

NOAA Key Observing and Information Systems Issues and Priorities

NESDIS

National Environmental Satellite,
Data, and Information Service

25 July 2025

Mike Ford, Senior Scientist for Environmental Satellites

Joint Spring Meeting of the Aeronautics and Space Engineering
Board and the Space Studies Board, 2025



Our Aspiration

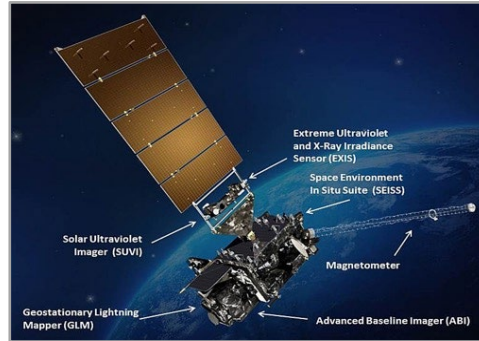
Provide a truly integrated digital understanding of our Earth environment that can evolve quickly to meet changing user expectations by leveraging our own capabilities and partnerships

NESDIS Advances Earth and Space Weather Observations



Low Earth Satellites (LEO) *500 miles above Earth*

- Joint Polar Satellite System (JPSS)
 - 3 on-orbit; 2 to launch
- Near Earth Orbit Network (NEON)
 - QuickSounder Project
 - Series-1: Sounder for Microwave-Based Applications (SMBA)
 - Future projects



Geostationary Satellites (GEO) *22,000 miles above Earth*

- Geostationary Operational Environmental Satellites (GOES)-R Series
 - GOES East and West
- Geostationary Extended Observations (GeoXO)
 - Next Gen Systems in Development



Space Weather Satellites *L1: ~1 million miles from Earth and other observation points*

- Space Weather Follow On (SWFO)
 - Compact coronagraph (CCOR) on GOES-19
 - SWFO-L1 launching late 9/2025
- Space Weather Next (SW Next)
 - Space weather Observations at Lagrange-1 (SOL)
 - L5 (partnership with ESA)

Modernizing NOAA Observing Systems

- Future NESDIS satellite programs will continue to tie to key weather observational requirements and advance the capabilities of NOAA satellites
 - GeoXO, NEON, and SW Next will fly advanced, next-gen instruments, building on the capabilities of the instruments currently flying on GOES-R, JPSS, and SWFO
 - Leverage commercial capabilities, and continue to foster interagency and international partnerships
- NESDIS will develop observations towards becoming a world leader in NWP computing
 - Advancing global and regional models, hurricane modeling, and tornado prediction.



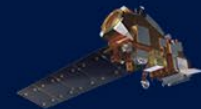
GeoXO



QuickSounder

The Role of NOAA's Satellites

GEO & LEO



Supports Innovation



**Wildfire Response
and Preparedness**



**Enhances Agricultural
Forecasts**



**Minimizes Risk to
Businesses**



**Keeps U.S. at
Forefront of Earth
Observation**



**Monitors Hazards for
Transportation**



**Provides Economic
Resilience**



**Helps Predict Energy
Demand**



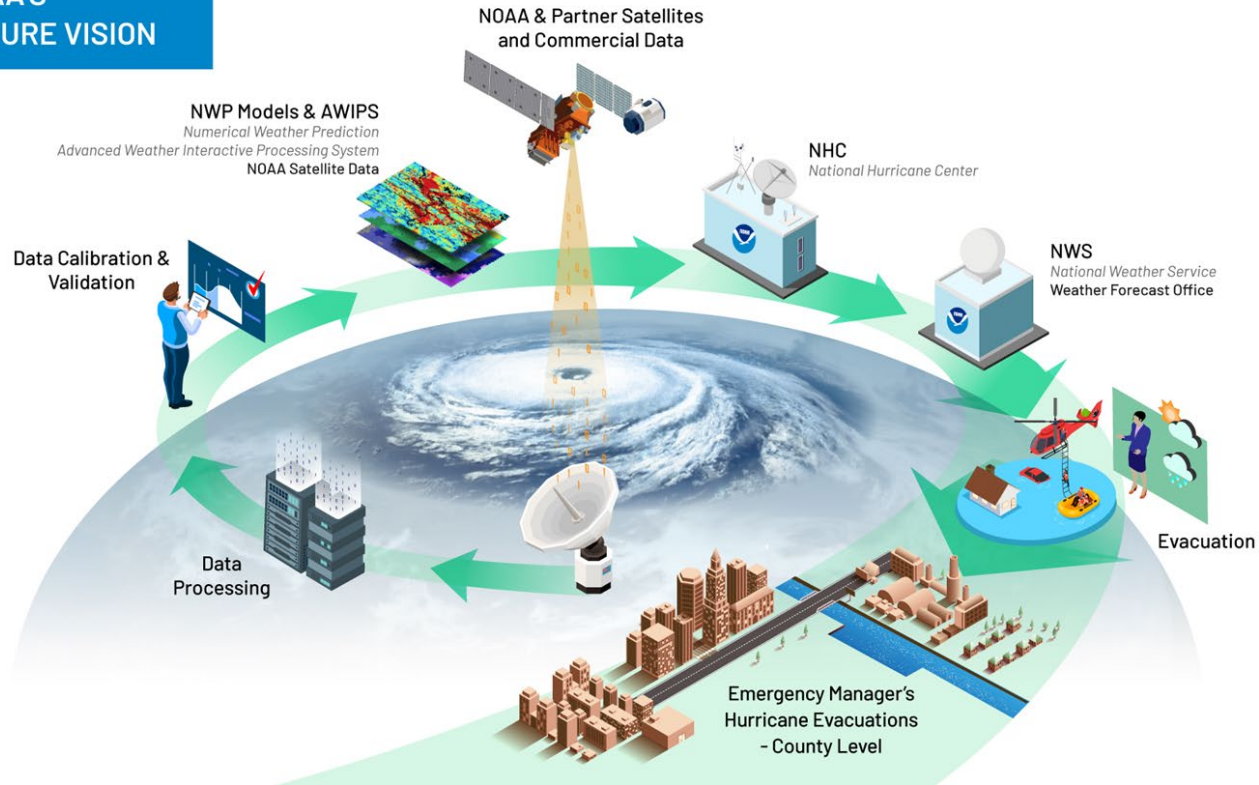
**Informs Energy
Production Estimates**

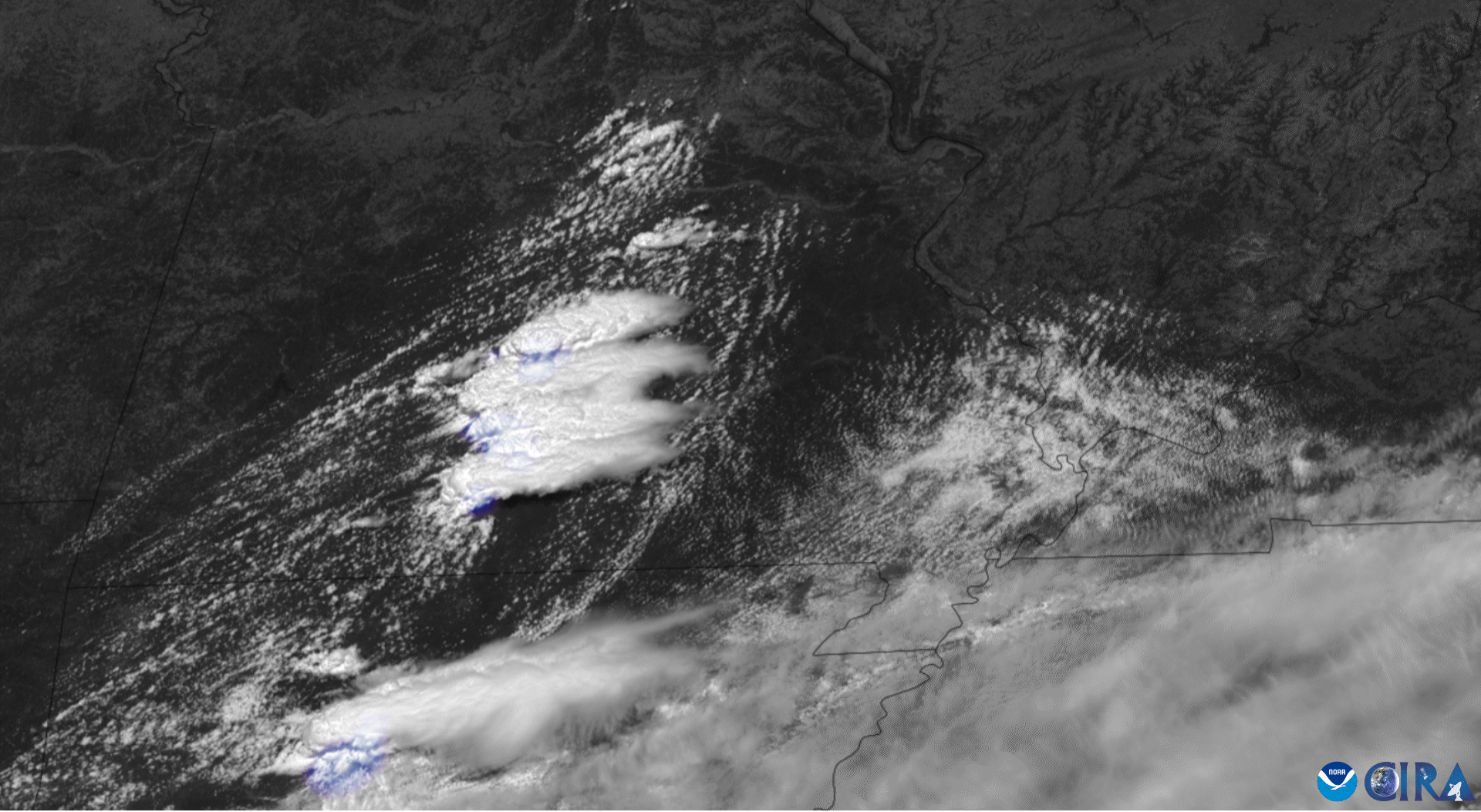


**Hurricane Response
and Preparedness**

Extreme Weather Prediction Starts with NOAA Satellites

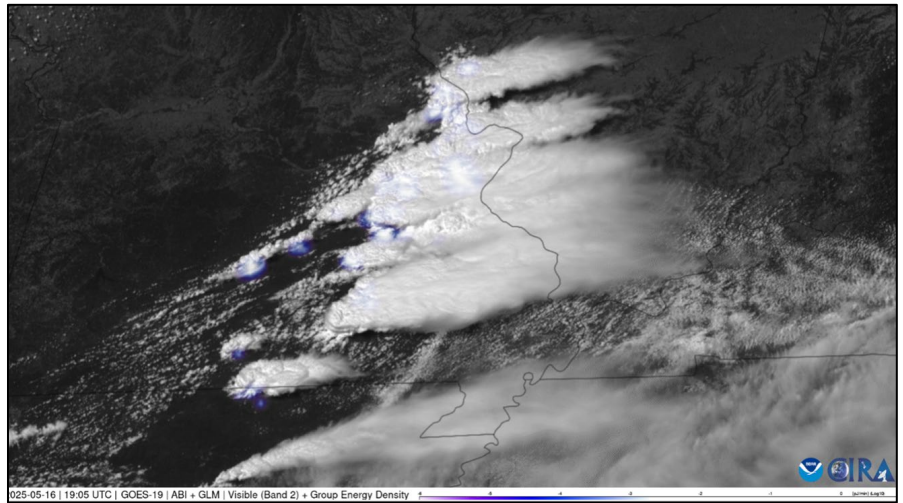
NOAA'S FUTURE VISION

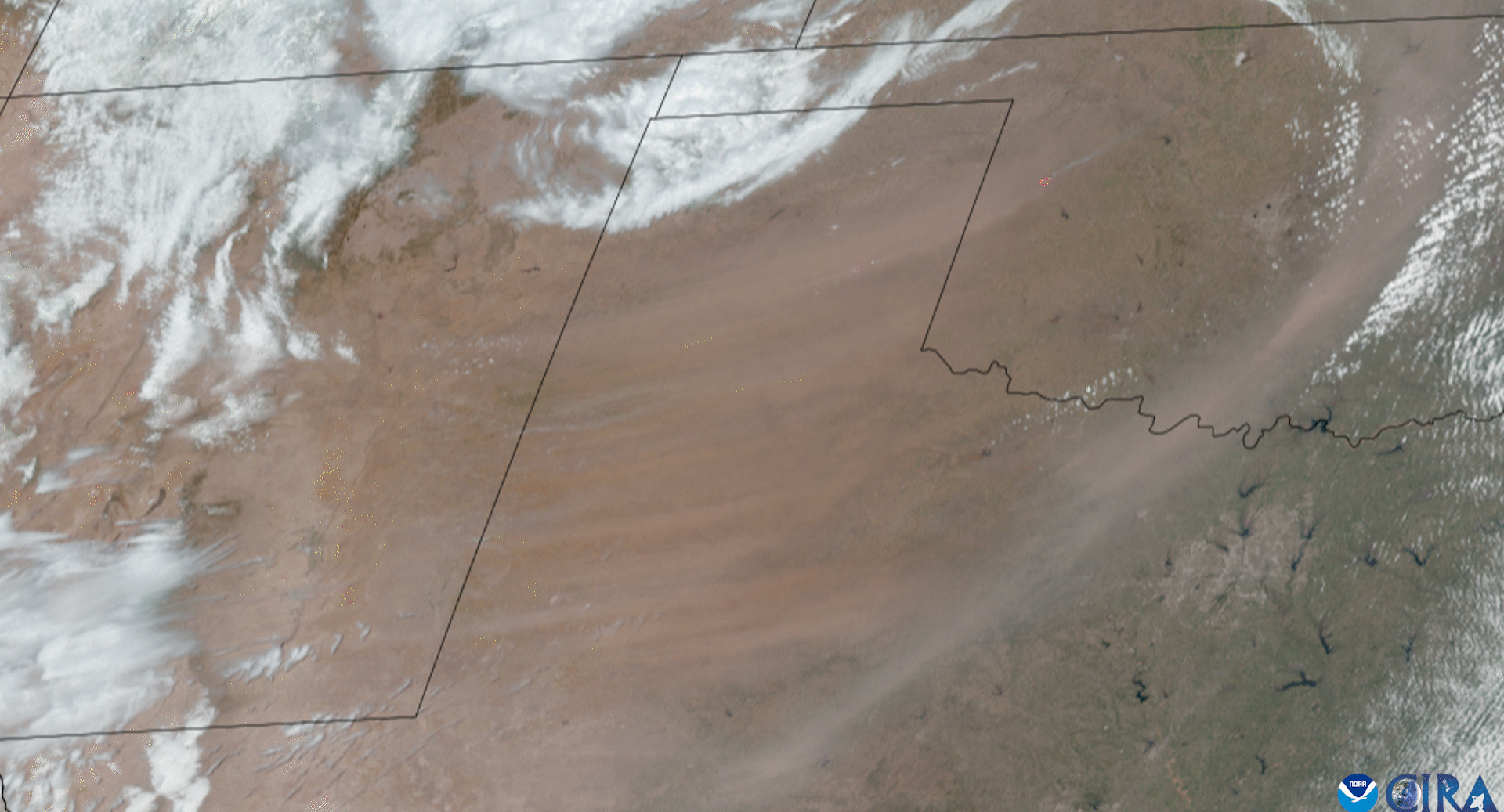




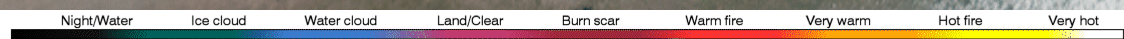
NOAA Satellites Drive Tornado Warnings

- Imaging, Sounding, and Lightning Mapping all play crucial roles in the detection of storms that form tornadoes
- An EF-3 tornado in St. Louis, MS, with winds up to 152 mph and a width of one mile struck. This caused widespread damage and five fatalities
 - The tornado's path was approximately 23 miles long
- The storm resulted in thousands of homes and businesses affected.
- NWS warnings were issued to give residents critical time to take shelter





2025-03-14 | 17:16 UTC | GOES-16 | ABI | GeoColor + Fire Temperature



Next Generation GEO Fire Program

- During the recent Oklahoma wildfire outbreak, state officials identified 19 fires for which NOAA geostationary satellites were credited as the primary discovery method
- According to state officials, preliminary analysis of fire spread modeling found that rapid firefighter response associated with the 19 fires first detected by GOES **likely saved more than \$850 million dollars worth of structures and property**
- Next Generation Fire System (NGFS) was explicitly cited in the official dispatch logs for 12 of these fires
- GeoXO will build on GOES-R's capabilities:
 - GeoXO Sounder will provide detailed 3-dimensional measurements of atmospheric temperature and humidity
 - GeoXO Imager, with its improved spatial resolution, will allow for faster detection of smaller fires and more precise location.

NOAA unveils powerful convergence of AI and science with revolutionary Next-Generation Fire System technology

Early success of AI-powered fire detection system is winning fans in firefighting community

Focus areas: Research Topics: wildfires, forecasting, artificial intelligence or AI, research

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May 20, 2025



Seeing Tomorrow's Floods Today: The Role of NOAA Satellites in Inundation Mapping

- River flooding poses a serious threat to communities across the United States, endangering roughly 41 million Americans and putting an estimated \$5.5 trillion in assets at risk
- NOAA's National Water Center has developed experimental Flood Inundation Mapping (FIM) Services based largely on NWP data
- LEO sounders provide essential data that strengthen the accuracy and effectiveness of hydrologic modeling, enabling more accurate flood inundation mapping



Example FIM Services map, blue shading marks the areas of a neighborhood in Campbell, Florida projected to experience river flooding over the next five days

Standard Nighttime Lights

A satellite image of the United States at night, showing a dense network of white and yellow lights representing urban areas and infrastructure. The lights are concentrated in the eastern half of the country, particularly in the Northeast and around major cities. The western half is significantly darker, with fewer lights visible. State boundaries are outlined in thin black lines.

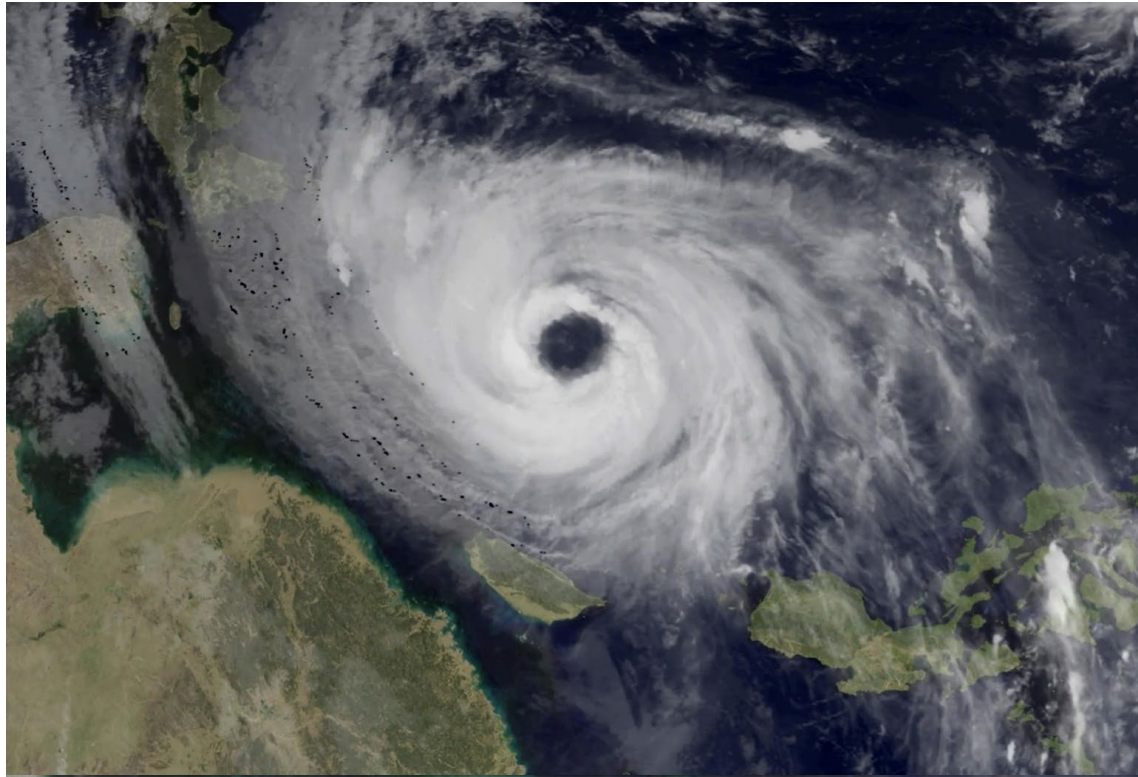
Assessing Power Outages in the Wake of Flooding



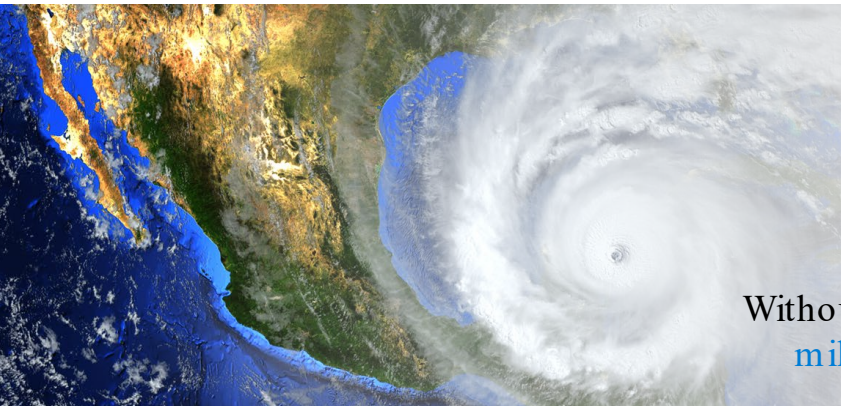
Next Generation LEO Observations

The first series of LEO's next generation of satellites, NEON, will focus on advancing microwave sounding, critical for NWP.

- Microwave sounding gives temperature and moisture information at multiple levels of the atmosphere
- These measurements are the two largest-impact sources of observations for forecasts.



Microwave Soundings: Real-world Applications



Each hurricane that strikes the U.S.
on average generates
\$22.8 billion in damages

Without LEO data, track predictions can be **off by more than 200 miles**, resulting in substantially greater damage and death

Flight delays cost airlines an estimated
\$30 billion annually

Without LEO data, **aviation forecasts will degrade**, causing reroutes, holding patterns, ground delays, and cancellations



Microwave Soundings: Real-world Applications

The Air Force 557th Weather Wing and Naval Meteorology and Oceanography Command (CNMOC) rely on **NOAA microwave sounding data** to produce global weather forecasts for all branches of the military and the intelligence community.



“Every DoD operational mission begins with a weather briefing ; either space weather, terrestrial weather, or both. The data required for DoD missions is often unique and necessitates 24/7 global ability to forecast weather in austere and denied environments.”

- U.S. Space Force Gen. David Thompson



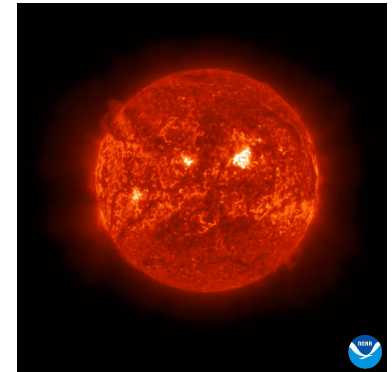
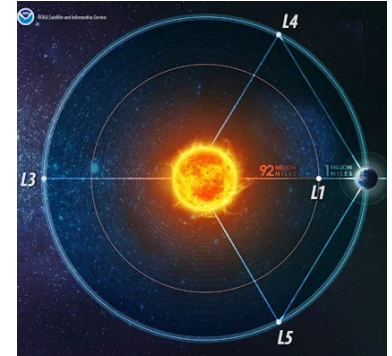
NOAA Satellites Observe Space Weather

Space Weather describes the **variations in the space environment between the sun and Earth**. As a space weather storm leaves the sun, it passes through the corona and into the solar wind, and energizes Earth's magnetosphere.

Space weather can impact technology on Earth, including:

- GPS/navigation
- Electrical power grids
- Airline navigation technology
- Space operations and equipment
- Radio communications

NOAA observes space weather phenomena from **multiple vantage points** in space.



Space weather impacts infrastructure and activities vital to national security and the U.S. economy



Space weather-induced blackout of the electric grid in North America (potential damages totaling over \$1 trillion): *Daily* domestic economic loss in the U.S. equal to **\$41.5 billion**, plus an additional **\$7 billion** loss through the international supply chain.

Source: *Quantifying the daily economic impact of extreme space weather due to failure in electricity transmission infrastructure*, Centre for Risk Studies, University of Cambridge, Jan



Space Weather is a National Priority

- **RISK**: The effects of space weather pose significant risks to the United States.
- **THREAT**: Space weather can disrupt technologies that form the backbone of this country's economic vitality and national security.
- **VULNERABILITY**: Potential impacts grow exponentially due to society's increased reliance on technology and aging infrastructure.
- **ACTION**: In 2020 President Trump signed the PROSWIFT Act, which “provides authorities to improve the gathering of space weather data and the forecasting of space weather”

Signing Statement from President Donald J. Trump on S. 881

— ENERGY & ENVIRONMENT | Issued on: October 21, 2020



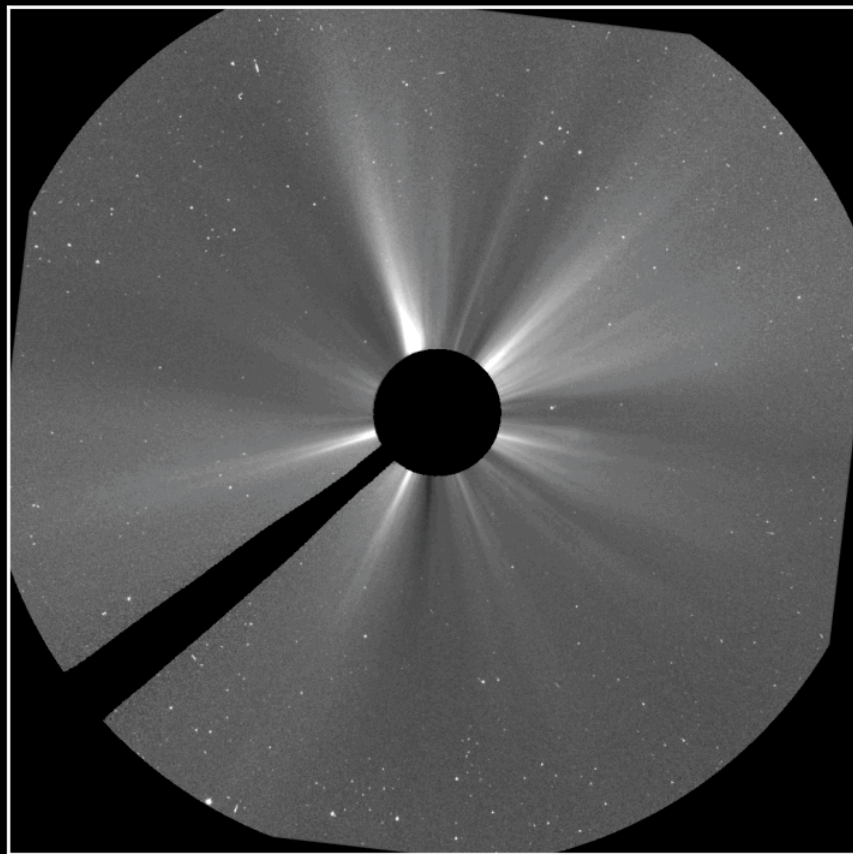
Today, I have signed into law S. 881, the “Promoting Research and Observations of Space Weather to Improve the Forecasting of Tomorrow Act,” or “PROSWIFT Act” (the “Act”). The Act provides authorities to improve the gathering of space weather data and the forecasting of space weather. I note, however, that certain provisions of the Act, while generally unobjectionable as a matter of policy, could limit my discretion under Article II of the Constitution to conduct the Nation's foreign affairs. These include applicable parts of section 2(a) and 51 U.S.C. 60601(c)(3) and 60603(c), as added by section 2(b). My Administration will treat these limitations as advisory and non-binding. Additionally, space weather can have devastating effects on national security assets and our Nation's critical infrastructure, including assets in space. The Act, however, does not address the resilience of national security assets or critical infrastructure to the effects of space weather. Without ensuring the resilience of these assets, our Nation will remain vulnerable to the effects of space weather, regardless of how accurate forecasting becomes. I look forward to working with the Congress to improve the resilience of national security assets and critical infrastructure to space weather.

DONALD J. TRUMP

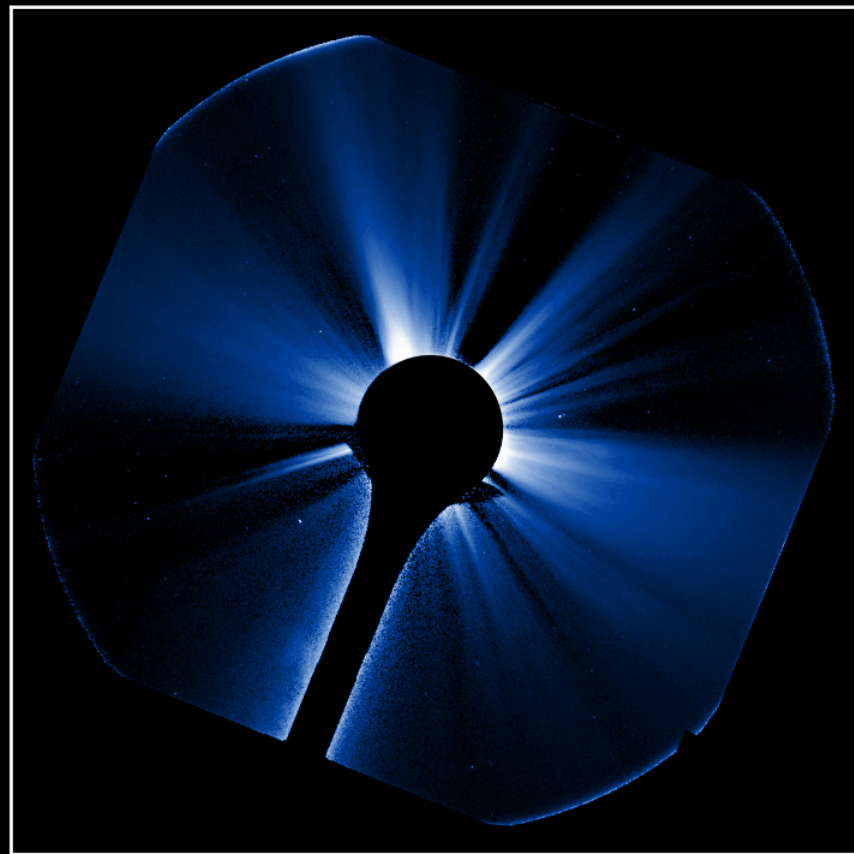
THE WHITE HOUSE,
October 21, 2020.



LASCO/C3
2024-11-09 07:06:08



GOES-19/CCOR-1
2024-11-09 07:00:20



Approved Mission to Ensure No Gaps Upstream

- SOL, the first project of the SW Next program, provides continuity for SWFO-L1 measurements of the solar wind, thermal plasma, the sun's magnetic field, and corona.
- SOL implementation:
 - Department approval July 2024; NASA key decision point "B" December 2024
 - Contracts awarded for spacecraft and all SOL-A instruments
 - Commercial coronagraph – not government-built CCOR
 - Preparing for SOL-A launch in 2029 to provide continuity with five-year SWFO-L1 design life
 - SOL-B to follow in 2032 (depending on budget) to provide required system resilience and availability



NOAA Partners to Observe Earth and Sun



NESDIS Commercial Data Program

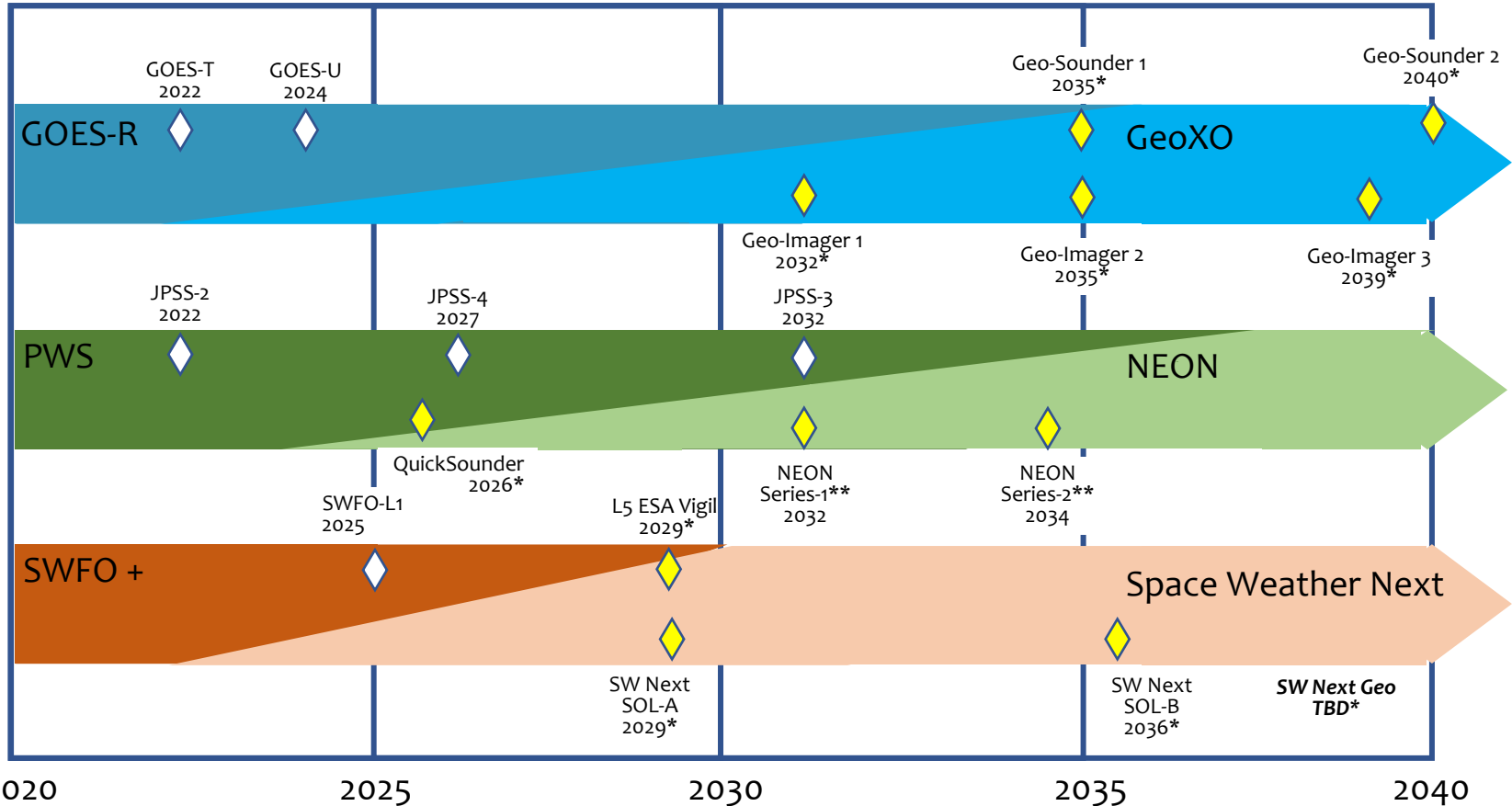
- The NESDIS **Commercial Data Program** acquires and assesses value-added commercial space-based environmental observation data to support NOAA's operational weather forecast mission.
 - For example, GNSS-Radio Occultation (RO) data purchases feed into NWP Neutral Atmosphere and Space Weather models
- The **Commercial Weather Data Pilot (CWDP)** studies assess the quality, characteristics, and impacts of available commercial observations and assess potential benefits to numerical weather prediction (NWP) by additional commercial capabilities over the current US government LEO backbone.
 - Examples include:
 - Microwave sounding data pilot
 - Ocean surface winds pilot



Artist rendering of Terran Orbital's SmallSat GEO. Credit: Terran Orbital



NESDIS Has Plans for Future Satellites



* Notional; pending appropriations

** The NEON mission sequencing after QuickSounder are subject to change based on the assessment of periodic mission impact assessments.

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Looking Forward: SWFO-L1 Launch

Space Weather Follow-On at Lagrange 1 (SWFO-L1) will launch in late September* 2025 as a rideshare on NASA's Interstellar Mapping and Acceleration Probe (IMAP) mission out of Cape Canaveral, FL

*Launch window opens late September



Rendering of the SWFO-L1 satellite



Thank You!