More Than an Image: Bridging Five Decades of Satellite Continuity with McIDAS-V

Bob Carp
University of Wisconsin – Madison
Space Science and Engineering Center
HAQAST Madison
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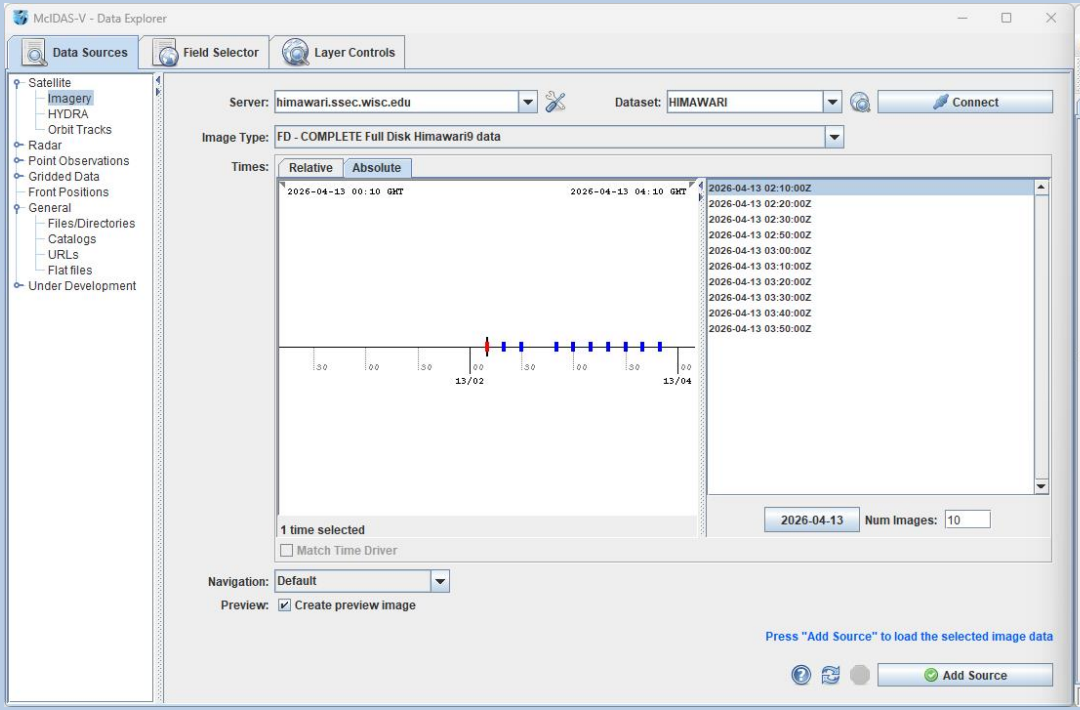
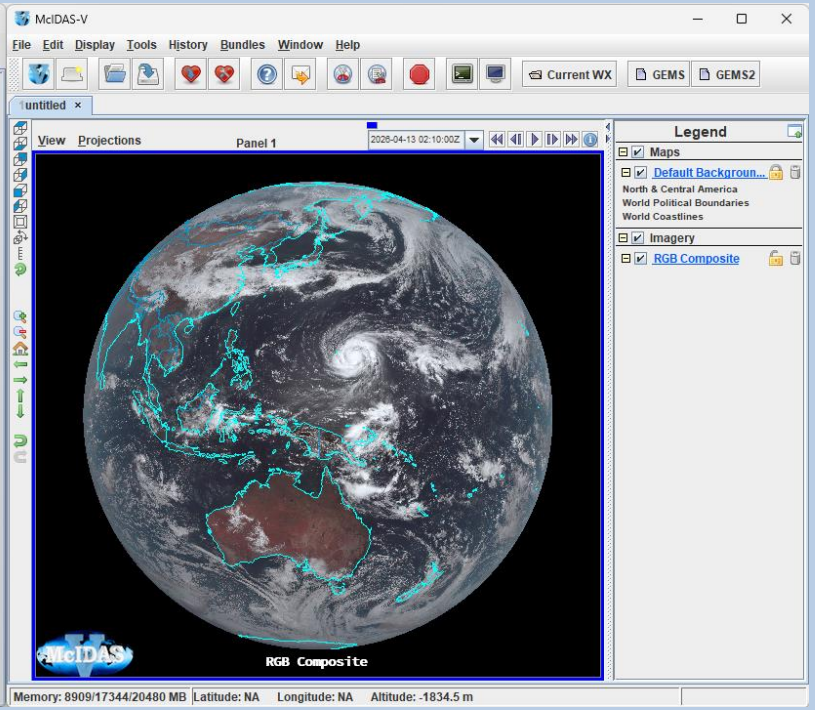
What is McIDAS-V?

- Universal Platform: Free, open-source software (UW-Madison) running on Windows, macOS, and Linux.
- Integrated Environment: A single interface for display, analysis, and manipulation of diverse datasets.
- The LEO/GEO Bridge: Seamlessly integrates legacy and next-gen sensors:
  - GEO: GOES, Himawari, MSG, **TEMPO**, **GEMS**
  - LEO: JPSS (VIIRS, CrIS, ATMS), **TROPOMI**, and polar-orbiting legacy sensors.
- Format Flexibility: Native support for NetCDF, HDF, and GRIB allows for cross-platform continuity without data conversion.

What is McIDAS-V



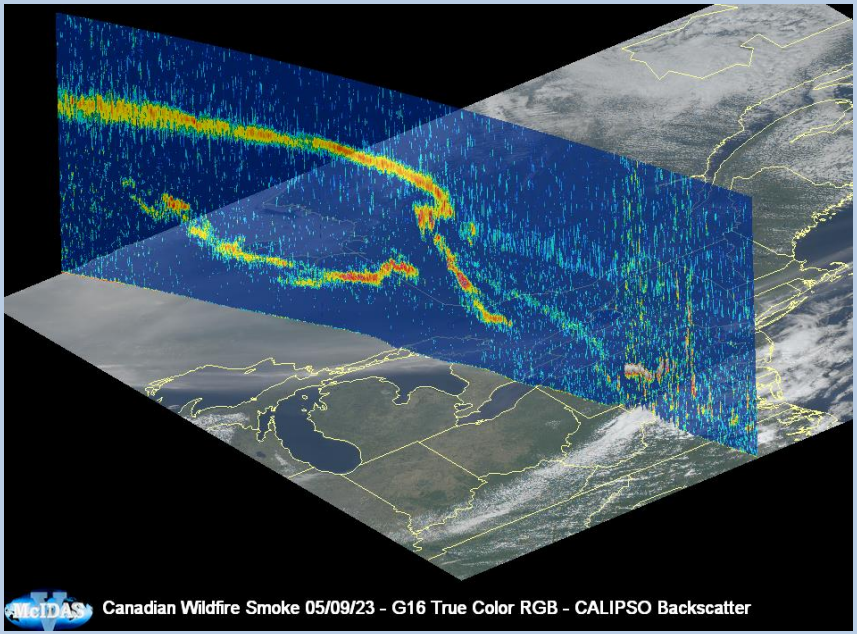


McIDAS-V is primarily composed of two windows: The Data Explorer and Main Display

Left = Data Explorer window. This is where users select what data they want to display and how they want to display the data.

Right = Main Display window. This is where most displays appear.

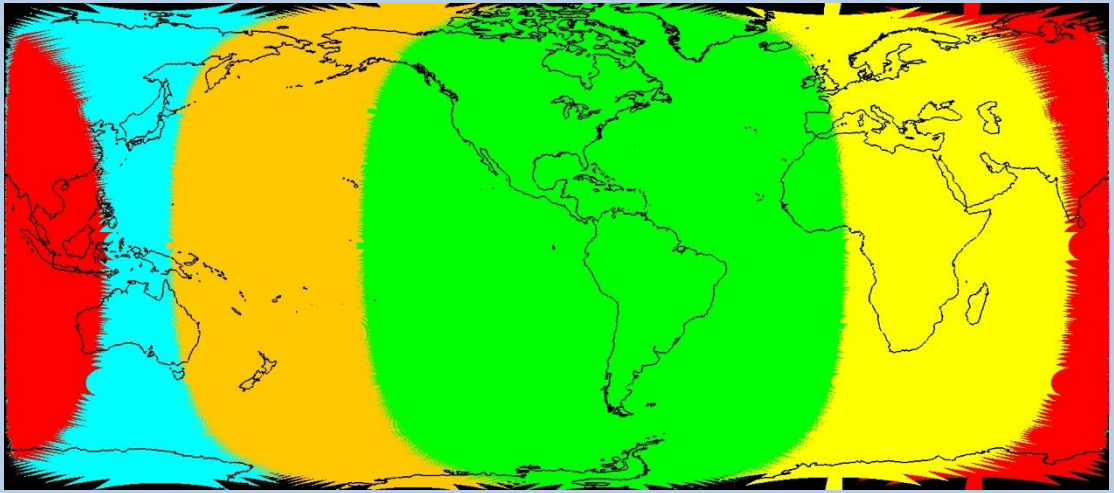
What Problems can McIDAS-V Solve?



Above – GOES-16 True Color RGB imagery with overlaid CALIPSO backscatter from a May 2023 Canadian wildfire smoke event. This illustrates continuity by combining complementary GEO and LEO observations.

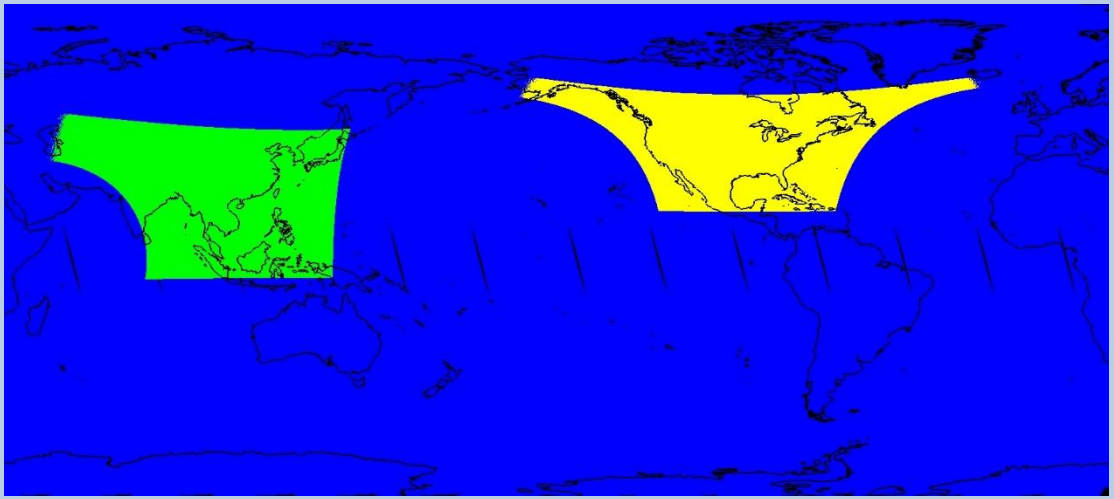
- Overlaying data from GEO and LEO instruments in one display for inter-comparison and adding context to imagery/data.
- Java3D allows for customizable 3D displays all through a point-and-click User Interface.

Data on a Global Scale



The image on the left shows coverages of:

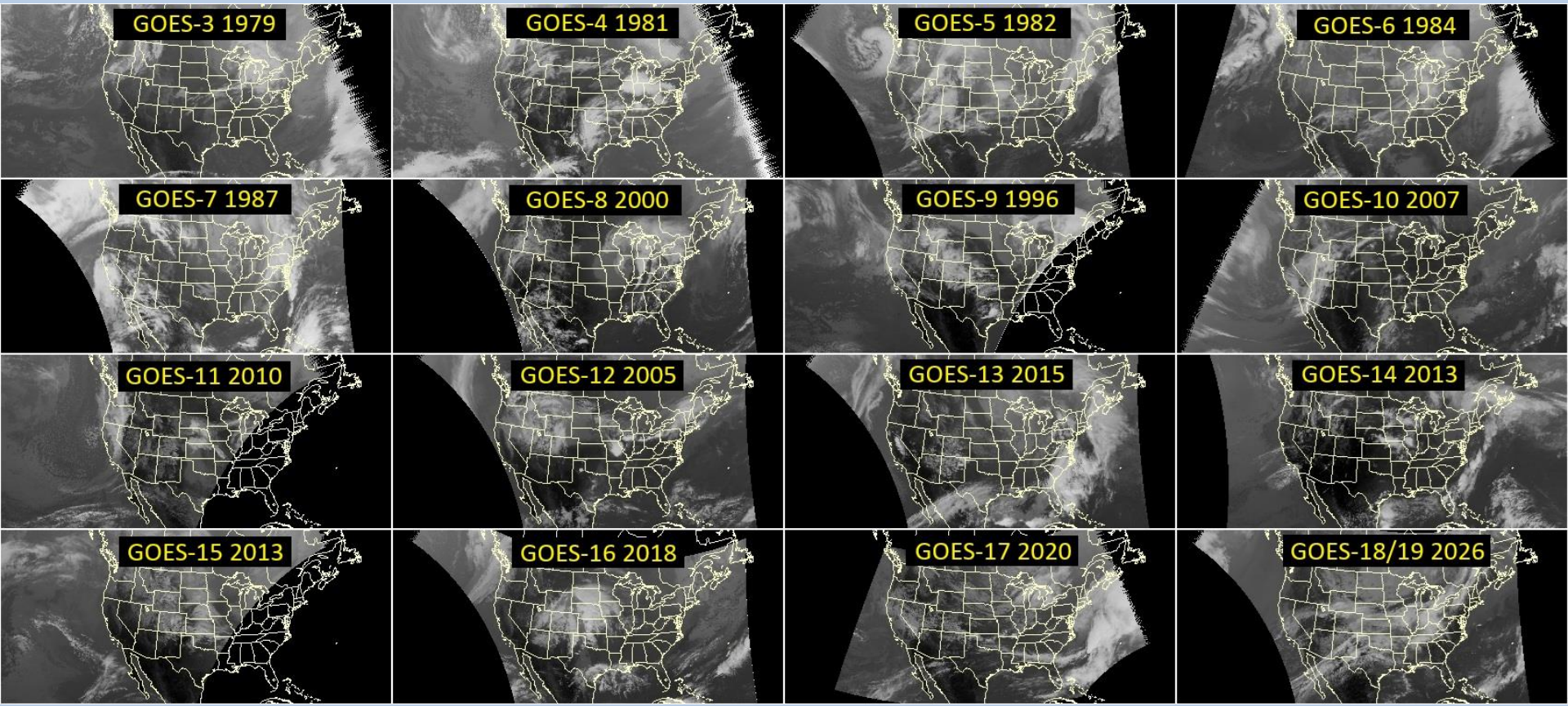
- = GOES East
- = GOES West
- = Himawari
- = Meteosat-9
- = Meteosat-10



The image on the left shows coverages of:

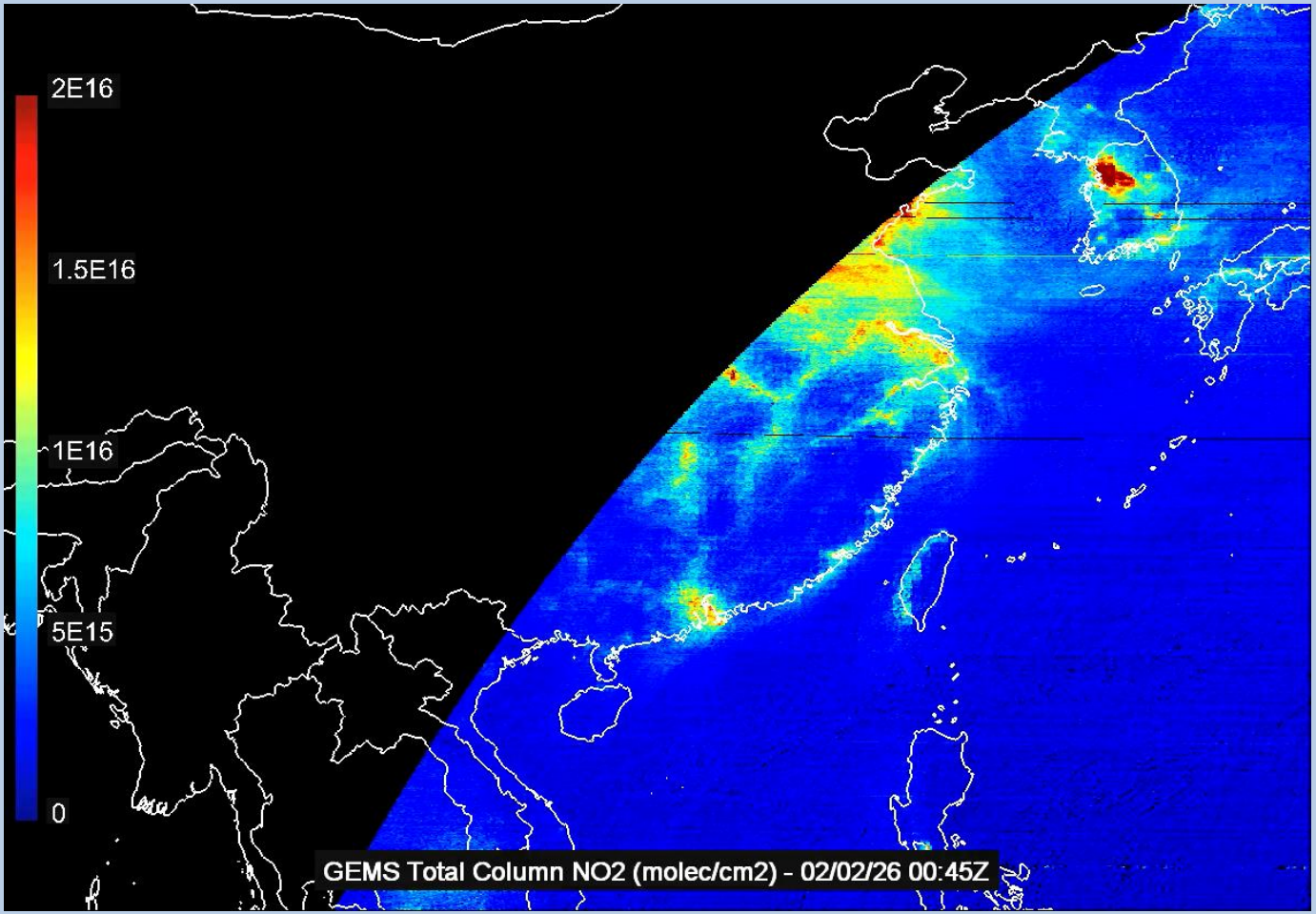
- = GEMS
- = TEMPO
- = LEO (e.g. TROPOMI)

Continuity Across Generations



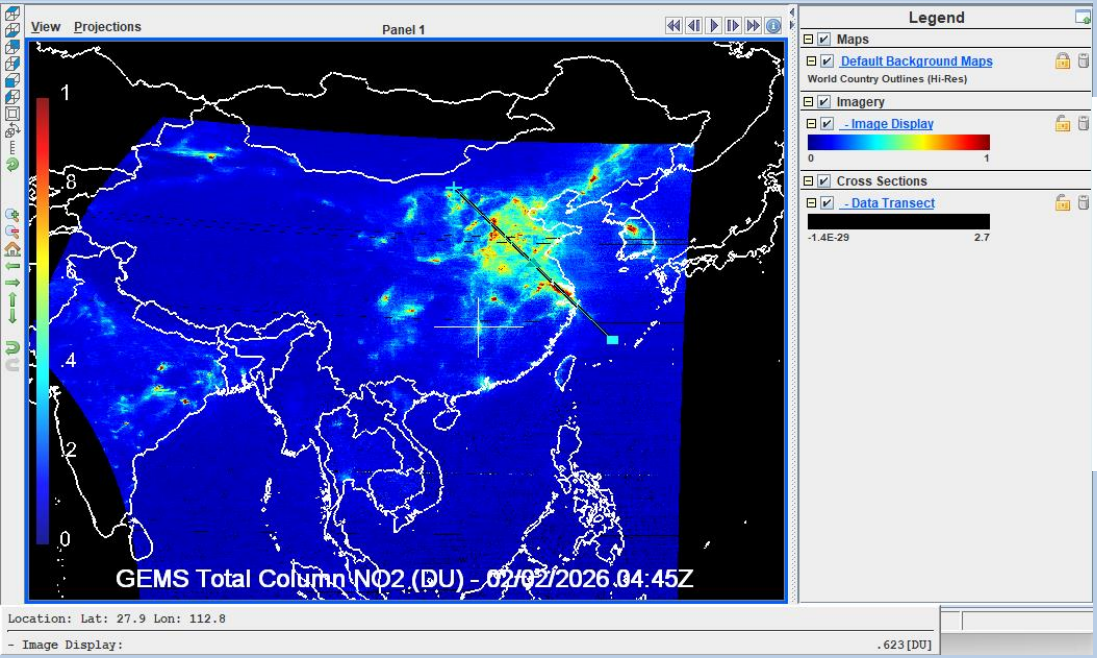
Support for a variety of sensors through time. Above demonstrates displays of GOES 3 (1979) through GOES 19 (current) all mapped to the same projection. Multiple generations of LEO instruments are supported as well, including MODIS to VIIRS and OMI to TROPOMI.

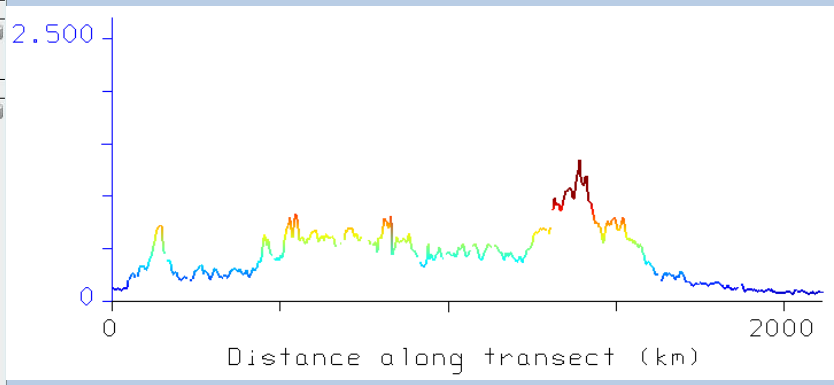
Expanding the Geo Constellation: GEMS Nitrogen Dioxide over East Asia



Animation of GEMS Total Column NO2. NetCDF files from https://nesc.nier.go.kr

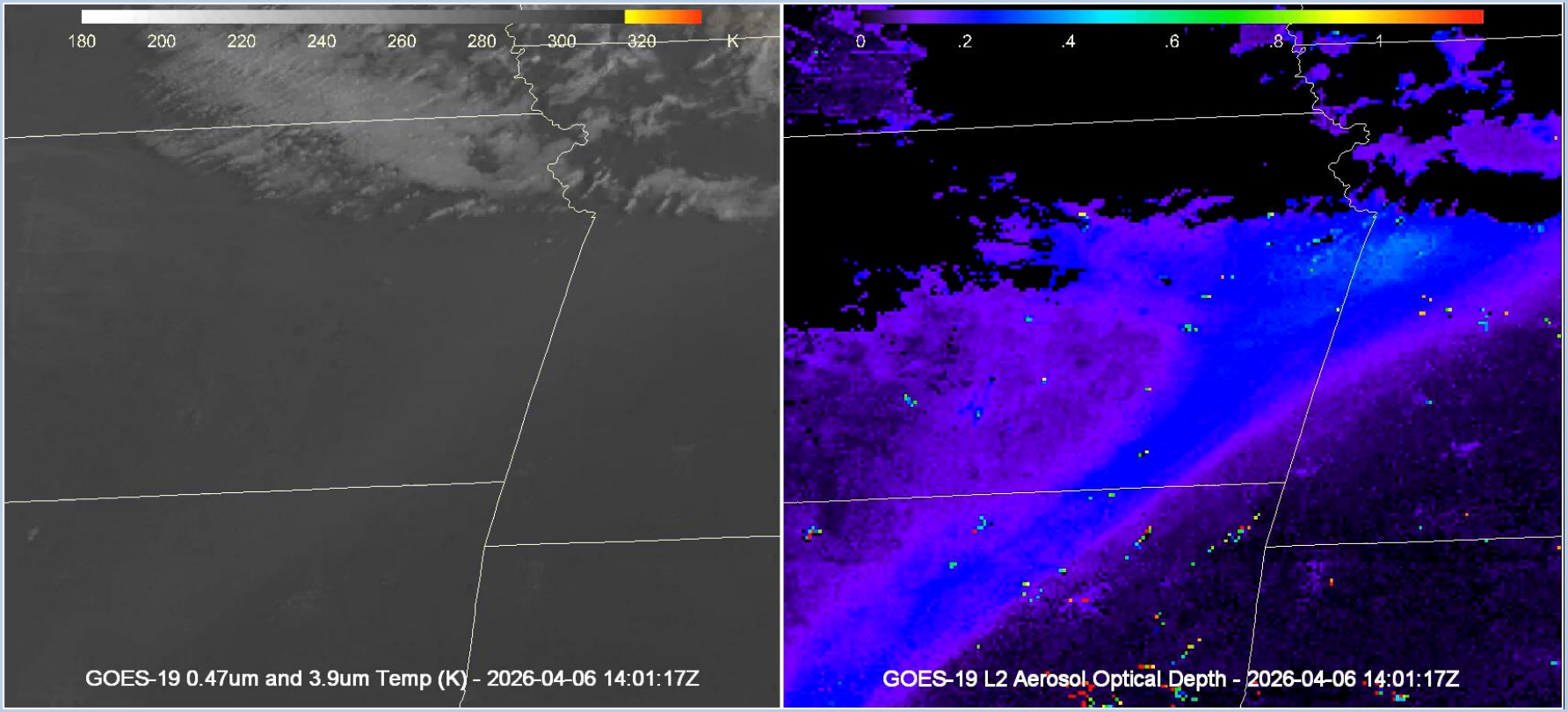
Quantitative Continuity: Beyond Visualization to Pixel-Level Analysis





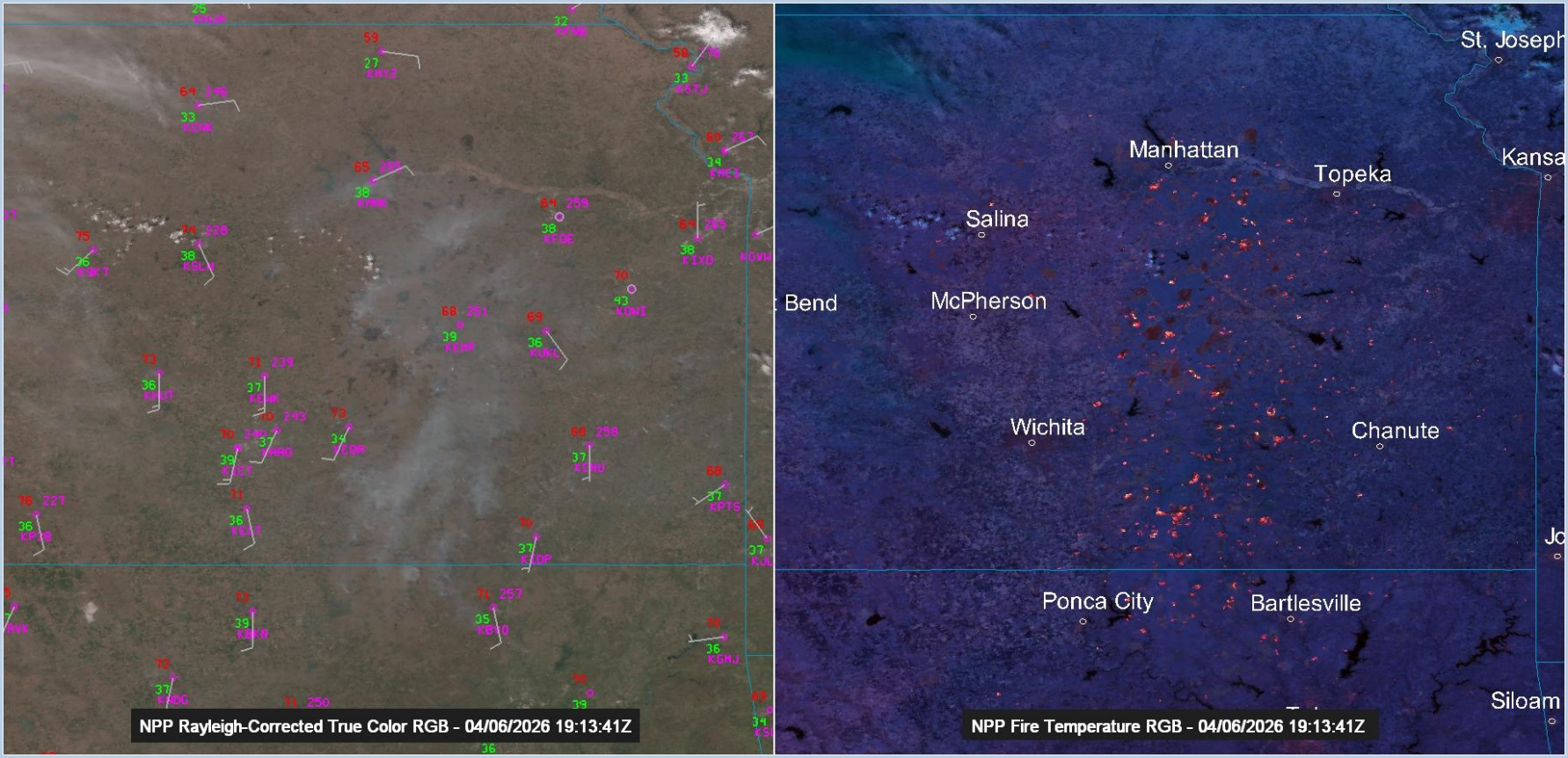
The left image above is an Image Display of GEMS Total Column NO2 (DU) with a black transect line where the endpoints are determined by the user. The transect showing the NO2 value along the line appears in the Data Explorer window and is shown on the right. The left image also demonstrates how McIDAS-V can analyze data on a pixel-by-pixel basis. Below the display shows the numerical value of the displayed variable at the cursor's location.

From Pixels to Products: Integrating L1b Imagery with L2 Aerosol Optical Depth



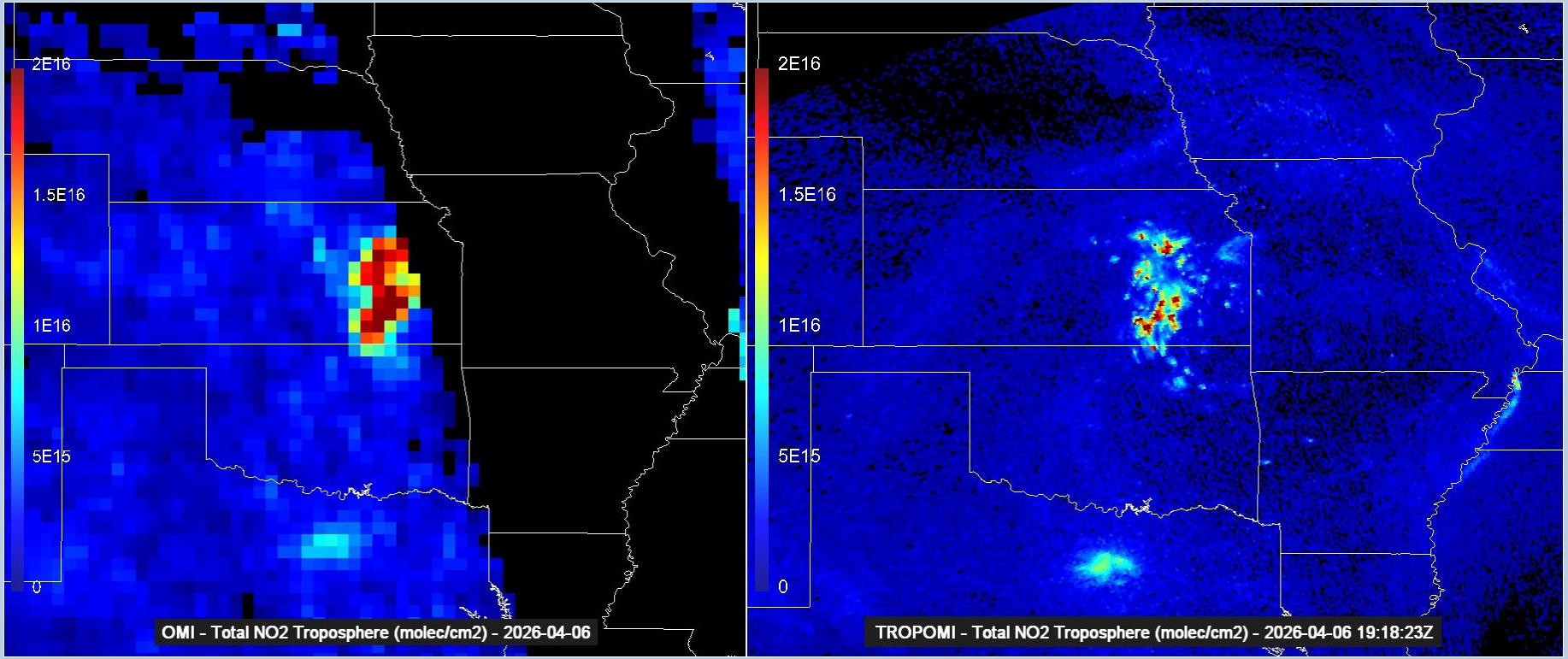
The GOES East animation above, from 04/06/2026, Highland fire activity over Kansas.
Left = Band 1 visible image overlaid with 3.9um Temperatures highlighting fire activity.
Right = L2 Aerosol Optical Depth. This allows for both qualitative and quantitative analysis.

JPSS VIIRS RGBs and METARS



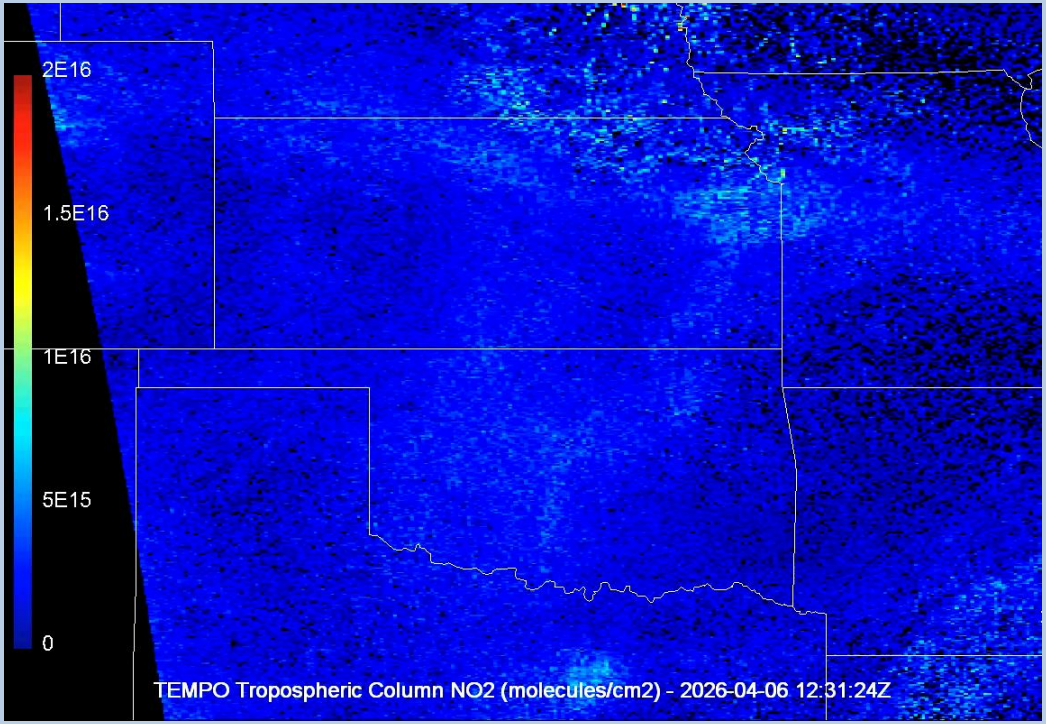
Left = Suomi NPP Rayleigh Corrected True Color RGB overlaid with METARs.
Right = Suomi NPP Fire Temperature RGB overlaid with city labels.

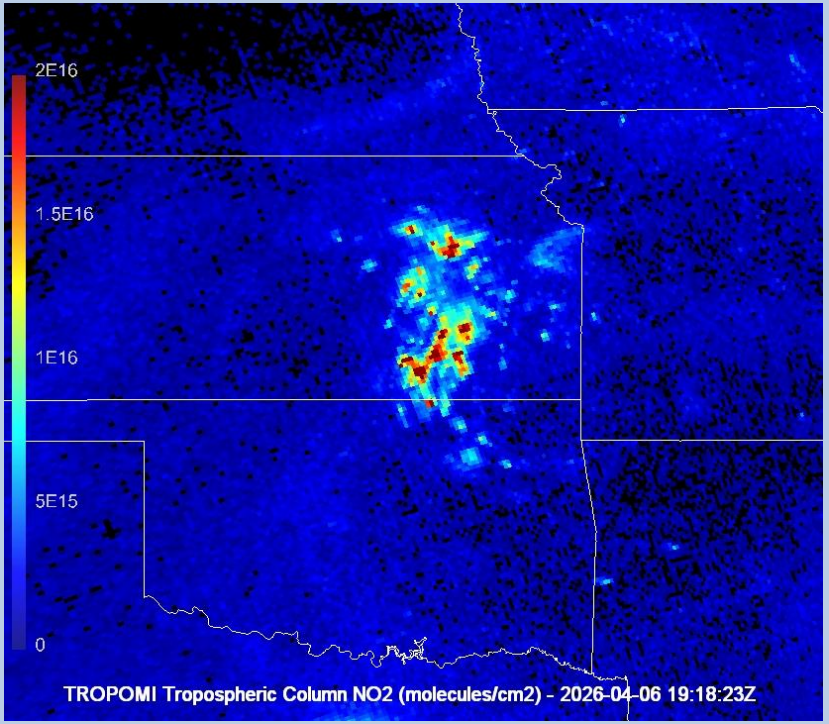
NO2 from OMI and TROPOMI



Left = OMI Tropospheric NO2 (molecules/cm2)
Right = TROPOMI Tropospheric NO2 (molecules/cm2)
Side by side comparison of the same product with matching enhancements and domains allows for easy comparison across sensors for validation and comparison.

NO2 from TEMPO and TROPOMI





Left = Animation of TEMPO NO2 v4 (molecules/cm2) from 13-19Z (hourly) on 04/06/2026.
Right = Image of TROPOMI NO2 (molecules/cm2) from 19Z on 04/06/2026.
McIDAS-V allows for quick comparisons of data across different sensors.

Summary

- McIDAS-V is a freely available software package that can be used to display and analyze a wide variety of data relevant to air quality applications for research or real-time monitoring and decision making. Supported instruments include TROPOMI, TEMPO, and GEMS.
- McIDAS-V can be used in a variety of ways related to satellite data continuity including:
  - Support for a variety of current and legacy instruments (back ~50 years)
  - Support for data on a global scale
  - Support for combining GEO and LEO data in the same display

Thank You!

Bob Carp

UW-Madison SSEC

rcarp@ssec.wisc.edu

https://www.ssec.wisc.edu/mcidas/software/v/
Installers – Tutorials – Documentation - Support