AOMSUC-11 FY-USERCON 2021 1-5 November 2021 Beijing,China

NOAA: Current and Future Satellite Systems

11th Asia-Oceania Meteorological Satellite Users Conference

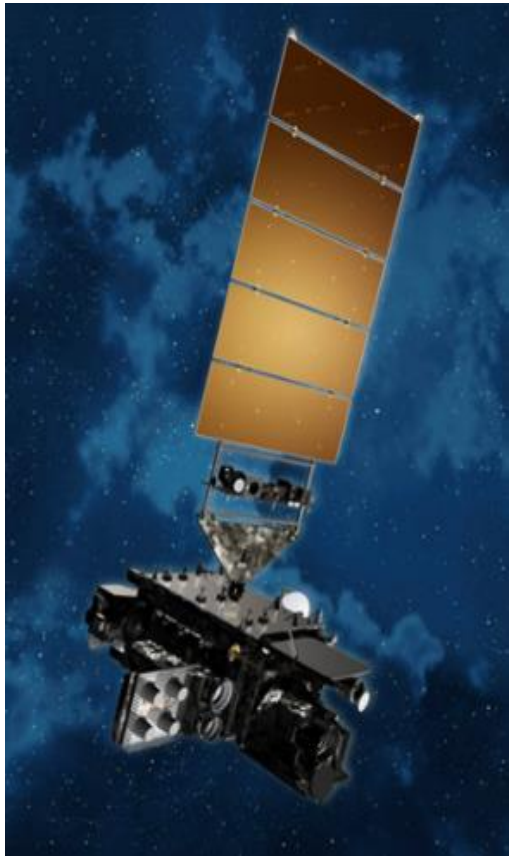
National Environmental Satellite, Data, and Information Service

November 1, 2021

Mark S. Paese
Deputy Assistant Administrator for Satellites and Information Services,
National Oceanic and Atmospheric Administration

NOAA's National Environmental Satellite Data and Information Service (NESDIS) -- at a Glance

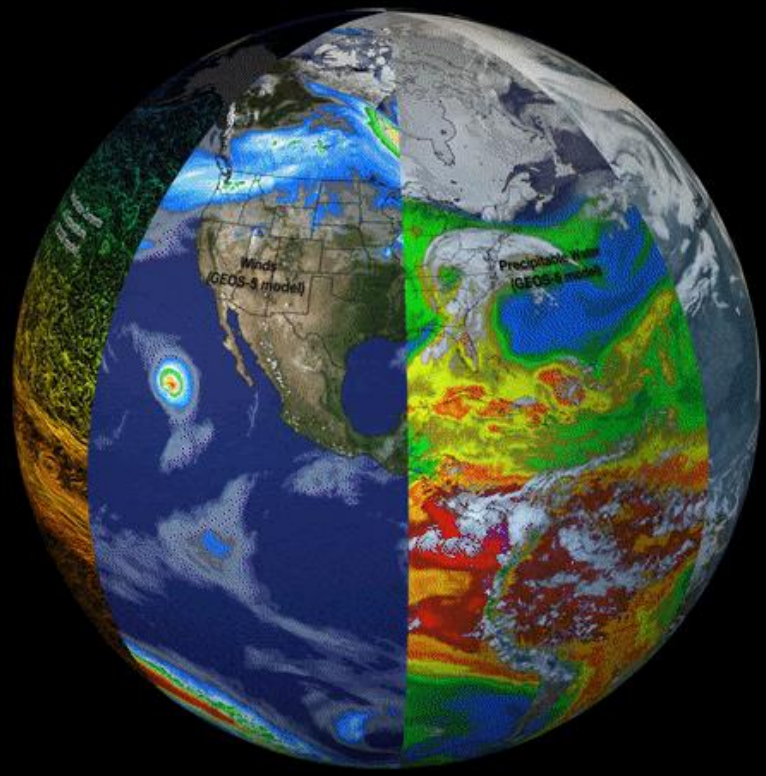
- NESDIS operates the Nation's weather satellites, 24/7
- Acquires next-generation Earth observation satellites
- Provides data and imagery for predictive environmental and atmospheric modeling
- Provides definitive assessments of the U.S. and global climate
- Maintains one of the most significant archives of environmental data on Earth



… With a Global Perspective

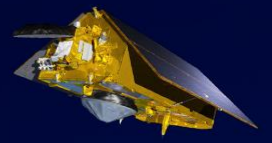
NESDIS Mission

Provide a truly integrated digital understanding of our earth environment that can evolve quickly to meet changing user expectations by leveraging our own capabilities and partnerships



NESDIS Programs of Record

SENTINEL-6 Michael Freilich



Sentinel-6 Michael Freilich - LAUNCHED NOV 21, 2020

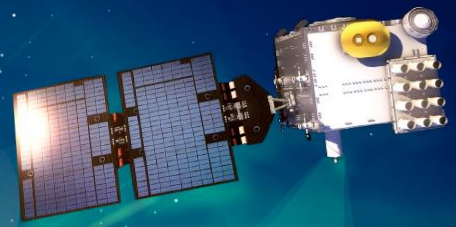
DSCOVR

OPERATIONAL JULY 27, 2016

SWFO

SWFO L1 - FY 2024

COSMIC-2



COSMIC-2 - OPERATIONAL FEB 25, 2020

JASON-3

OPERATIONAL JULY 1, 2016

GOES-R SERIES

GOES-16 - OPERATIONAL DEC 18, 2017
GOES-17 - OPERATIONAL FEB 12, 2019
GOES-T - FY 2022
GOES-U - FY 2025

JPSS SERIES

NOAA-20 - OPERATIONAL MAY 30, 2018
JPSS-2 - FY 2023
JPSS-3 - FY 2026
JPSS-4 - FY 2031

NOAA's Next-Gen Earth Observation Strategy

Integrated, Adaptable, and Affordable: Orbits, Instruments & Systems

LEO

Miniaturized instruments on small, lower cost, and proliferated satellites and partner data improving forecasts through better and additional data. Better precipitation forecasts, wave height predictions, ocean currents, and more.

GEO

Continuous real-time observations supporting warnings and watches of severe weather and hour-by-hour changes. High-inclination orbits to observe northern latitude & polar regions.

Space Weather

Reliably monitoring coronal mass ejections from L1, GEO, and LEO can protect the nation's valuable, vulnerable infrastructure. New capabilities at L5 and high earth orbit can provide additional insight and improve forecasts.

Common Ground Services

Secure ingest of data in different formats from different partners requires a flexible, scalable platform. Common Services approach integrates cloud, AI, and machine-learning capabilities to verify, calibrate, and fuse data into new and better products and services.

Geostationary Satellites

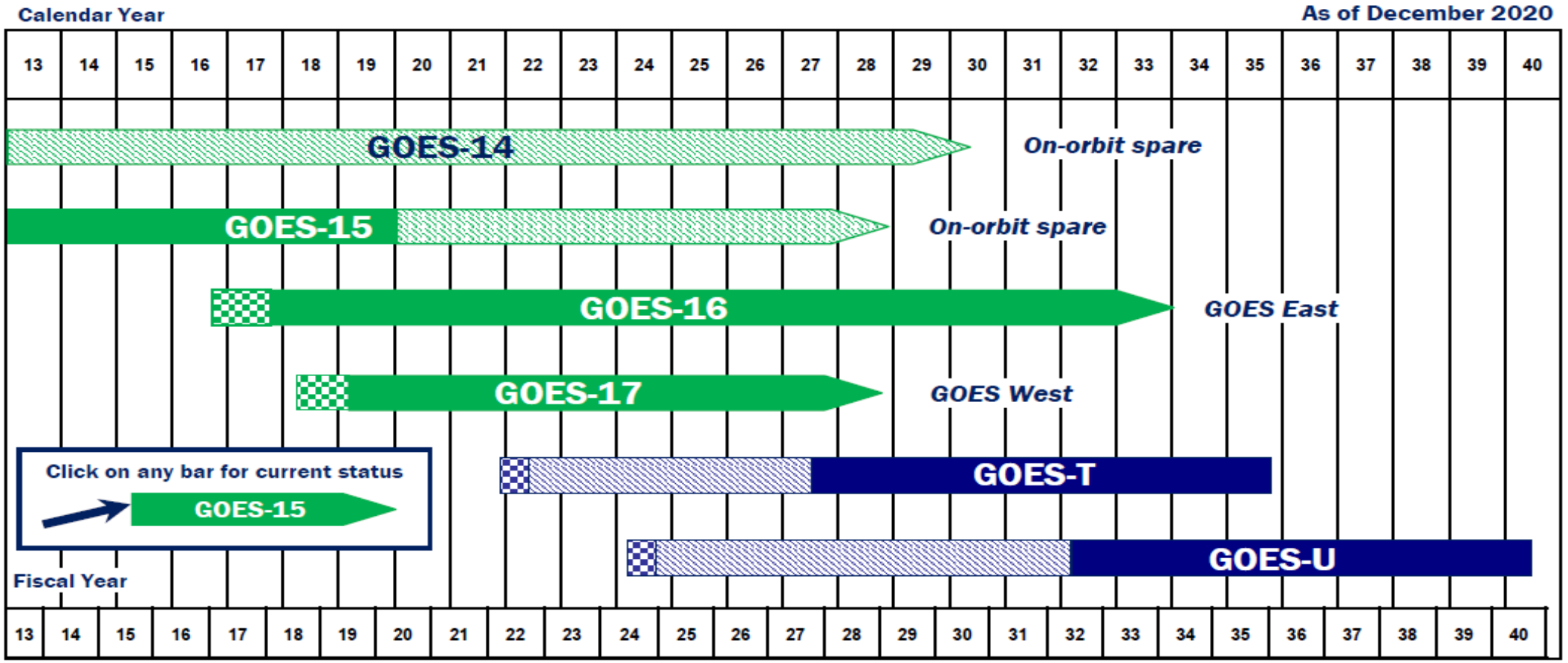
Launched November 2016 (Series will extend through ~2036)

COUNTDOWN TO GOES-T LAUNCH

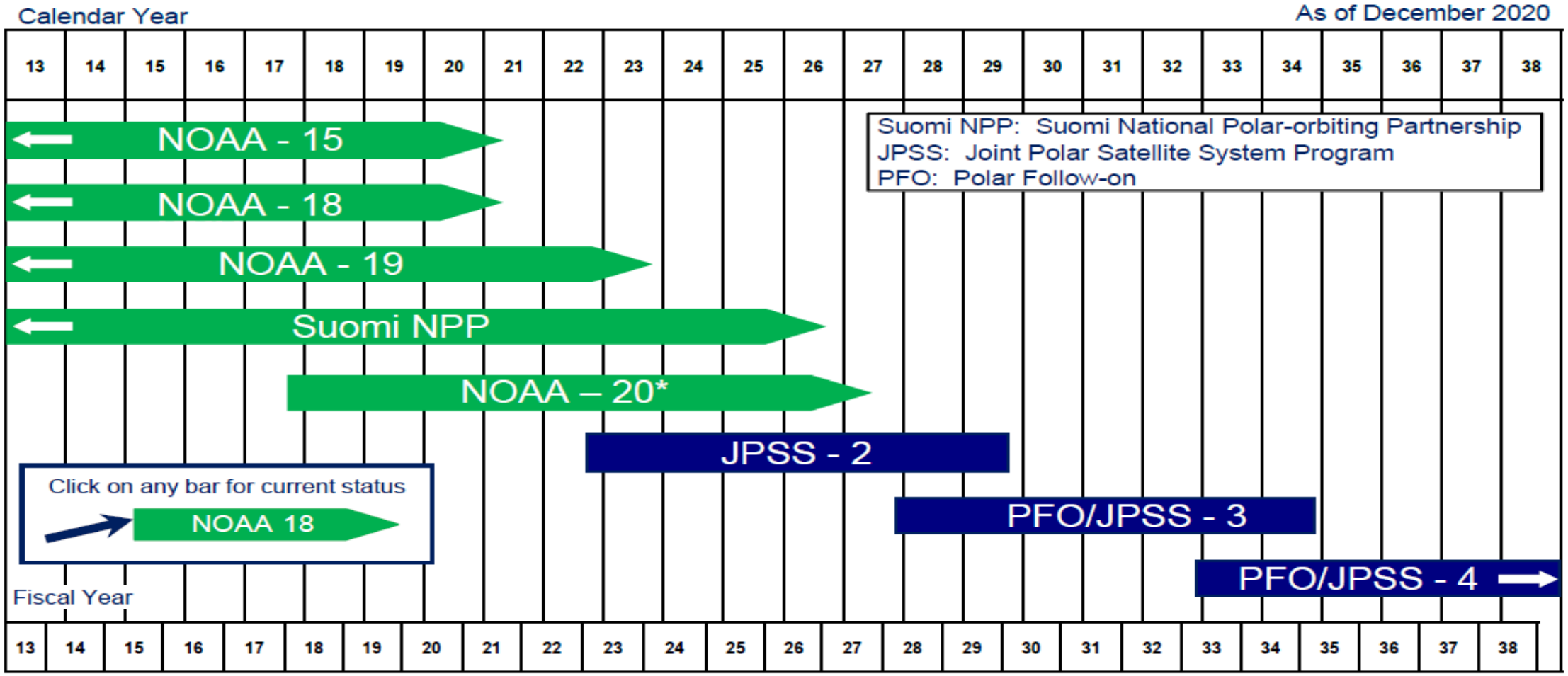
106 days

GOES-T is scheduled to launch no earlier than February 16, 2022.

NOAA Geostationary Satellite Programs
Continuity of Weather Observations



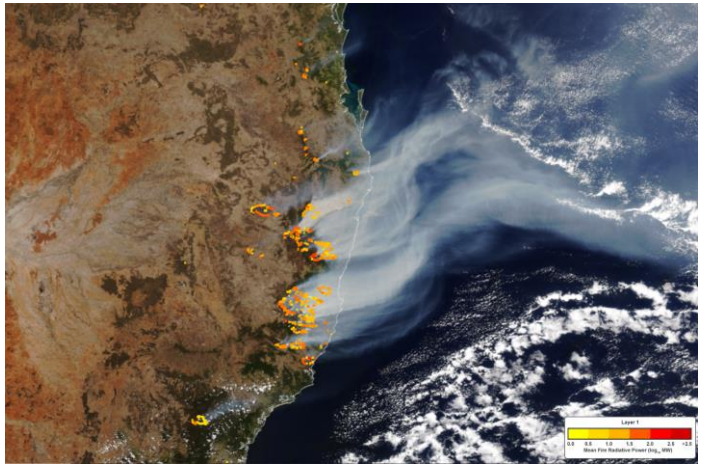
NOAA LEO (Polar Satellite) Programs
Continuity of Weather Observations

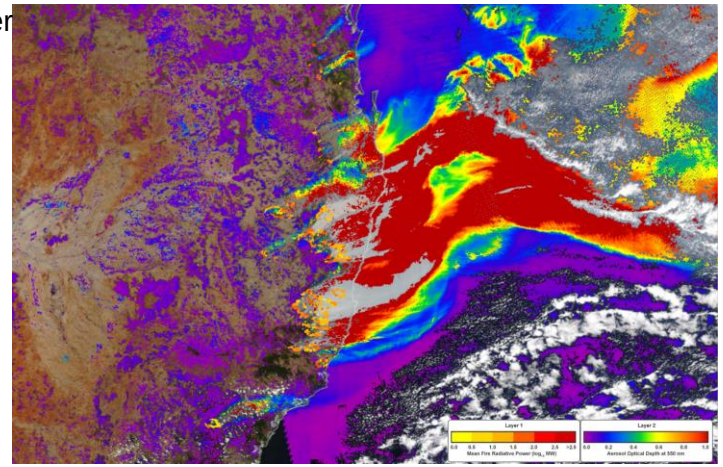


Commercial Weather Data Pilot

- Publish standards for space-based commercial weather data
- Contract with one or more private sector entities capable of providing data that meet published standards
- Assess data's ability to meet standards and its impact to weather models

Application: Fire Weather Forecast Exchange with Australia's Bureau of Meteorology





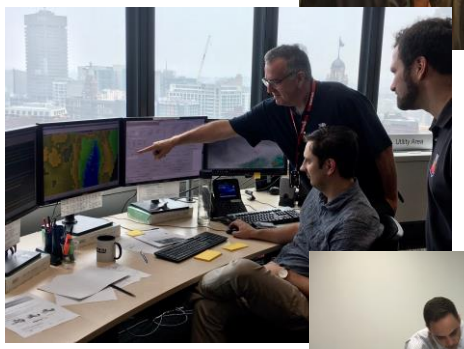
Images from NOAA-20 VIIRS. November 2019

Mutually benefit from

- Developing a unified approach to fire forecasting
- Using best practices for estimation of fuel loads and fire direction to keep fire fighting teams safe

Australia's 2019-2020 Fire season

- From October 2019 – March 2020 NOAA NWS Incident Meteorologists traveled to Australia on 6-week rotations
- Assisted with fire weather forecasting for 135 individual fires



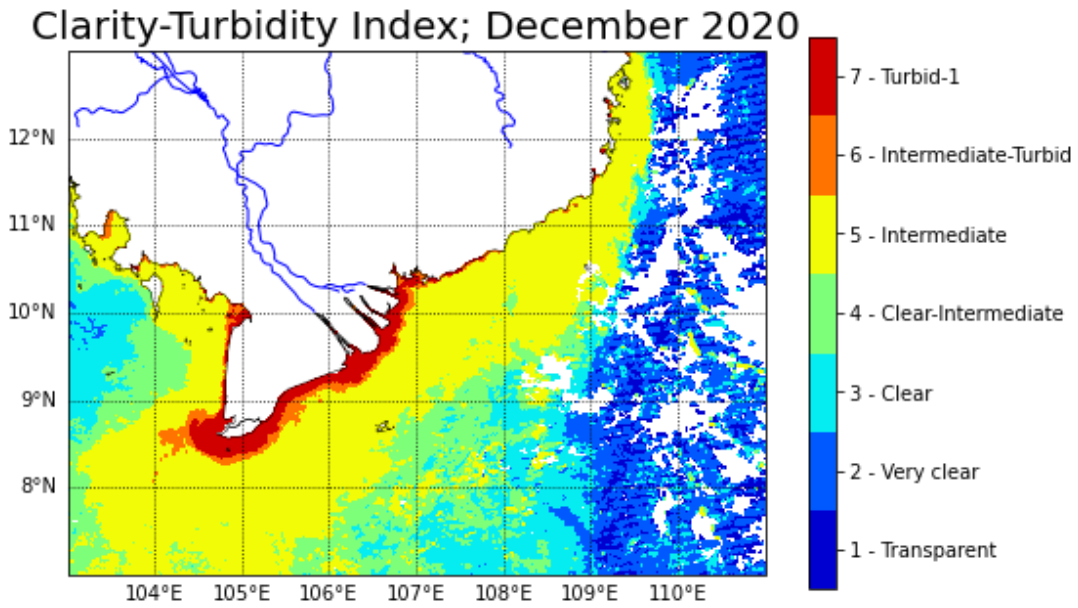
Application: Partnership between NESDIS & Indonesia's LAPAN

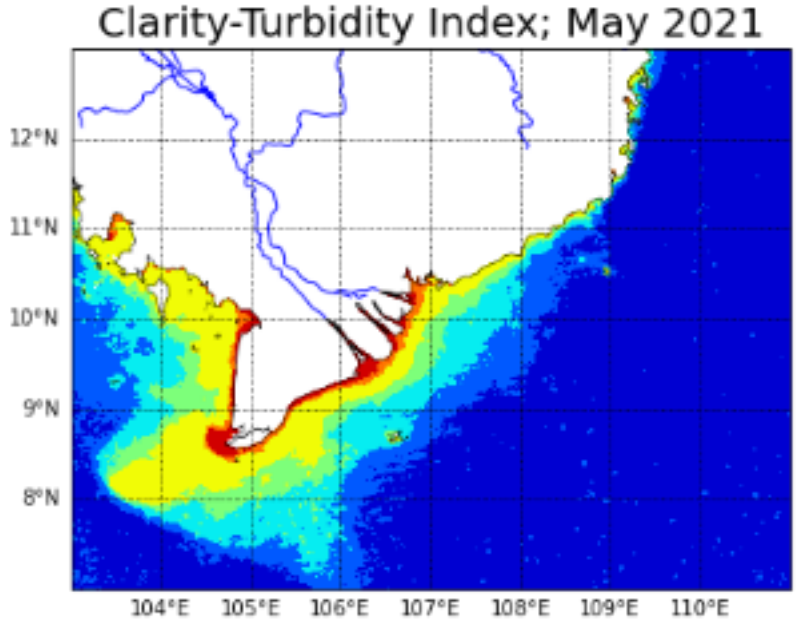
Main Goals:

- Advance satellite-based fire monitoring capabilities using NOAA (S-NPP and NOAA-20) and non-NOAA (e.g., Landsat-8, Himawari-8) assets, and specialized software (e.g., NOAA's Hazard Mapping System)
- Promote capacity building through online training, collaborative R&D activities, visiting scientist programs

Biomass burning regional workshop including NOAA & NASA participants LAPAN/Jakarta Nov 2019

Application: NOAA Water Clarity-Turbidity Index (CTI) off the coast of Vietnam

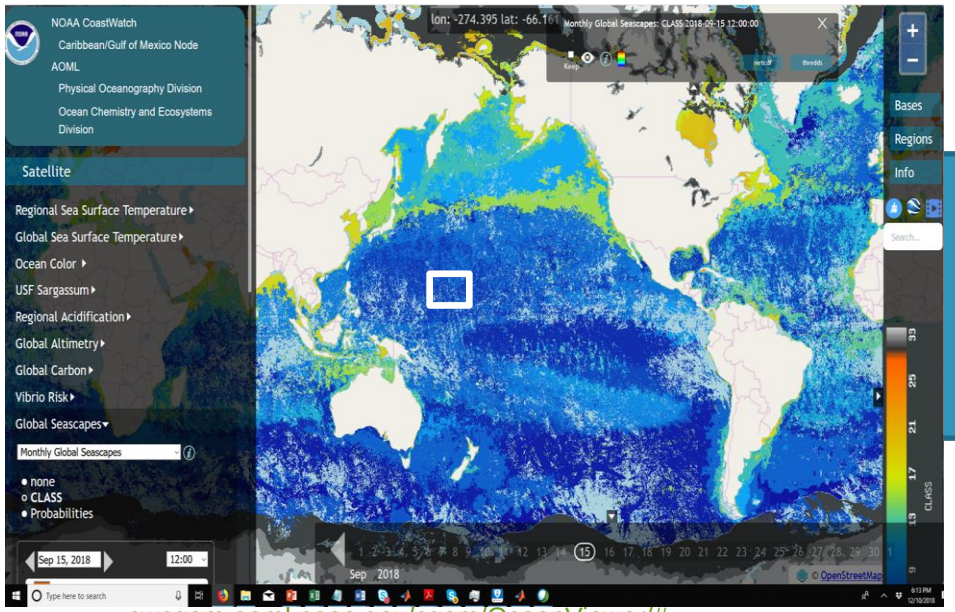




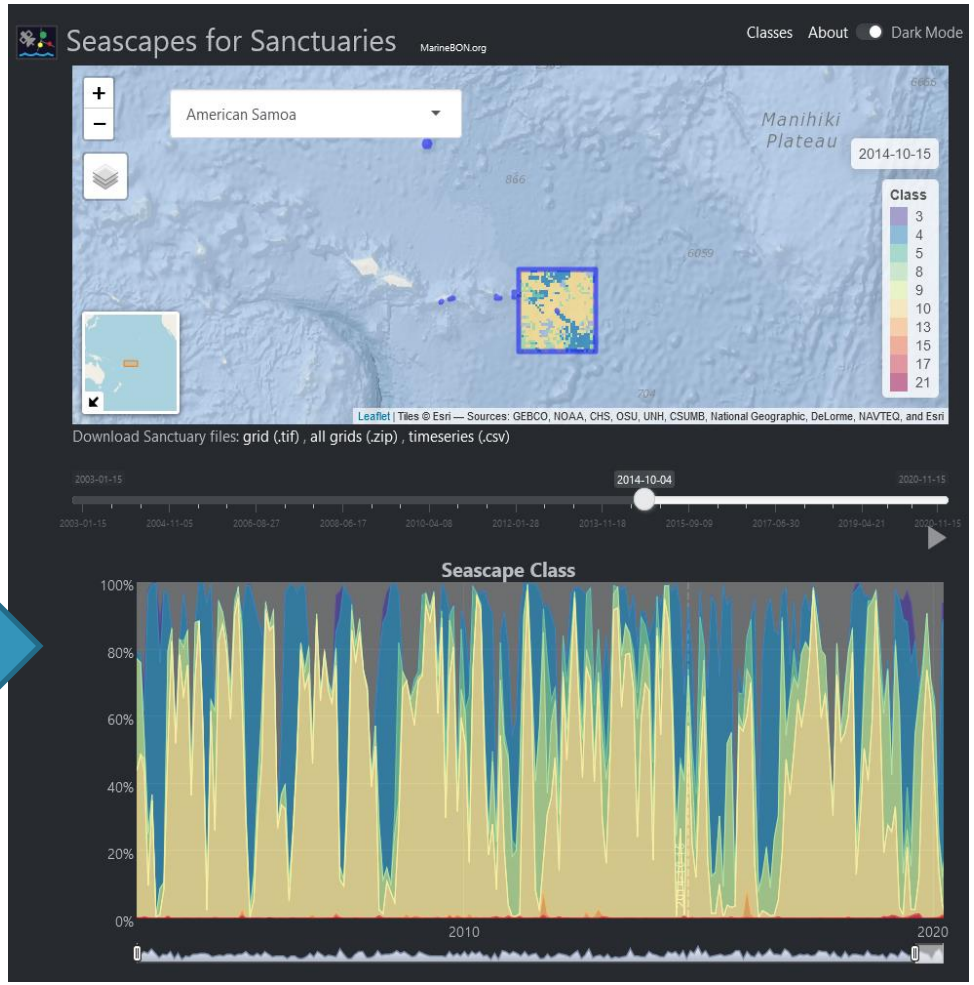
- This CTI product (G. Zheng and P. DiGiacomo, 2021), a simple indicator of water quality, was generated from NOAA VIIRS ocean color data.
- It depicts the south coast of Vietnam near the mouth of Mekong River for the end of the rainy season (July–December; left panel) and during the dry season (May; right panel).
- Much higher and extended zones of turbid water are observed along the coast following the rainy season.

Application: Dynamic seascapes support monitoring and management of pelagic ecosystems

- Seascape pelagic habitats are classified in space and time from NASA and NOAA satellite data.
- Habitat occupancy and diversity patterns are validated by MBON nodes and community partners.
- Seascapes are distributed through NOAA CoastWatch, R package, R-shiny



seascapeR
marinebon.org



cwcgom.aoml.noaa.gov/cgom/OceanViewer/#
cwcgom.aoml.noaa.gov/thredds/SEASCAPE_MONTH.html
marinebon.org/seascapeR/
shiny.marinebon.app/seascapes

Alone: NOAA Operates 15 Satellites

Together: We Form an International Community

9 Feb 2020: Himawari-8, GOES-17, GOES-16, Meteosat-11

(image credit: CIMSS/SSEC)

Additional Informational Slides

NOAA Mission

As an Agency within NOAA, NESDIS works to support NOAA's mission of:

- NOAA climate **Science** is the foundation for smart policy, and decision-making in a changing world.
- NOAA delivers climate **Services** to federal agencies, states, tribes, communities, and businesses across America, helping people protect themselves and their livelihoods in a changing world.
- NOAA's climate **Stewardship** protects our lands, waters, resources, and people.

Evolution from GOES-R to GeoXO
Growing needs require new observations

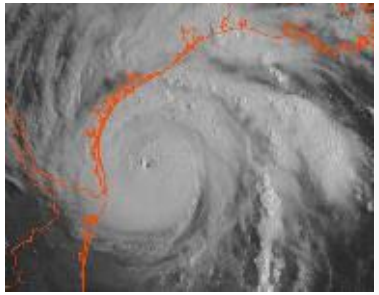
GOES-R provides Visible/Infrared Imagery and **Lightning** data:

- Essential for short-range forecasting, issuing severe weather watches and warnings, and monitoring hazardous environmental conditions including tropical storms, severe storms, damaging winds, snow, ice, flooding, fog, fires, smoke, and volcanic ash

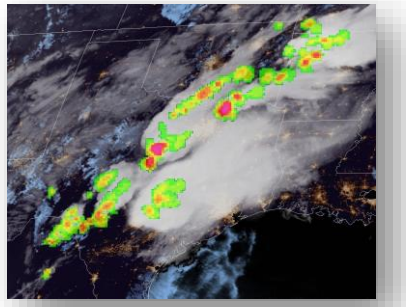
GeoXO will continue and improve Imagery and Lightning data and add new observations:

- **Hyperspectral IR Sounder** for numerical weather prediction and local nowcasting
- **Ocean Color Instrument** for monitoring dynamic coast/ocean features, ecosystem change, water quality, and hazards
- **Atmospheric Composition Instrument** for monitoring air quality and the linkage between air quality, weather, and climate

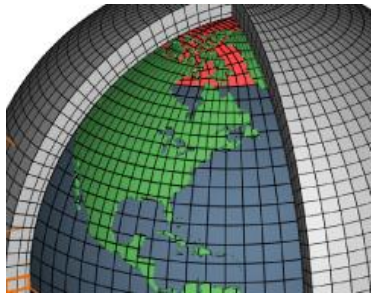
Vis/Near-IR Imagery



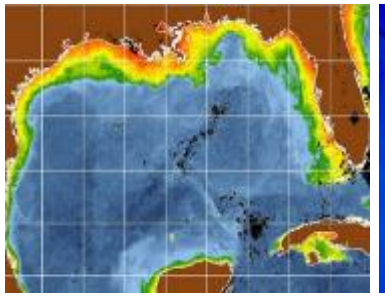
Lightning Mapping



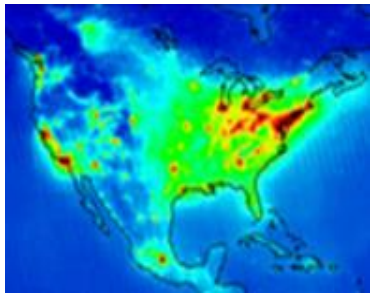
IR Sounding



Ocean Color



Atmo. Composition



Highly Diverse LEO Observations

Foundational Products: ***Satellite Radiances and Satellite Imagery***

NESDIS Level Requirements – Geophysical Products

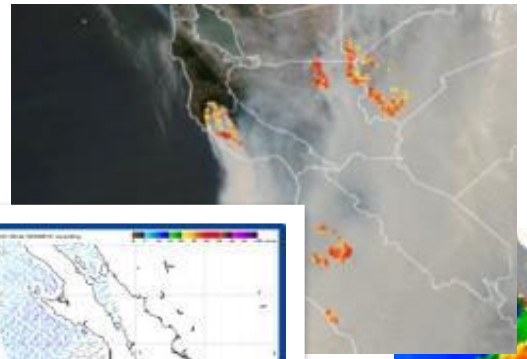
Atmosphere	Cryosphere	Land	Ocean, Fresh Water & Coasts

Analytical

Climate & Weather

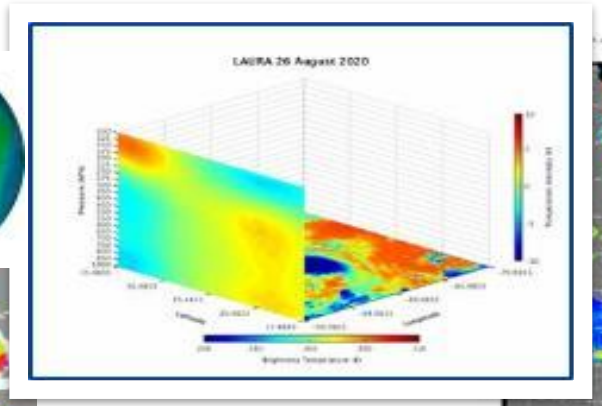
Ocean, Fresh Water & Coasts

Multipurpose VIS/NIR/IR Imagery

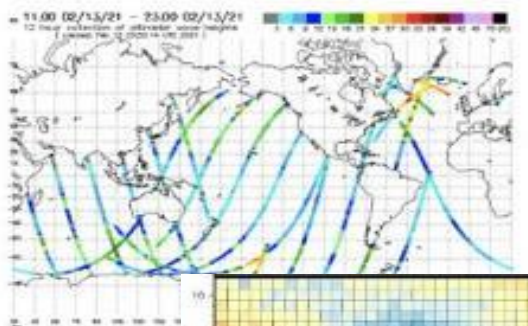


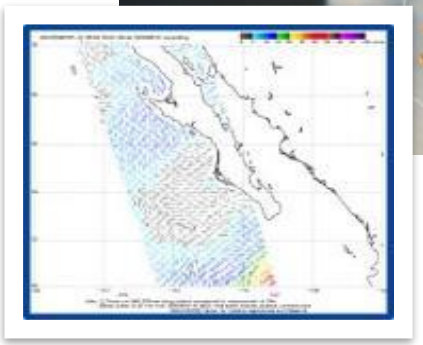
UV Imagery

Soundings from IR/MW/RO

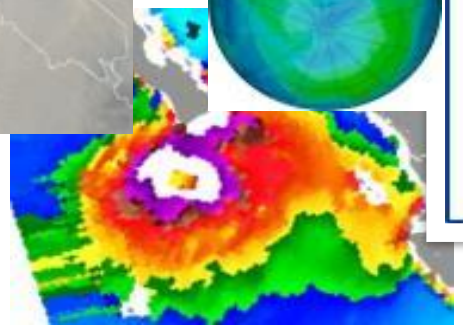


Altimetry

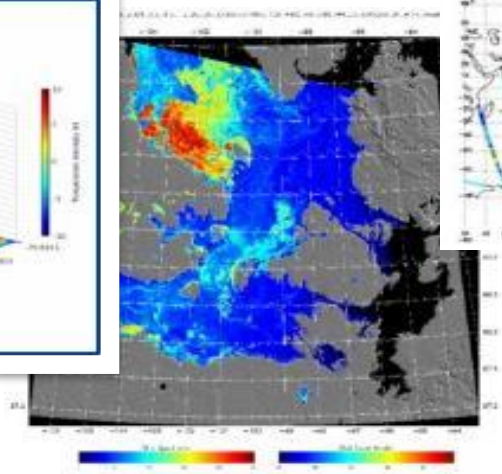




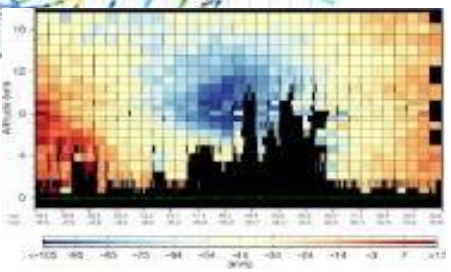
Scatterometry



MW Imagery



RADAR Imagery

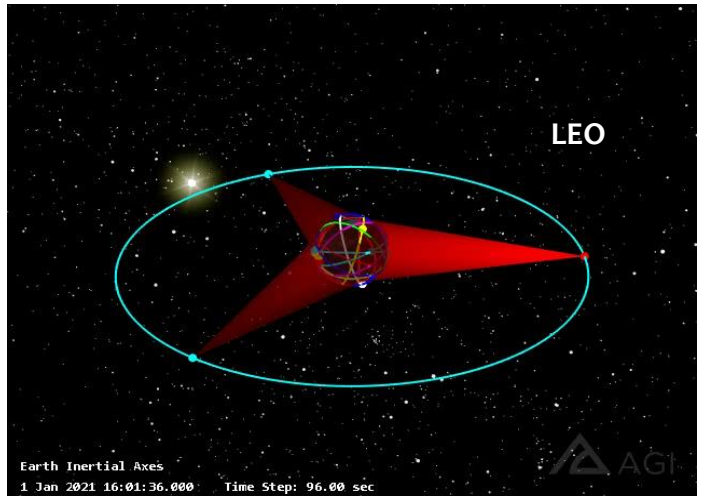


LIDAR

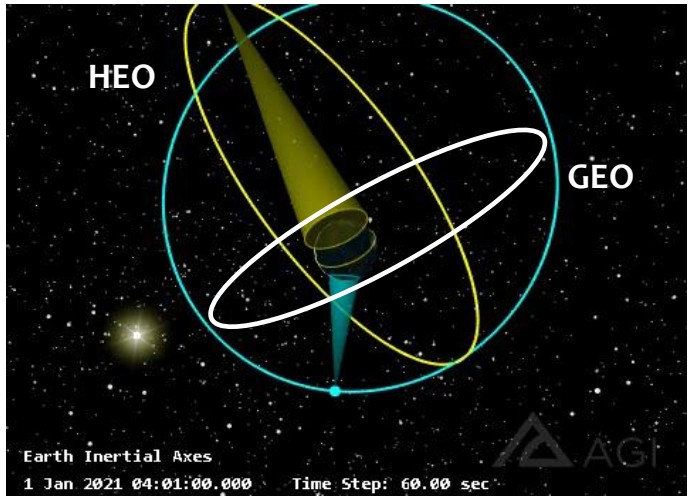
Space Weather Observations Program

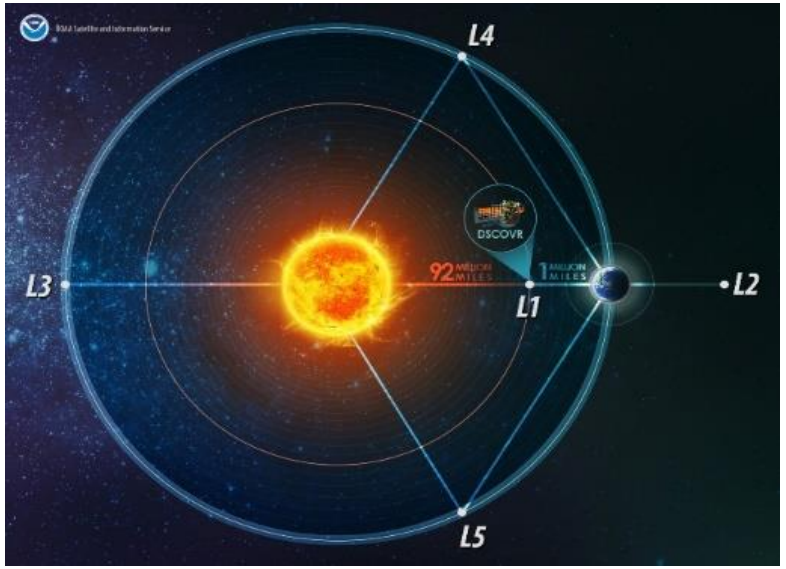
The Space Weather Program will need a comprehensive observational capability for several orbital regimes.

Thermospheric and ionospheric objectives will require in situ measurements from LEO as well as imaging capabilities from GEO.



For the magnetosphere, in situ measurements from GEO and HEO can combined with auroral imaging.

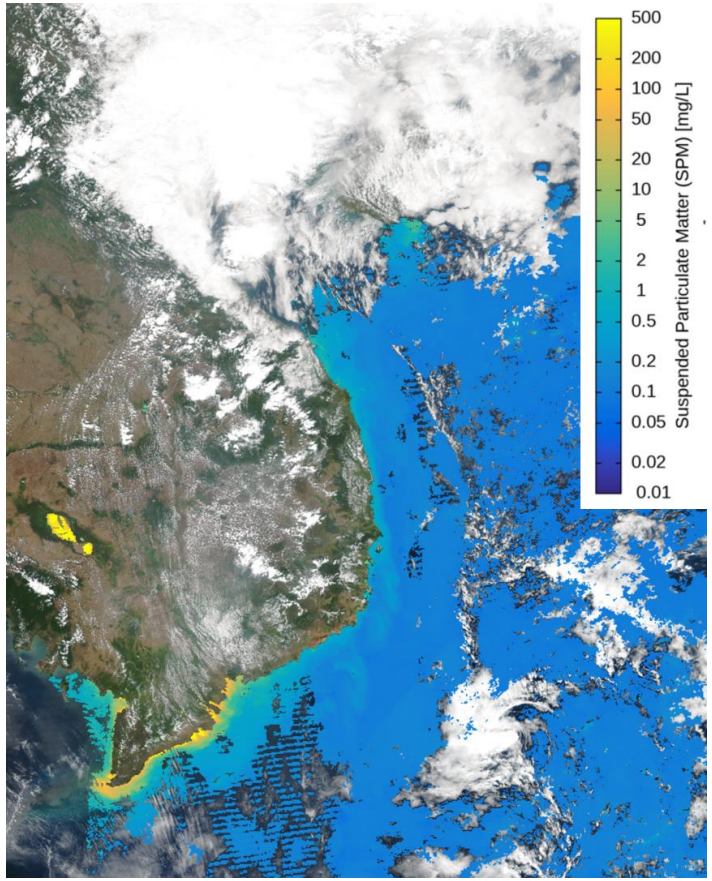




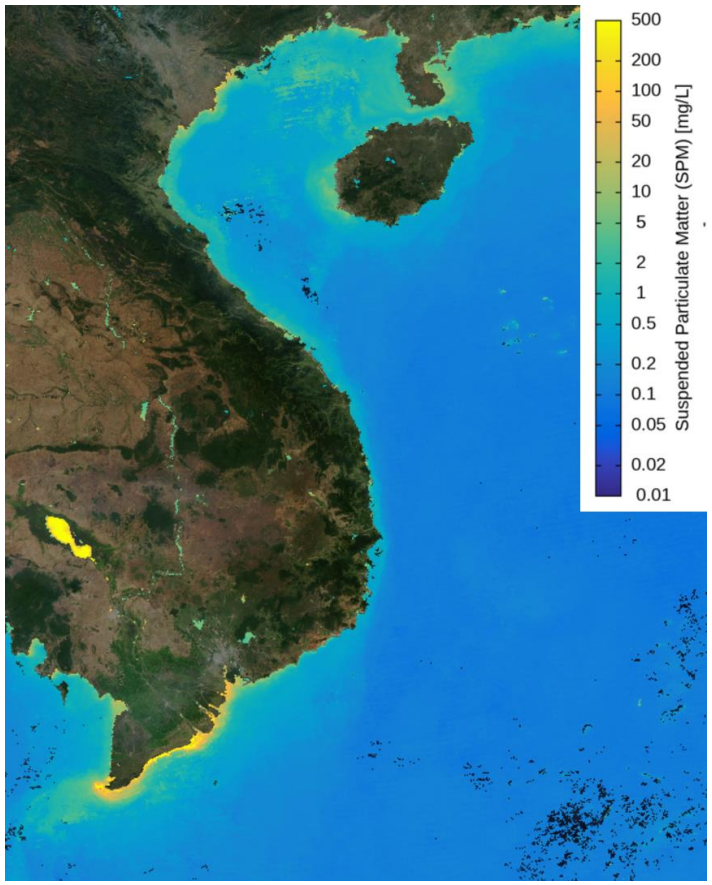
Coronal and photospheric imagery from L1 and L5 can be used for stereoscopic analysis. In situ plasma/field data will drive heliospheric models.

Application: VIIRS Suspended Particulate Matter in coastal waters of Vietnam

- Suspended Particulate Matter (SPM) is an indicator of water clarity (~turbidity); higher SPM means lower water clarity
- Source: NOAA/NESDIS/STAR Ocean Color Team (J. Wei, M. Wang et al., 2021 – JGR-Oceans)



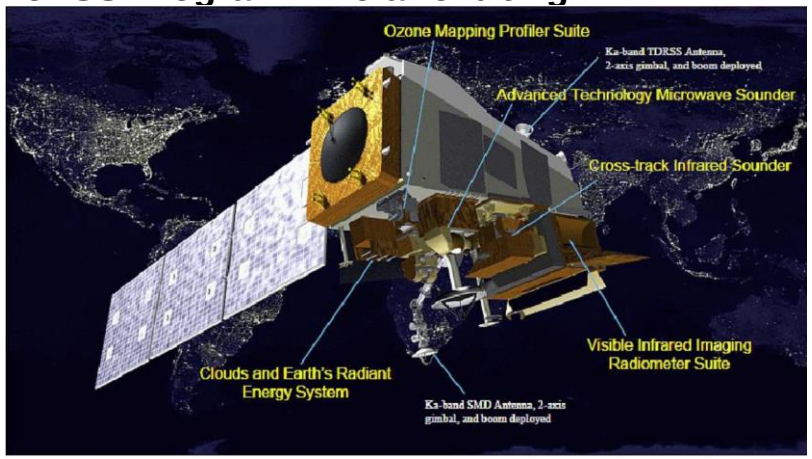
Daily SPM Product (27 Feb 2021) from merge of data from 3 ocean color sensors: VIIRS-SNPP, VIIRS-NOAA-20, OLCI-Sentinel-3A

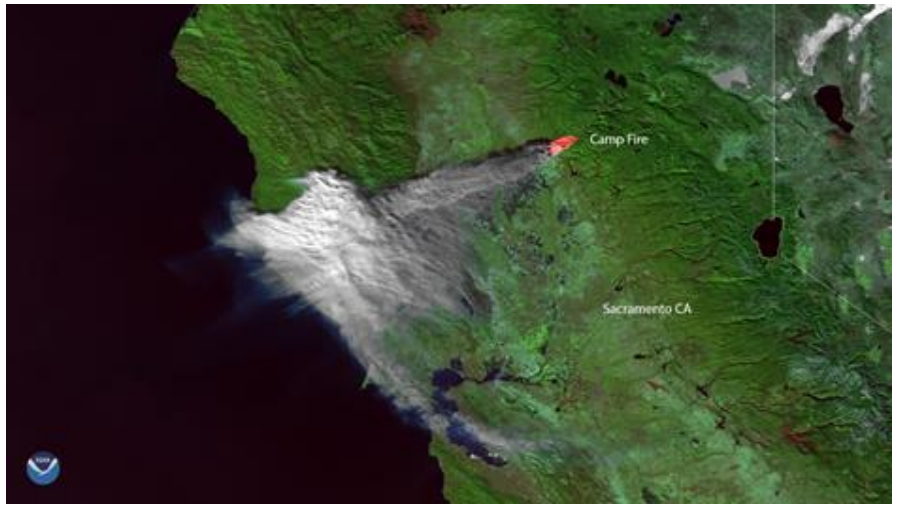


Monthly SPM Product (Feb 2021) from VIIRS-SNPP ocean color data. Note higher SPM levels off Mekong River Outfall (lower left corner)

Application: NOAA Satellites Monitoring Fires

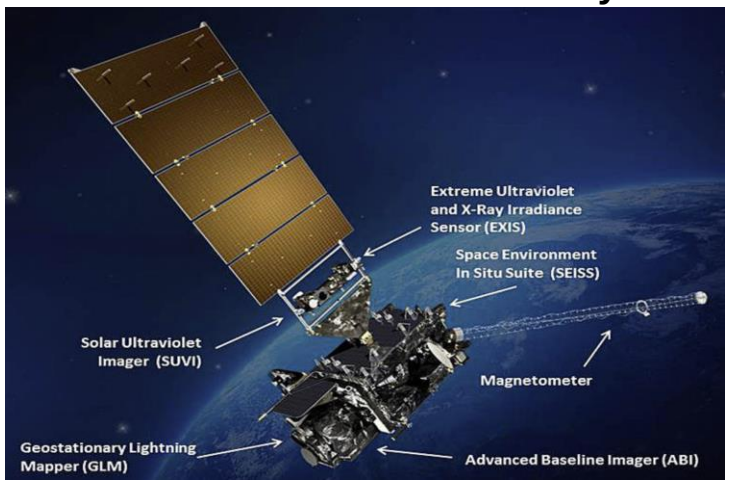
JPSS Program – Polar orbiting

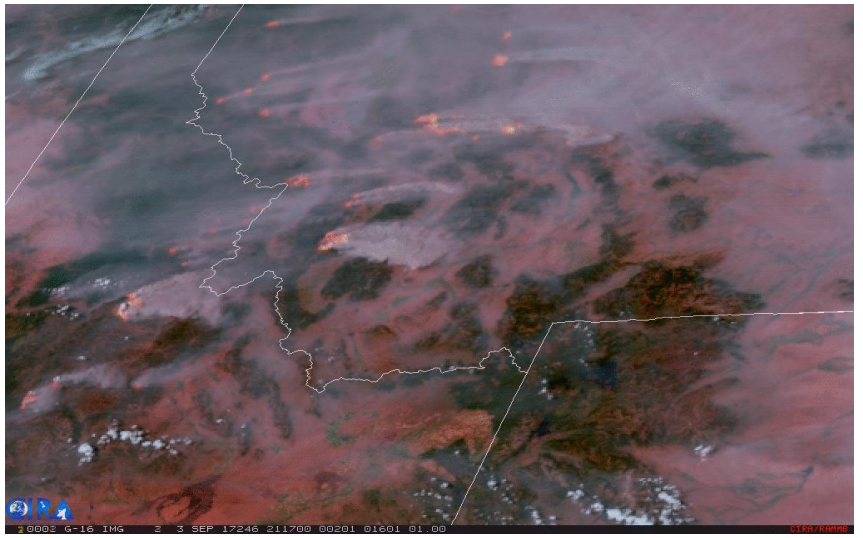




NOAA-20 captures plumes of smoke from the Camp Fire in Northern California

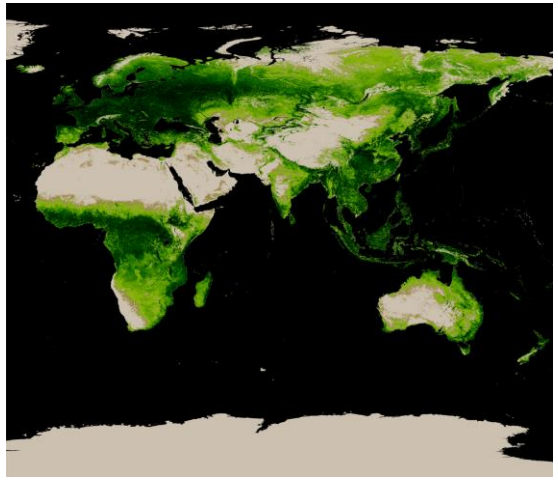
GOES-R Series - Geostationary



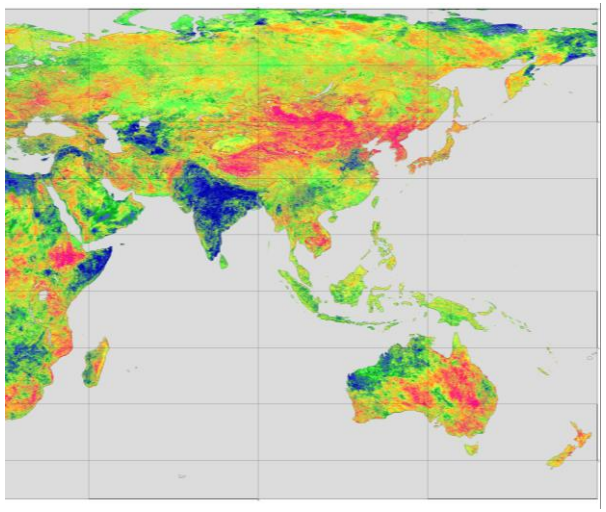


GOES-R provides nearly continuous observations of fires

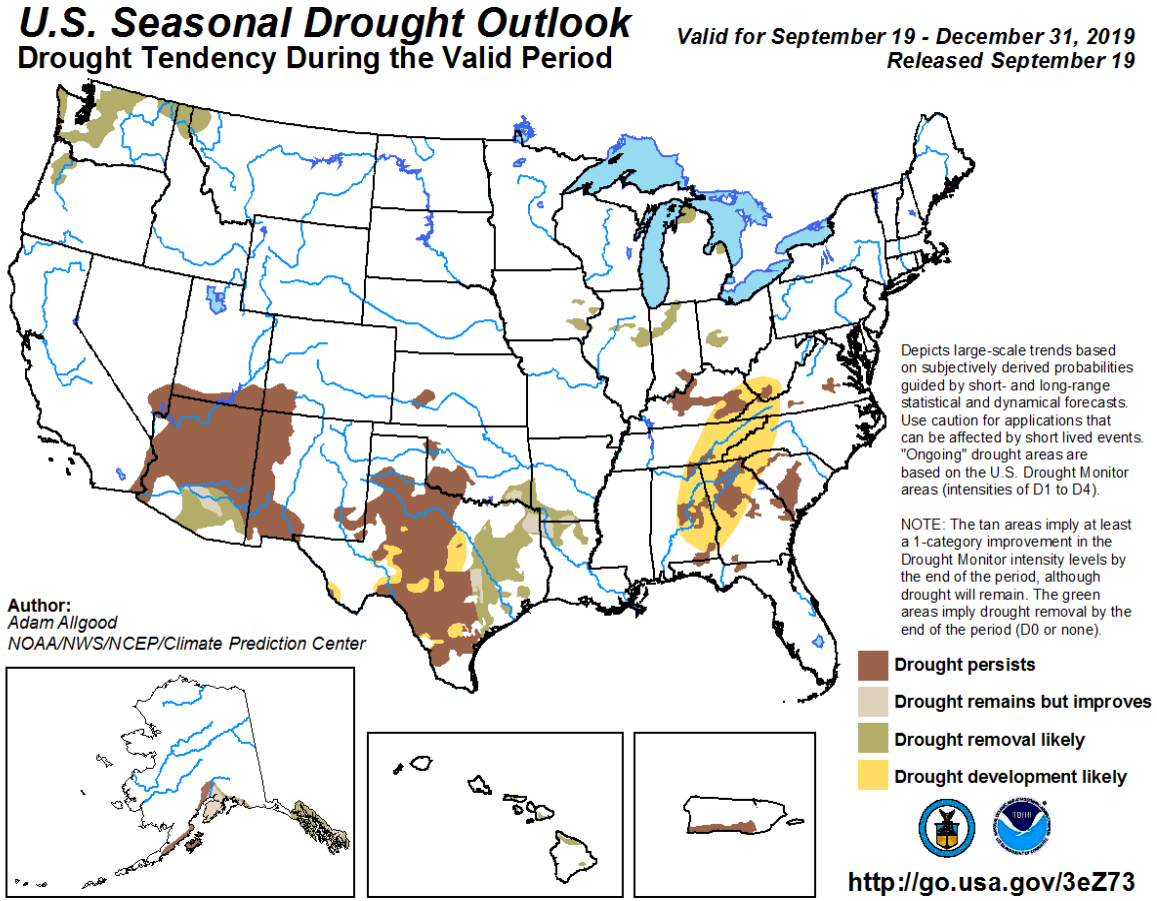
Application: NOAA Satellites & Drought



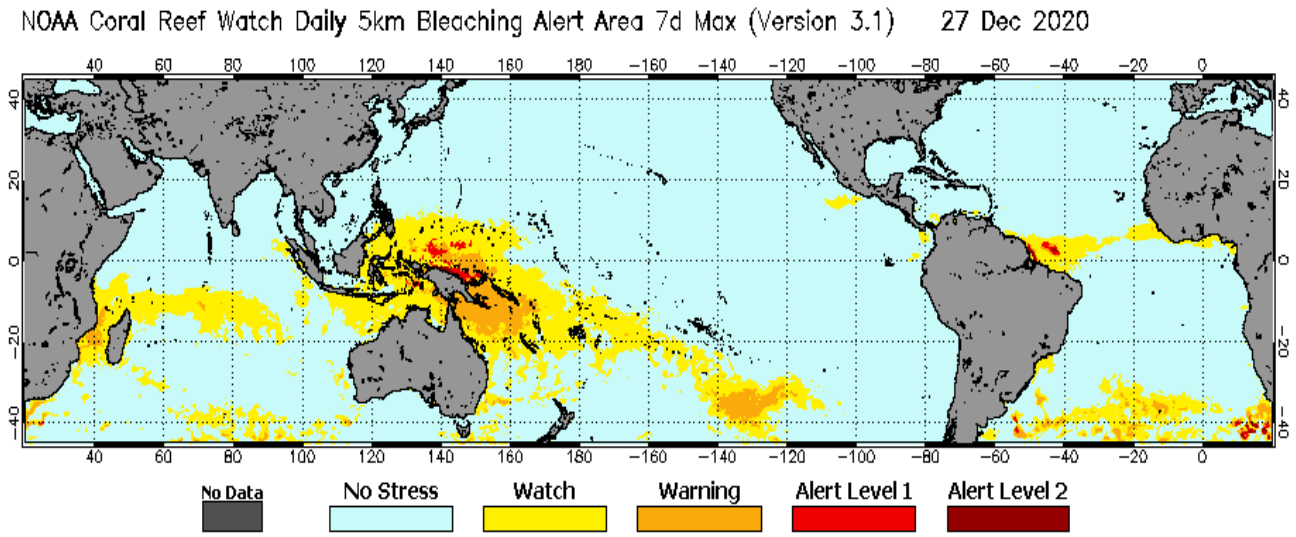
VIIRS Green Vegetation Fraction Product

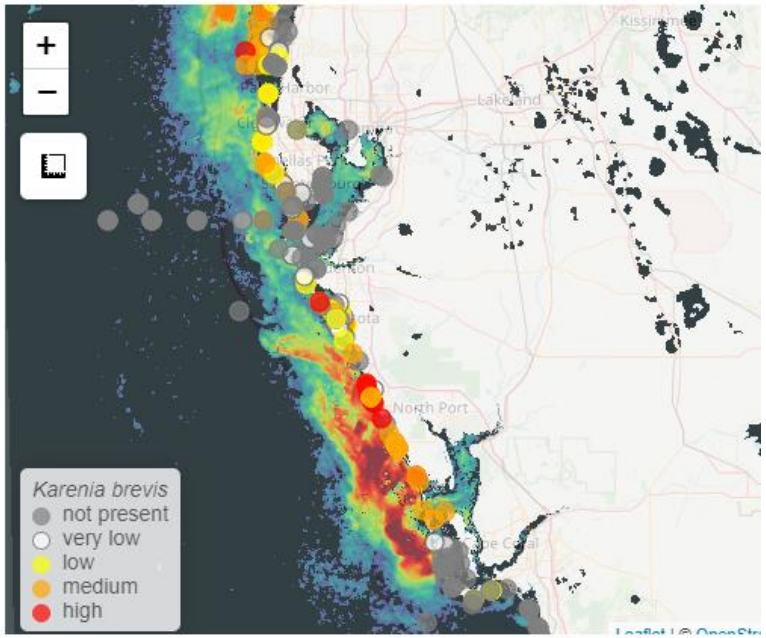


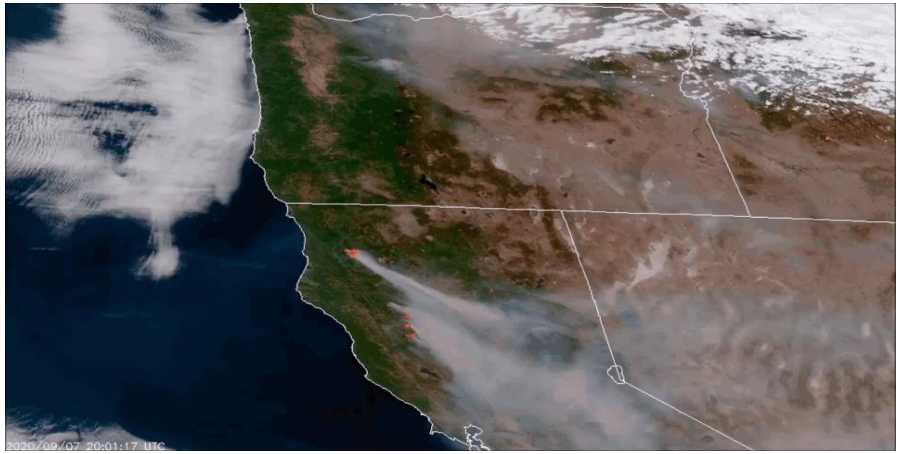
VIIRS Vegetation Health Product (VVHP)

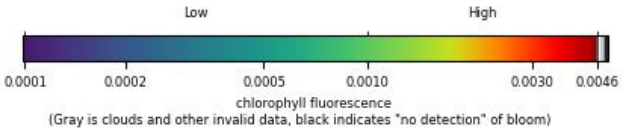


Application: Climate Response and Economic Recovery









Top Left: *Coral Reef Watch bleaching alert, December 2020 - January 2021*

Bottom left: *Oregon and California Fires, Sept. 7-9, 2020*

Top right: *Harmful Algal Bloom products, Aug 18, 2021*