

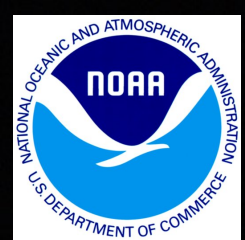


Community Satellite Processing Package (CSPP) for Low Earth Orbit (LEO) Satellites: Current Status and Future Evolution

Liam Gumley, Kathy Strabala, Geoff Cureton,
Matthew Odle, Tom Rink, Jess Braun, Graeme Martin

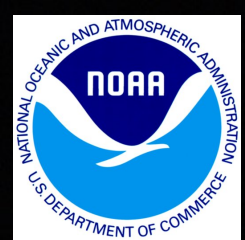
Cooperative Institute for Meteorological Satellite Studies
Space Science and Engineering Center
University of Wisconsin-Madison

CSPP Users' Group Meeting, May 2026



Changes since CSPP UGM in June 2022

- 04/2023: FY-3G launch
- 06/2023: NASA Direct Readout Lab shutdown
- 08/2023: FY-3F launch
- 11/2023: NOAA-21 declared operational
- 05/2024: Terra direct broadcast deactivated
- 08/2024: Arctic Weather Satellite launched
- 06/2025: NOAA-18 decommissioned
- 08/2025: NOAA-19 decommissioned
- 08/2025: Metop-SGA1 launched
- 09/2025: FY-3H launched



Community Satellite Processing Package



- Community Satellite Processing Package - Low Earth Orbit (CSPP LEO) is a suite of freely available software for processing data acquired via direct broadcast from polar orbiting earth observation satellites.
- CSPP LEO supports the creation of calibrated observational data, geophysical derived products, and imagery from visible, infrared, and microwave sensors.
- CSPP LEO is funded by NOAA JPSS and LEO Program.

<https://cimss.ssec.wisc.edu/cspp/>

CSPP LEO supports users worldwide

Cordoba, Argentina



Dhahran, Saudi Arabia

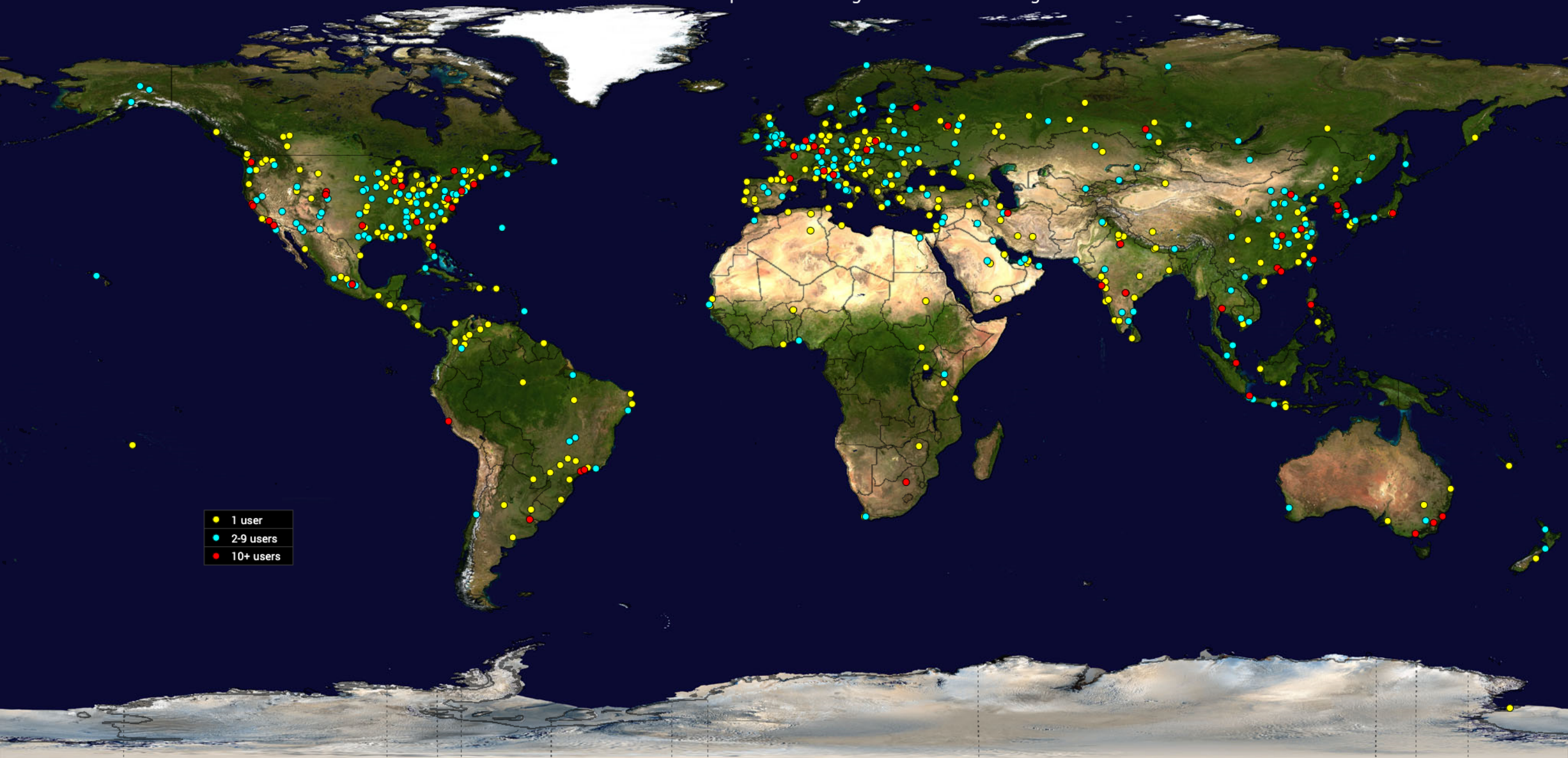


Union Glacier, Antarctica

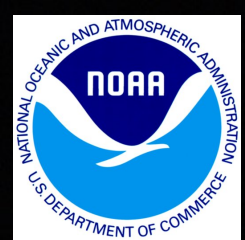


Who uses CSPP LEO?

CSPP user database on 2026-05-12 comprises 3769 registrants downloading to 107 countries



CSPP LEO is used by operational agencies including EUMETSAT, Meteo France, BoM, Met Office, ECCC, KMA, FMI, SMHI, CMA, INPE, CONAE, IMD, NIWA

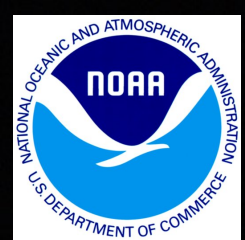


Features of CSPP LEO

- Uses NOAA/NESDIS/STAR enterprise algorithms and software;
- Supports multiple satellites and sensors;
- Ready to run on 64-bit Rocky Linux 8 (source code available on request);
- Easy to install and run;
- Prompt, friendly, and expert user support.

CSPP LEO Satellites and Sensors

- JPSS: NOAA-21, NOAA-20 and Suomi NPP (VIIRS, CrIS, ATMS, OMPS)
- Metop: Metop-B/C (IASI, AMSU-A, MHS, HIRS, AVHRR)
- EOS: Aqua (MODIS, AIRS)
- GCOM: GCOM-W1 (AMSR-2)
- Fengyun: FY-3D (MERSI-2) and FY-3E (MERSI-LL)



CSPP LEO Products

Sensor Data Records

Calibrated and geolocated VIIRS, CrIS, ATMS, and OMPS

Imagery

Georeferenced single band, RGB, true color, false color in GeoTIFF, JPEG, AWIPS2, KML for many sensors and products...

Atmosphere

Cloud Mask, Cloud Properties, Aerosol Optical Depth, Volcanic Ash Properties, Temperature and Moisture Profiles, Trace Gases, Precipitation, Snowfall, ...

Land

Active Fires, Surface reflectance, Land surface temperature, Vegetation indices, Flood detection, Snow properties

Ocean

Sea surface temperature, Sea ice



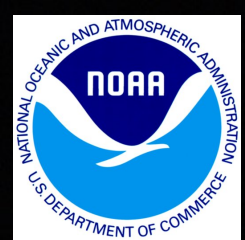
CSPP LEO Software Packages (May 2026)



CSPP Package	Product Description
1. Sensor Data Records (SDR) v4.1.1	VIIRS, CrIS, ATMS, and OMPS geolocated calibrated earth observations (NOAA algorithm).
2. VIIRS Radiance Clusters v1.0	VIIRS Radiance statistics within CrIS field of view (NOAA algorithm).
3. Polar2Grid v3.2	Reprojected imagery (single and multi-band) in GeoTIFF and AWIPS formats.
4. VIIRS Atmosphere v1.0	VIIRS imager aerosol optical depth, cloud properties, and volcanic ash (NOAA algorithm).
5. VIIRS Active Fires v2.1	VIIRS imager wildfire detection (NOAA algorithm).
6. VIIRS Flood Detection v2.0	VIIRS imager flood detection (NOAA algorithm).
7. VIIRS Surface Properties v2.0	VIIRS imager surface reflectance, NDVI, and EVI (NOAA algorithm).
8. VIIRS Cryosphere v1.0	VIIRS imager ice age, concentration, and thickness (NOAA algorithm).
9. MIRS v4.0	Microwave sounder retrievals of temperature and moisture profiles; surface properties; snow and ice cover; rain rate; and cloud/rain water paths (NOAA algorithm).
10. HEAP v3.0	Combined hyperspectral infrared sounder and microwave sounder retrievals of temperature and moisture profiles, cloud cleared radiances, and trace gases (NOAA algorithm).
11. ACSPO v3.0	Multispectral imager retrievals of sea surface temperature (NOAA algorithm).
12. GAASP v1.0.2	Microwave retrievals of ocean, precipitation, soil, and cryosphere properties (NOAA algorithm).
13. Sounder Quicklook v1.3	Projected 2D maps of temperature and water vapor retrievals, and Skew-T profiles for individual atmospheric profiles.
14. HSRTV v2.0	Hyperspectral infrared sounder retrievals of temperature and moisture profiles, cloud properties, total ozone, and surface properties.
15. RT-STPS v7.0	Transform demodulated CADU bitstream to RDR for Level 0 ormat.

Recommended server specifications

- Processing load is increased with 3 x JPSS satellites in the same orbit plane and separation of 25 minutes.
- Need to avoid processing two passes simultaneously (VIIRS, CrIS, ATMS, OMPS).
- Recommended minimum server specs are 96 cores (Intel or AMD), 256 GB RAM, fast SSD for scratch/work space, and Rocky Linux 8.



CSPP LEO releases in the last year (1 of 2)

March 25, 2026 : SDR for VIIRS, CrIS, ATMS and OMPS v4.1.1

Patch for CSPP Sensor Data Record (SDR) Version 4.1 that implements the ATMS Beam Alignment Correction Rotation Matrix update that went into the JPSS global data processing system at 15 UTC on December 15, 2025. This affects the ATMS geolocation for all instruments (NOAA-21, NOAA-20 and SNPP ATMS). The patch can be installed either as part of a new SDR installation, or over an existing Version 4.1 installation.

March 2, 2026: Polar2Grid v3.2

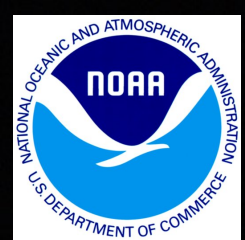
Update to the Polar Orbiter Satellite visualization software tool Polar2Grid. This version supports additional CSPP VIIRS Environmental Data Records, adds support for using data directly from the JPSS AWS Marketplace, and adds readers for the Arctic Weather Satellite and CSPP AMSR2 GAASP Level 2 products.

January 8, 2026: VIIRS Cryosphere v1.0

Software for creating JPSS VIIRS Cryosphere Product Environmental Data Records (EDRs). This software supersedes the Cryosphere Products that were created using the CSPP ASCI software. The software adds support for NOAA-21 VIIRS and the algorithms have been updated to NOAA atmosphere versions 3.3/3.2.

December 9, 2025: VIIRS Surface Reflectance and Vegetation Index v2.0

Updated release of NOAA-21, NOAA-20 and Suomi-NPP VIIRS software that supports the creation of JPSS VIIRS Enterprise algorithm Surface Reflectance Environmental Data Record (EDRs) and Vegetation Index retrievals. This version adds support for NOAA-21 VIIRS and uses inputs from CSPP VIIRS ATMOS.



CSPP LEO releases in the last year (2 of 2)

December 3, 2025: CSPP HEAP Sounder Retrieval v3.0

New release of the CSPP NOAA Hyper-Spectral Enterprise Algorithm Package (HEAP) NUCAPS EDR sounder software for retrieving atmosphere profiles of temperature, moisture and trace gasses as well as cloud-cleared radiances. This version adds support for NOAA-21 CrIS/ATMS with an updated code base to NOAA HEAP Version 3.2.

August 13, 2025: VIIRS Radiance Clusters v1.0

First release of software that ingests JPSS VIIRS and CrIS Sensor Data Records (SDRs) and produces Binary Universal Form for Data Representation (BUFR) product files containing CrIS radiances and collocated VIIRS radiance cluster statistics. Supports the NOAA-20 and NOAA-21 missions.

July 24, 2025: VIIRS Flood Detection v2.0

New release of the VIIRS I-Band resolution (375m) flood detection software. This version includes significant updates including support for NOAA-21 VIIRS, as well as improvements in execution speeds. The output files are now in NetCDF4 format with standard JPSS EDR file naming conventions.

June 19, 2025: Advanced Clear-Sky Processor for Oceans (ACSPO) v3.0

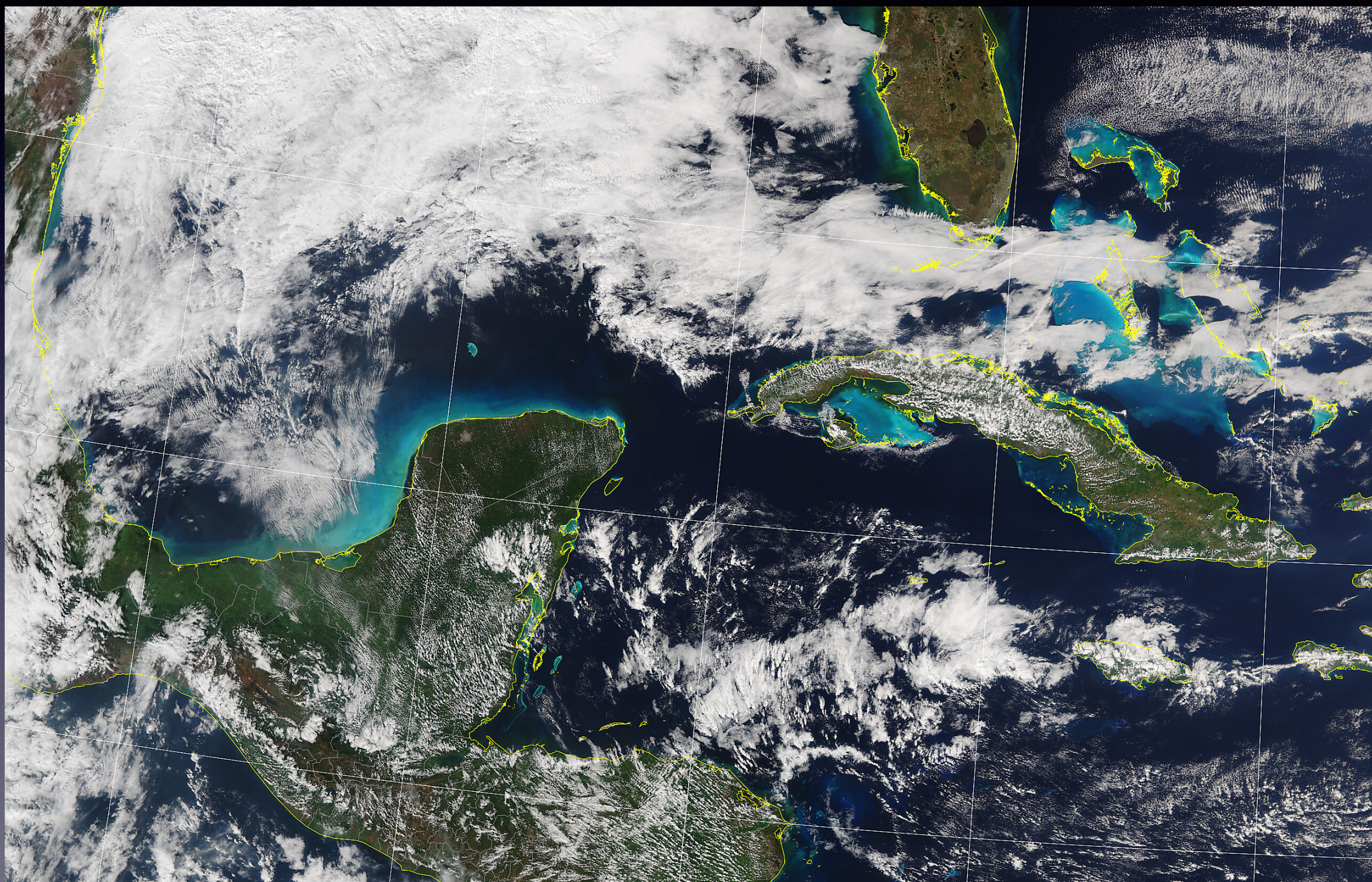
New release of the of the NOAA/NESDIS/STAR ACSPO software that retrieves sea surface temperatures from input JPSS VIIRS imagers. This release adds support for NOAA-21 VIIRS and includes significant performance improvements.

March 20, 2025: VIIRS EDR Atmosphere v1.0

Software for creating JPSS VIIRS Atmosphere Product Environmental Data Records (EDRs). This software supersedes the Atmosphere Products that were created using the CSPP ASCI software. The software adds support for NOAA-21 VIIRS and the algorithms have been updated to NOAA atmosphere version 3.2.

NOAA-21 VIIRS from CSPP

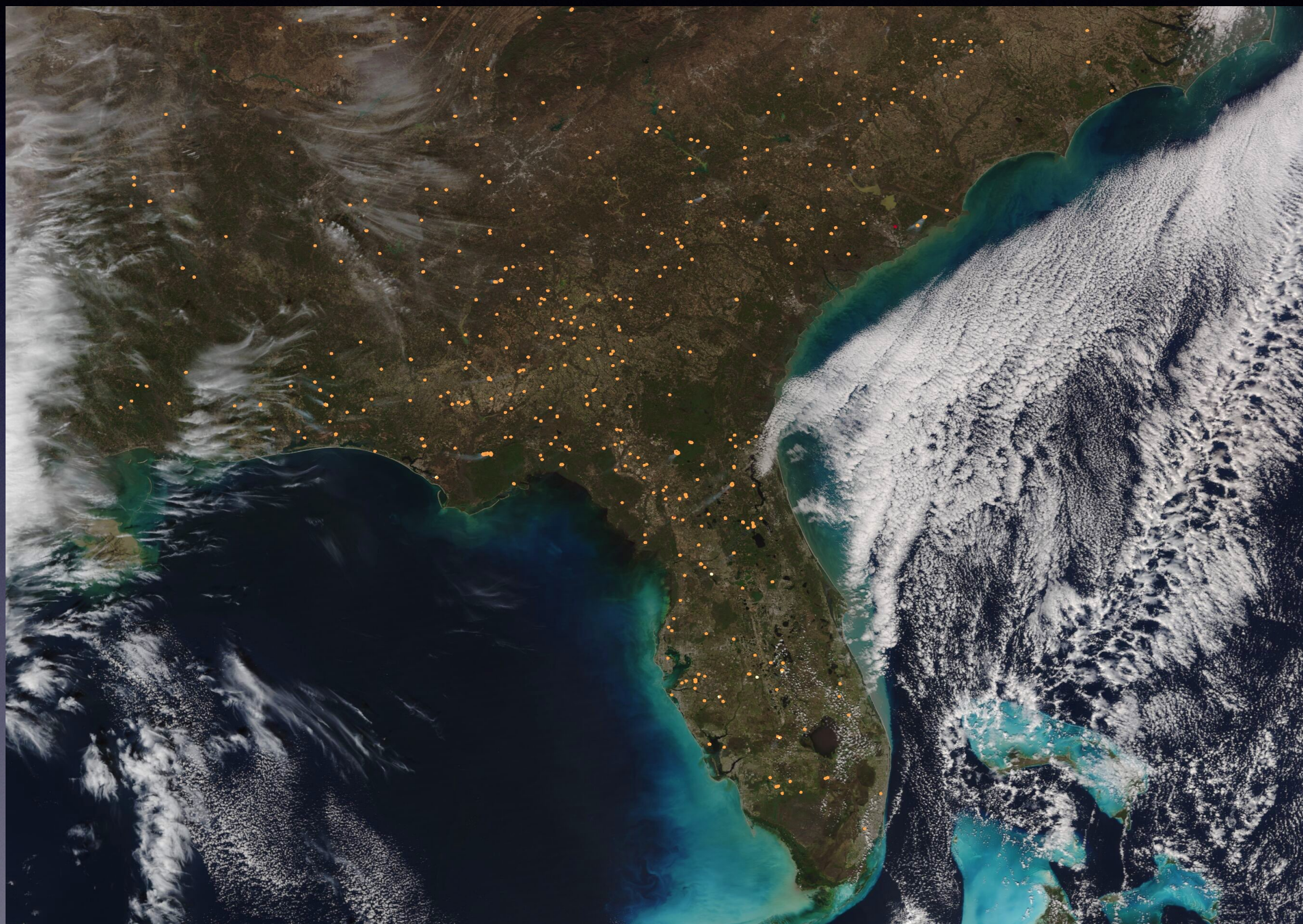
NOAA-21 VIIRS True Color 2025/01/12 18:53 UTC
Received at UPR-Mayaguez; processed by CSPP SDR and Polar2Grid



NOAA-21 VIIRS Active Fires from CSPP

NOAA-21 VIIRS True Color 2024/02/07 18:24 UTC

Received at NOAA AOML; processed onsite by CSPP SDR 4.0, Actives Fires 2.1, and Polar2Grid 3.0



NOAA-21 VIIRS Flood Detection from CSPP

NOAA-21 VIIRS Flood Map 23 Feb 2025

Received at SSEC; processed onsite by CSPP SDR and VIIRS Flood Detection

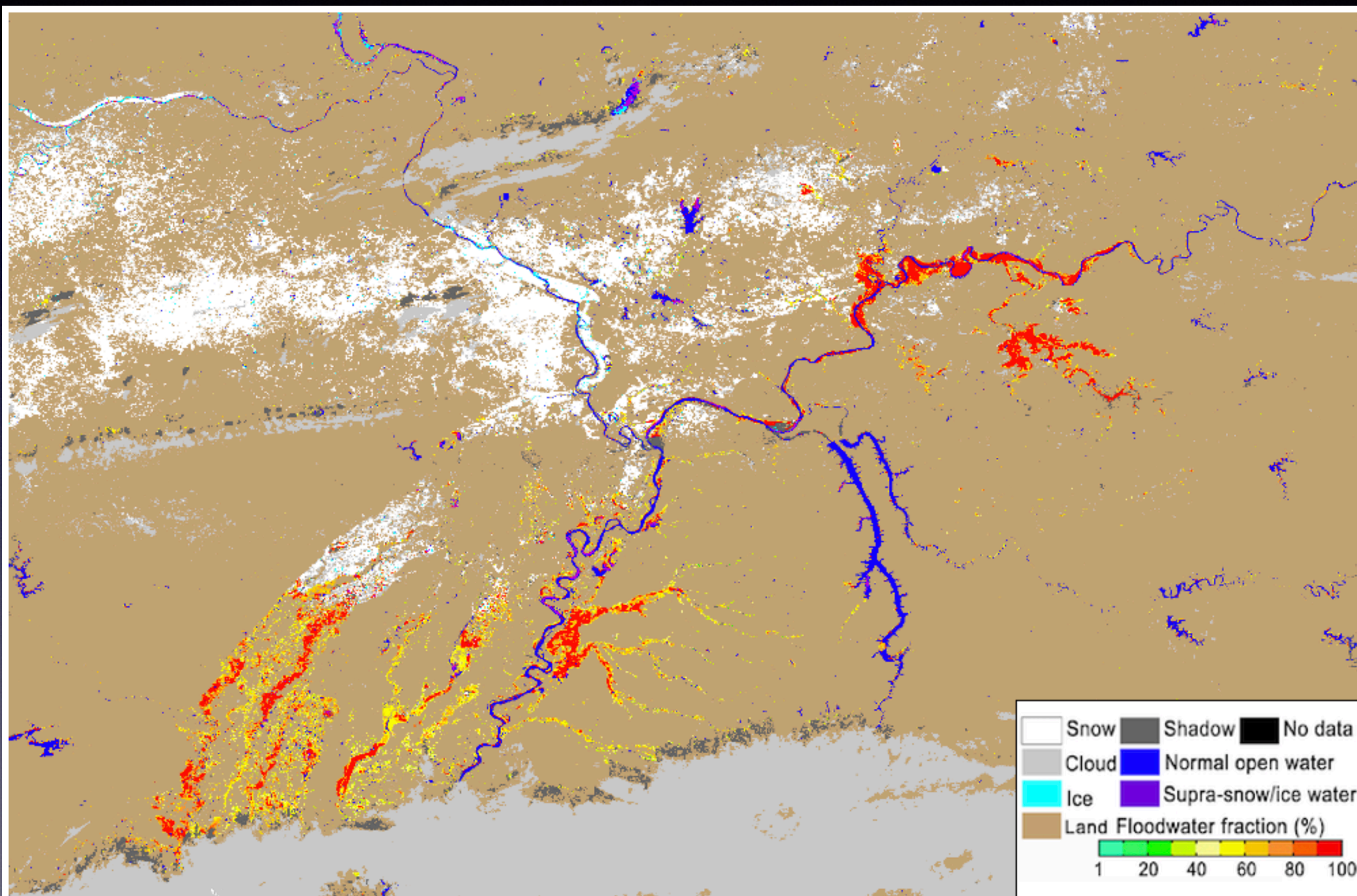
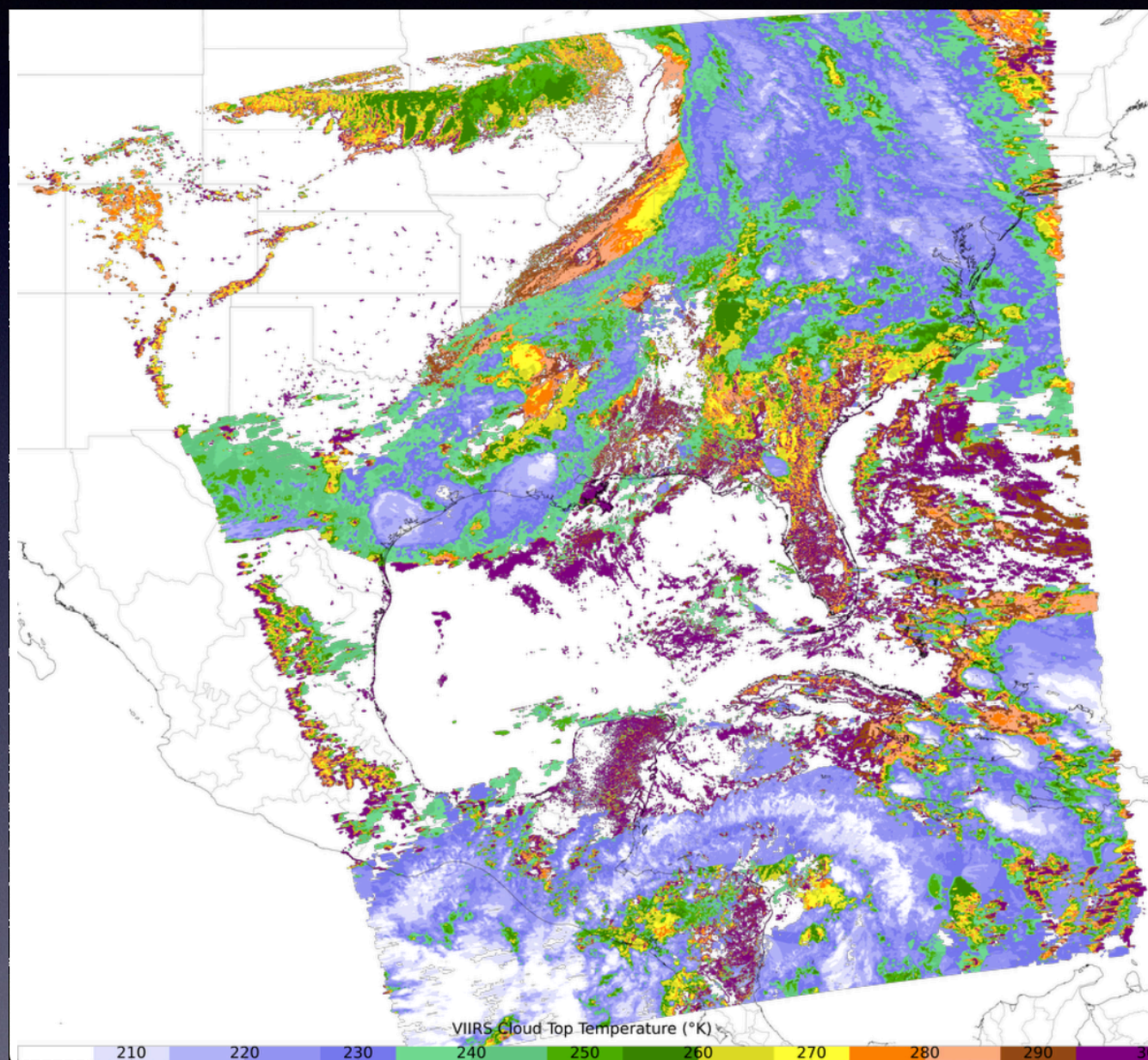


Figure 2. GeoTIFF merged image of the CSPP Flood Product covering an Area of Interest that includes flooding in the US Ohio and Mississippi river and tributaries. The data was acquired from NOAA-21 VIIRS on 23 February 2025.

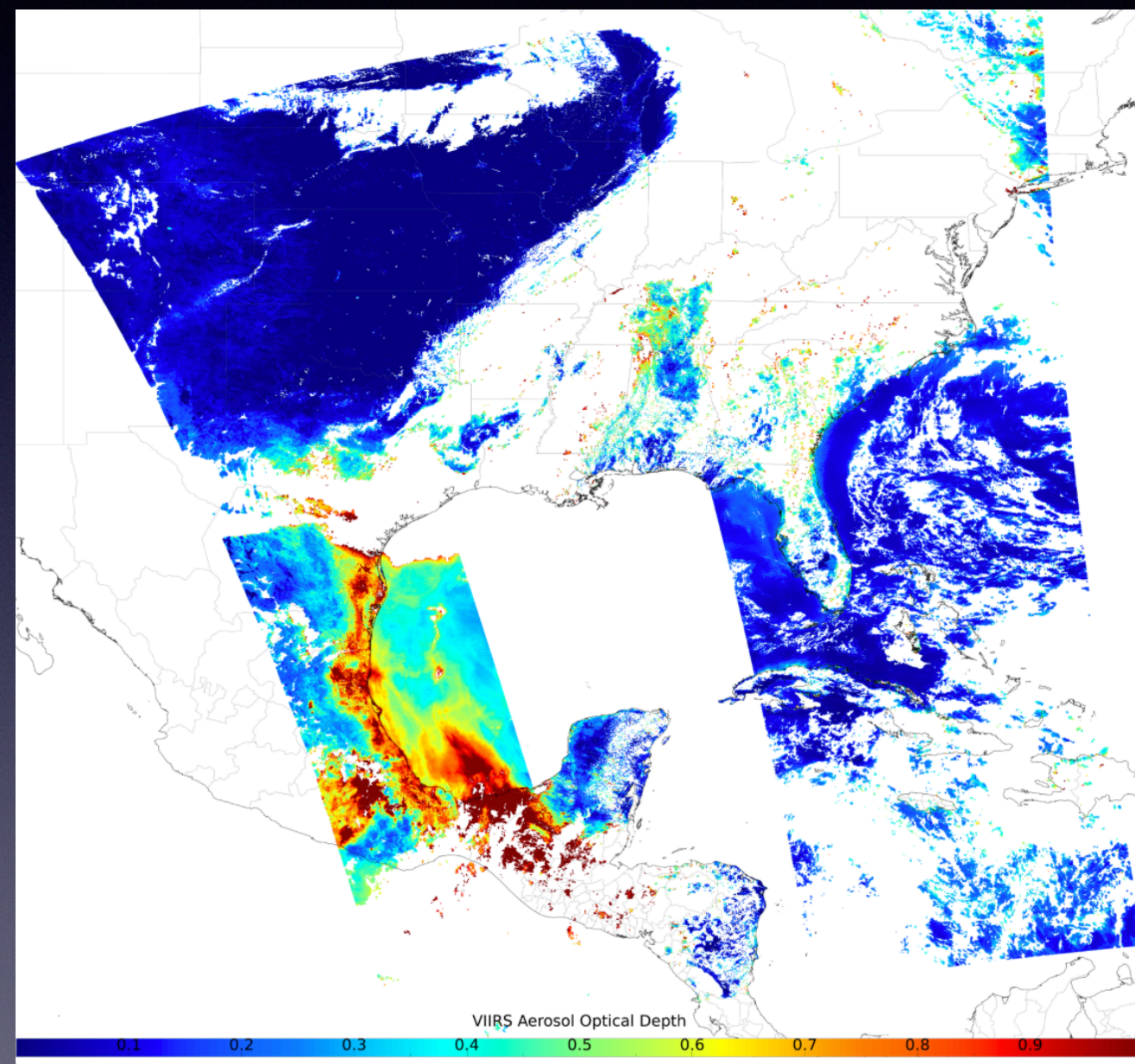
NOAA-21 VIIRS Cloud Product from CSPP

NOAA-21 VIIRS Clouds and Aerosols 5 June 2024 18:50 UTC

Received at SSEC; processed onsite by CSPP SDR, VIIRS ATMOS, and Polar2Grid



Cloud Top Temperature

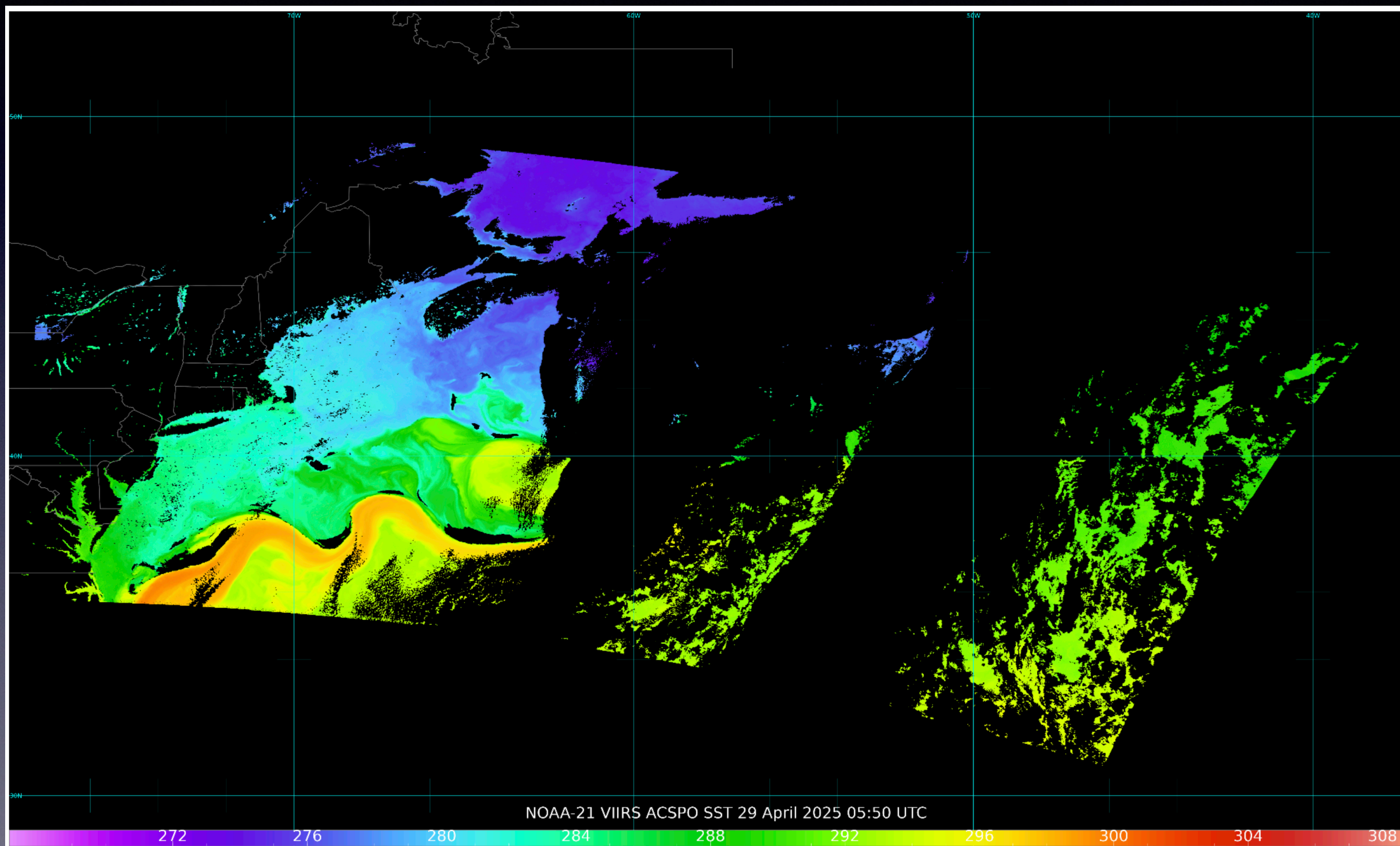


Aerosol Optical Depth

NOAA-21 VIIRS SST from CSPP

NOAA-21 VIIRS Sea Surface Temperature 29 April 2025 05:50 UTC

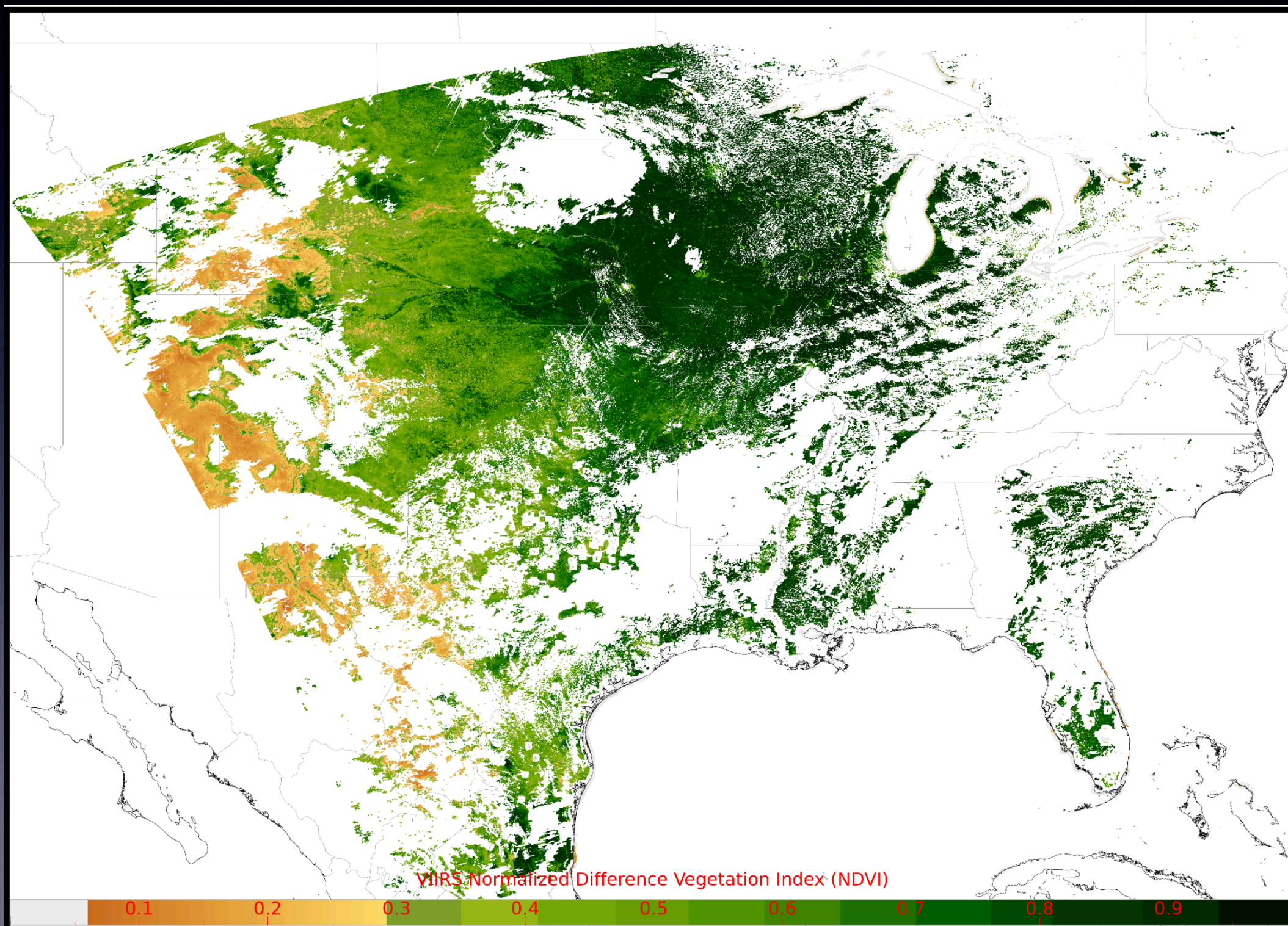
Processed by CSPP VIIRS ACSPO and Polar2Grid



NOAA-21 VIIRS NDVI from CSPP

NOAA-21 VIIRS NDVI 13 August 2025

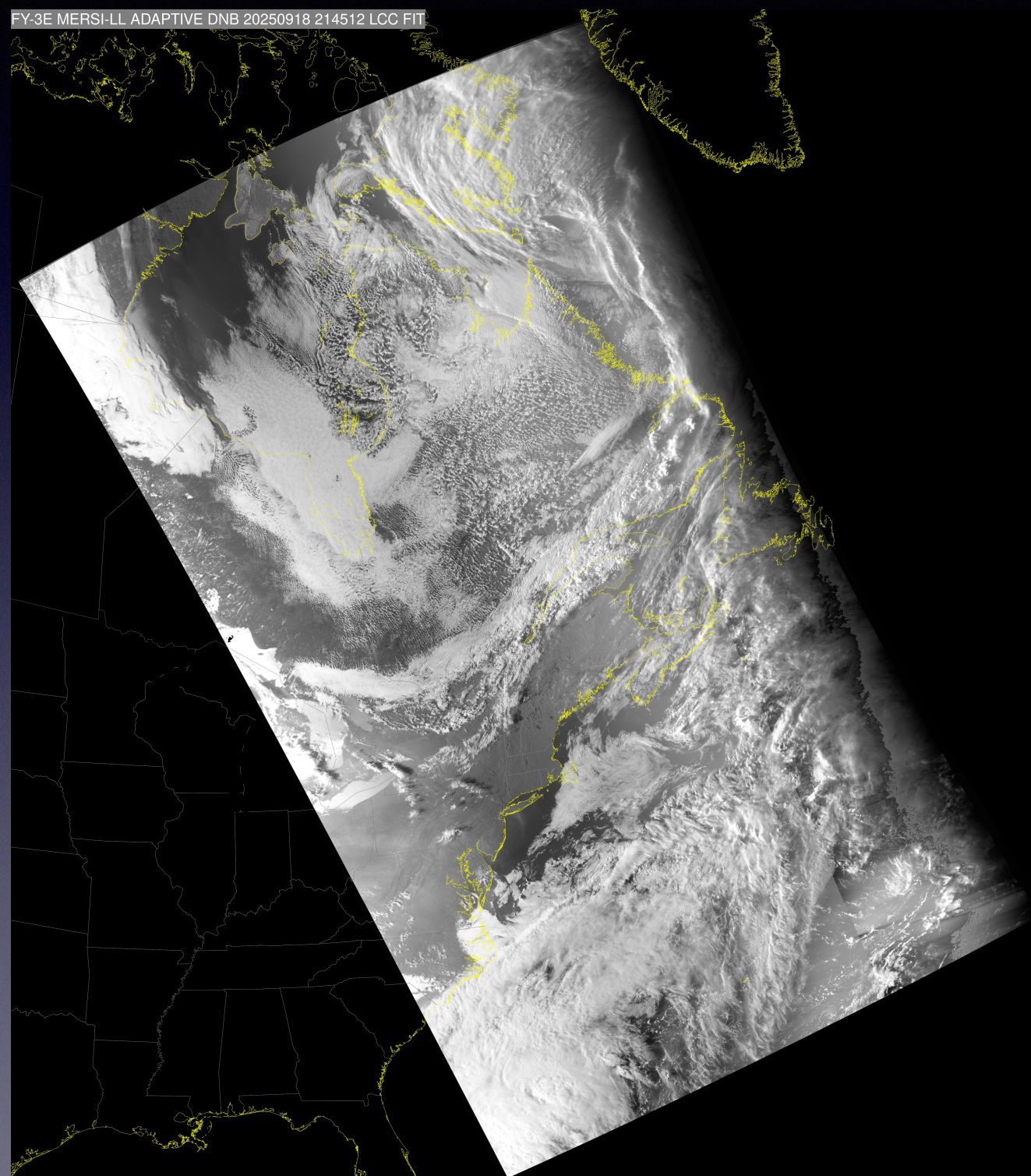
Processed by CSPP VIIRS Land Surface Reflectance and Polar2Grid



FY-3E MERSI-LL imagery from CSPP

FY-3E MERSI-LL low light channel 18 September 2025 21:45 UTC

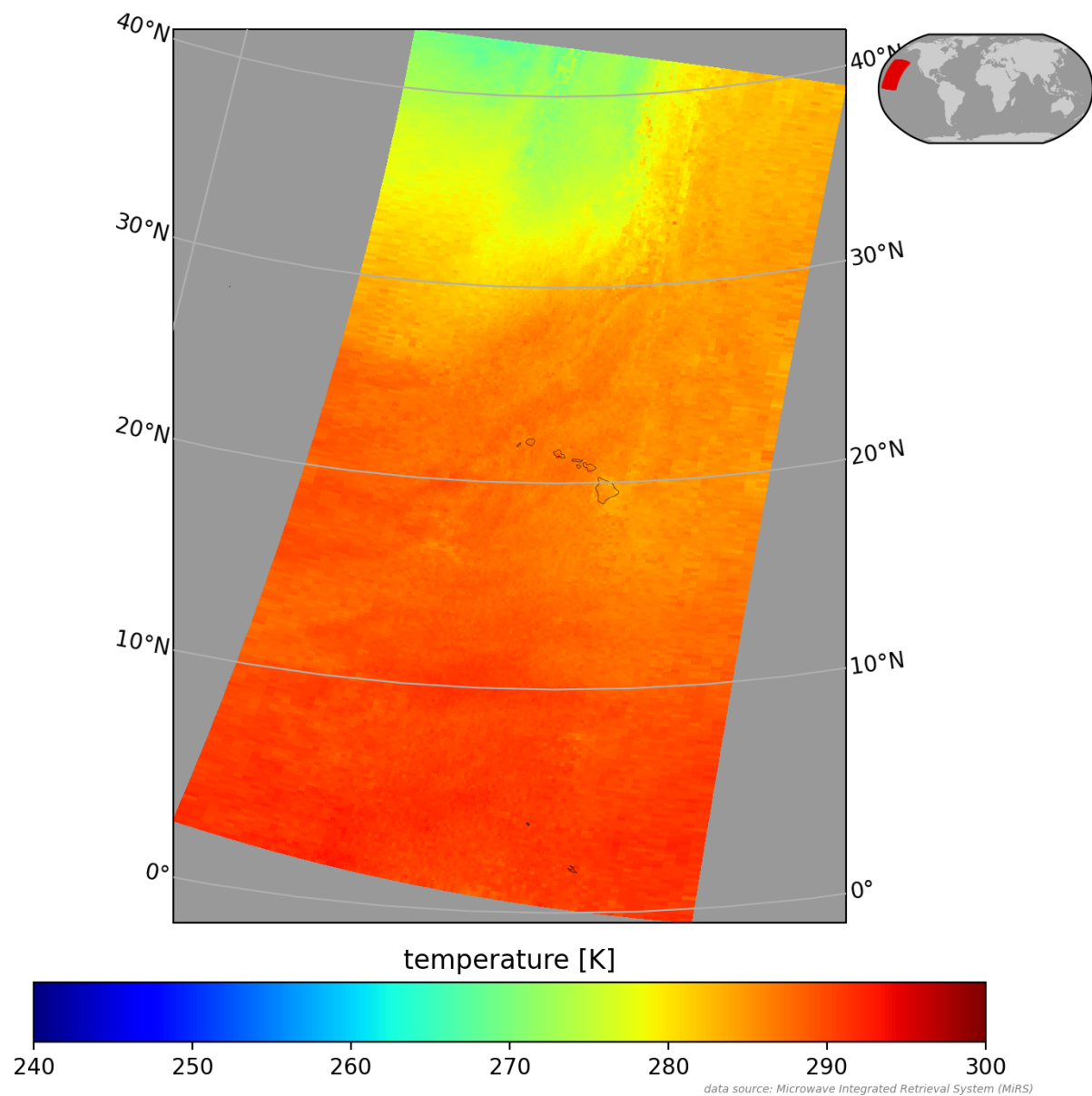
Received at SSEC and processed by CSPP Polar2Grid



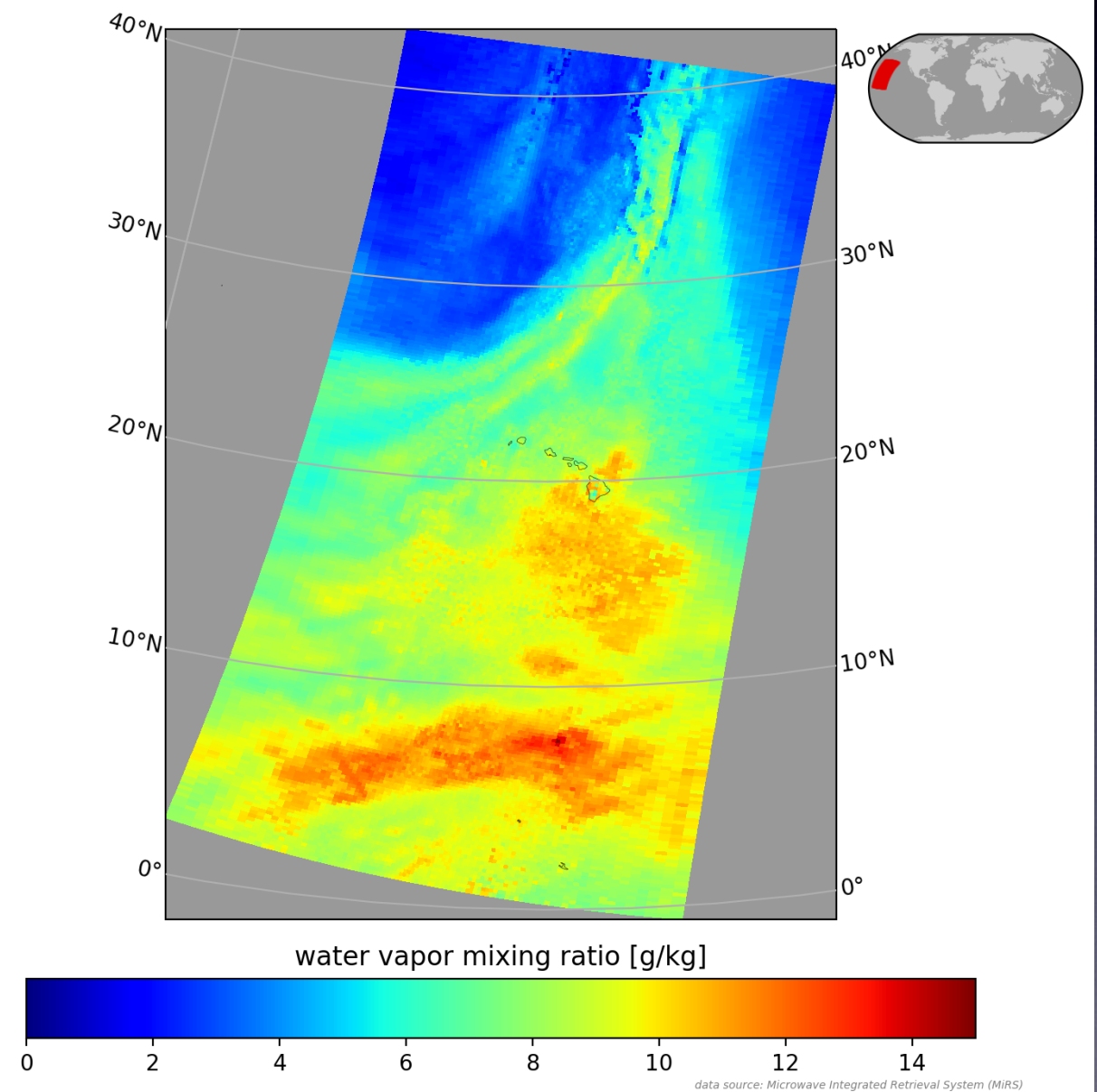
NOAA-21 ATMS MiRS from CSPP

NOAA-21 ATMS 2025/01/14 12:08 UTC
Received at HCC Honolulu; processed onsite by CSPP SDR 4.0 and MiRS 4.0

NOAA-21, MiRS temperature @ 840.08 hPa
2025-01-14 12:08Z

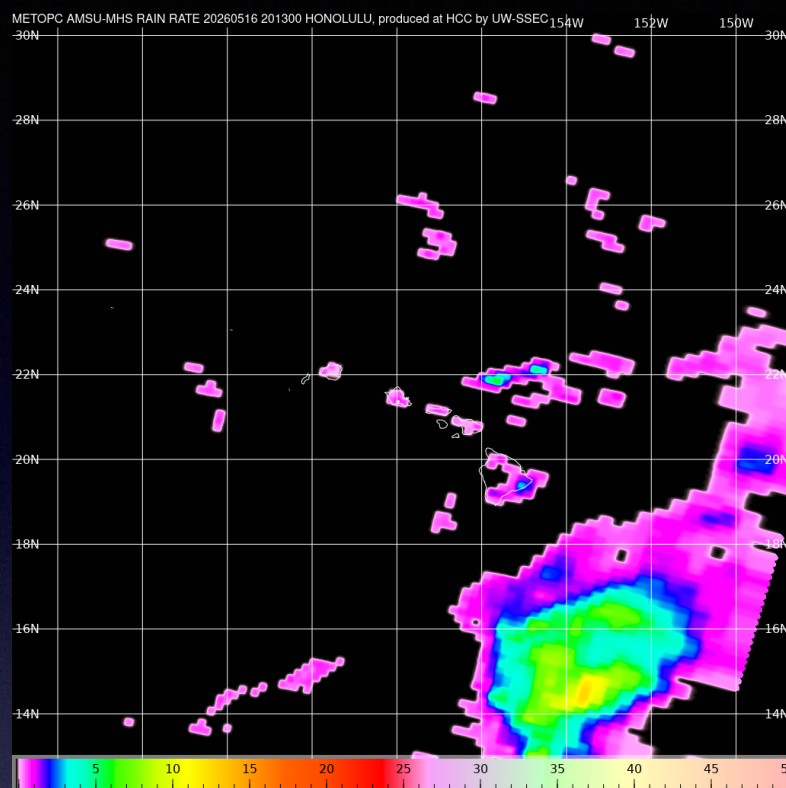


NOAA-21, MiRS water vapor mixing ratio @ 840.08 hPa
2025-01-14 12:08Z

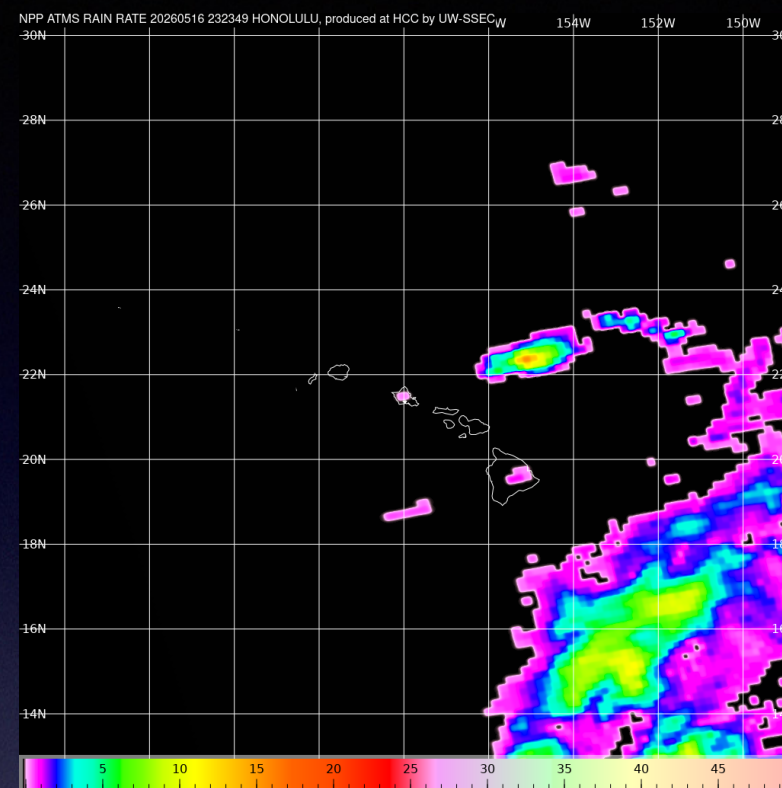


CSPP MiRS and GAASP rain rate

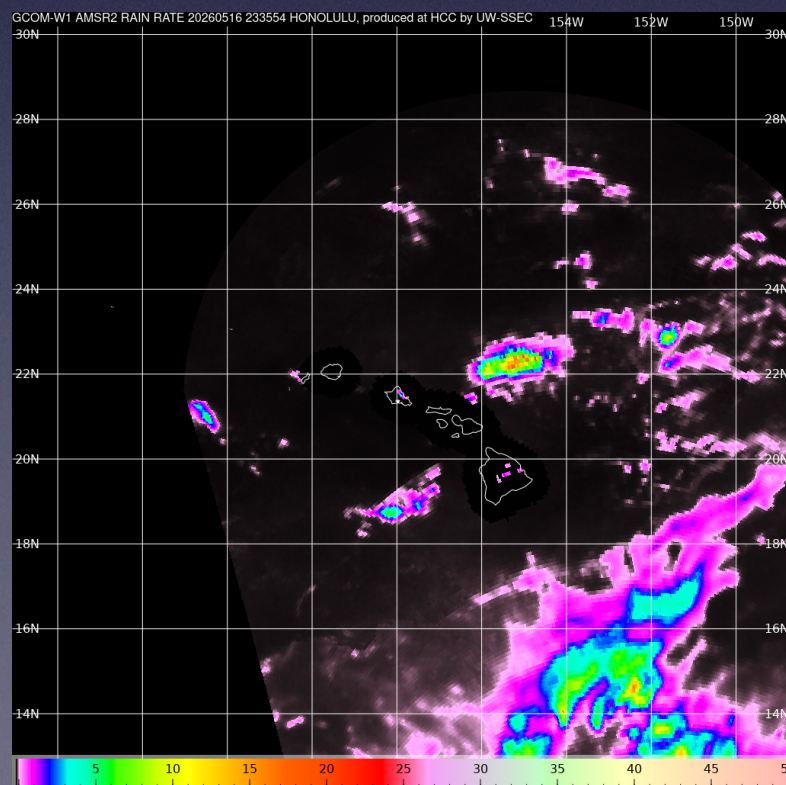
Metop-C
AMSU/MHS
20260516
20:13
CSPP MiRS



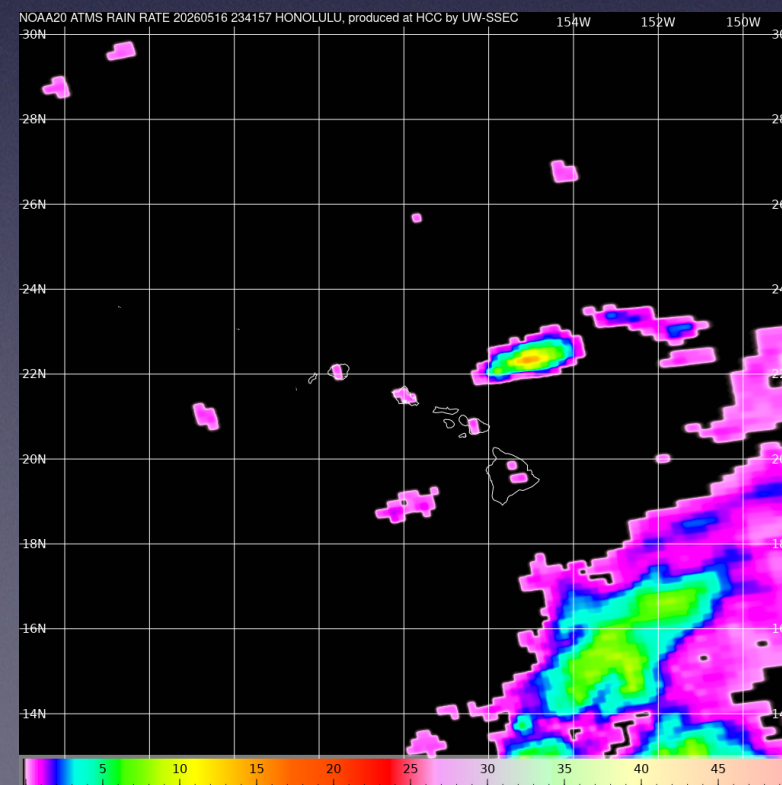
SNPP
ATMS
20260516
23:23
CSPP MiRS



GCOM-W1
AMSR2
20260516
23:35
CSPP GAASP

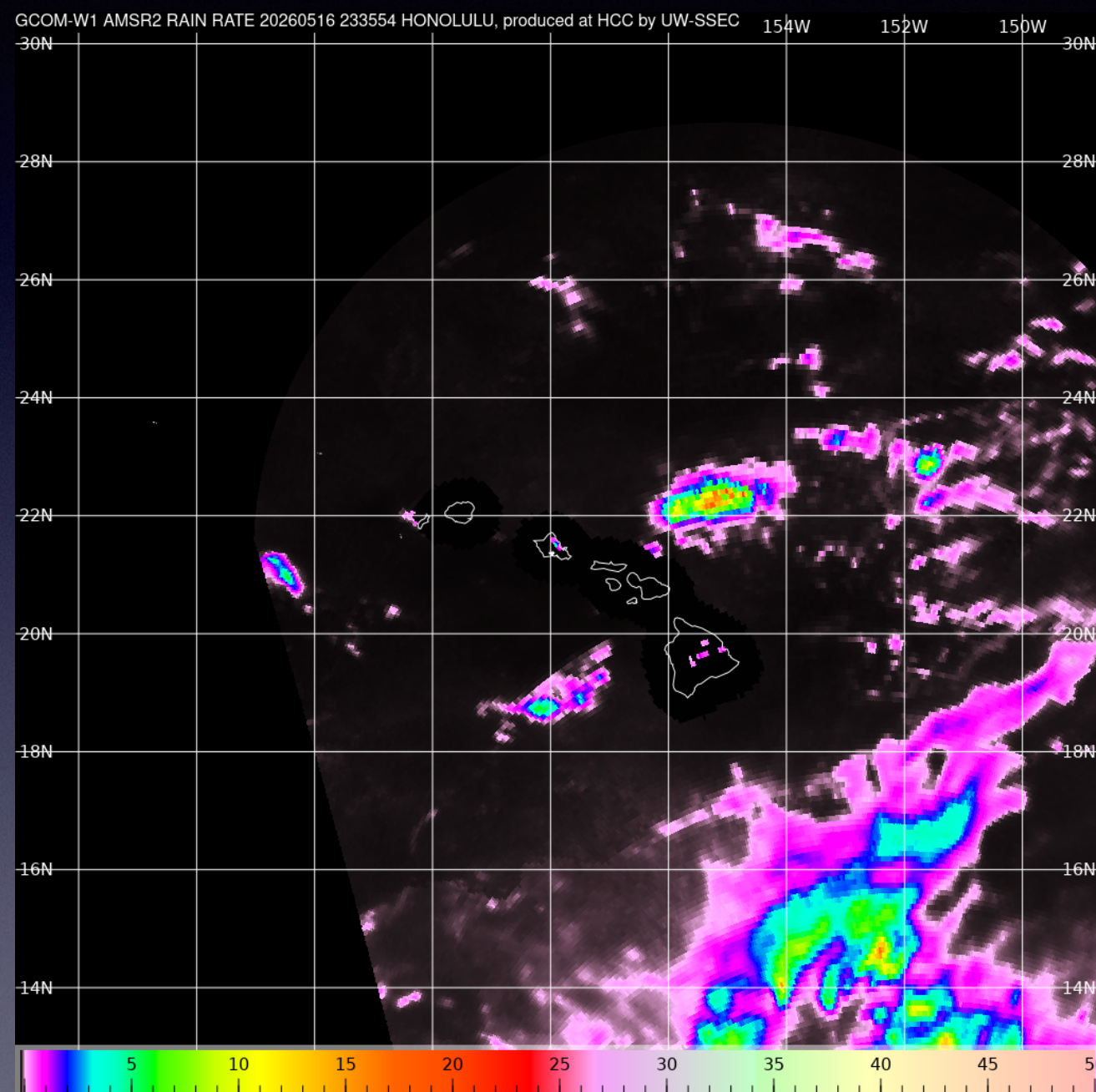


NOAA-20
ATMS
20260516
23:41
CSPP MiRS

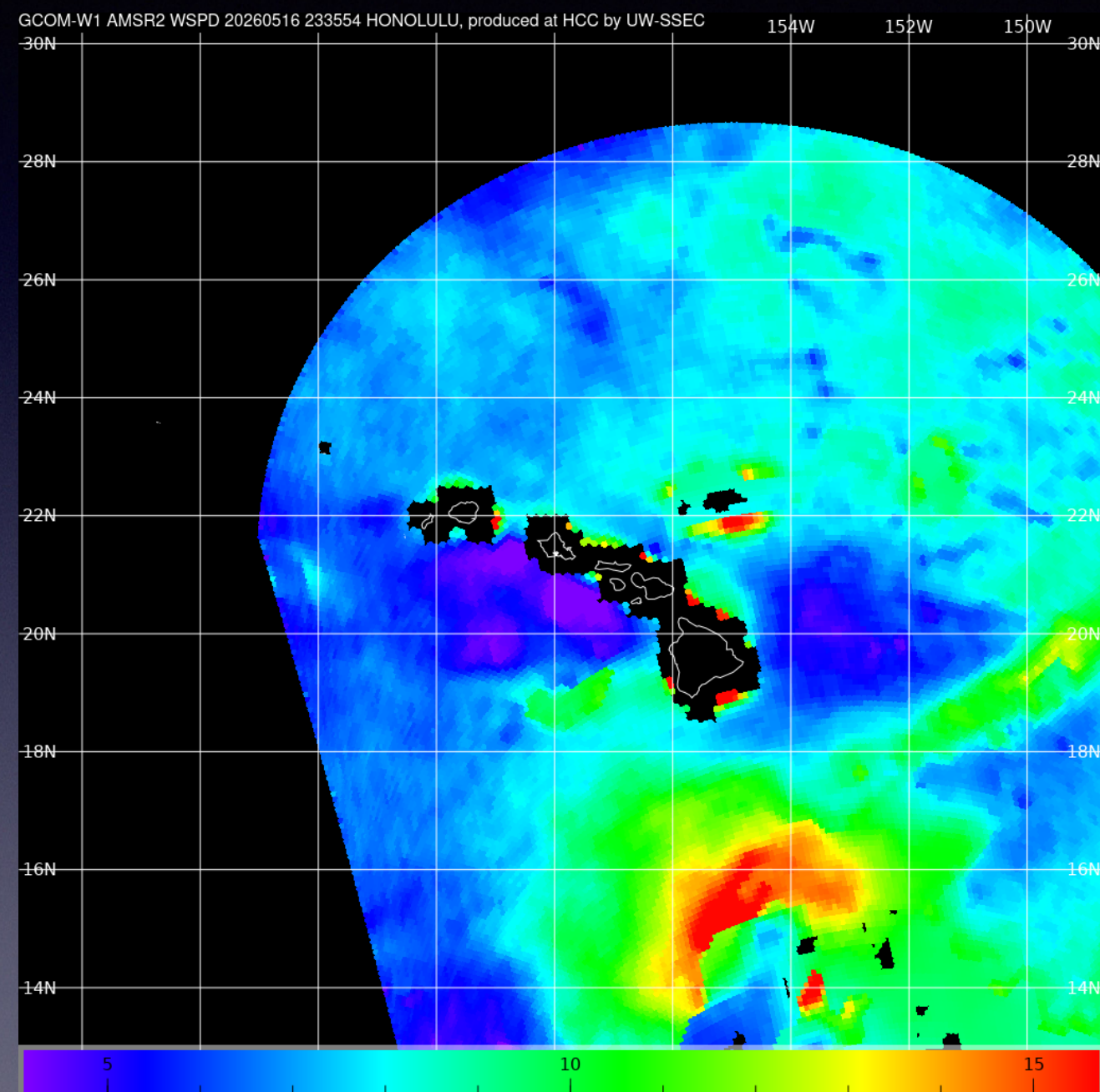


CSPP GAASP rain rate and wind speed

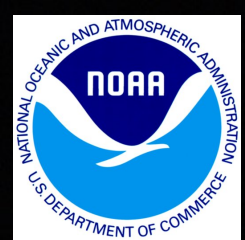
GCOM-W1 AMSR2 20260516 23:35



CSPP GAASP Rain Rate



CSPP GAASP Surface Wind Speed



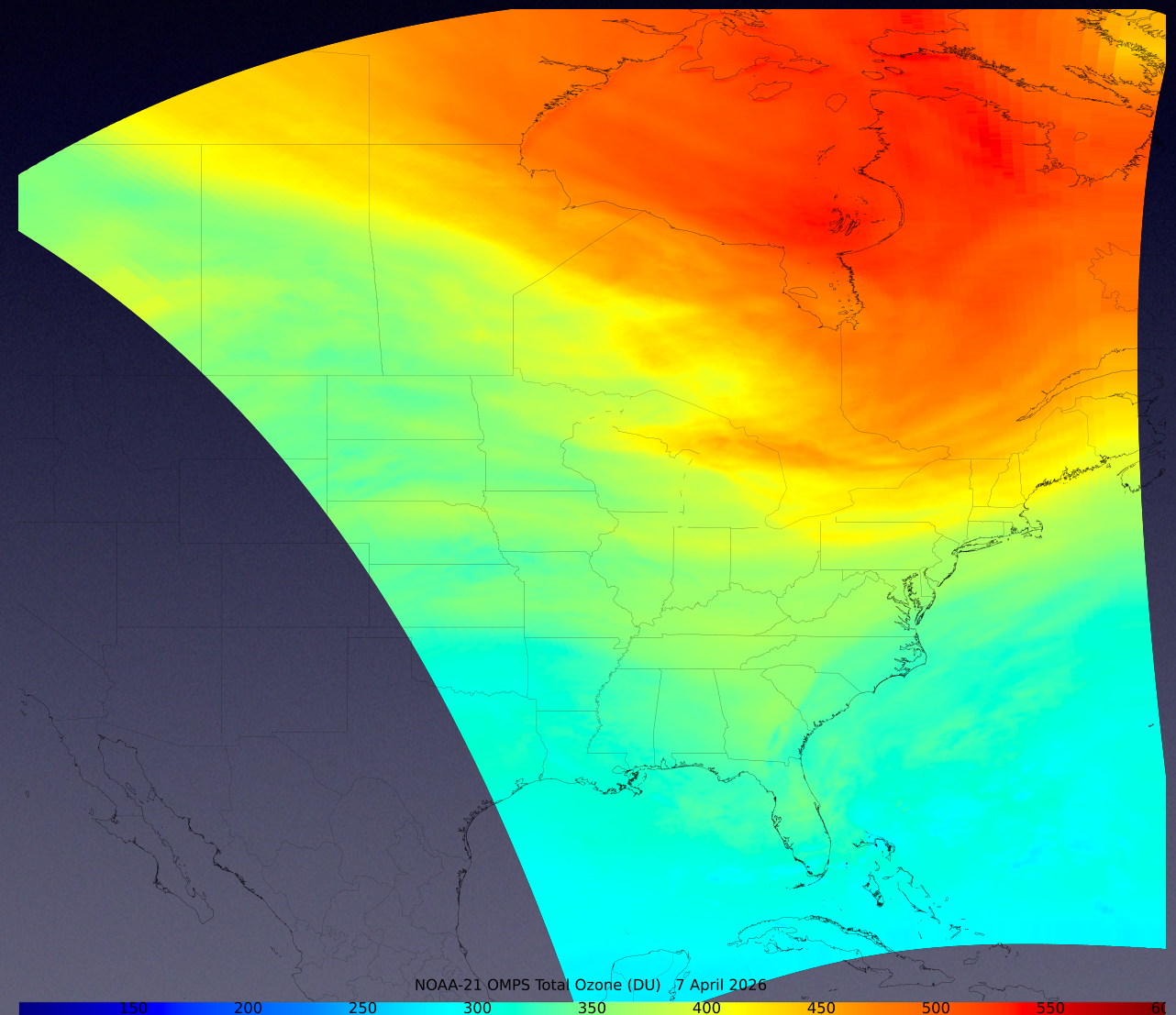
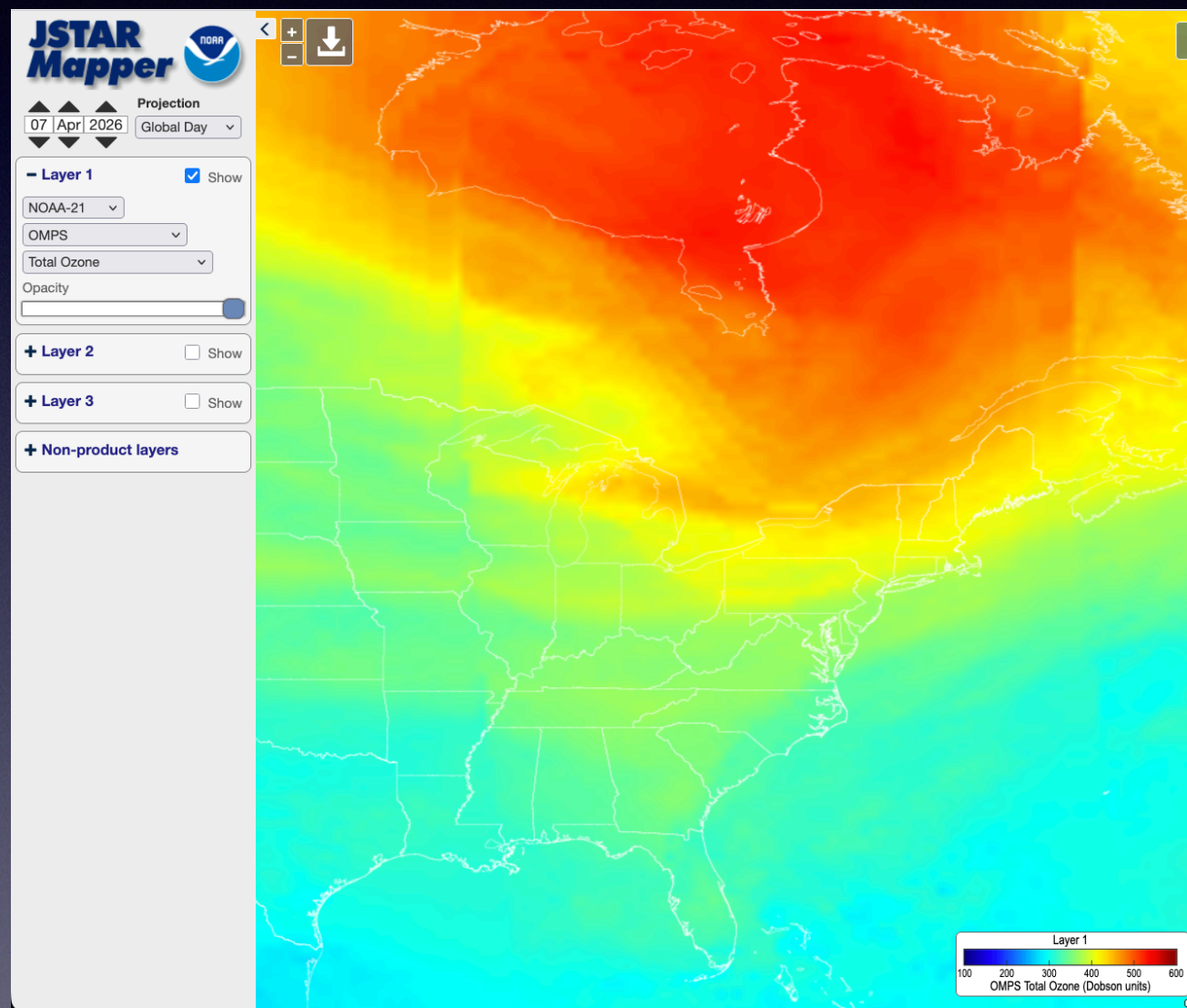
Upcoming CSPP LEO releases

	Name	Completion	Description
1	RT-STPS	Jun 2026	RT-STPS update with configurations for Metop-SGA1 and AWS
2	OMPS Ozone and Aerosol	Jul 2026	NOAA OMPS total ozone, ozone profile, and aerosol optical depth retrieval
3	Microwave Snowfall Rate	Aug 2026	NOAA ATMS/AMSU/MWS/AMSR Snow Fall Rate retrieval
4	VIIRS Land Surface Properties	Sep 2026	NOAA Land Surface Temperature and Emissivity retrieval
5	OMPS Sulfur Dioxide	Oct 2026	NOAA OMPS Sulfur Dioxide retrieval
6	AMSR3 GAASP	Nov 2026	NOAA GAASP AMSR3 retrieval
7	CSPP SDR	Dec 2026	CSPP SDR with initial support for JPSS-4 (NOAA-22)
8	VIIRS Cloud, Aerosol, VolAsh	Mar 2027	NOAA VIIRS Cloud, Aerosol, and Volcanic Ash Properties retrieval
9	VIIRS ACSPO	Apr 2027	NOAA VIIRS ACSPO SST retrieval
10	CSPP SDR	Jun 2027	CSPP SDR v5.1 with launch-ready support for JPSS-4 (NOAA-22)
11	RT-STPS	Jun 2027	RT-STPS configurations for JPSS-4 and JPSS-3
12	VIIRS NGFS	Jul 2027	NOAA VIIRS Next Generation Fire System

OMPS Total Ozone from NOAA vs. CSPP

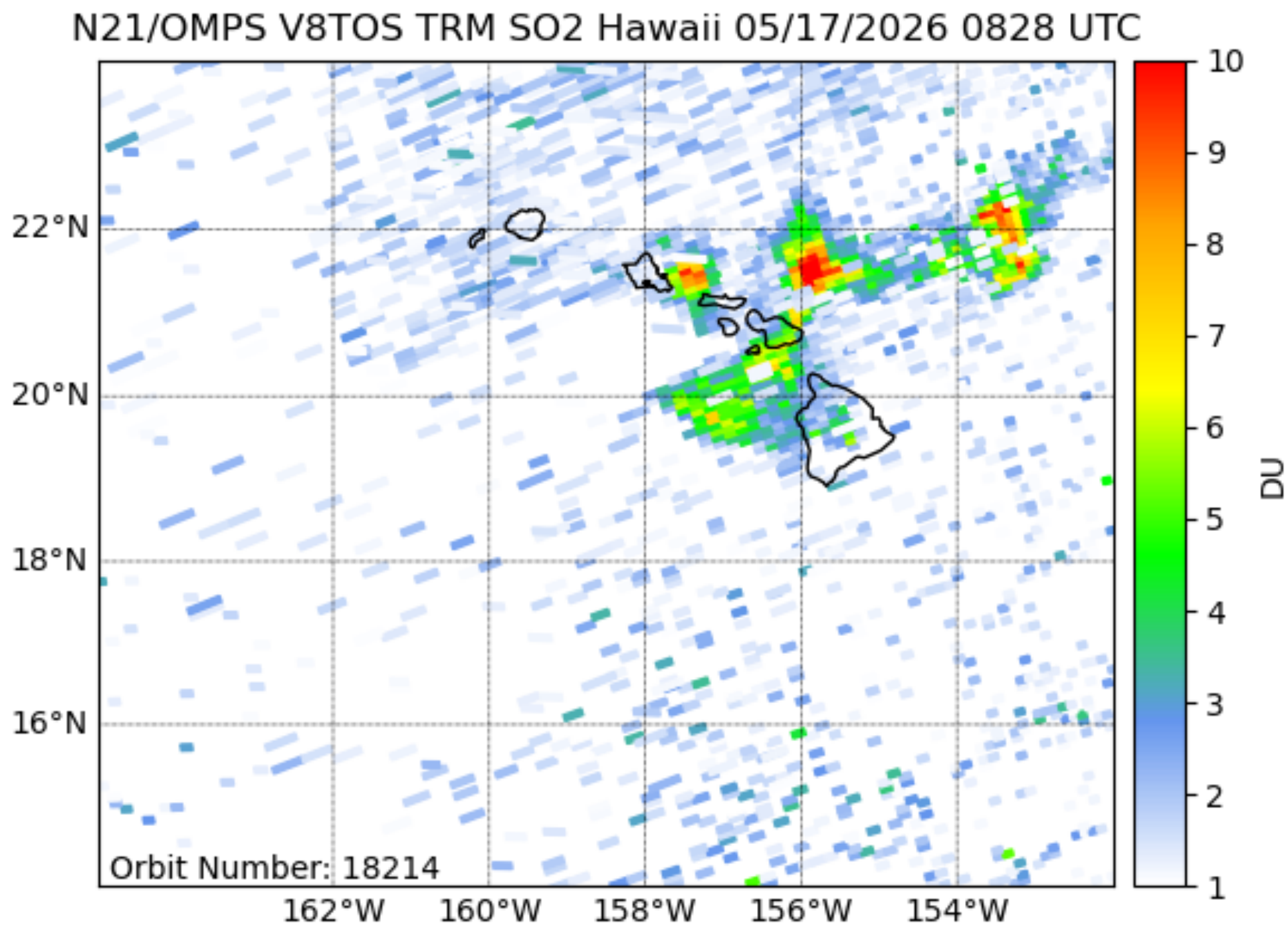
NOAA global product in JSTAR Mapper

CSPP DB product in Polar2Grid



NOAA-21 OMPS Nadir Mapper Total Ozone 2026/04/07

OMPS Total Sulfur Dioxide (coming soon)





AWS MWR Snow Fall Rate (coming soon)



NOAA NESDIS Liquid Equivalent SFR



Home

Product ▾

Document ▾

Publication

About ▾

Images generated using direct broadcast data received at [CIMSS](#).

[Instructions](#)

[SFR Quick Guide](#)

The date range is limited to 7 days.

Start Date

03/16/2026 00:00

← Previous Day

Next Day →

End Date

03/17/2026 00:00

Satellites:

☒ All

☒ NOAA-21

☒ NOAA-20

☒ S-NPP

☒ NOAA-19*

☒ Metop-B

☒ Metop-C

☒ F16

☒ F17

☒ F18

☒ GPM

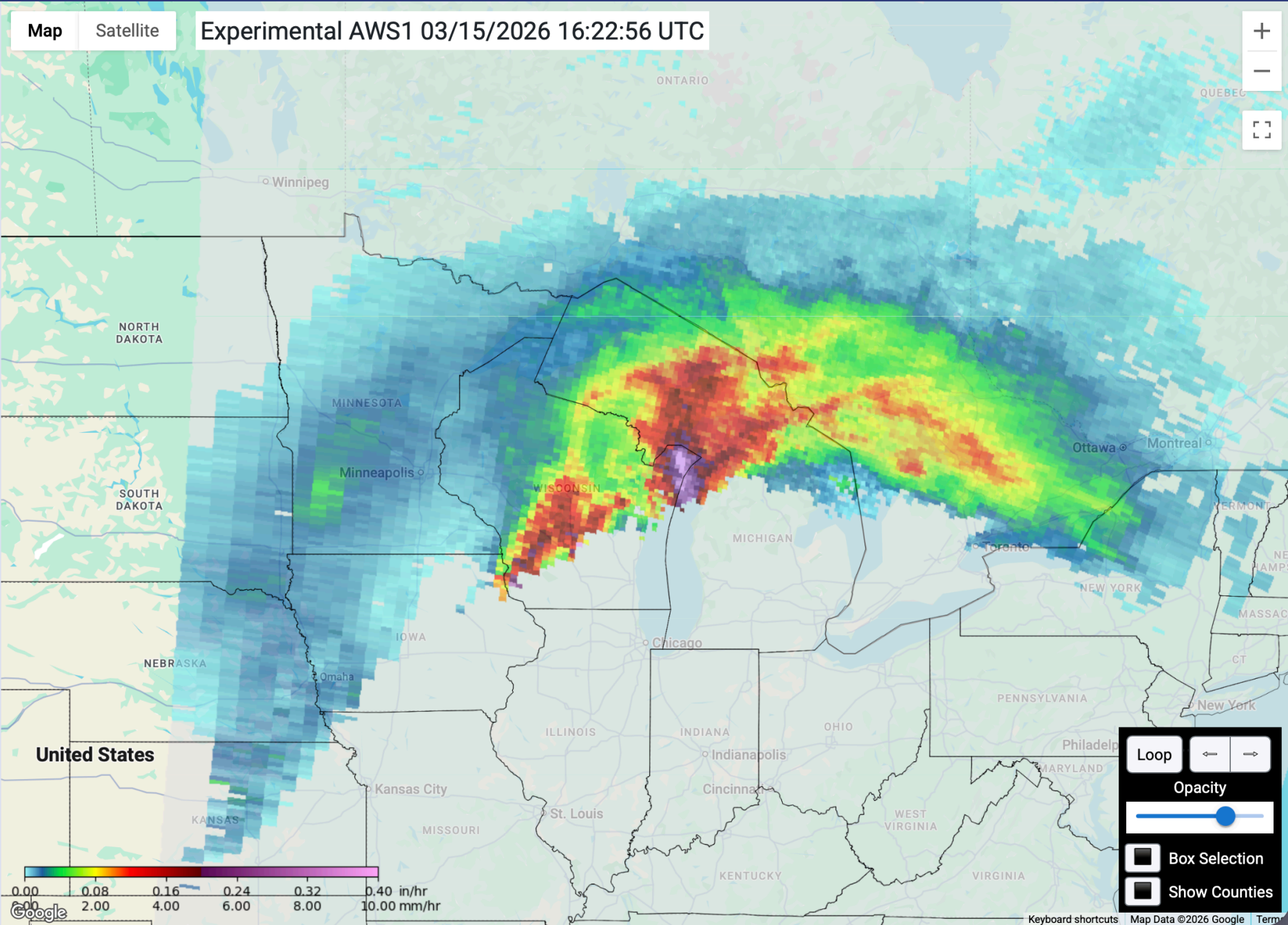
☒ AWS1

* No NOAA-19 images after 06/16/2025- satellite was decommissioned on 08/13/2025.

Map

Satellite

Experimental AWS1 03/15/2026 16:22:56 UTC



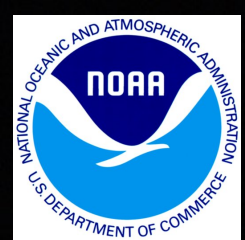
0.00 0.08 0.16 0.24 0.32 0.40 in/hr
2.00 4.00 6.00 8.00 10.00 mm/hr

Loop

Opacity

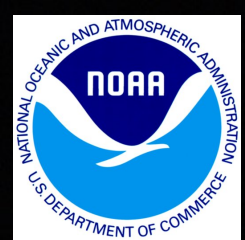
Box Selection

Show Counties

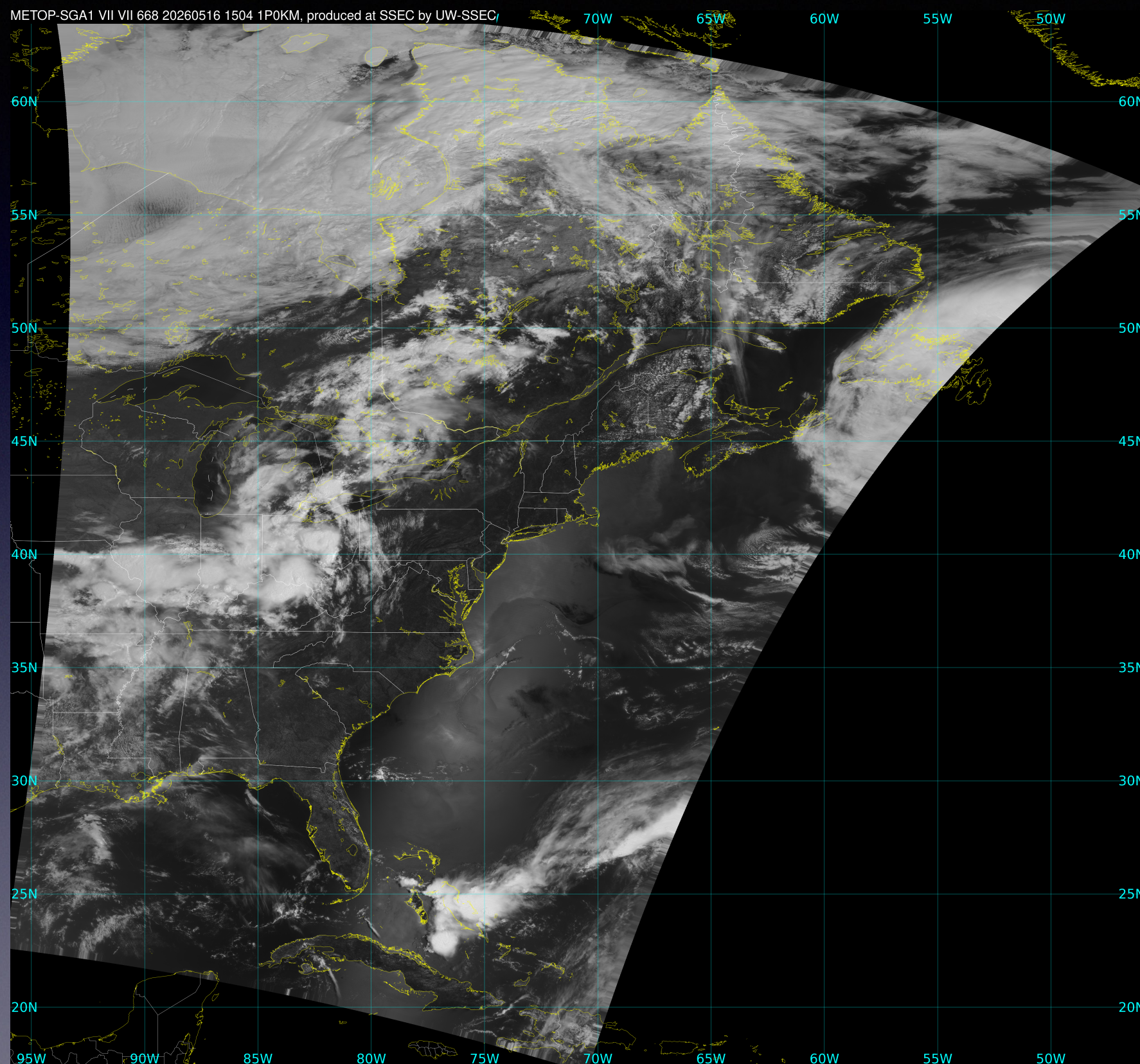


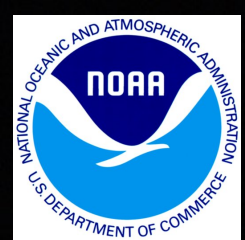
CIMSS/SSEC Recent Innovations

1. Antenna Control System (see poster).
2. Metop-SGA1 and AWS reception, decoding, and processing.
3. DBNet full spectral channel IASI and CrIS dissemination via WIS 2.0.
4. VIIRS Ultra Low Latency Fire Detection (see presentation by Bruce Flynn): VIIRS fire detections within 45 seconds of observation.
5. CrIS Ultra Low Latency: CrIS calibrated radiances and dual regression retrievals of CAPE within 60 seconds of observation.
6. Upgrade of all CIMSS/SSEC antenna sites to support Metop-SGA1 and AWS by end of 2026.

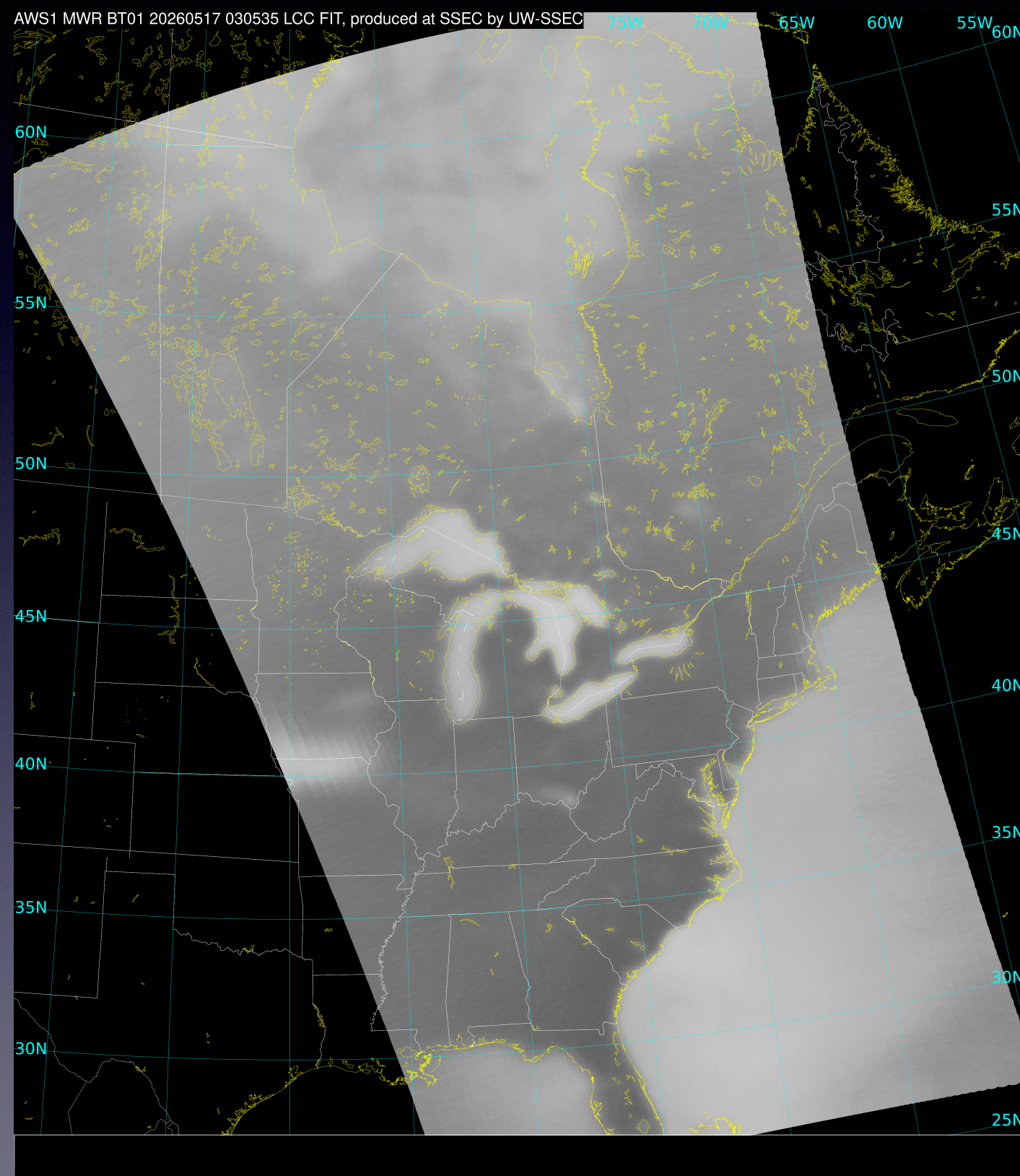


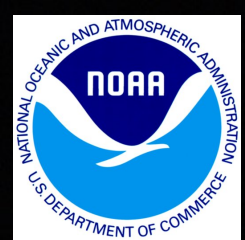
Metop-SGA1 METimage received at SSEC





Arctic Weather Satellite MWR received at SSEC





Thanks for listening

Liam.Gumley@ssec.wisc.edu

<https://cimss.ssec.wisc.edu/cspp>