Using McIDAS-V to visualize and validate real time simulated WRF-CHEM data sets for GOES-R ABI bands and products.

Kaba Bah
(CIMSS/UW-Madison)

Timothy J. Schmit, Mat Gunshor, Brad Pierce, Tom Greenwald, Joleen Feltz, Marek Rogel, Allen Lenzen, Todd Schaack, Jim Nelson.

Annual MUG Meeting
Madison, WI
Sept- 09-11- 2013

Content

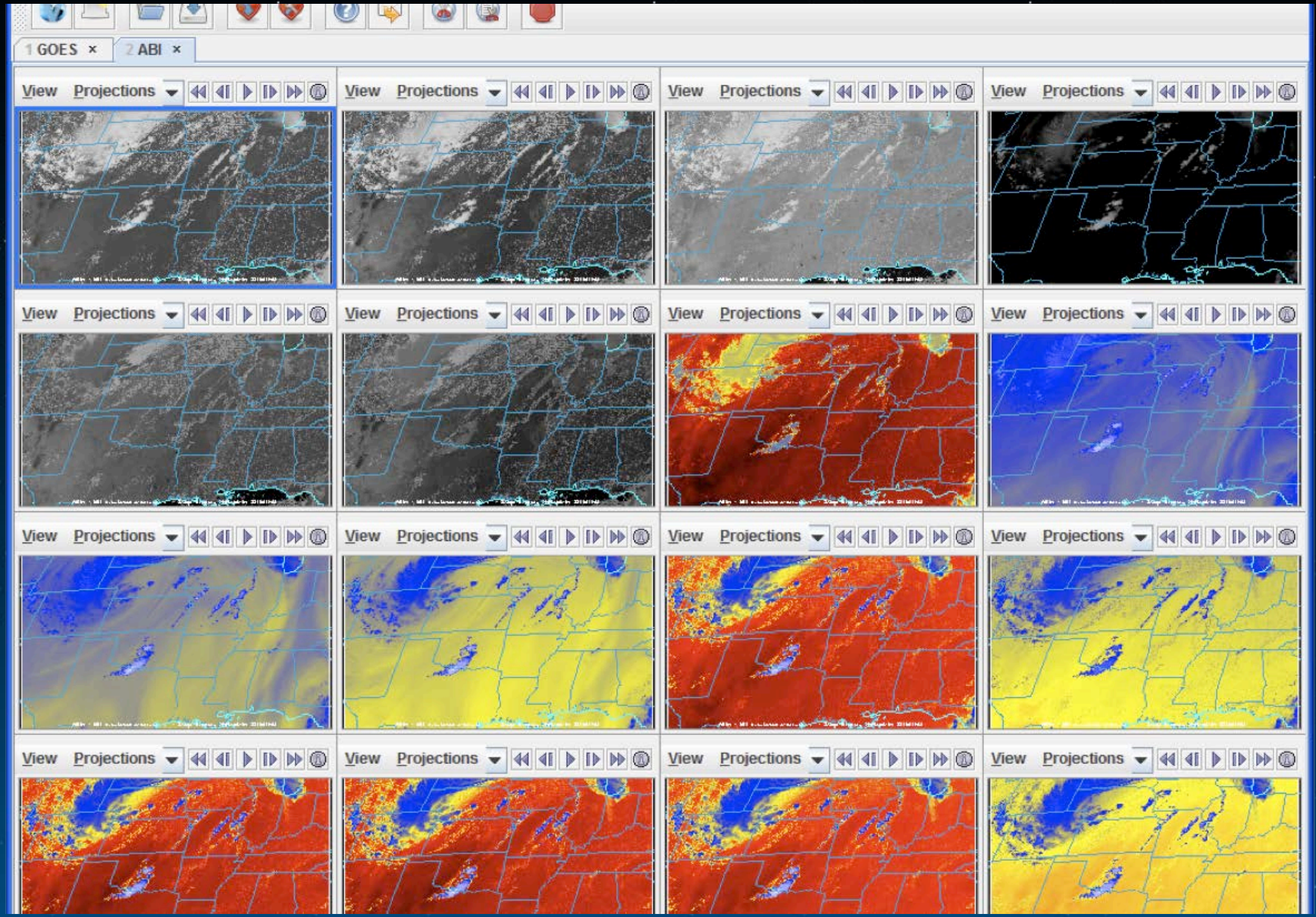
- Introduction
- Visualize
- Analyze
- Validate/ Deep-dive
- Summary

Introduction.

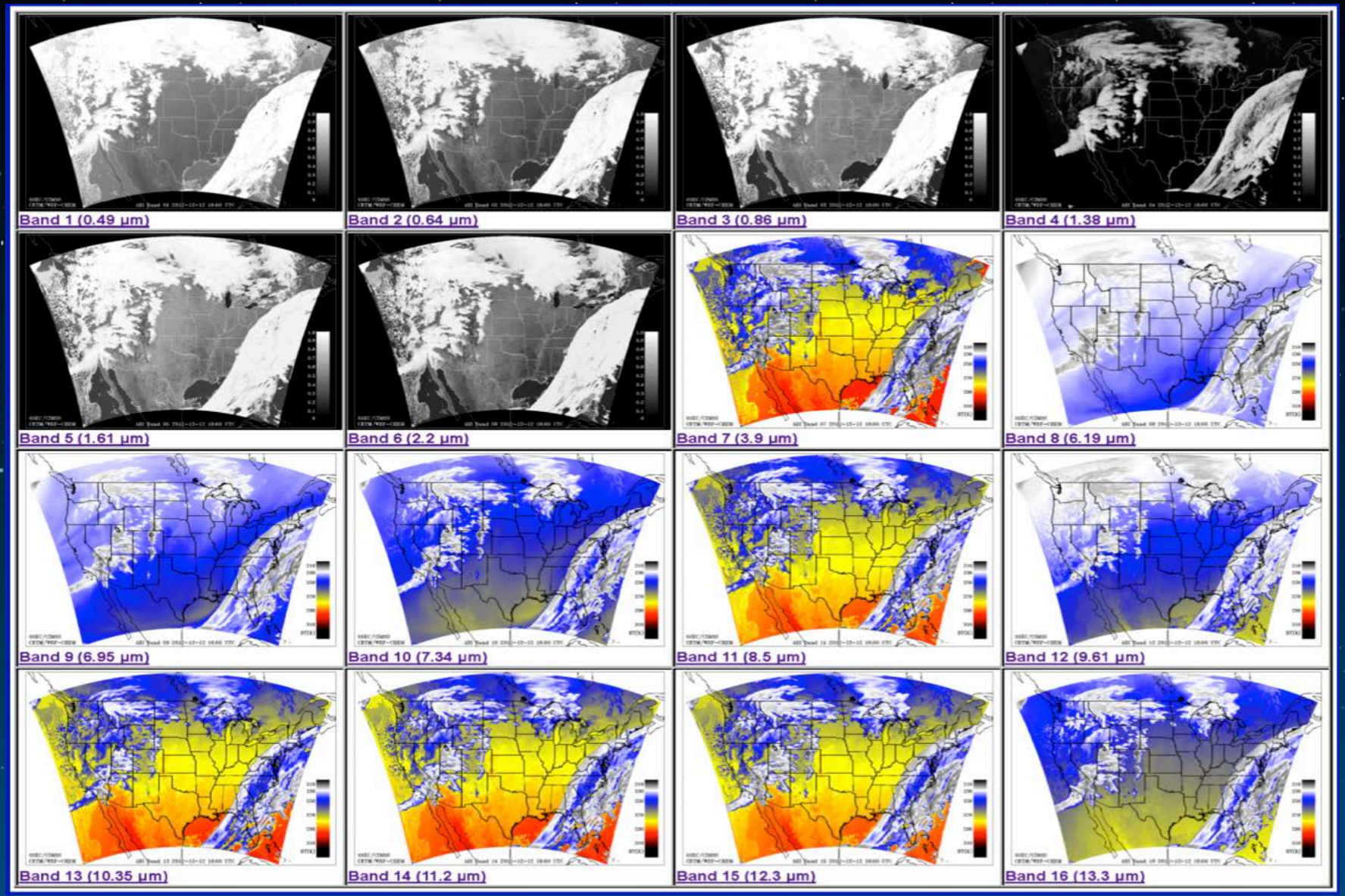
- McIDAS-V is a powerful and versatile visualization and data analysis software.
- It is Java based, open source and freely available.

- WRF-Chem is the Weather Research and Forecasting (WRF) model coupled with Chemistry.
- Simulates the emission, transport, mixing, and chemical transformation of trace gases with the meteorology.

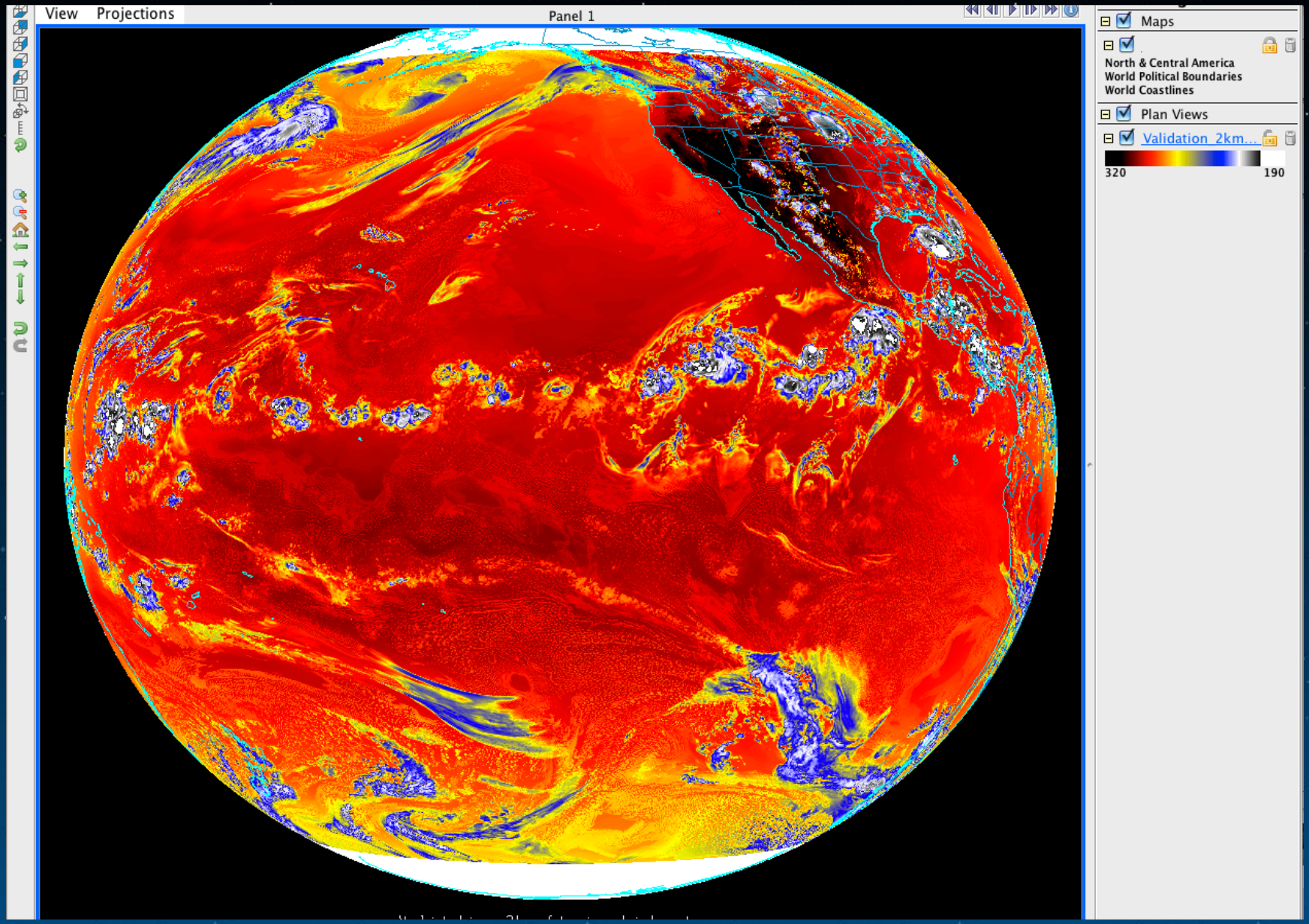
Visualiztion



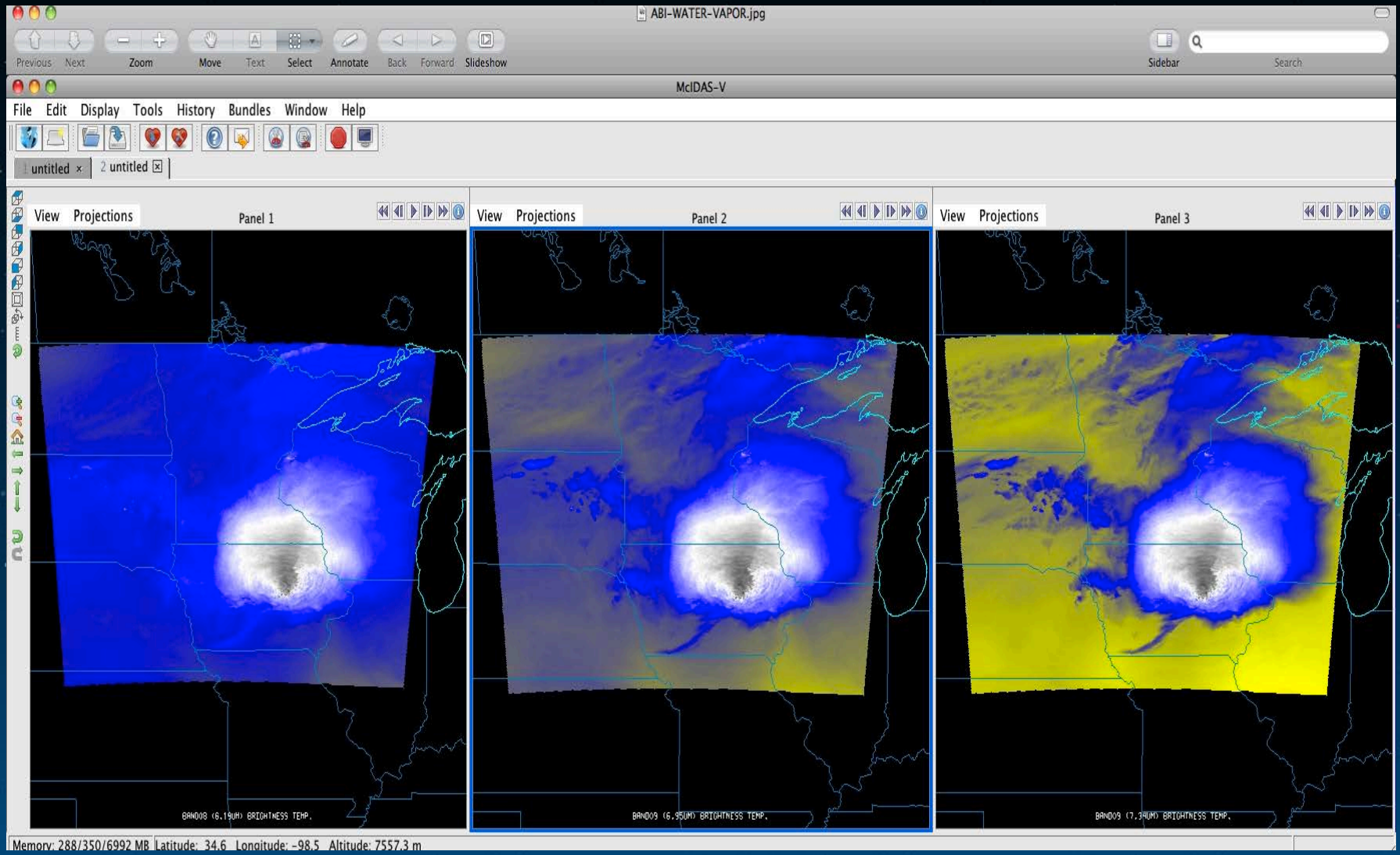
Visualiztion



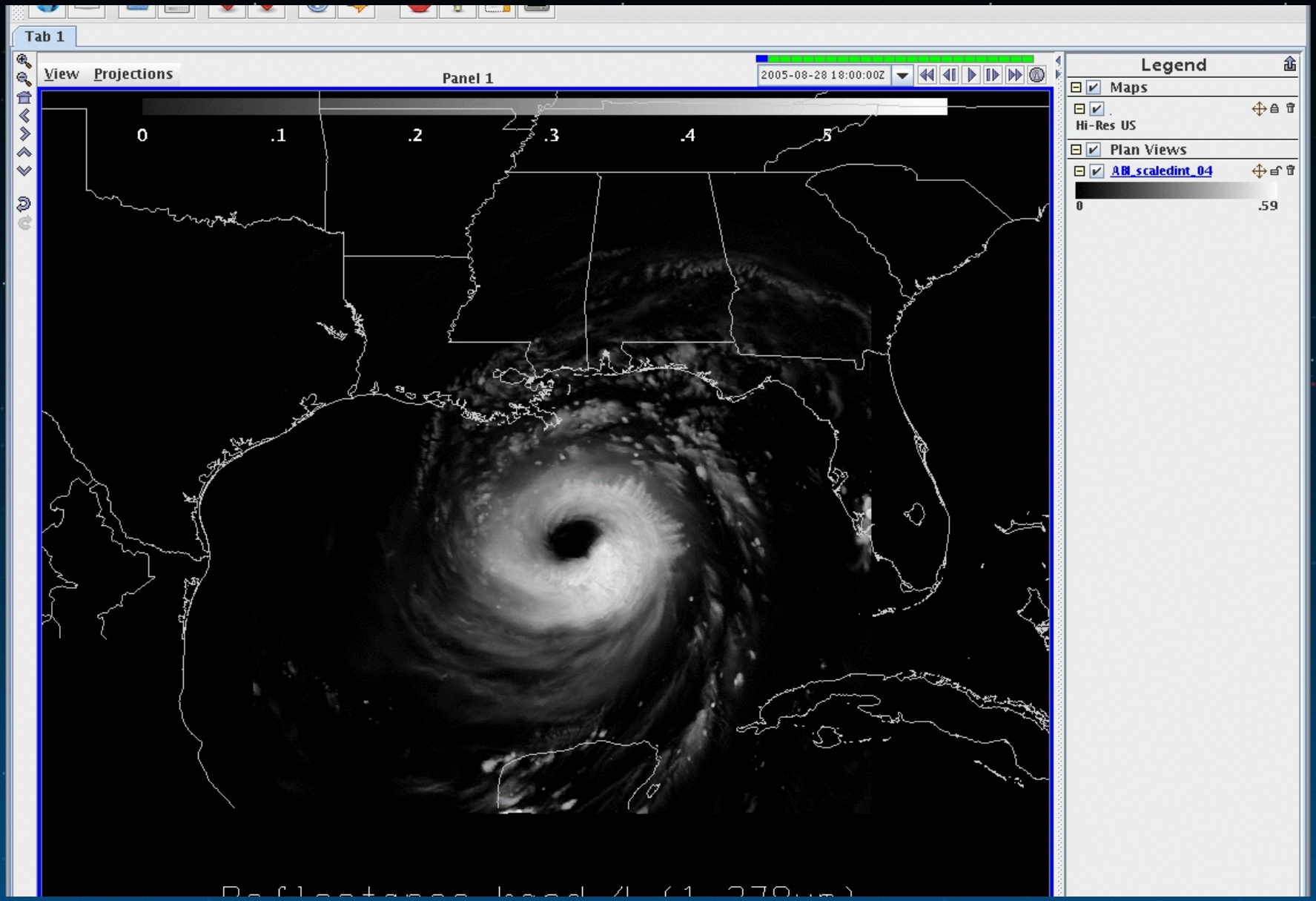
Full disk simulation of ABI band14 (11.2um) and displayed in McIDAS-V for the June-26-2008 storm outbreak at 21:00UTC.



Visualization



Visualiztion



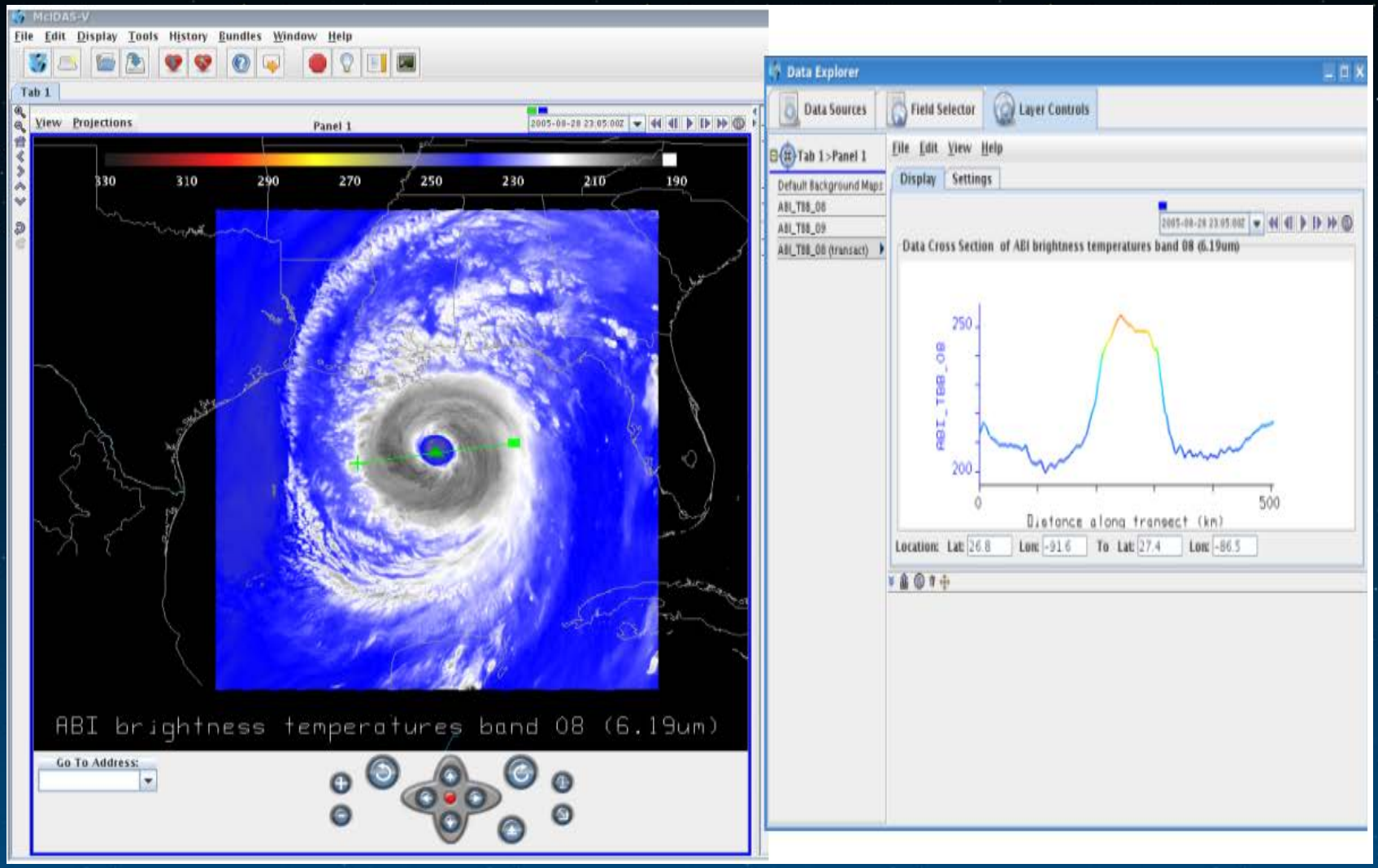
Visualiztion

- Simultaneously (16 bands)
- Full disk (Big picture)
- Mesoscale (Focus)
- Loops (over time)

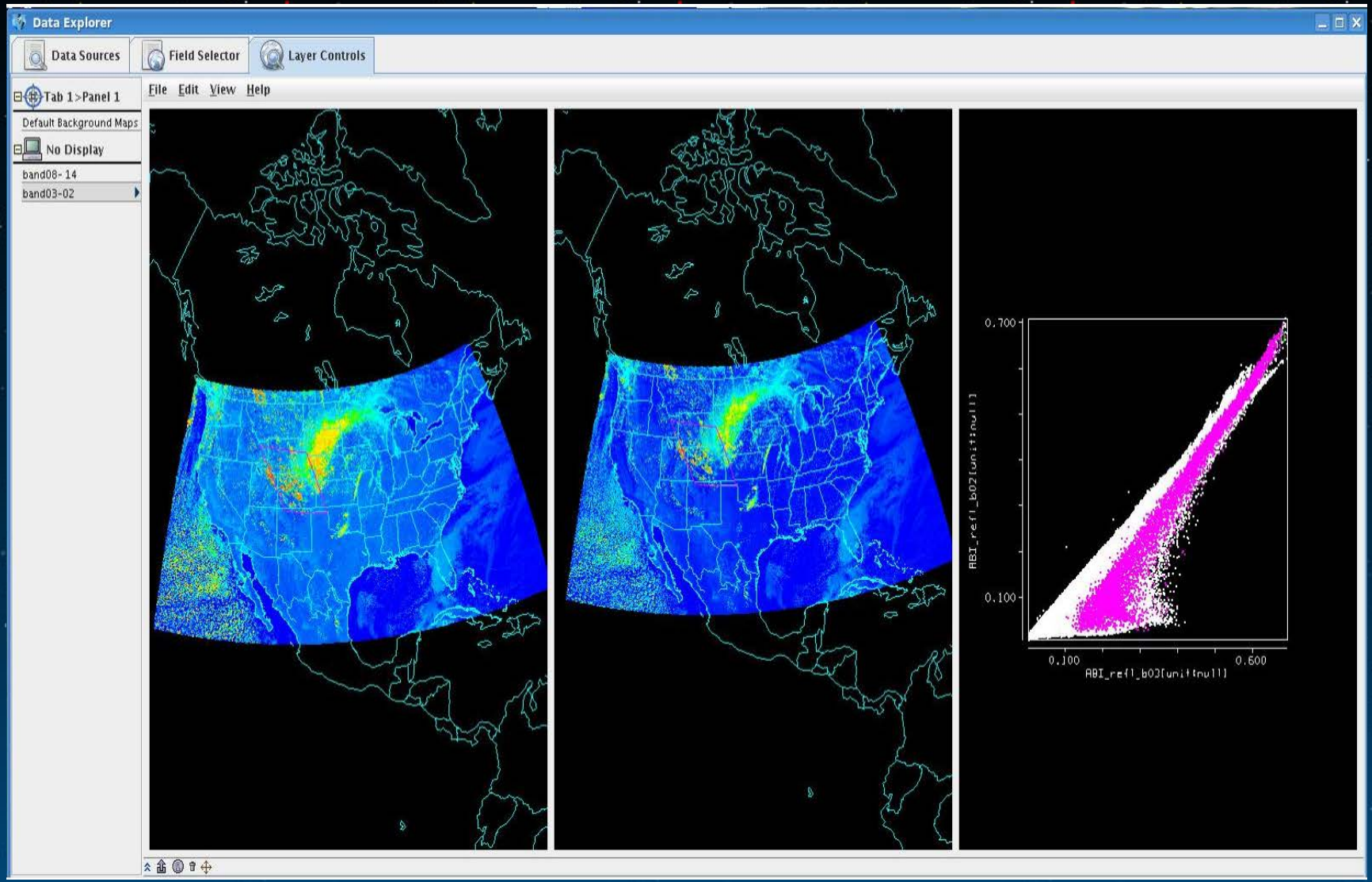
Analyze

Analyze

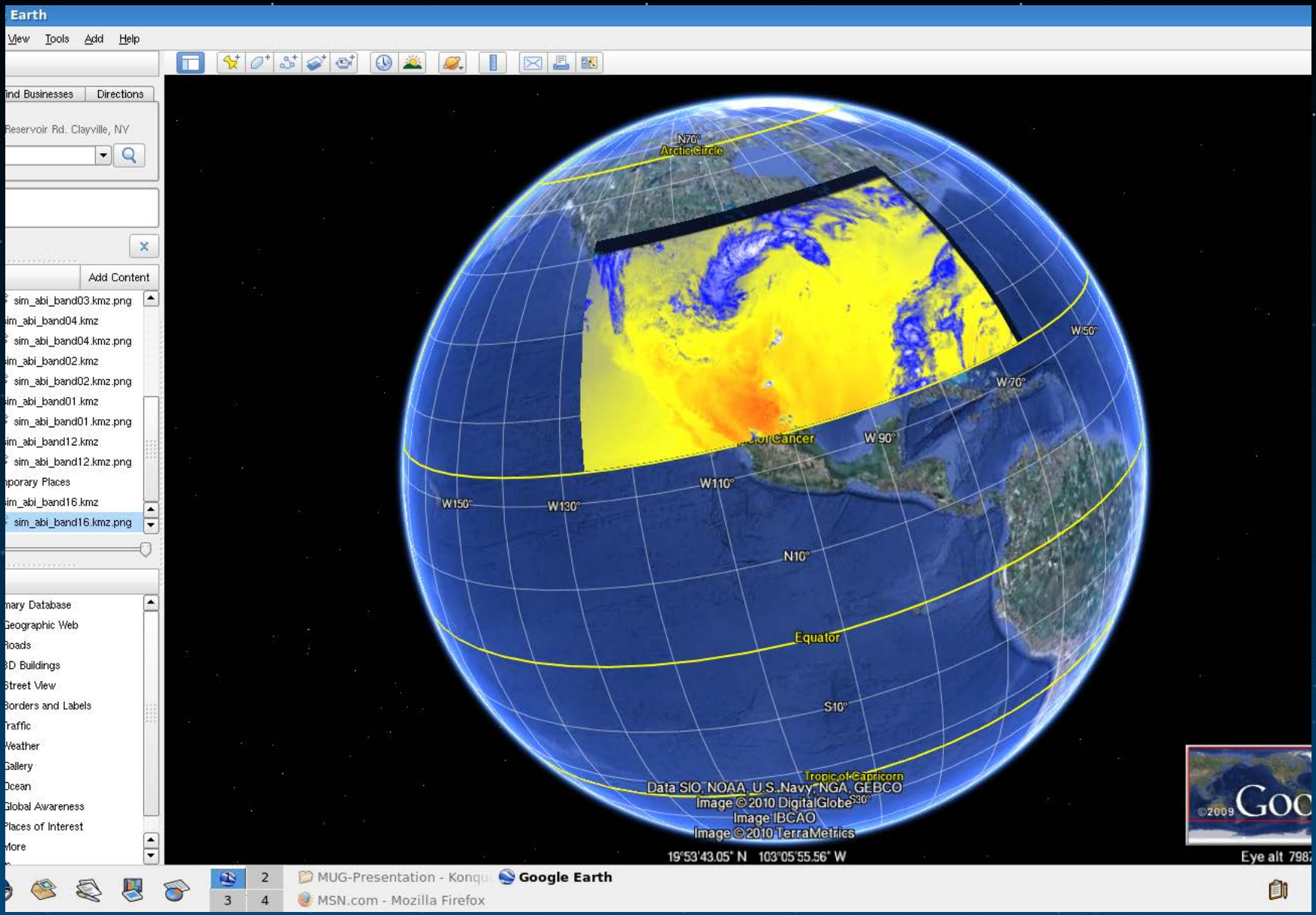
- Transact



Scatter analysis



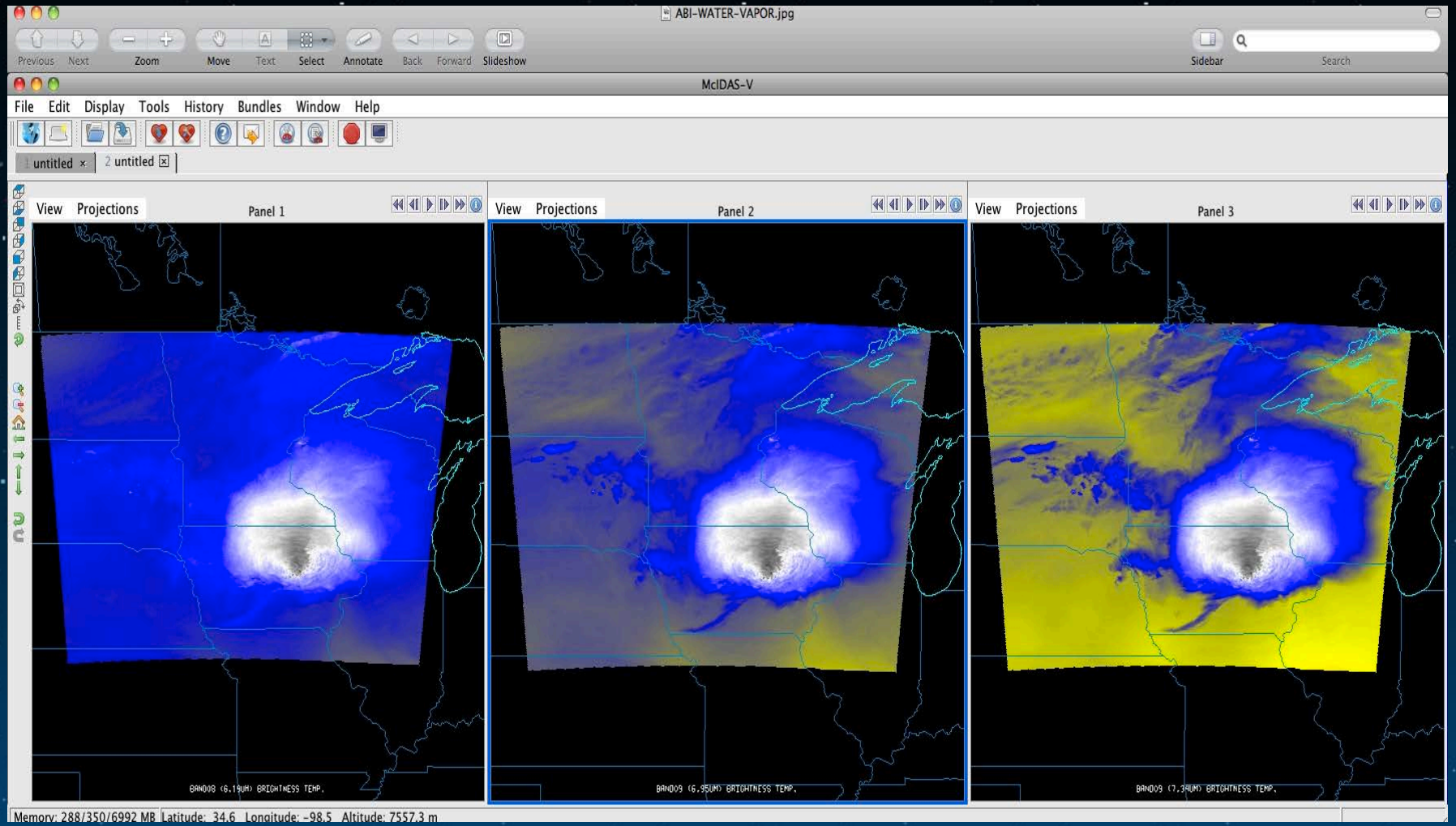
Scripting for other displays



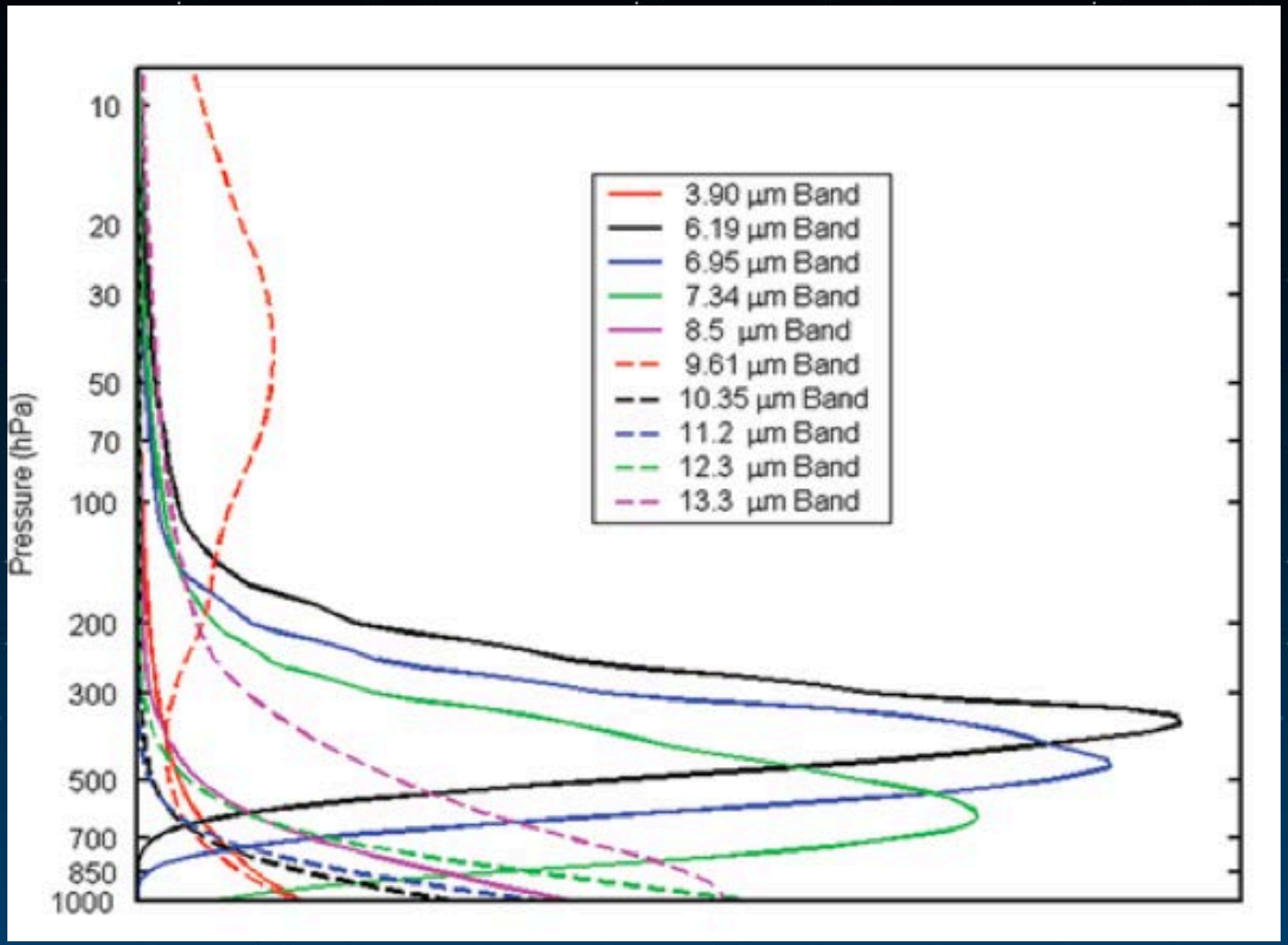
Analyze: Tell a story

- Once upon a time:
  - There was a GOES East and GOES West.
    - Both had only one water vapor band.
    - We could see what had happened after it rains.
    - It was exiting.
  - Then we heard, GOES-R was coming
    - With thee water vapor bands and 30 times better.
    - We will see what is happening when it rains.
    - Hmm.., Wait a minute, where was all this rain before?
    - Now what are we going do if something happens?

Analyze: Tell a story

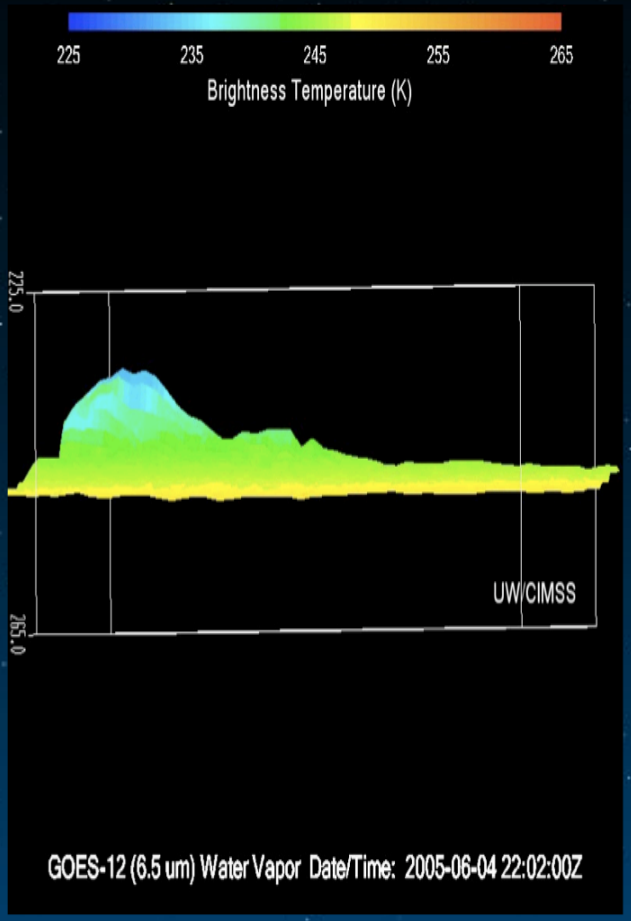


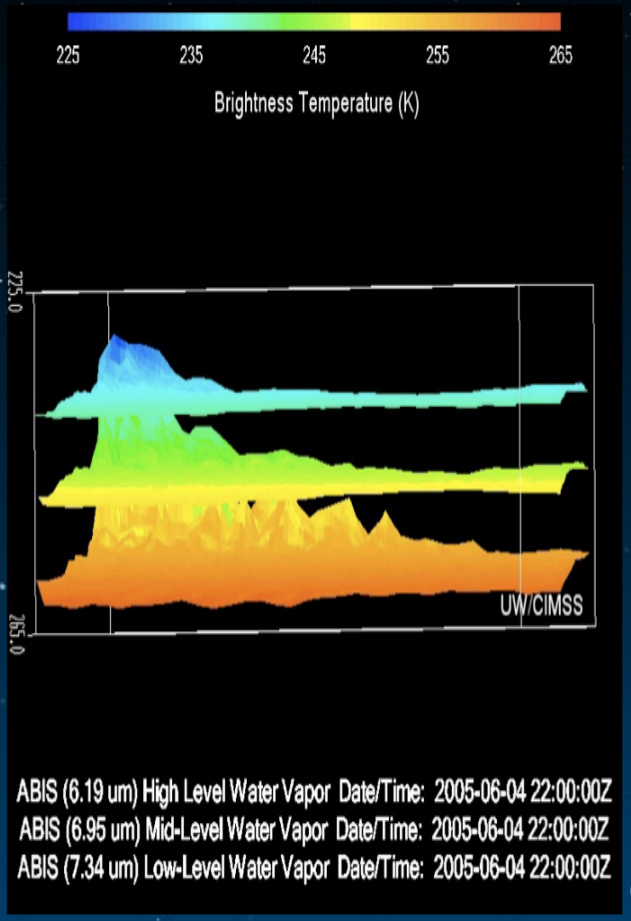
ABI- weighting functions



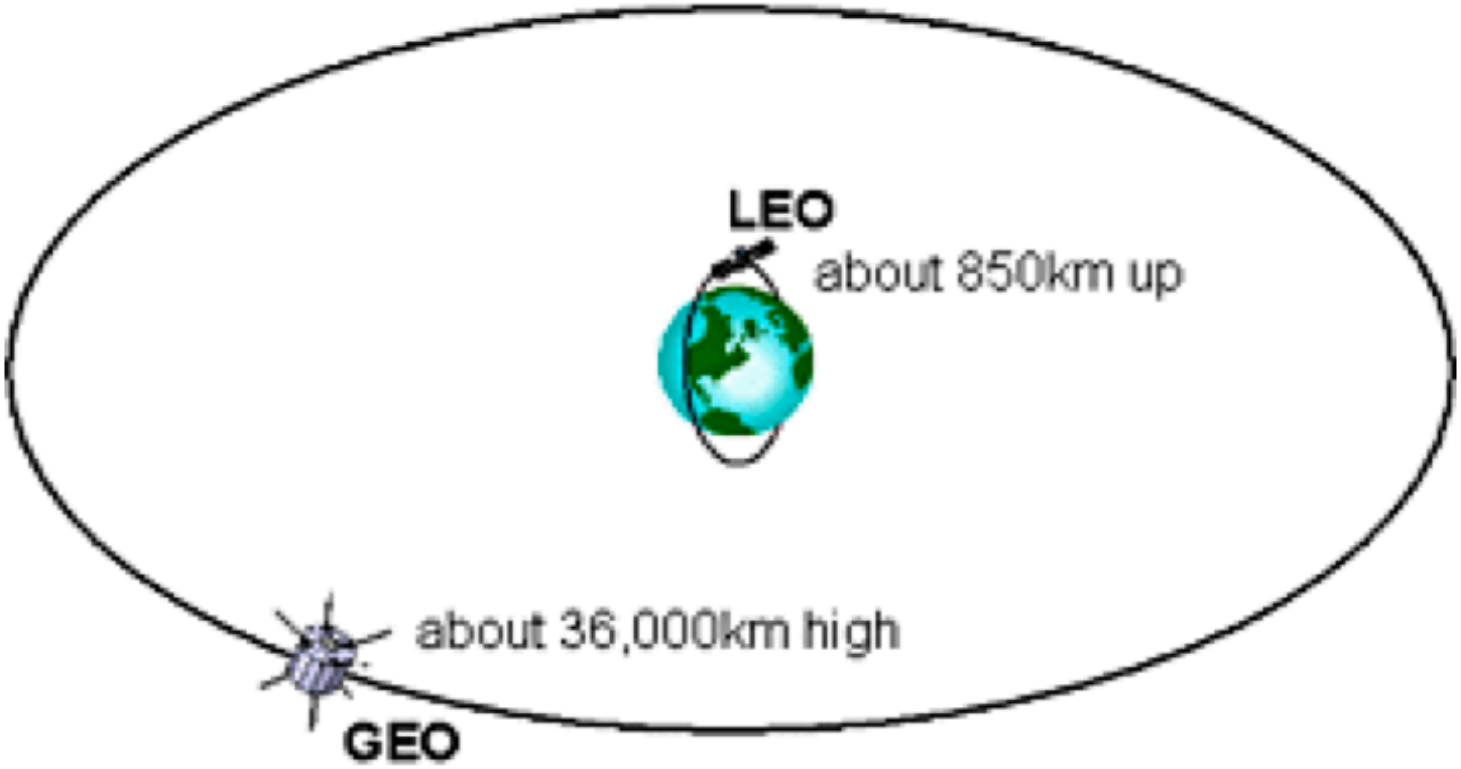
The weighting functions were calculated using simulated spectral response functions based on proposed ABI bandwidths.
http://www.epssi.mtu.edu/seminar/i1520-0477-86-8-1079.pdf

Analyze 1


225
235
245
255
265
Brightness Temperature (K)
225.0
265.0
UW/CIMSS
GOES-12 (6.5 um) Water Vapor Date/Time: 2005-06-04 22:02:00Z

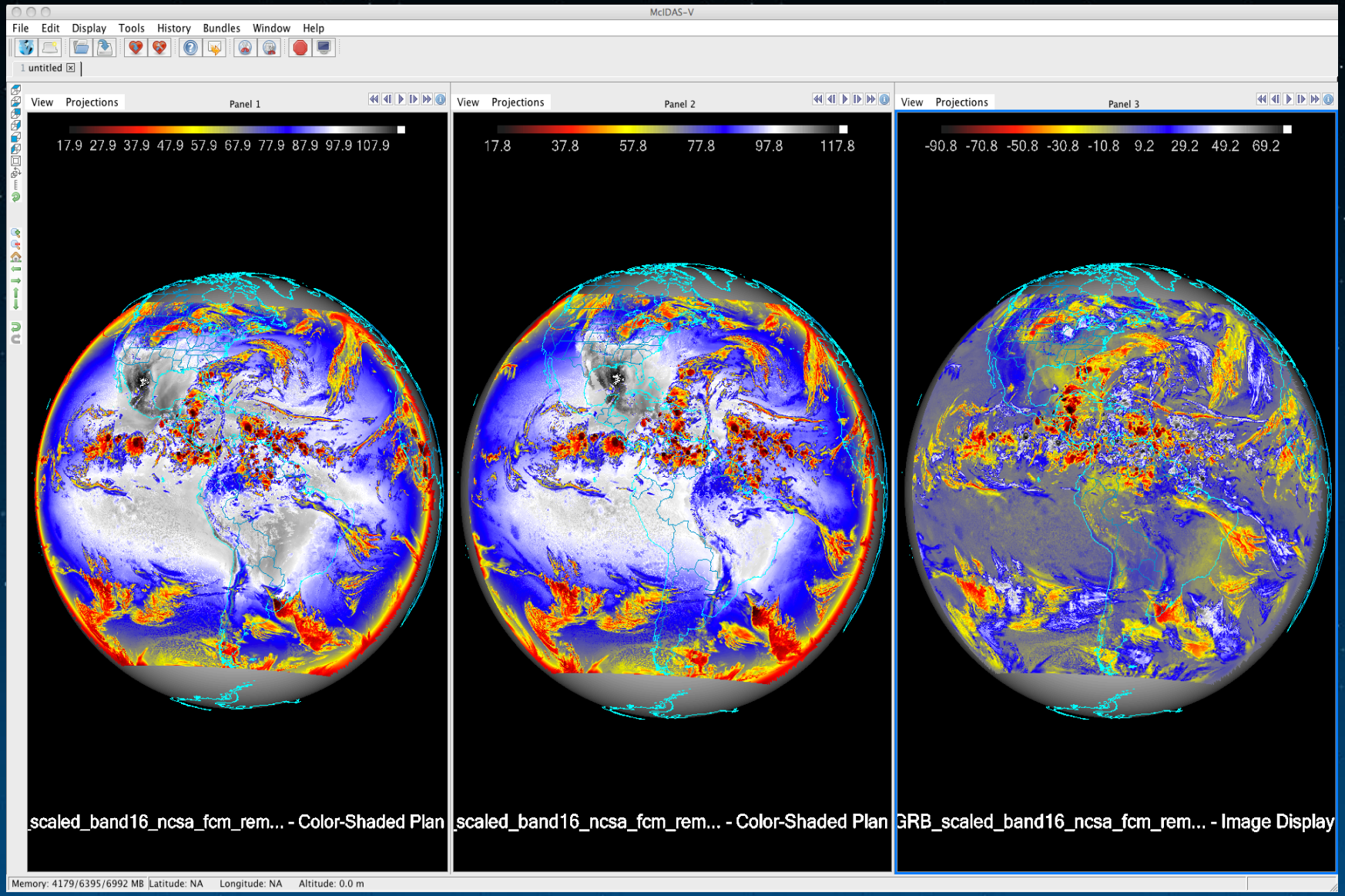

225
235
245
255
265
Brightness Temperature (K)
225.0
265.0
UW/CIMSS
ABIS (6.19 um) High Level Water Vapor Date/Time: 2005-06-04 22:00:00Z
ABIS (6.95 um) Mid-Level Water Vapor Date/Time: 2005-06-04 22:00:00Z
ABIS (7.34 um) Low-Level Water Vapor Date/Time: 2005-06-04 22:00:00Z

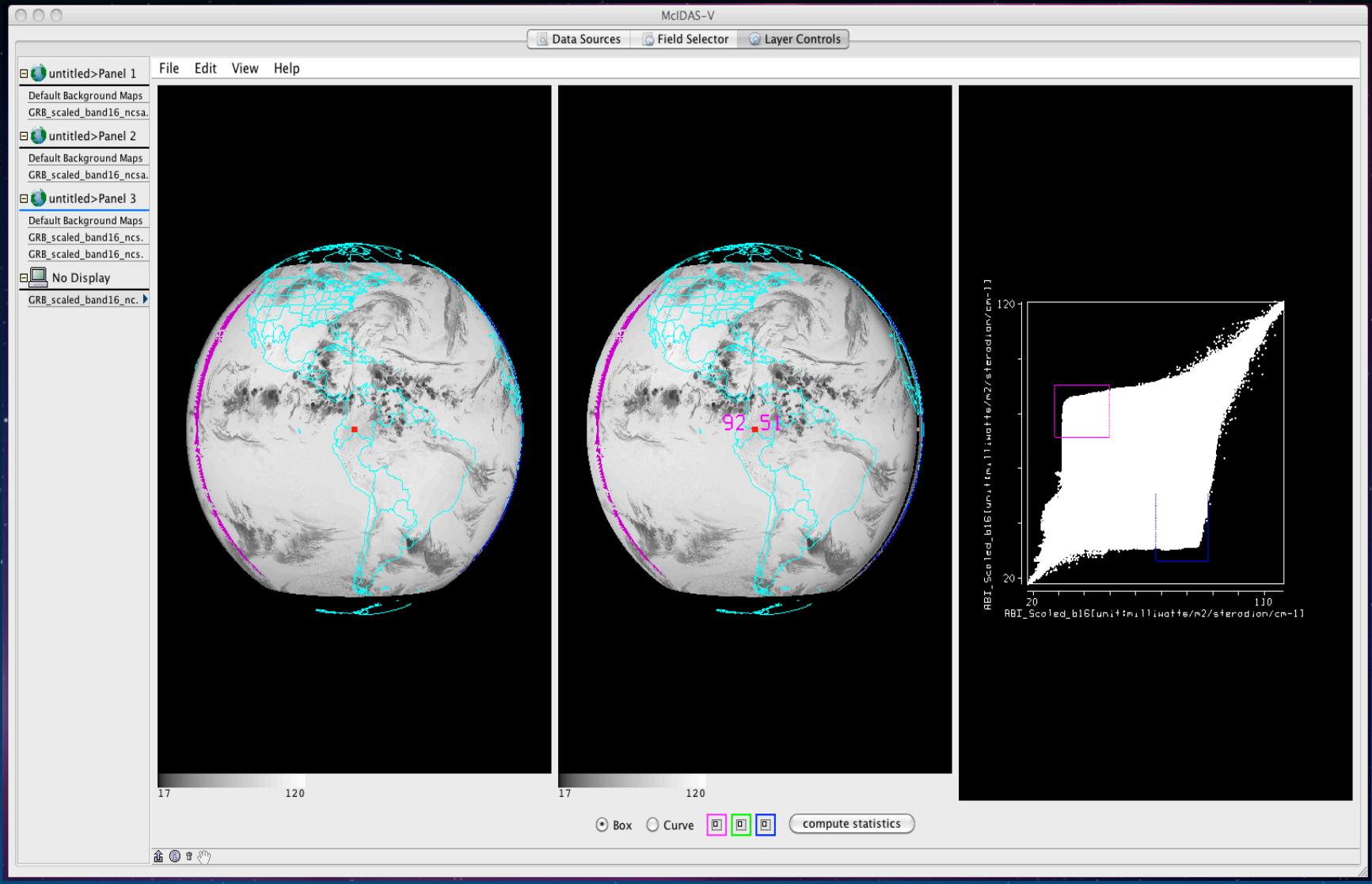
Puzzle: 5
Analyze: 75W vs 89.5W



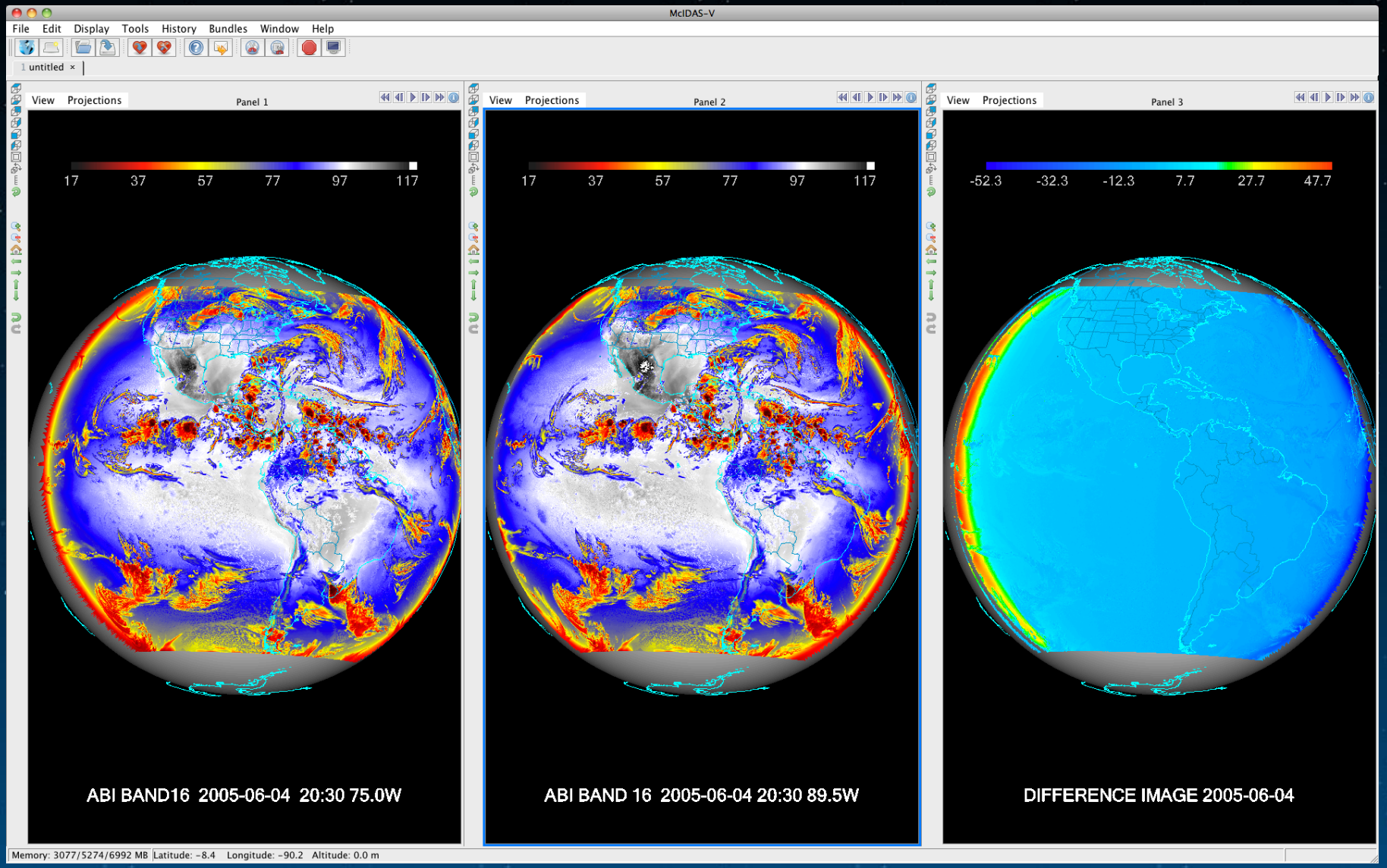
LEO and GEO orbit elevations

http://weatherstories.ssec.wisc.edu/work/suomi.html


McIDAS-V
File Edit Display Tools History Bundles Window Help
1 untitled
View Projections
Panel 1
17.9 27.9 37.9 47.9 57.9 67.9 77.9 87.9 97.9 107.9
_scaled_band16_ncsa_fcm_rem... - Color-Shaded Plan
View Projections
Panel 2
17.8 37.8 57.8 77.8 97.8 117.8
_scaled_band16_ncsa_fcm_rem... - Color-Shaded Plan
View Projections
Panel 3
-90.8 -70.8 -50.8 -30.8 -10.8 9.2 29.2 49.2 69.2
GRB_scaled_band16_ncsa_fcm_rem... - Image Display
Memory: 4179/6395/6992 MB
Latitude: NA
Longitude: NA
Altitude: 0.0 m


McIDAS-V
Data Sources
Field Selector
Layer Controls
File
Edit
View
Help
untitled>Panel 1
Default Background Maps
GRB_scaled_band16_ncsa.
untitled>Panel 2
Default Background Maps
GRB_scaled_band16_ncsa.
untitled>Panel 3
Default Background Maps
GRB_scaled_band16_ncs.
GRB_scaled_band16_ncs.
No Display
GRB_scaled_band16_nc.
92
51
17
120
17
120
120
20
20
110
ABI_Scaled_b16[unit:milliwatte/m2/sterodion/cm-1]
ABI_Scaled_b16[unit:milliwatte/m2/sterodion/cm-1]
Box
Curve
compute statistics

Sat. Sub point: 75W vs 89.5W

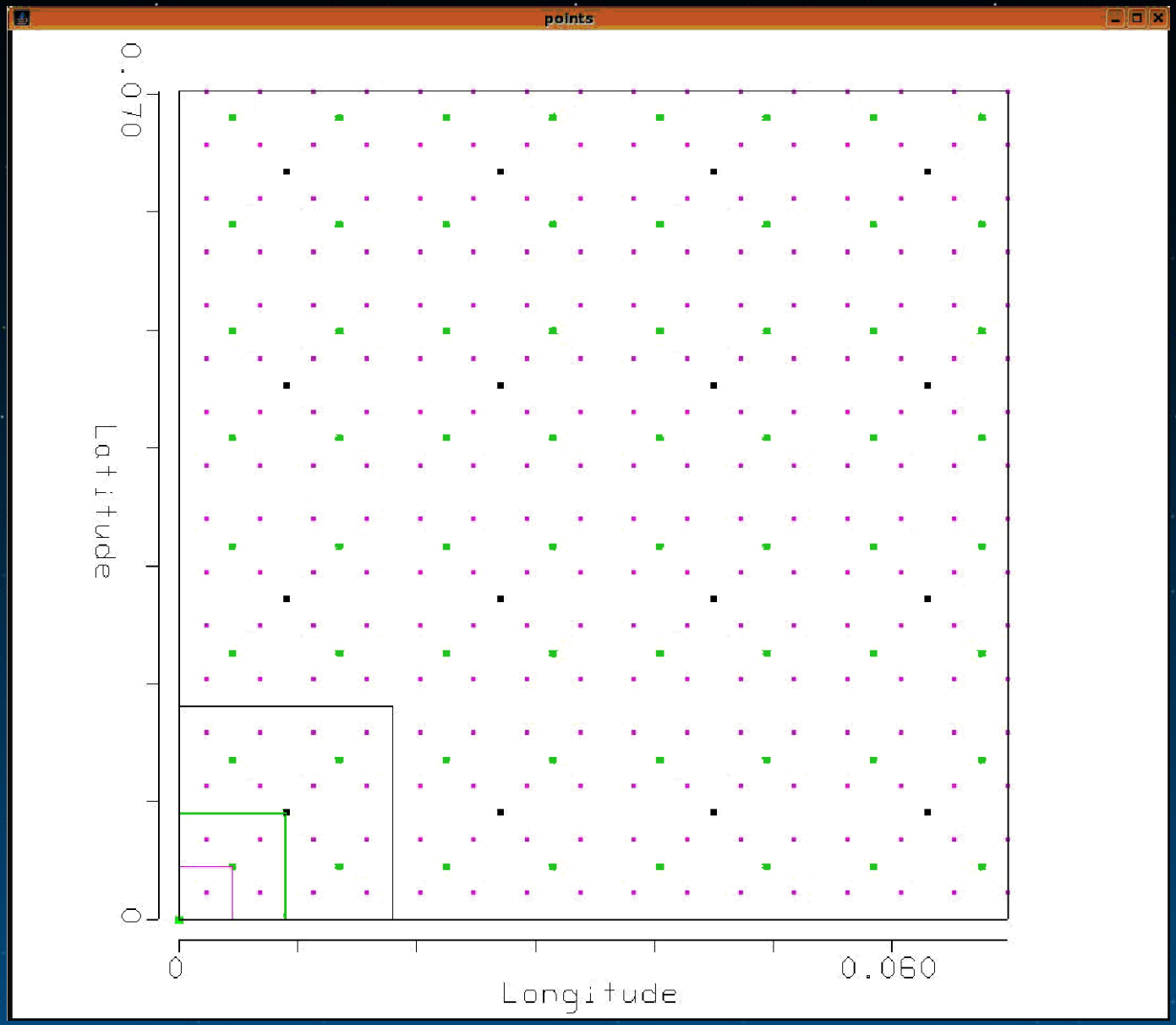


Analyze

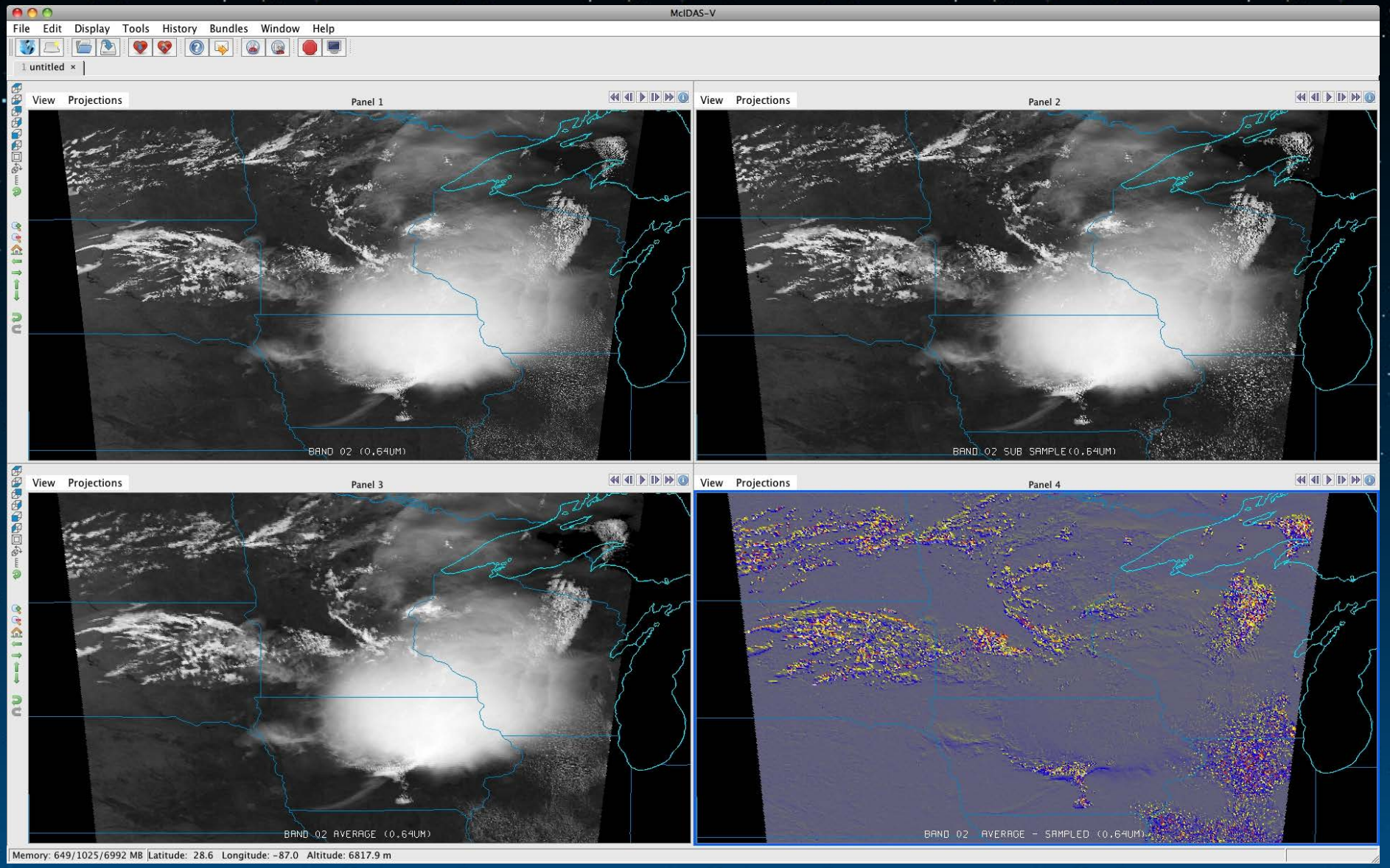
- Data Transacts
- Scatter plots
- Google maps
- Tell a story
- Solve a puzzle

Validation and deep diving

Sub-sampling vs Averaging



Sub-sampling vs Averaging



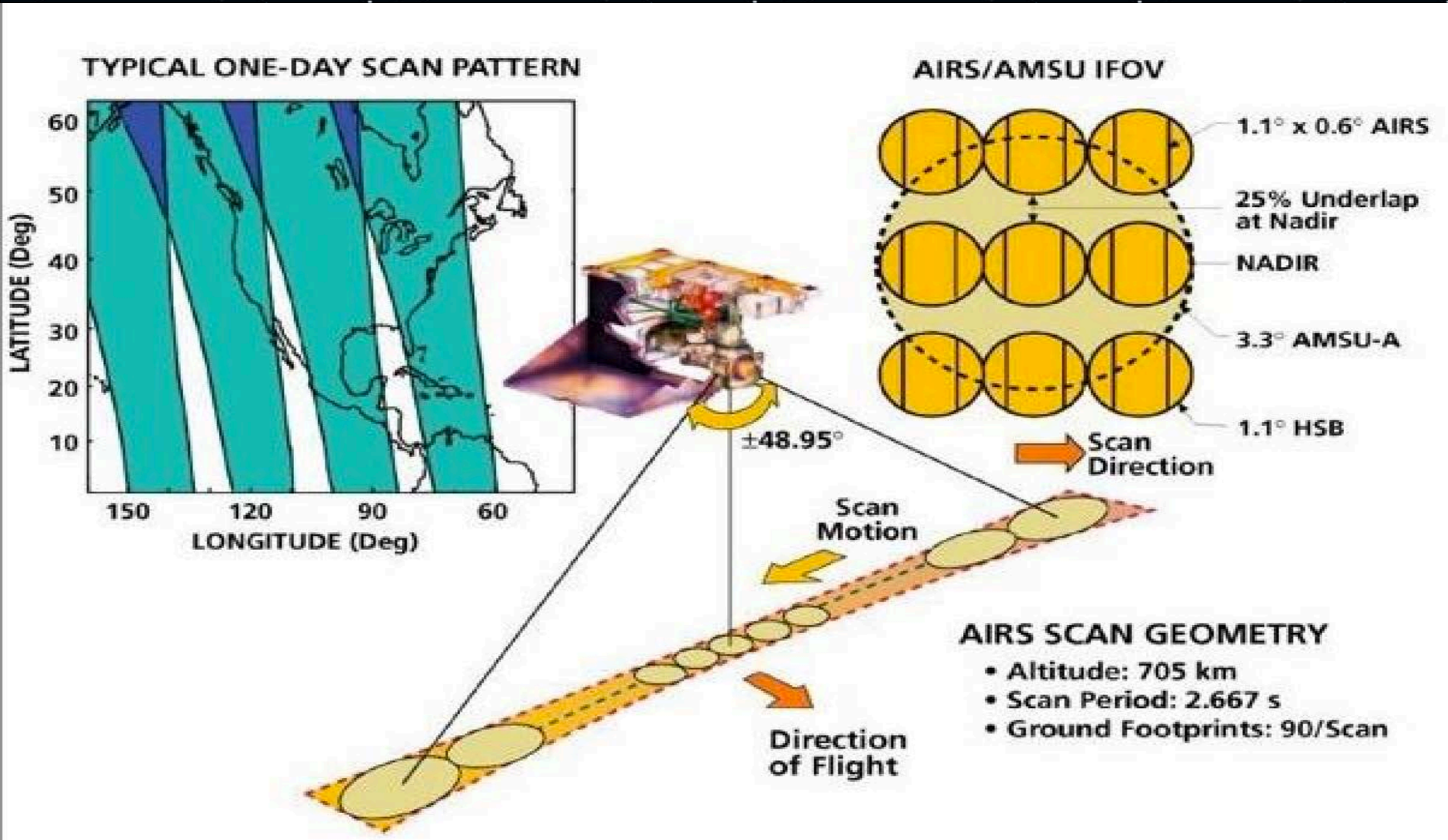
Sanity check/Navigation

AIRS DPI in AWIPS

TO DO LIST.

- Remapping data for AWIPS.
- Stitch files together for each pass.
- Setup and test new files in McIDAS-V.
- Setup and test new files in AWIPS.

The Atmospheric Infrared Sounder (AIRS) is a cross-track rotary scanning sensor with a ± 49.5 degrees (from nadir) ground coverage

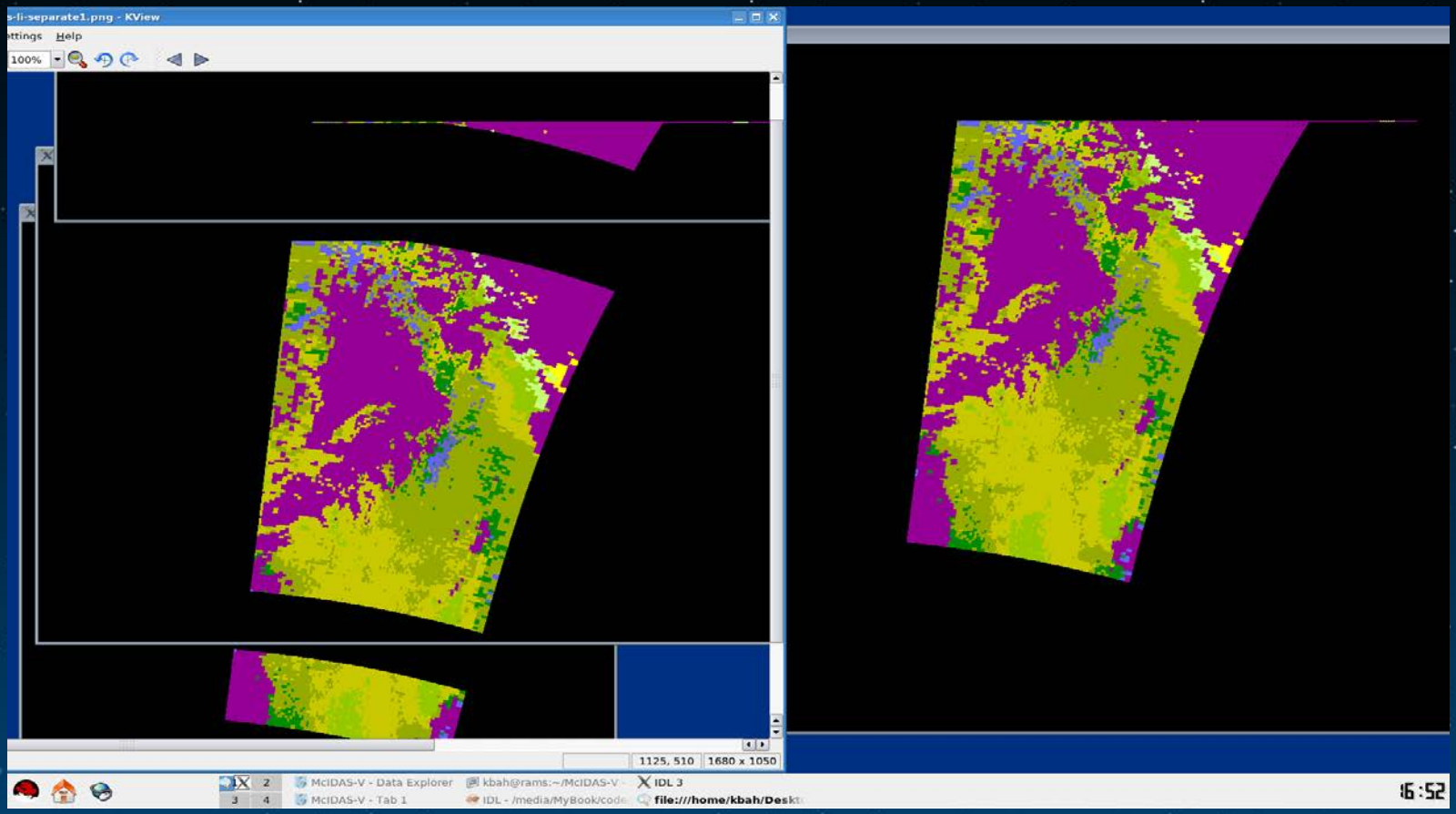


http://www.star.nesdis.noaa.gov/smcd/spb/LANDEM/website/instr_AIRS.php

Sanity check/Navigation

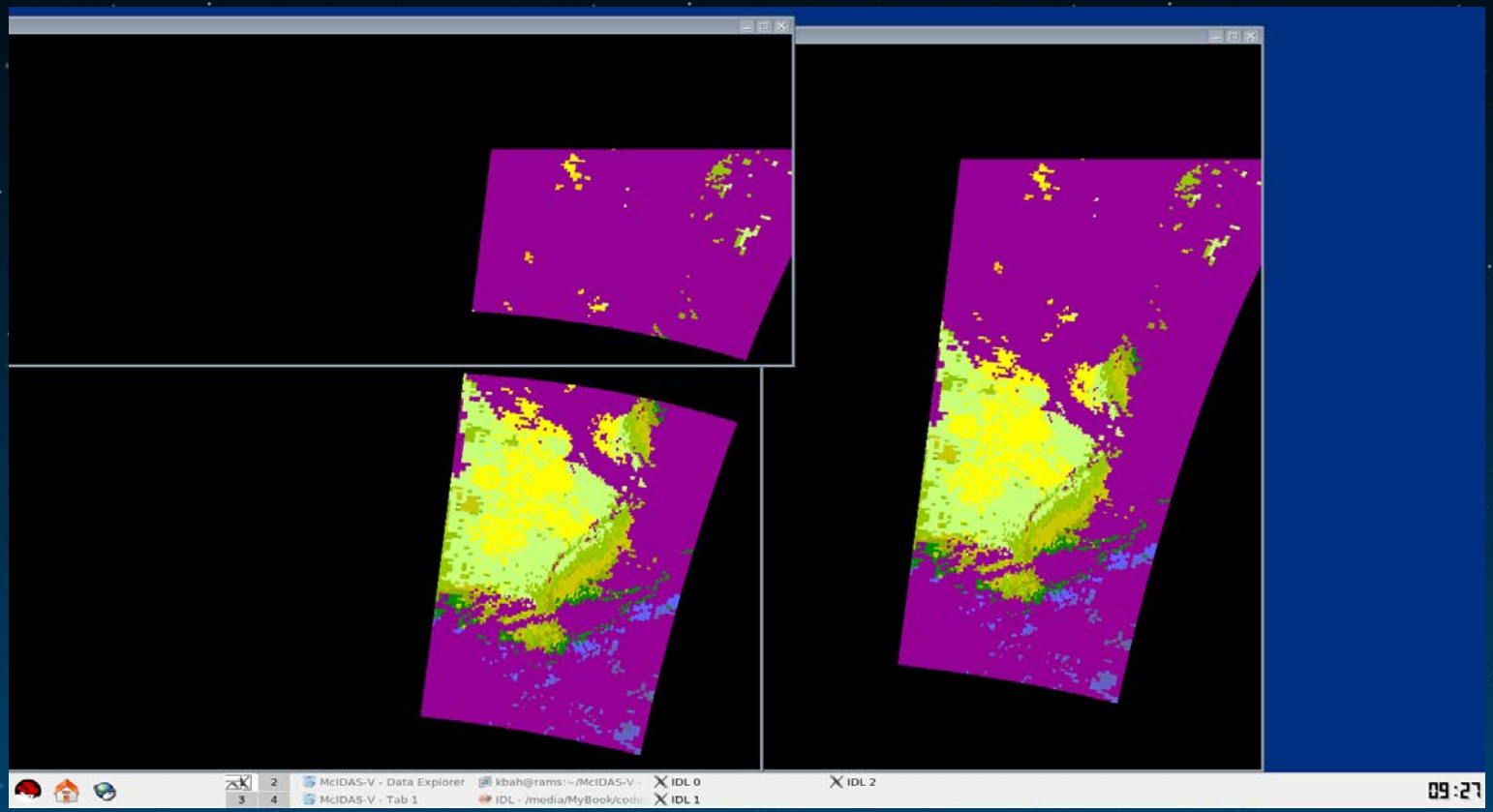
GOAL:Stitch AIRS files together for each pass

Before and after

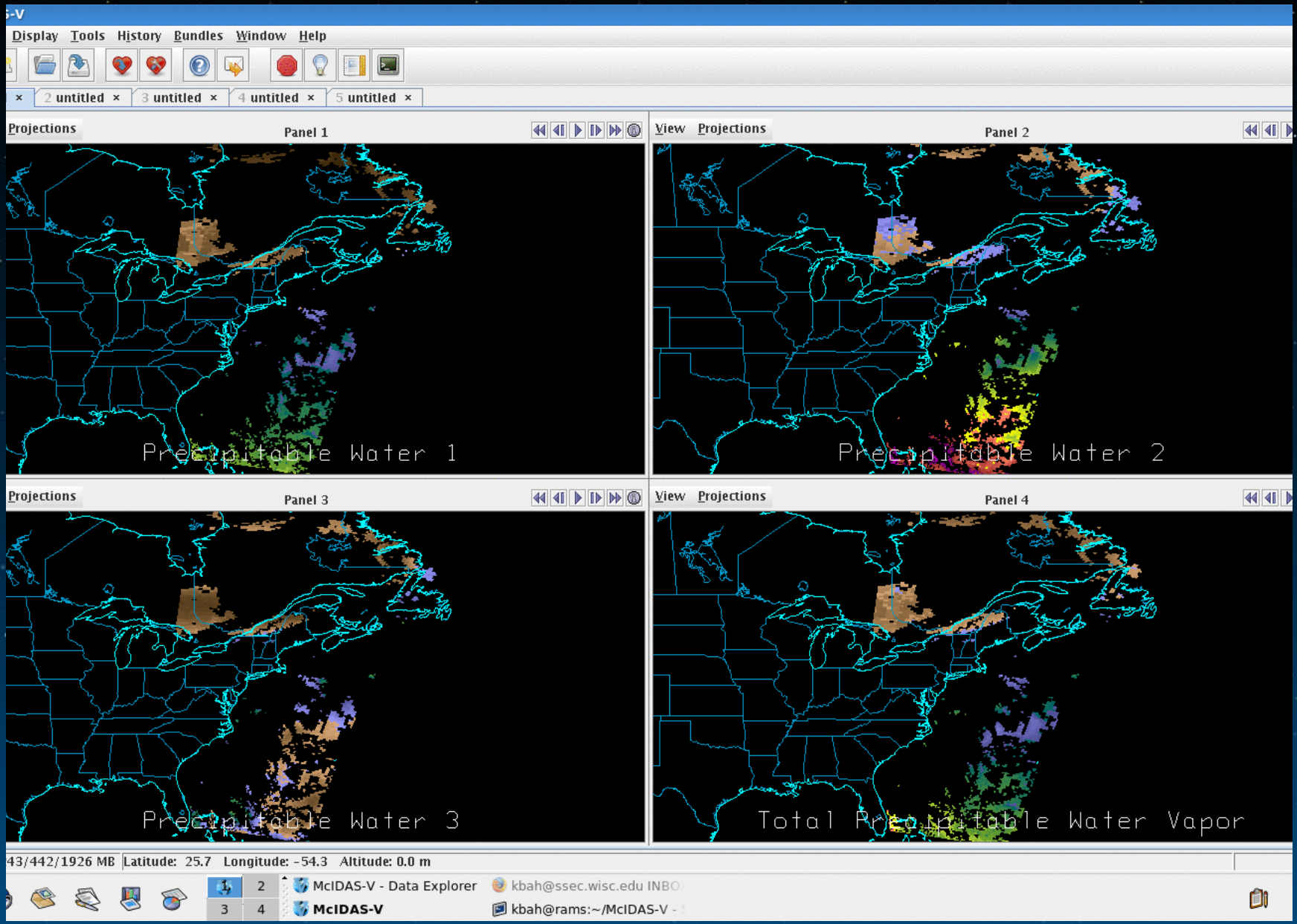


Stitching files together for each pass

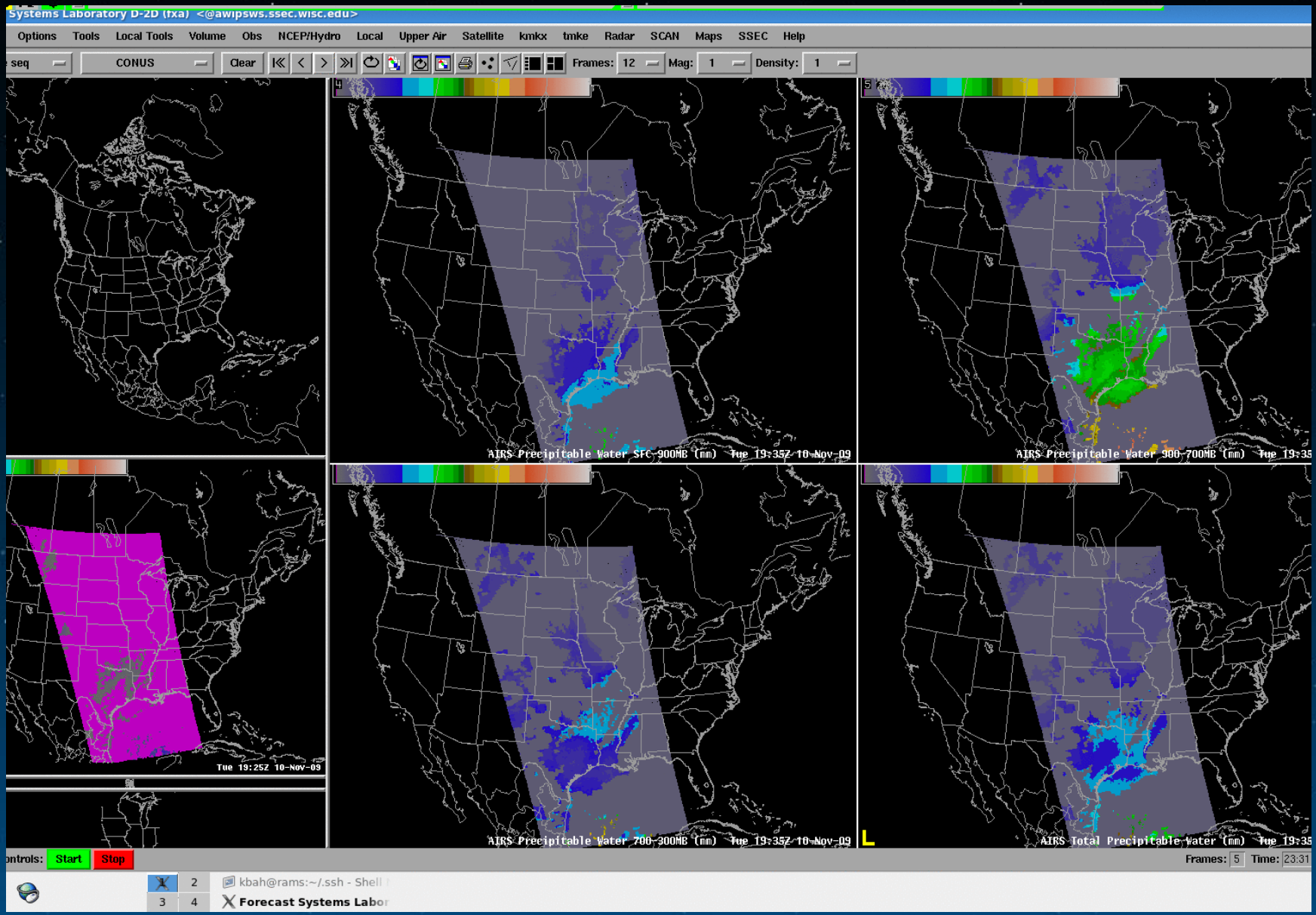
- Before and after stitching files. Test 02



Setup and test new stitched files in McIDAS-V



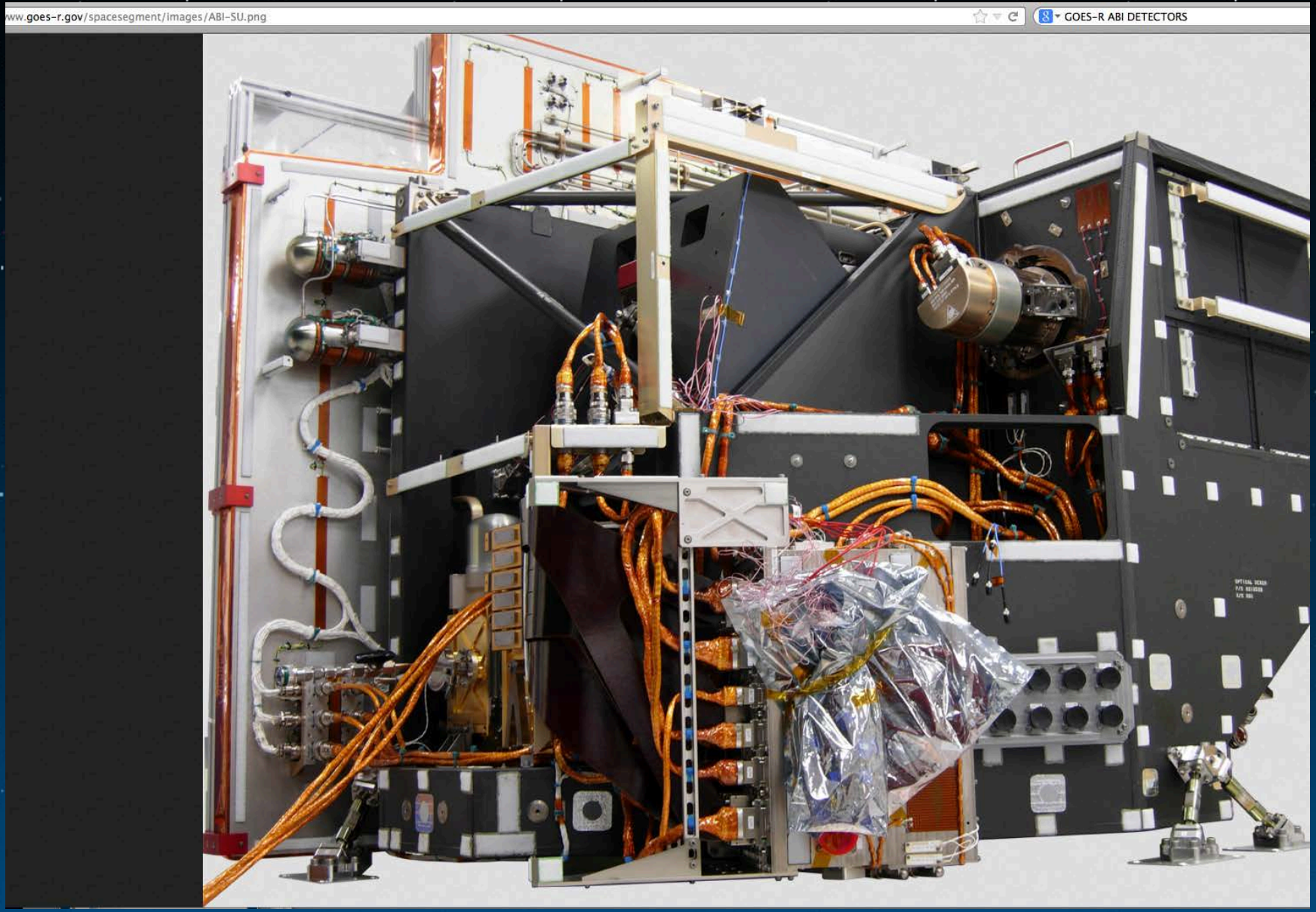
Setup and test new stitched files in AWIPS



Detector Analysis

- HERE WE DIVE.

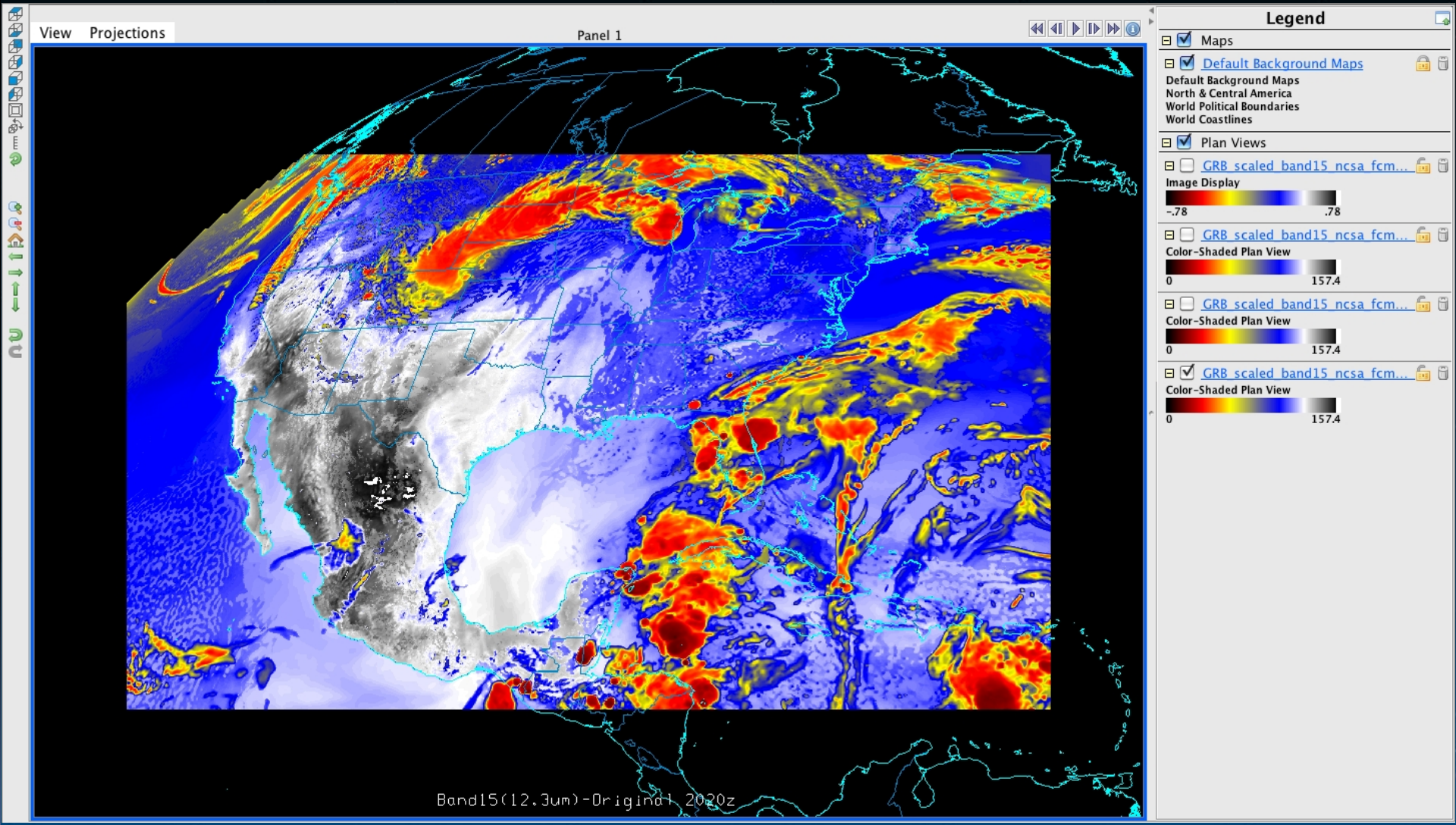
Detector Analysis



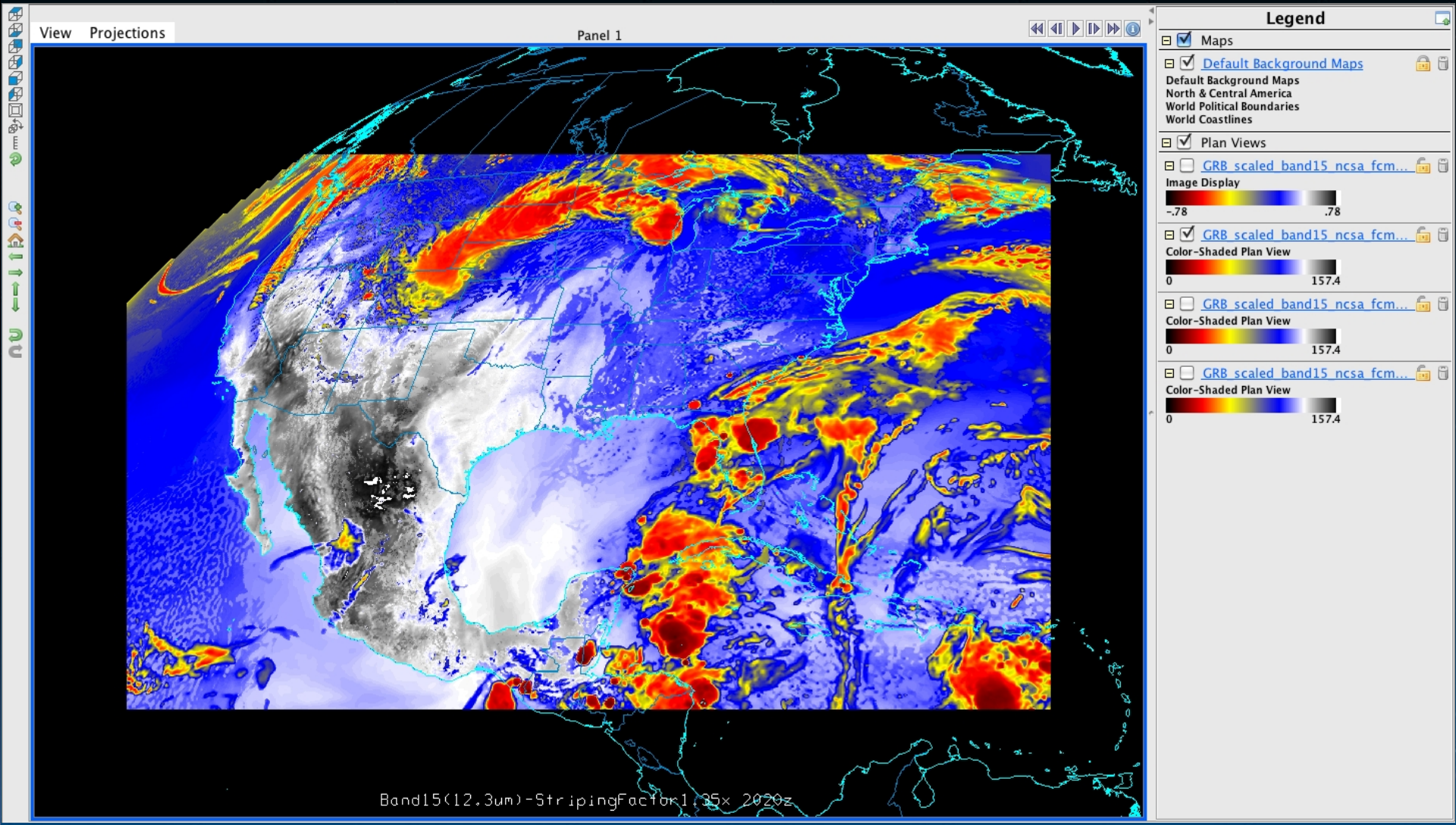
CONUS Simulation

- CONUS Simulation for 4 June 2005
  - Noise free from NWP
  - Remapped to ABI Fixed Grid Format (FGF), nominally 2km
- CONUS sector is 2500 by 1500 pixels
  - 3,750,000 total pixels
  - 3,661,932 of these are on the Earth
- Deviation simulated by adding 0.135K @300K noise to the 12.3um band image for every 100th line.
- Products besides Imagery are generated using first all noise-free data and comparing to those generated with all bands noise-free data except band 15 (12.3um) with striping

12.3um Band 15 Simulation

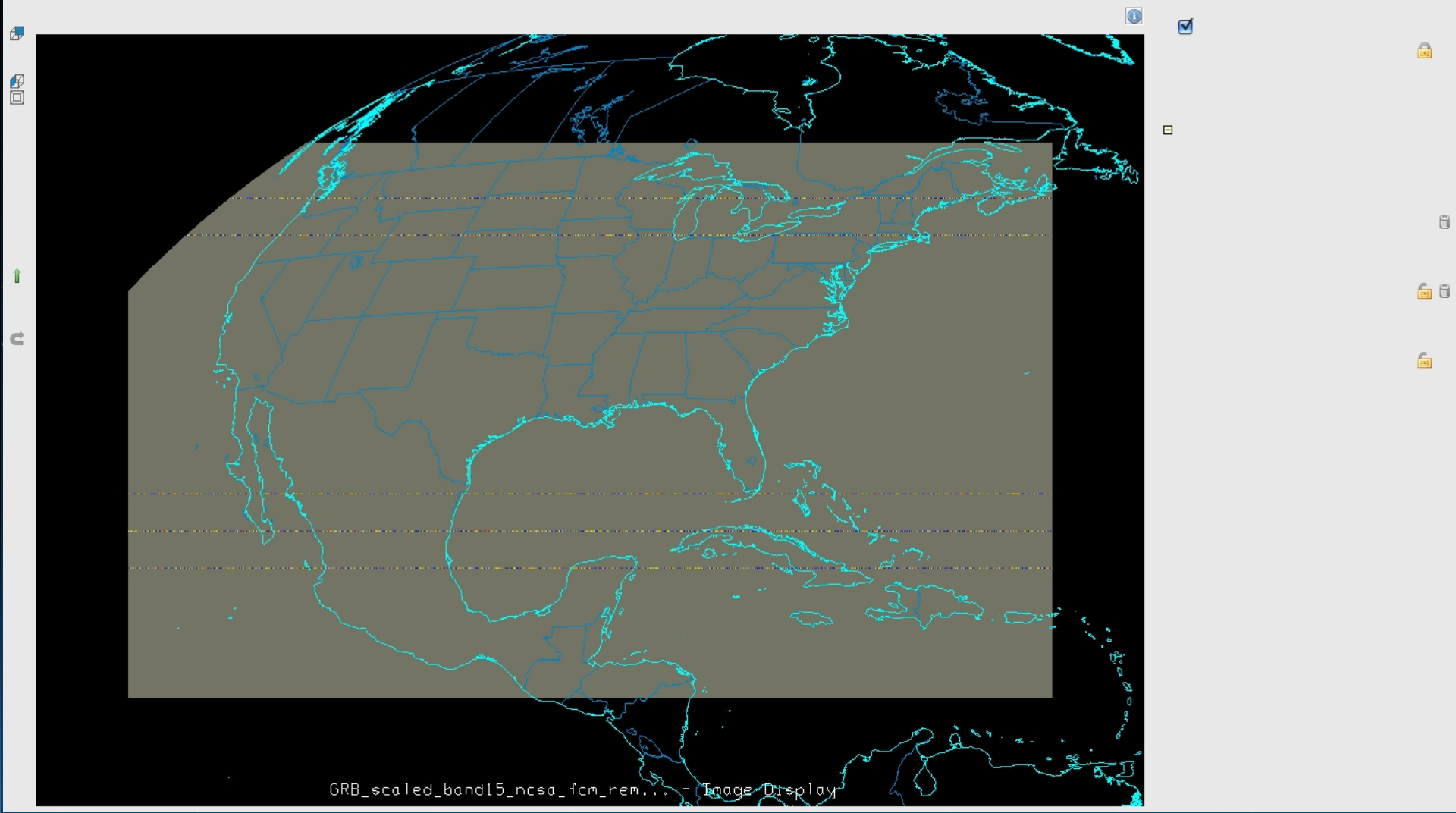


12.3um Band 15 Simulation with Striping



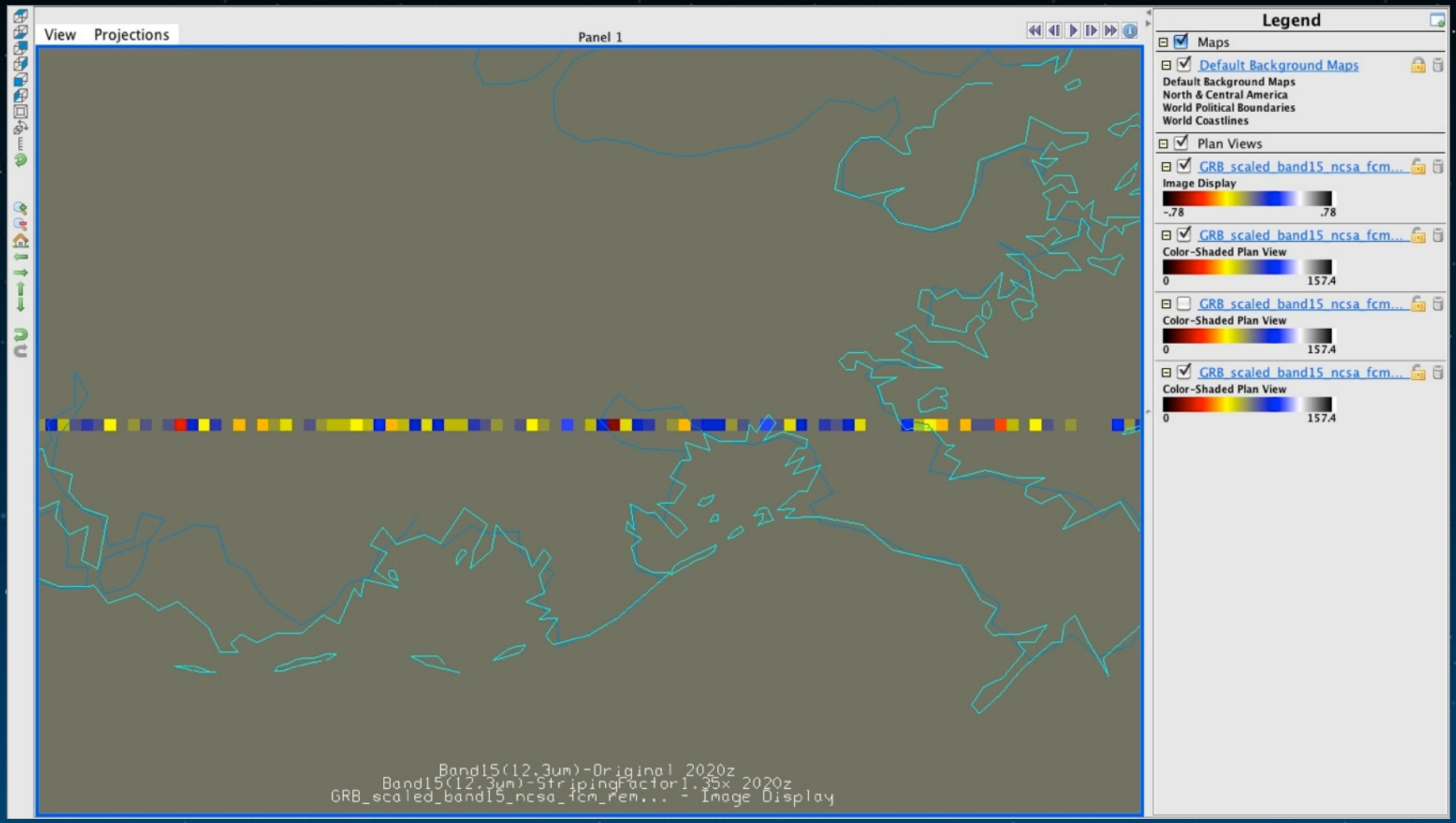
12.3um Band 15 Simulation with Striping

Difference Image

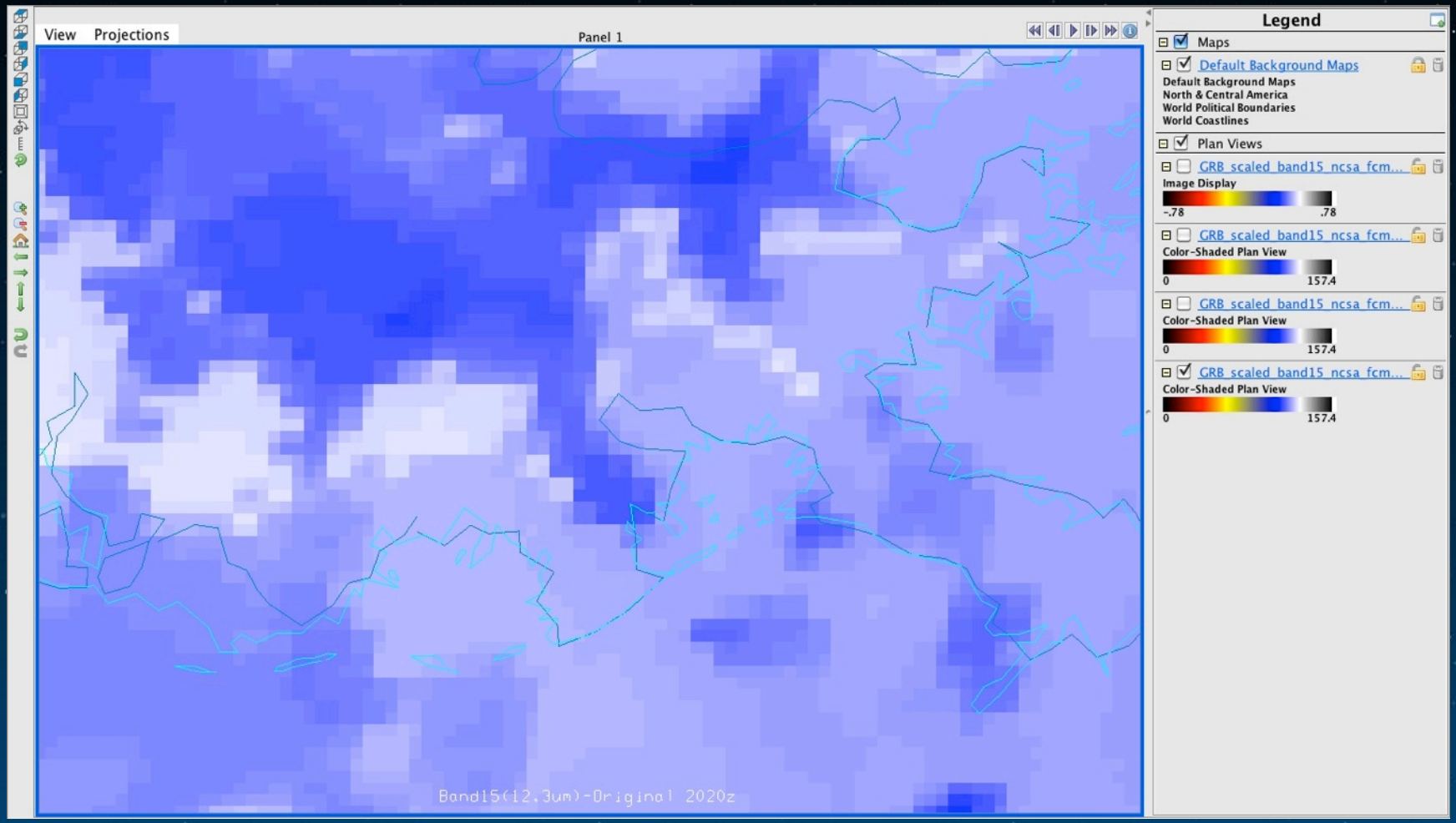


12.3um Band 15 Simulation with Striping

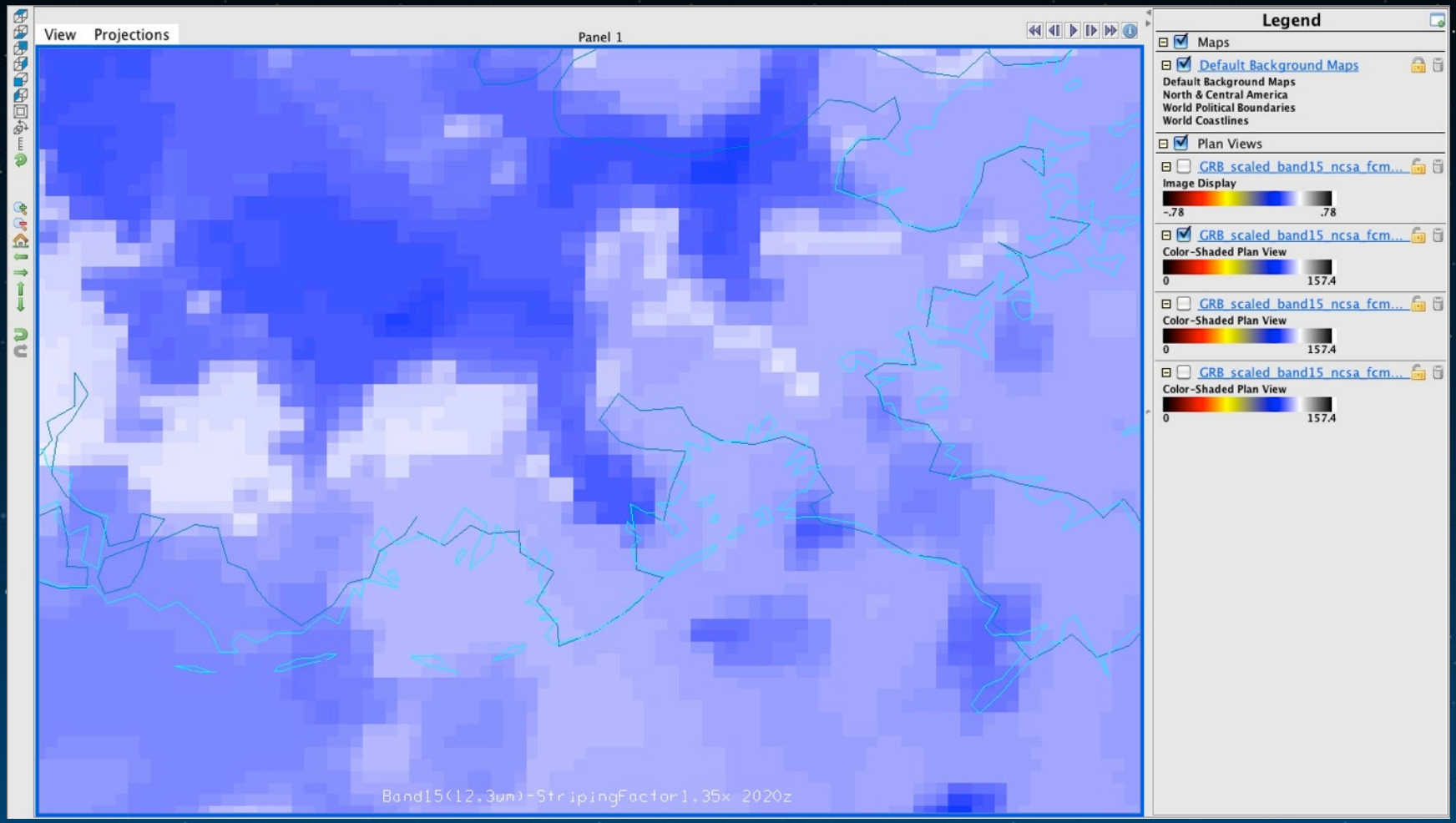
Difference Image



12.3um Band 15 Simulation



12.3um Band 15 Simulation with Striping



Imagery Analysis

- Based on image generation and viewing, it is thought that:
  - The band 15 Imagery product is not affected significantly
  - Users would not notice visible striping in the imagery without clean data for comparison
  - A "smart" remapper could effectively mitigate this
  - It is not worth affecting the other detector arrays for a problem this insignificant for one detector.
- Bottom line: Investigate a smarter resampler, but this particular issue is not a "show stopper"

Diving deep

- Sampling vs Averaging
- AIRS DPI navigation
- Detector Analysis

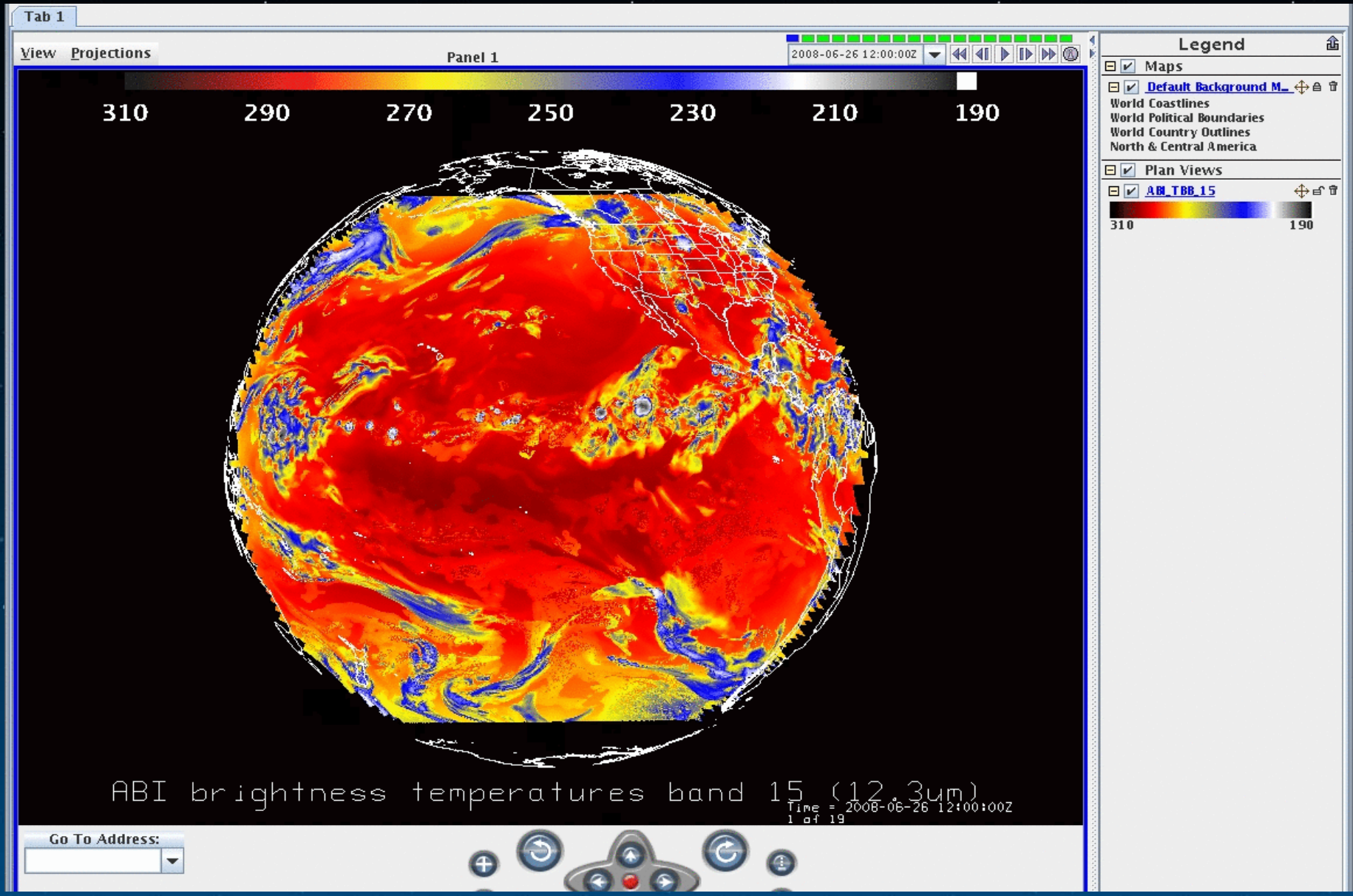
Summary

- Very interactive.
- Has something to offer for most.
- Easy to install easy to use
- Free, Free, free

- Now go get it.!!

- END

QUESTIONS ??


Tab 1
View
Projections
Panel 1
2008-06-26 12:00:00Z
310
290
270
250
230
210
190
ABI brightness temperatures band 15 (12.3um)
Time = 2008-06-26 12:00:00Z
1 of 19
Go To Address:
Legend
Maps
Default Background M...
World Coastlines
World Political Boundaries
World Country Outlines
North & Central America
Plan Views
ABI_TBB_15
310
190