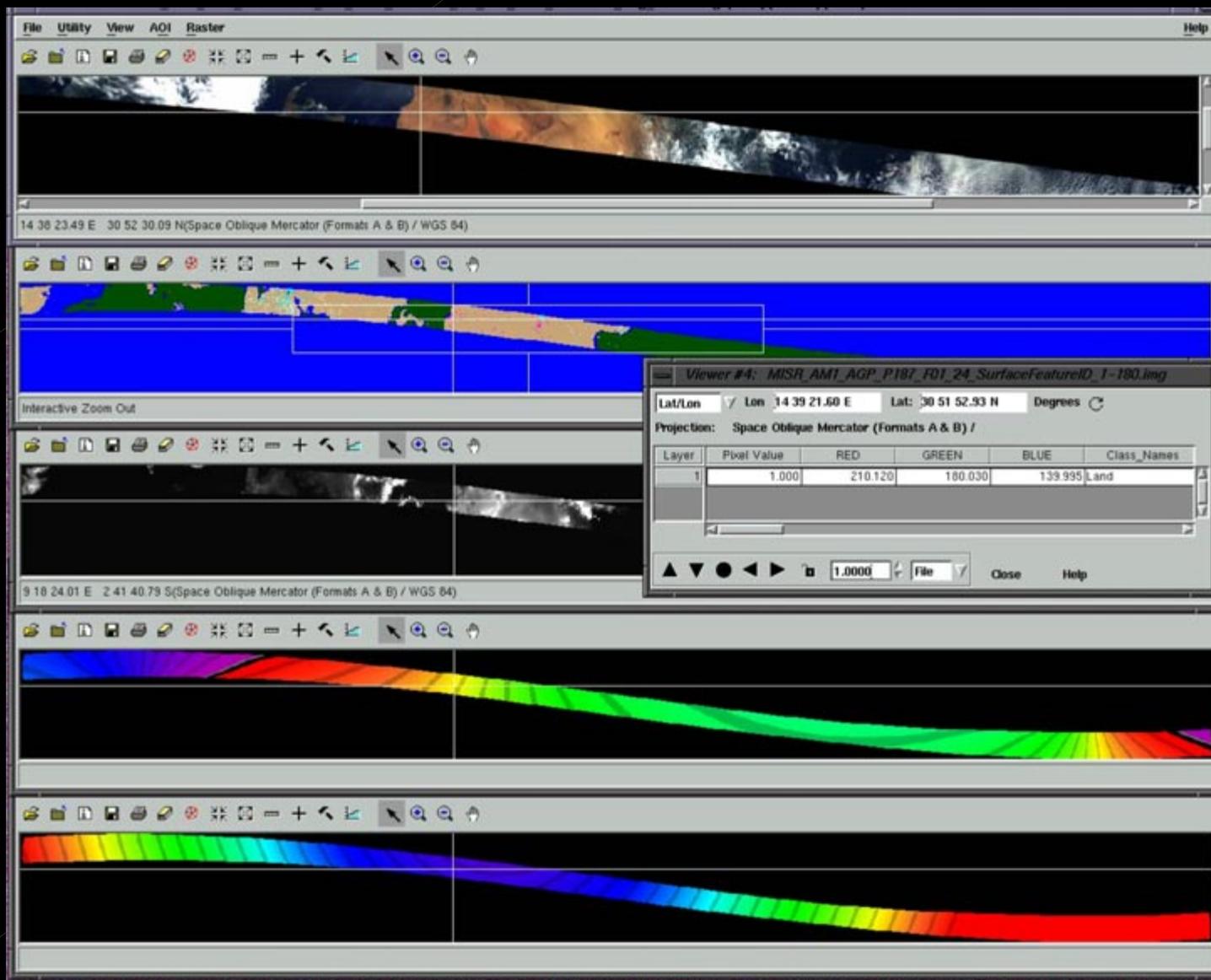


# ERDAS Imagine – Raster/Vector Overlay



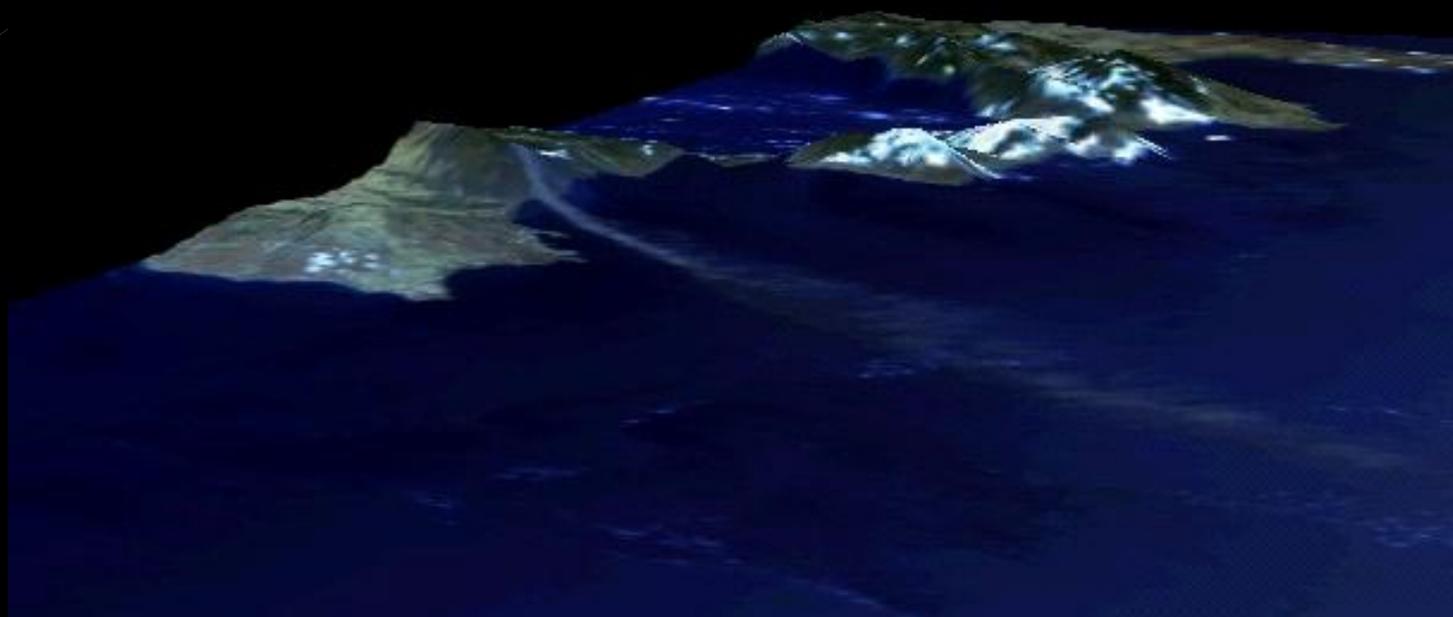


# ERDAS Imagine – GIS Data Analysis





*ERDAS Imagine – Mount Enta  
Perspective DEM Overlay*

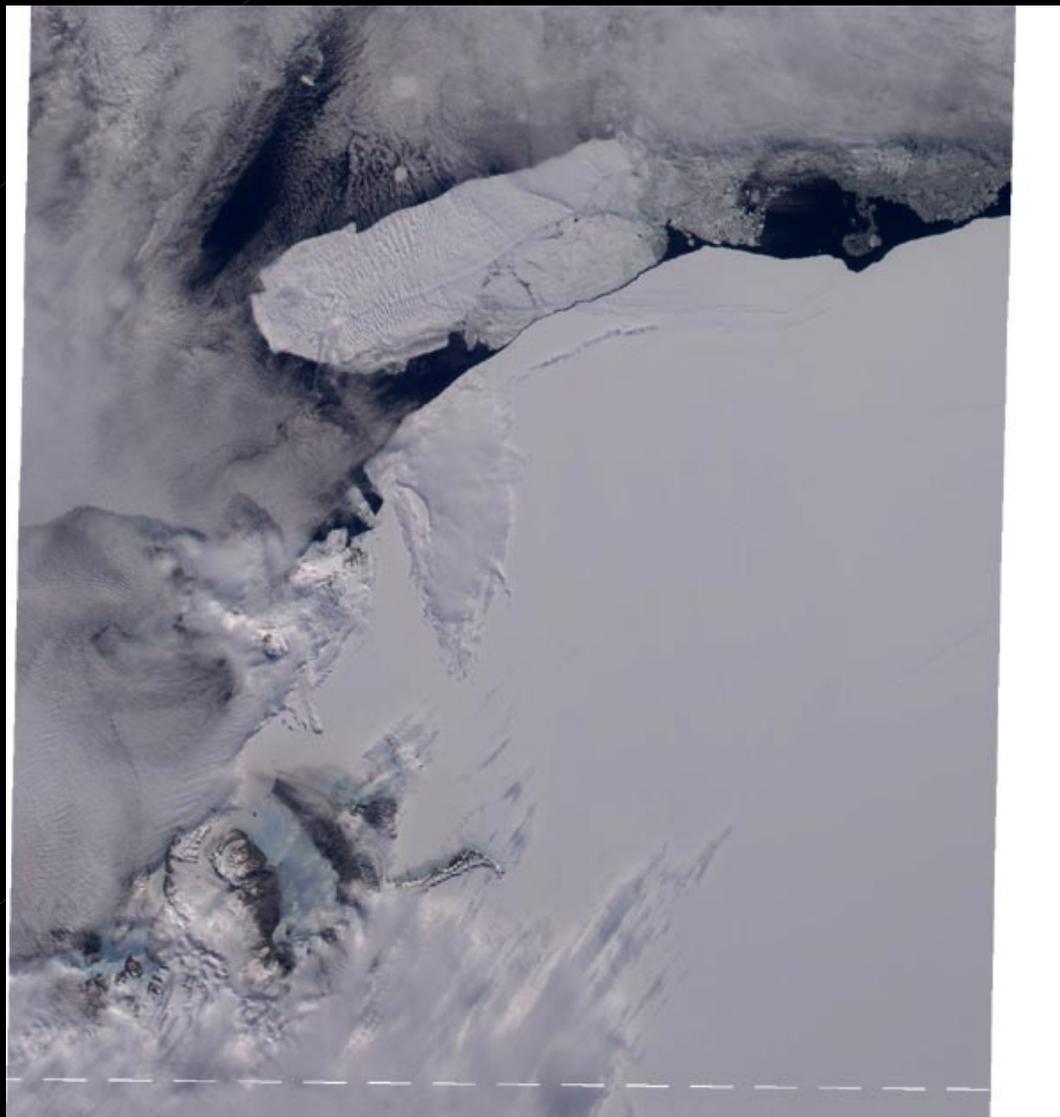


Convert MISR imagery into generic format readable by any preferred GIS tool:

- tiff / geotiff format
- Preserve geolocation / projection information
- Reproject to any GCTP-supported projection
- Facilitate subset and mosaic procedures.



*L1B2\_to\_geotiff – Ross Ice Shelf  
SOM Path 51 Orbit 5089*



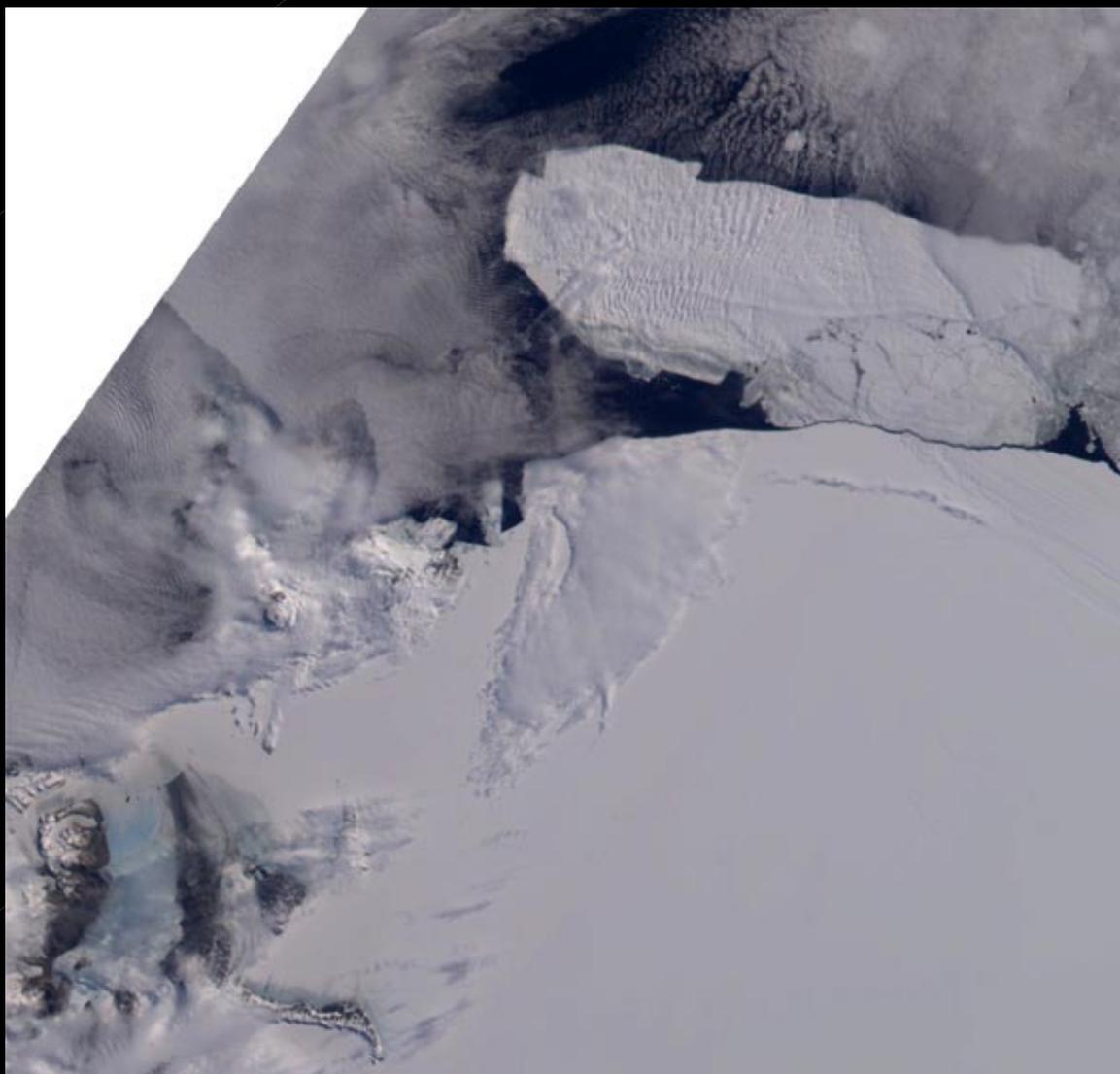


*L1B2\_to\_geotiff – Ross Ice Shelf  
SOM Path 50 Orbit 5220*



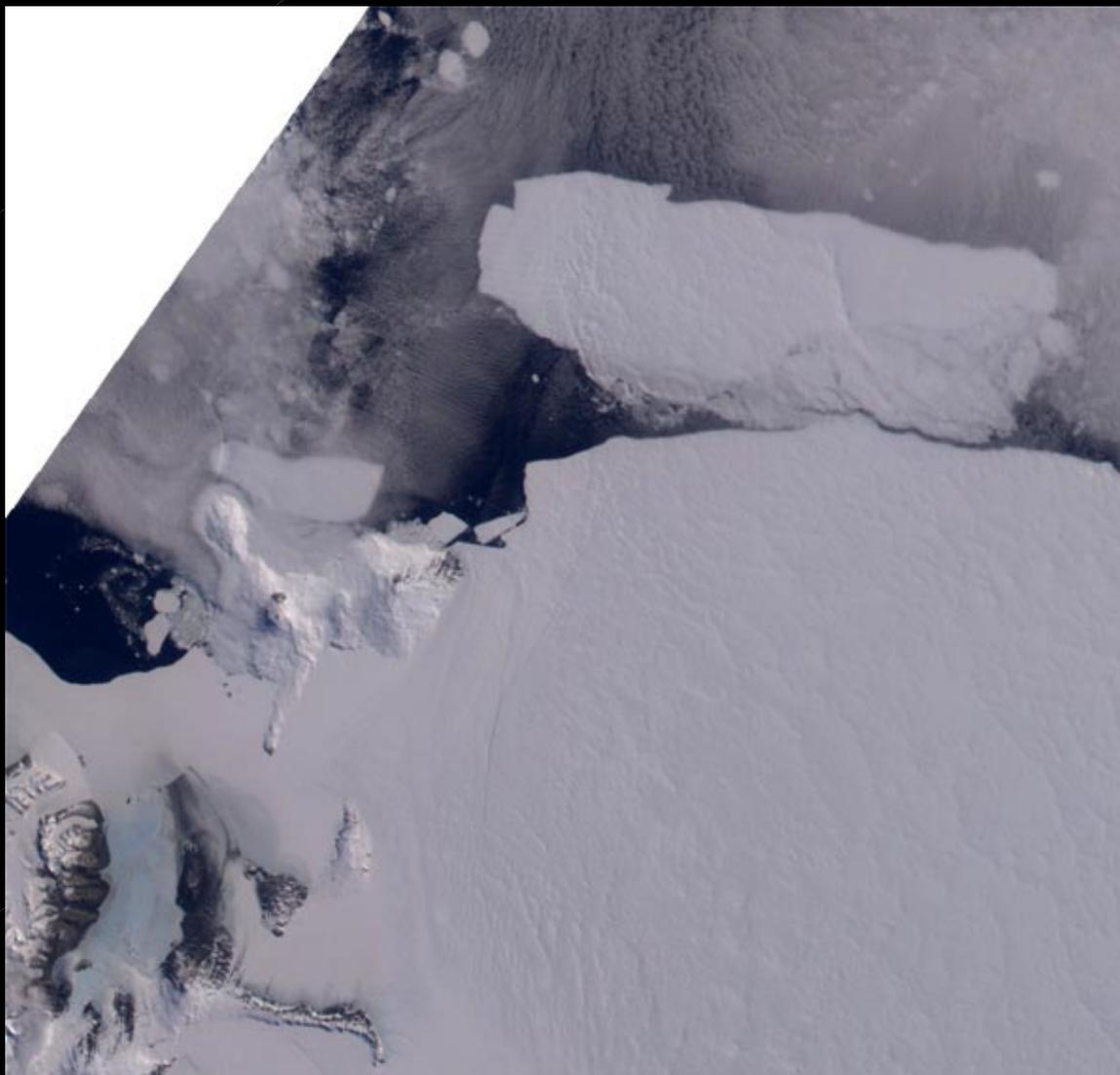


*L1B2\_to\_geotiff – Ross Ice Shelf  
Polar Stereographic Path 51 Orbit 5089*



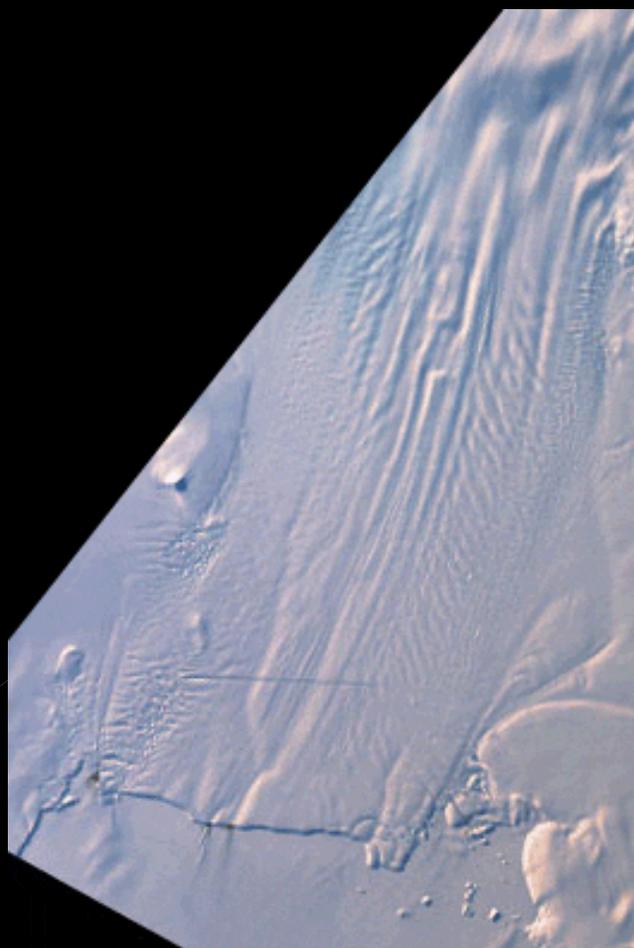


*L1B2\_to\_geotiff – Ross Ice Shelf  
Polar Stereographic Path 50 Orbit 5220*



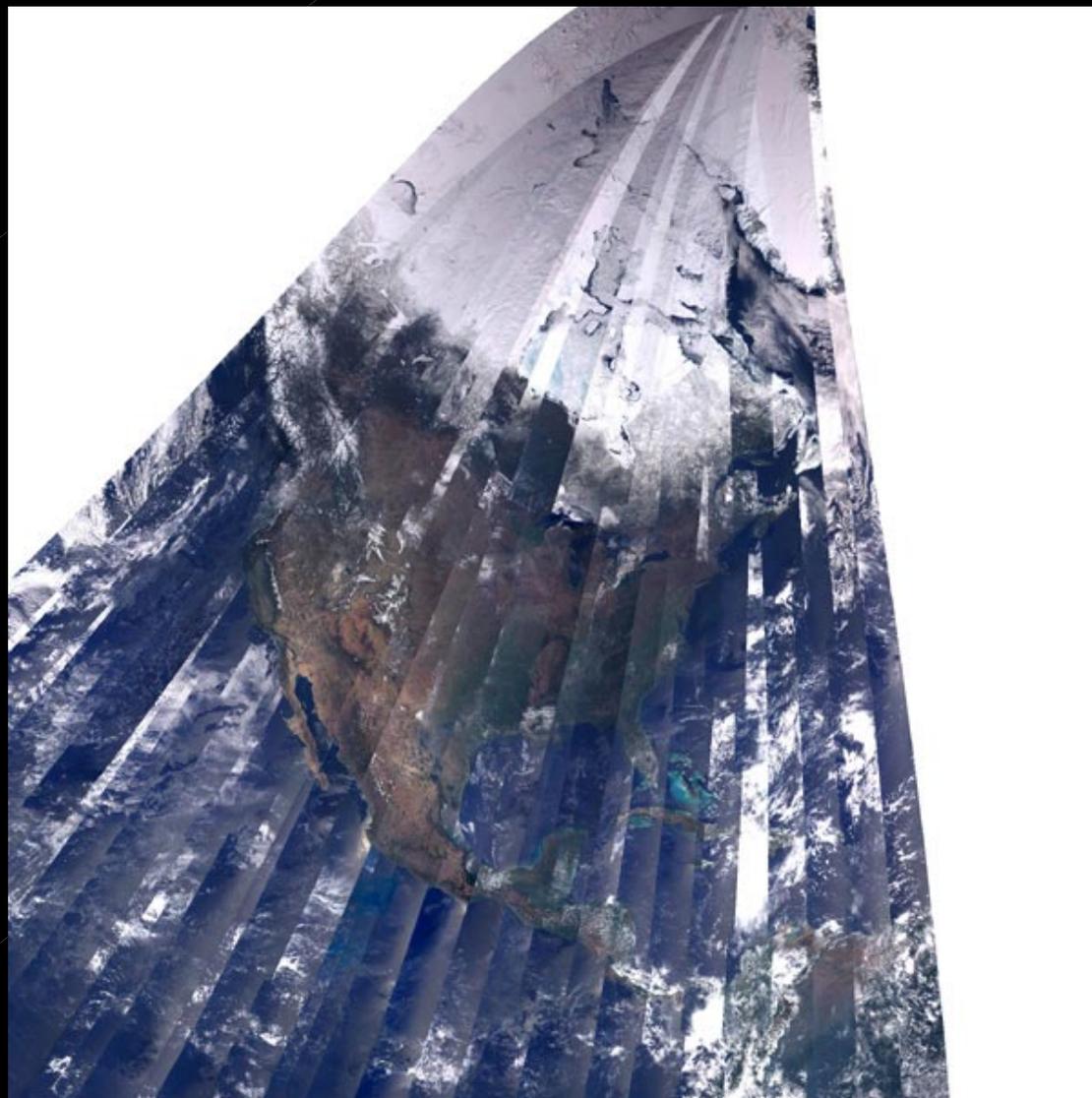


*L1B2\_to\_geotiff – Pine Island  
Glacier Time Series*





## *Lambert Conformal Conic*

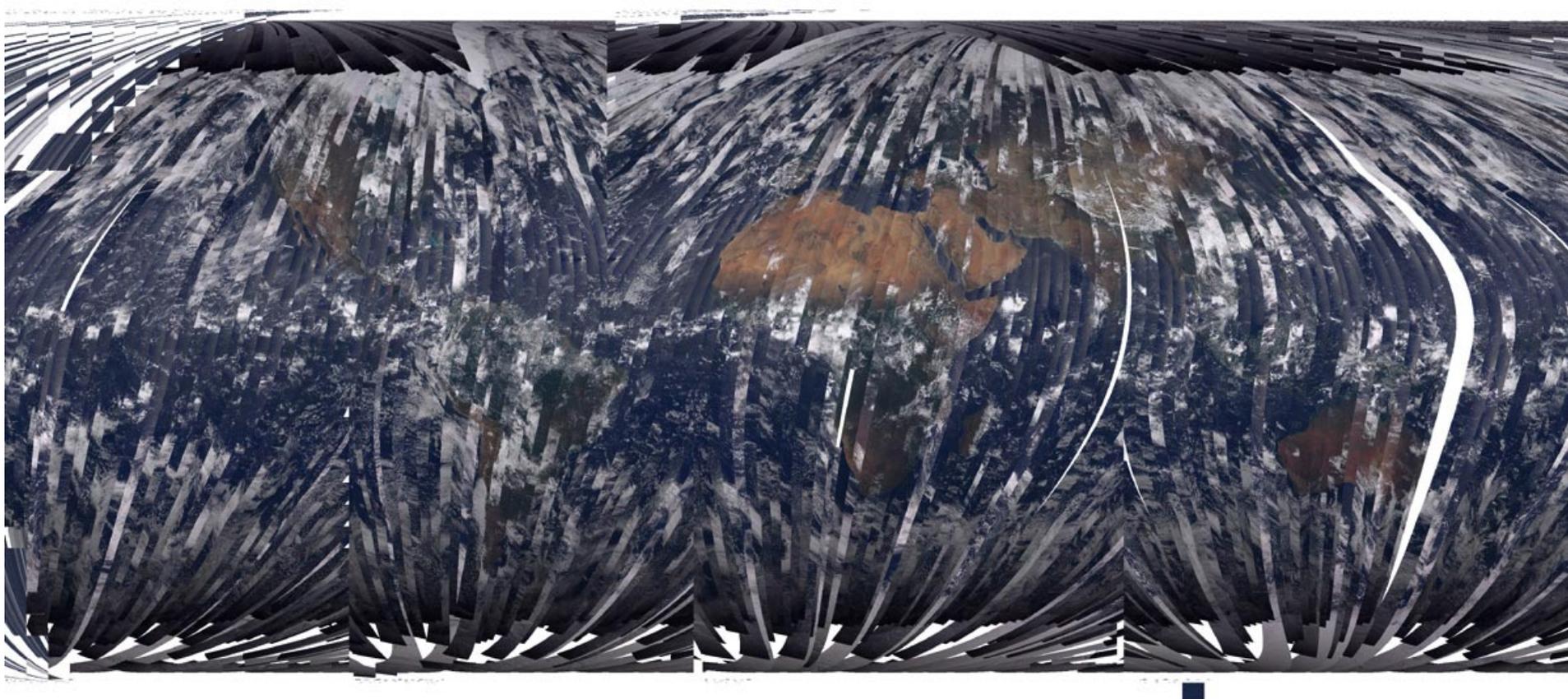


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# *Interrupted Goode Homolosine*





## US/Mexico Geographic Mosaic

Courtesy Jim Knighton, JPL



Multiple MISR Swaths were Reprojected with L1B2\_to\_geotiff Prior to custom Mosaic, cloud Removal and Equalizations.