Creating a Digital Earth
NESDIS' Role Delivering Information to the World

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NOAA
Satellite and Information Service
@NOAASatellites

Working to Provide an Integrated Digital Understanding of Our Earth Environment to Meet NOAA and the World's Needs

Outline

- NESDIS Mission
- Brief history of satellite earth observations
- NOAA and the Global Observing System
- What is NESDIS' role in NOAA and in the Global system?

NESDIS's Mission is Essential to National Security, Safety, and Prosperity

- Operates the Nation's weather satellites, 24/7
- Acquires NOAA's Earth and Sun observation satellites for environmental forecasting
- 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

95% of the data used in weather forecast models come from satellites

NOAA's Role in National Space Policy

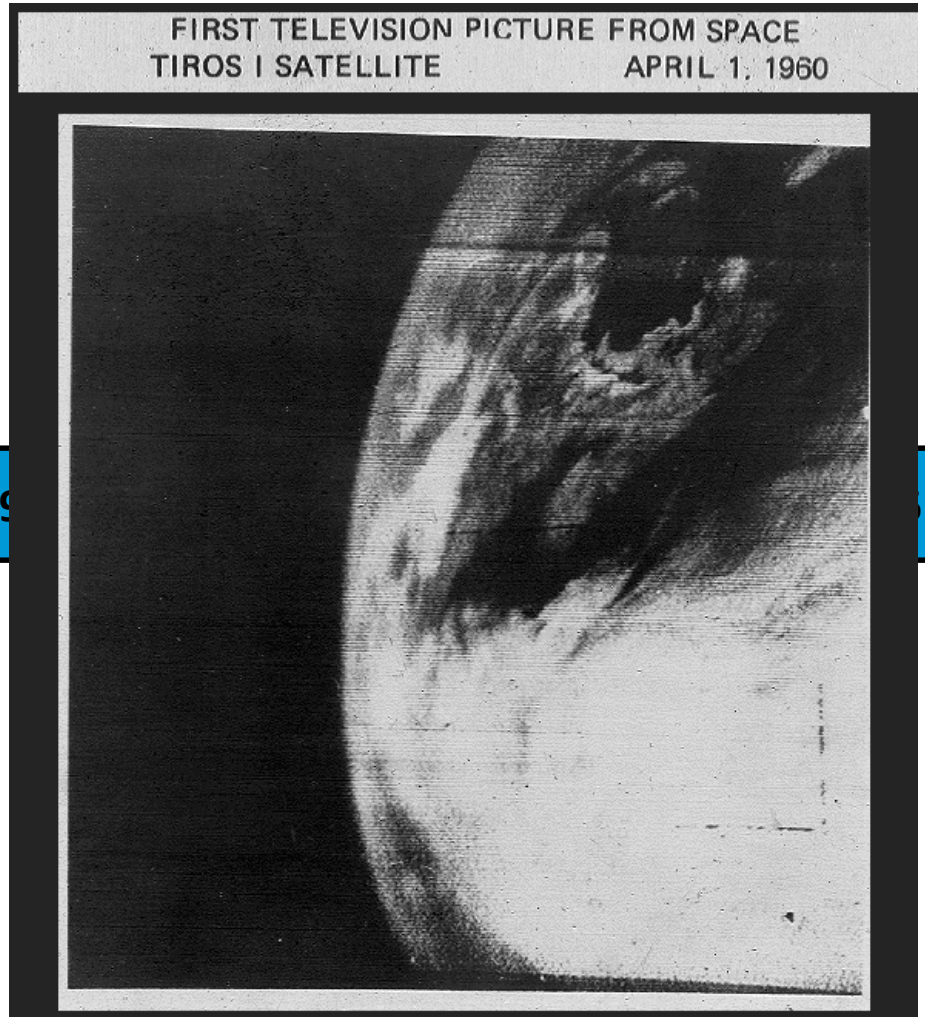
Civil Space Sector			Defense Space Sector
Focus on Earth system research	Focus on weather and space weather observations and applications	Focus on land remote observations and land use applications	Focus on intelligence gathering and weather and environmental applications to support military operations
Usually no more than one satellite per new research area. No backup satellites and less demanding reliability requirements	Operational, continuous missions. 2-4 satellites per block purchase, spares on ground or in space	Operational, continuous missions – utilizing capabilities provided by NASA (Landsat series)	Operational, continuous missions – block purchase of satellites, spares on ground or in space
Large, changing array of research observations dictated by national research priorities	Core set of observational requirements, with requirements increasing in response to operational needs		Core set of observational requirements, increasing in response to operational needs
Partners with both NOAA and USGS to leverage satellite building expertise	History of relying on NASA for space segment development		Independent space and ground segment development capability

Short History of Satellite Earth Obervations

Satellite Observations since 1958

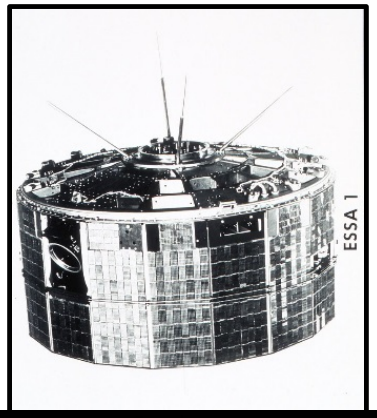
Explorer-1

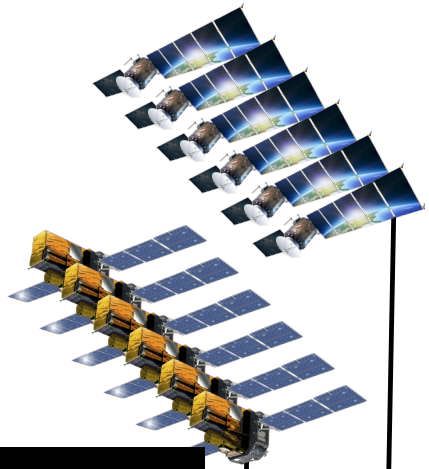
1958 → 1960 → 19 → 2017



TIROS-1

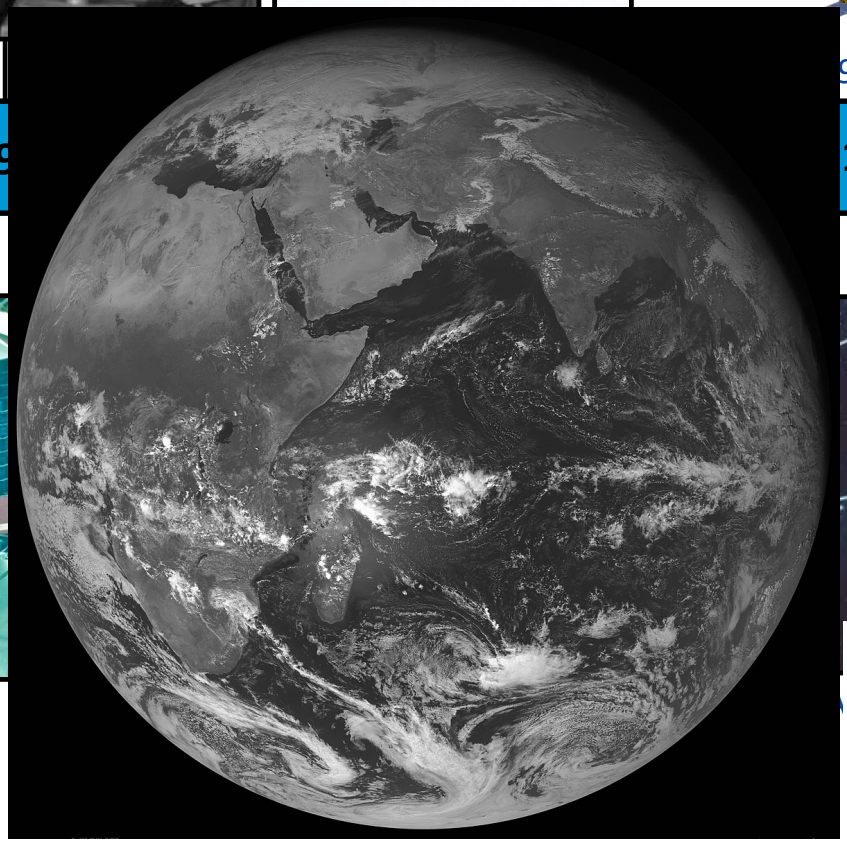
Satellite Observations since 1958

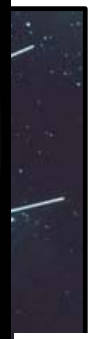




GOES-1-15

19 | 1972-2010 | 2016 | 2017



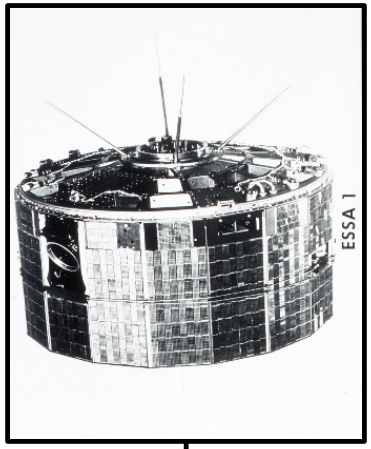


GOES-1

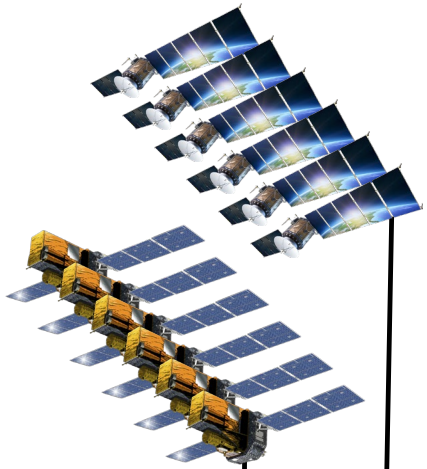
1979

Satellite Observations since 1958

Explorer-1



ESSA-1



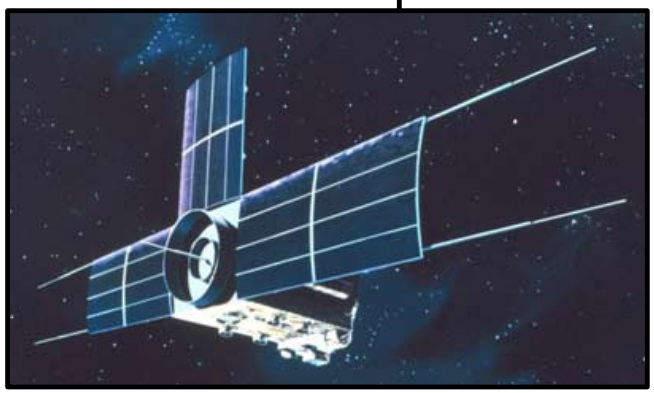
NOAA-2-19

GOES-1-15

GOES-16

1958 | 1960 | 1966 | 1970 | 1972-2010 | 2016 | 2017

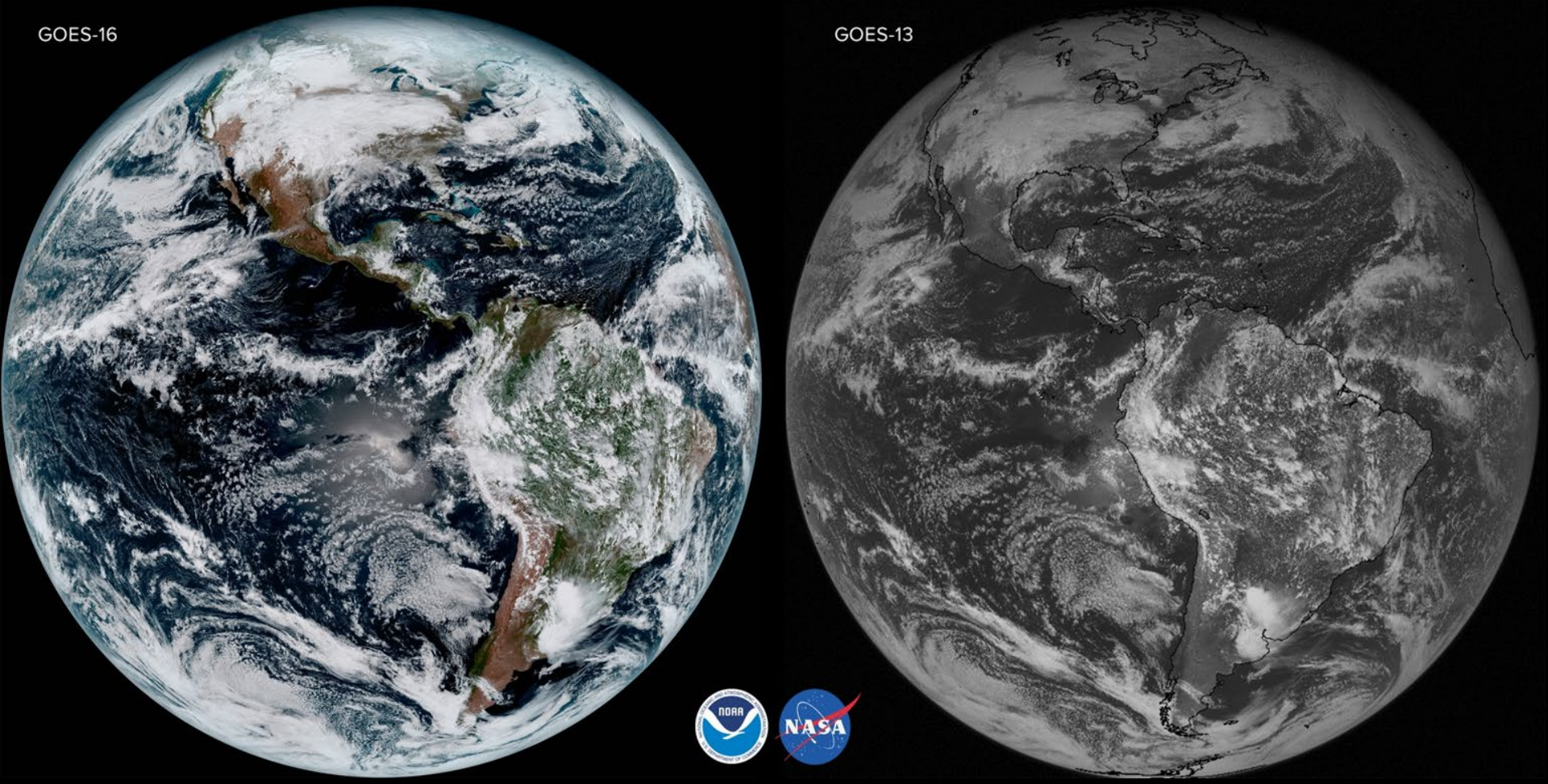
TIROS-1

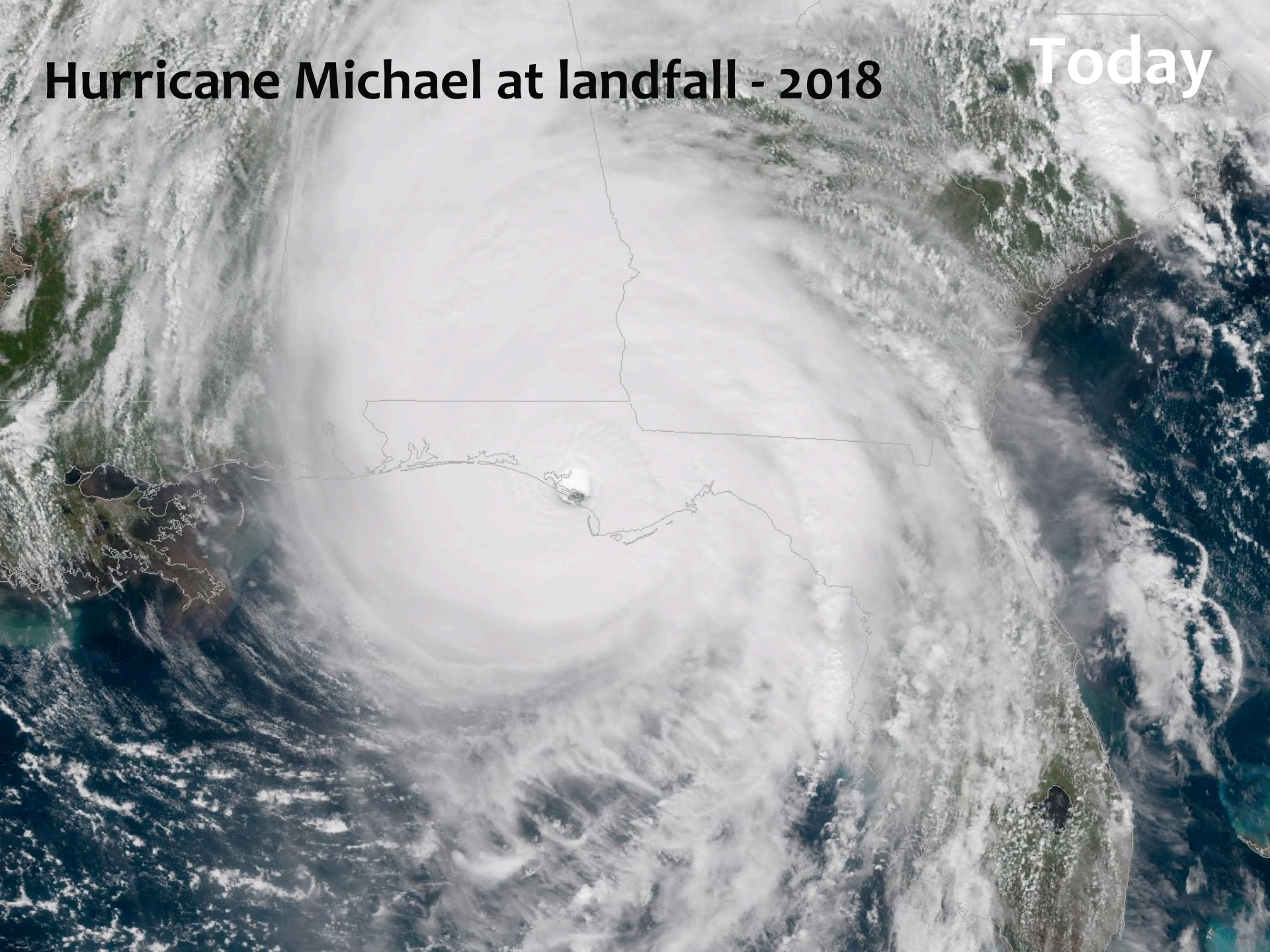


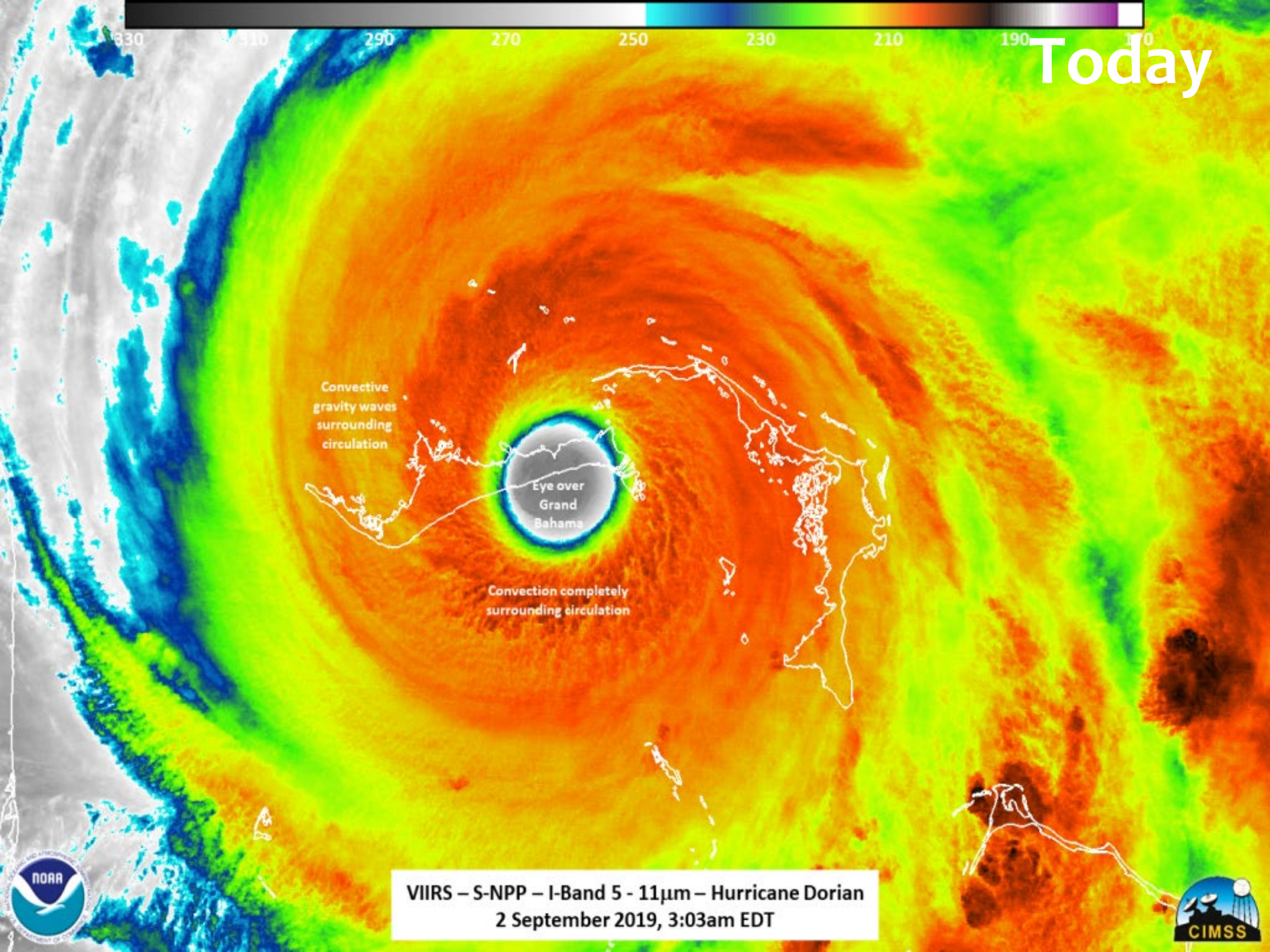
NOAA-1

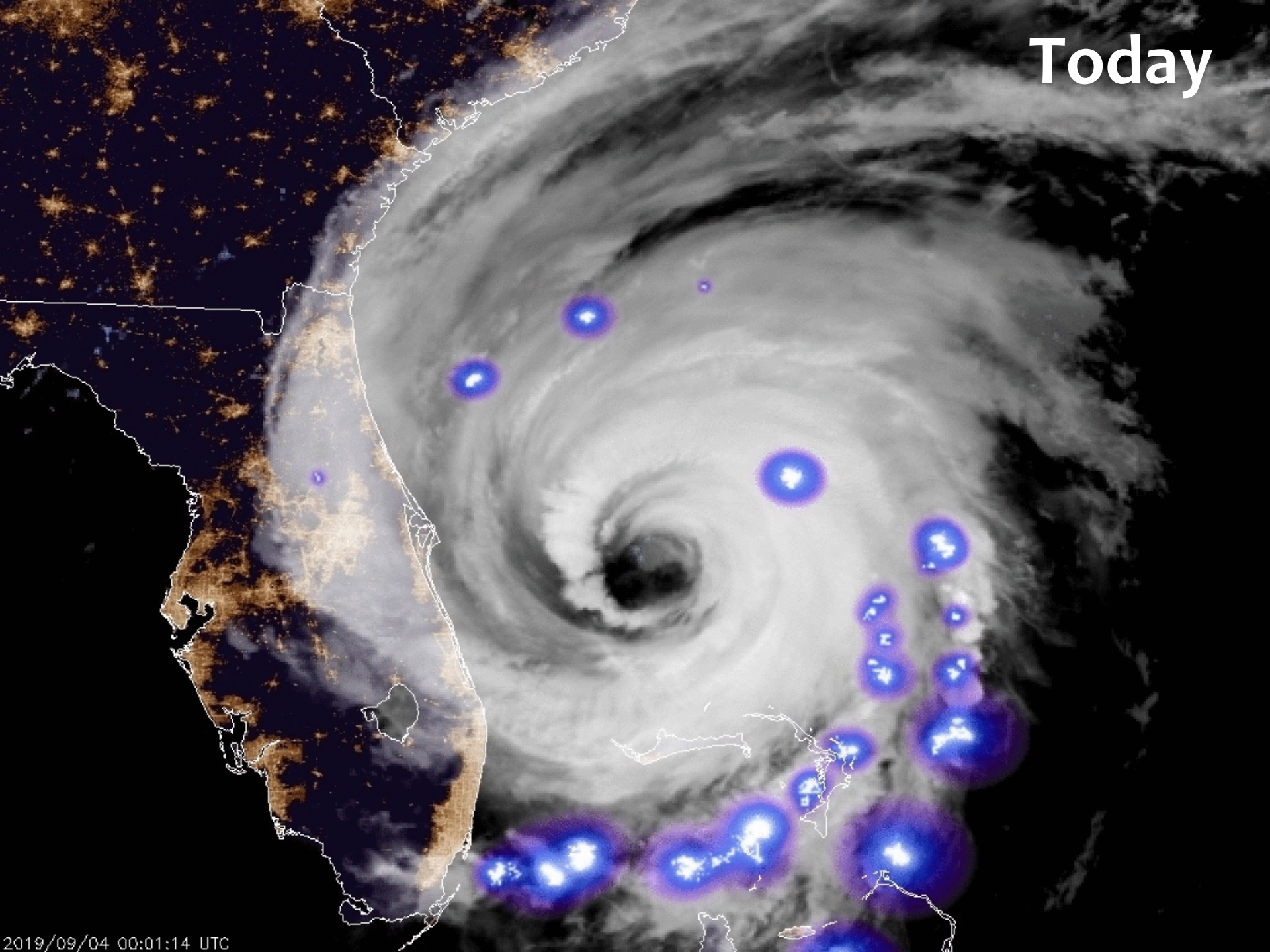
NOAA-20

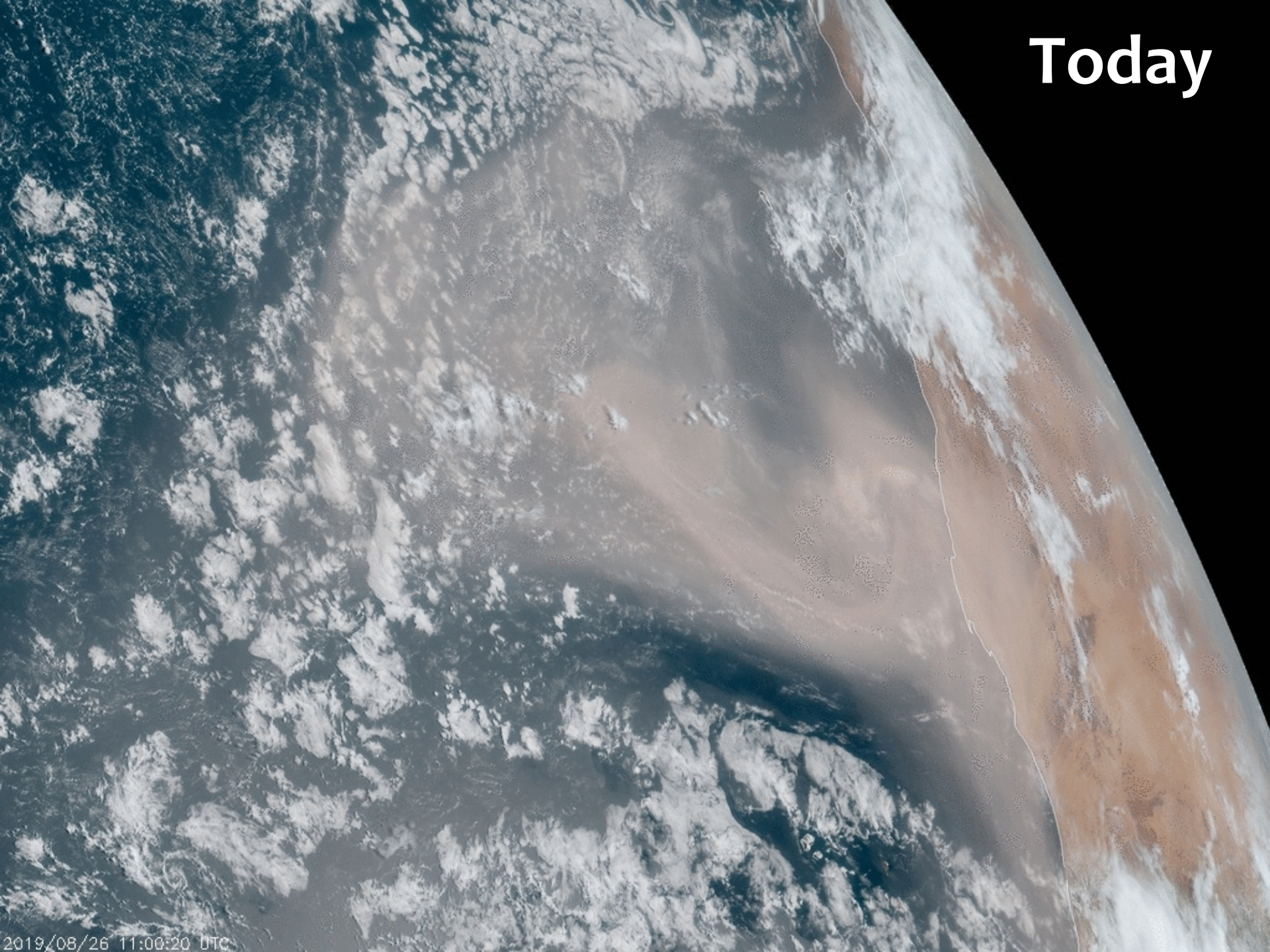
Major Upgrade

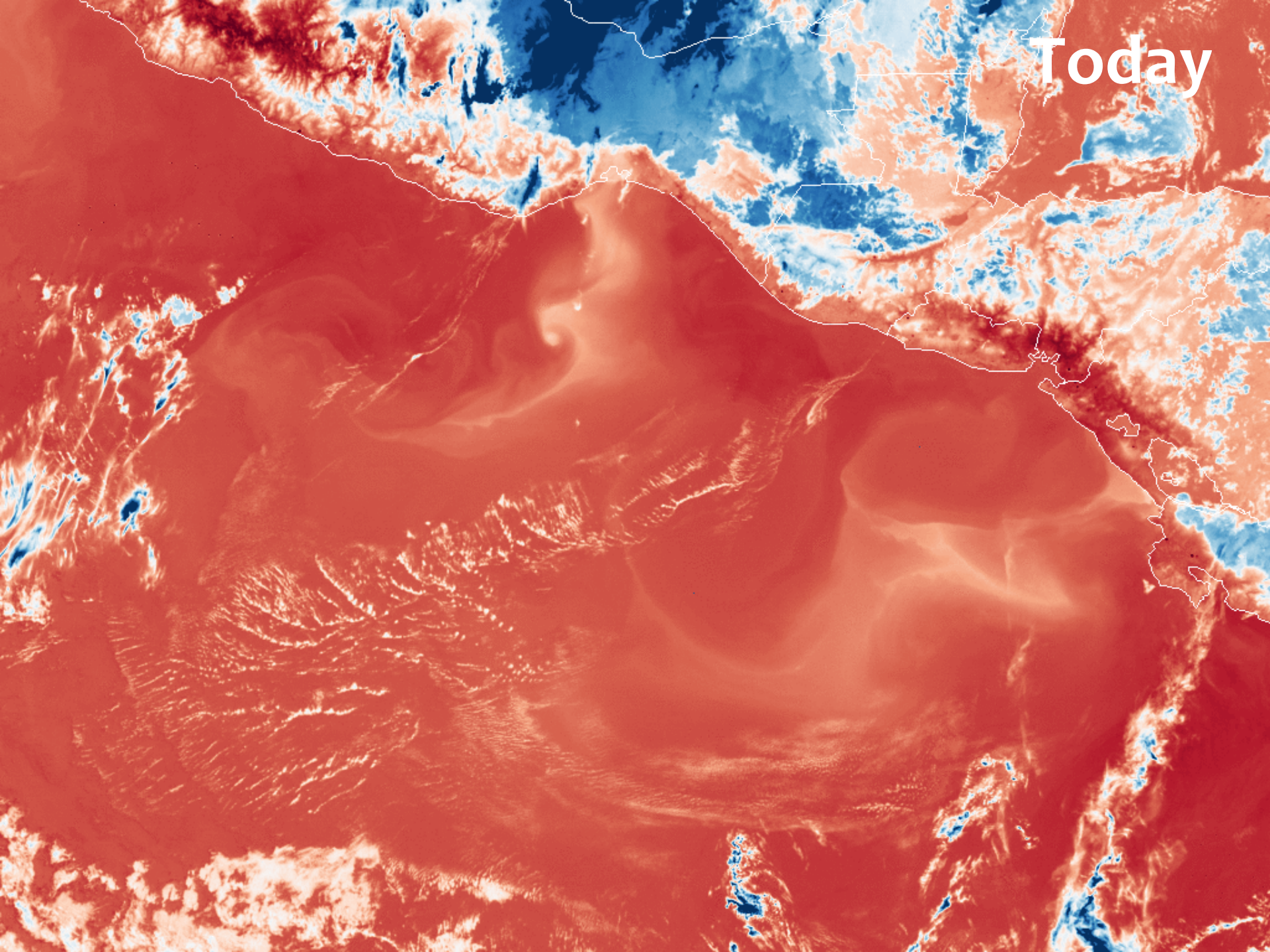



Hurricane Michael at landfall - 2018
Today


330
310
290
270
250
230
210
190
170
Today
Convective gravity waves surrounding circulation
Eye over Grand Bahama
Convection completely surrounding circulation
VIIRS – S-NPP – I-Band 5 - 11μm – Hurricane Dorian
2 September 2019, 3:03am EDT
NOAA
CIMSS


Today
2019/09/04 00:01:14 UTC


Today
2019/08/26 11:00:20 UTC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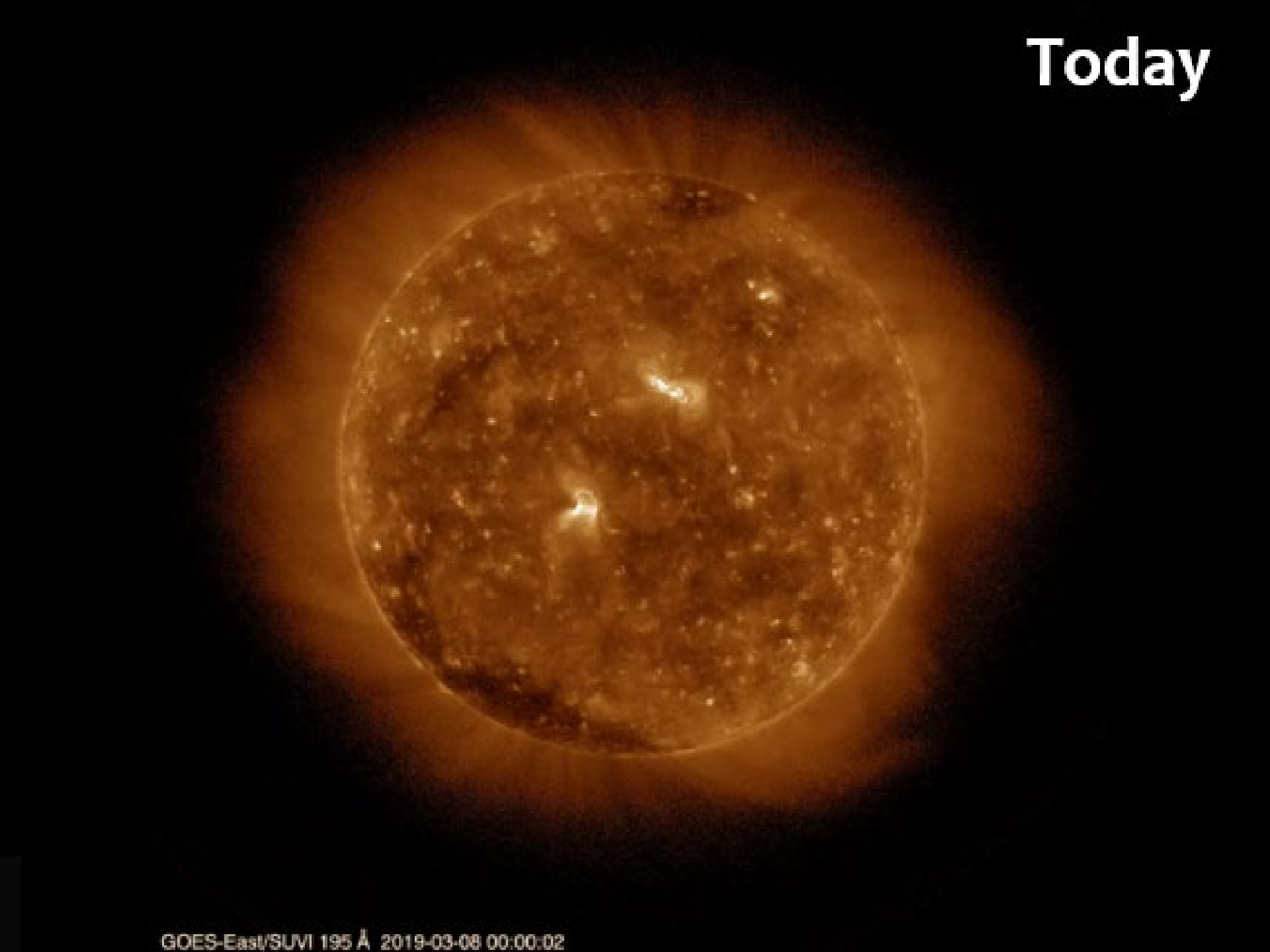

Today
GOES-East/SUVI 195 Å 2019-03-08 00:00:02

NESDIS and the Global Observing System

The Evolving Landscape: Five Trends

1. An **unprecedented pace of innovation** and technology advances (artificial intelligence, quantum computing, and machine-learning) is advancing forecast modeling.

2. Increasing demand for **timelier and more accurate predictions** of extreme weather events, delivered in faster, user-friendly communications.

3. Increased infrastructure sensitivity to environmental effects is intensifying demand for environmental assessments and projections to **inform infrastructure and commercial investments.**

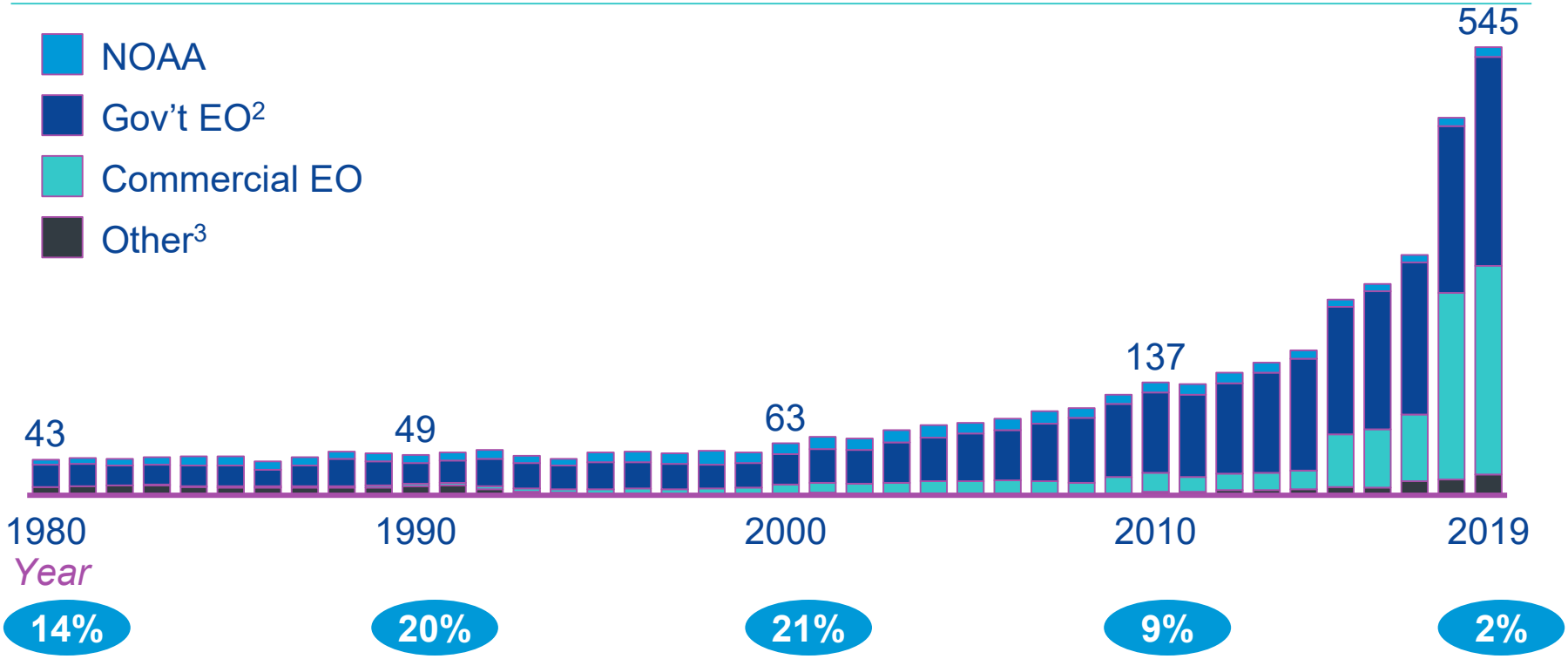
4. **Emerging capabilities among the U.S. aerospace industry** and **our international partners** for both launch and remote sensing.

5. **Increasing vulnerability** of our technological society to the magnetic, electrodynamic, and particle effects of space weather.

NOAA's share of EO assets in orbit has decreased from 14% in 1980 to just 2% in 2019

Earth Observation Satellite Market Share

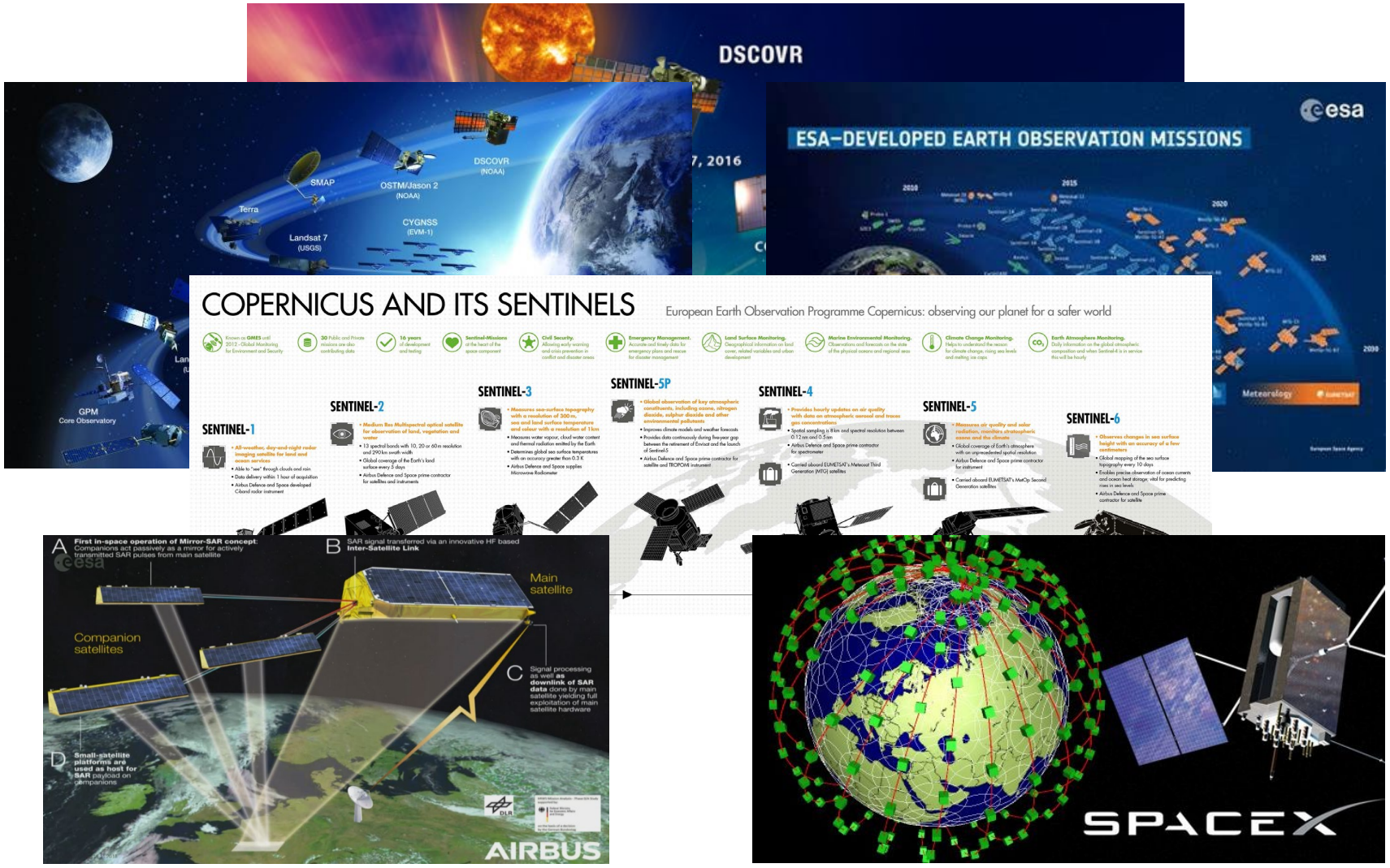
Total EO assets[1] in orbit



1 Includes assets that are primarily purposed for EO activity from all orbits and mass categories 2 Includes civil government and military assets 3 Includes university and unclaimed assets

SOURCE: Seradata SpaceTrak database, Team analysis

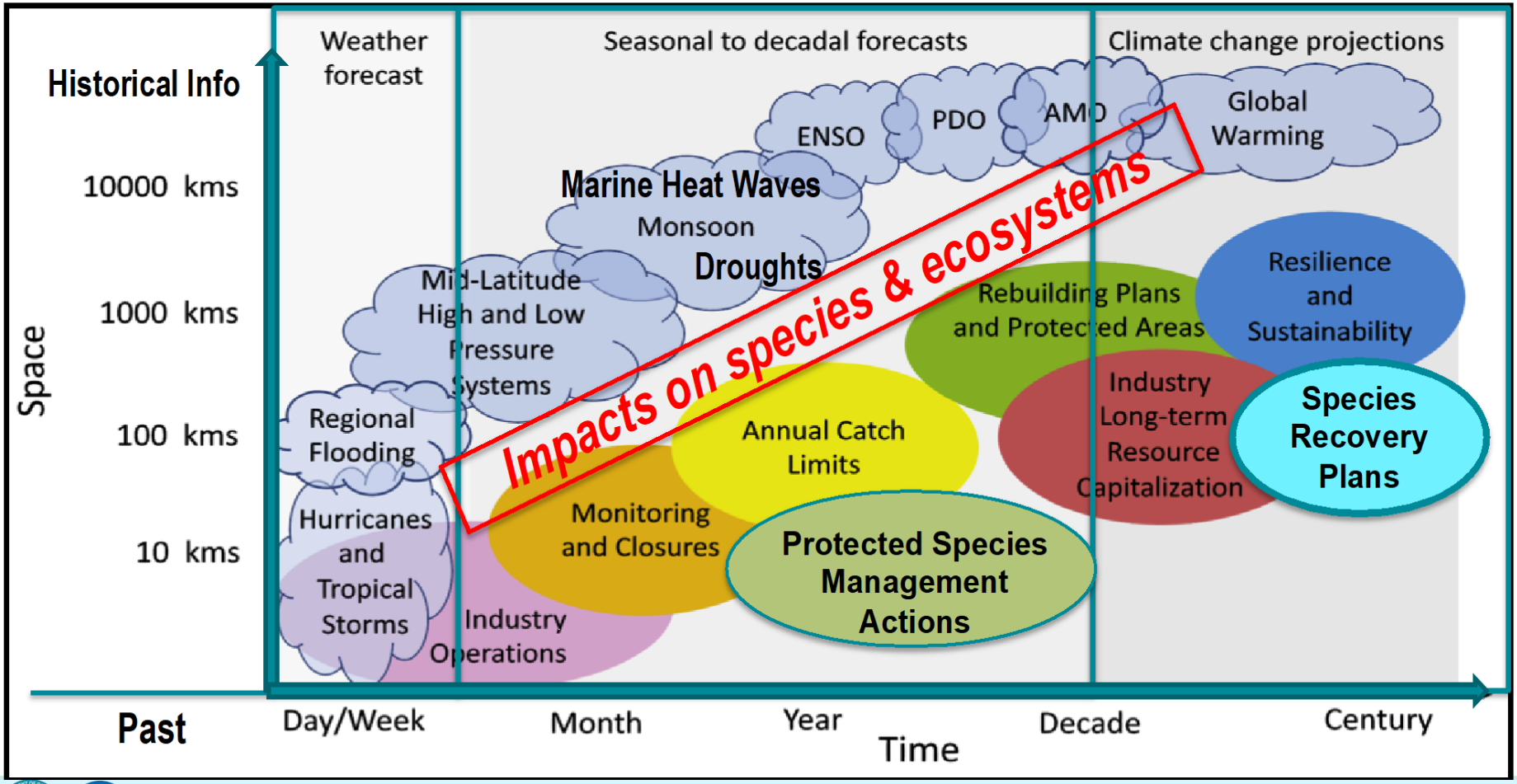
What does the Future Look like for Earth Observation Constellations?



Those are the assets, but what are the needs?

Observing and Understanding the planet to address NMFS Challenges

NMFS Climate Information Needs



Providing NWS with Information and Observations

"Ready, Responsive, Resilient"

Becoming a Weather-Ready Nation is about
building community resilience in the face of increasing vulnerability
to extreme weather, water and climate events

Touching every county every day.
Supporting national security and public safety.

This requires:

Better forecasts and warnings

Consistent products and services

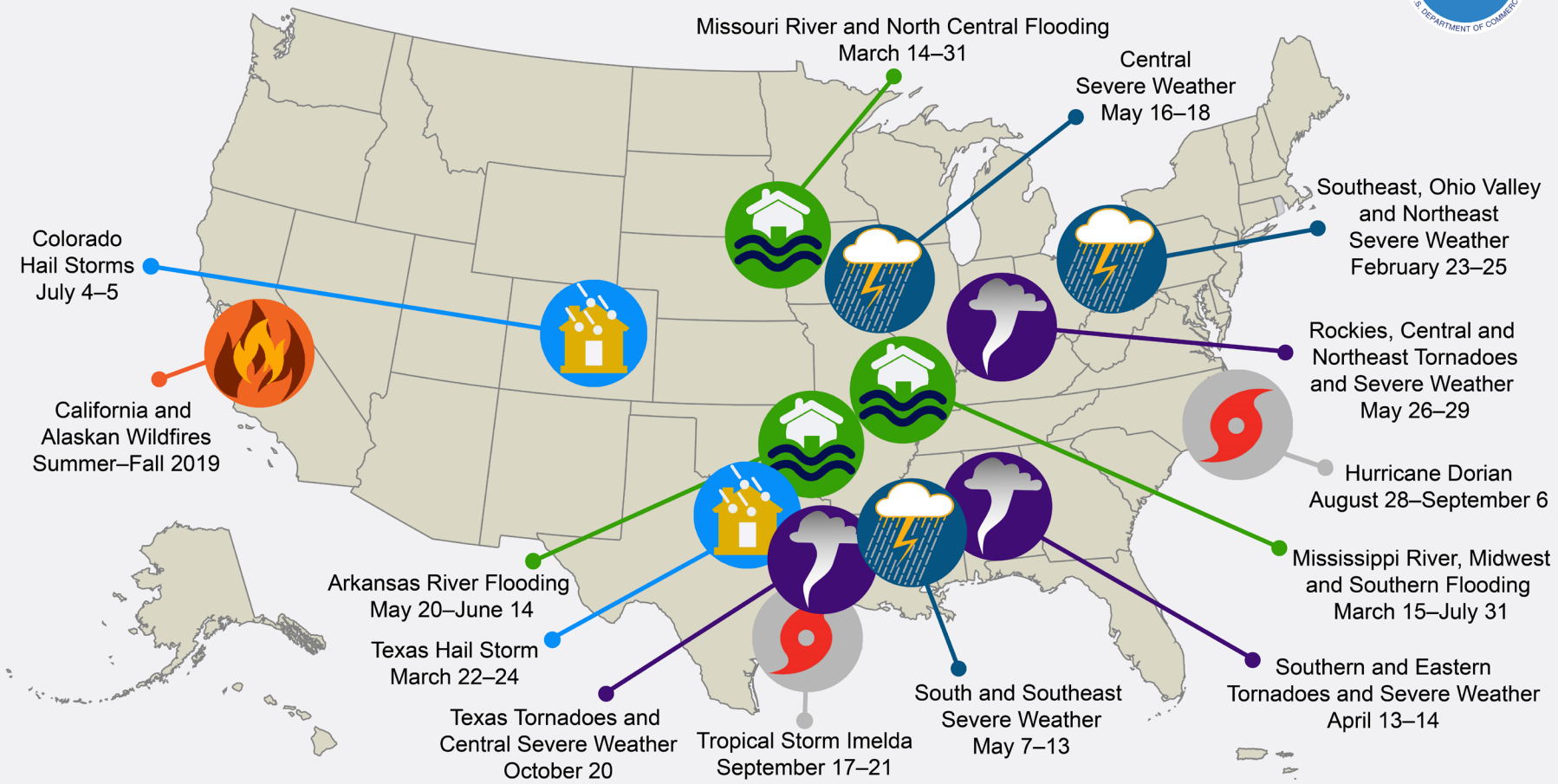
Actionable environmental intelligence

Revolutionary change connecting forecasts to decisions through ***impact-based decision support services***

Involves the entire US Weather, Water and Climate Enterprise WORKING TOGETHER

Why Our Observing & Data Systems Matter

U.S. 2019 Billion-Dollar Weather and Climate Disasters



*This map denotes the approximate location for each of the **14 separate billion-dollar weather and climate disasters** that impacted the United States **during 2019**.*

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 Reimagined

NESDIS Strategic Focus in the Transition to the Future

1. Advance observational leadership in geostationary and extended orbits

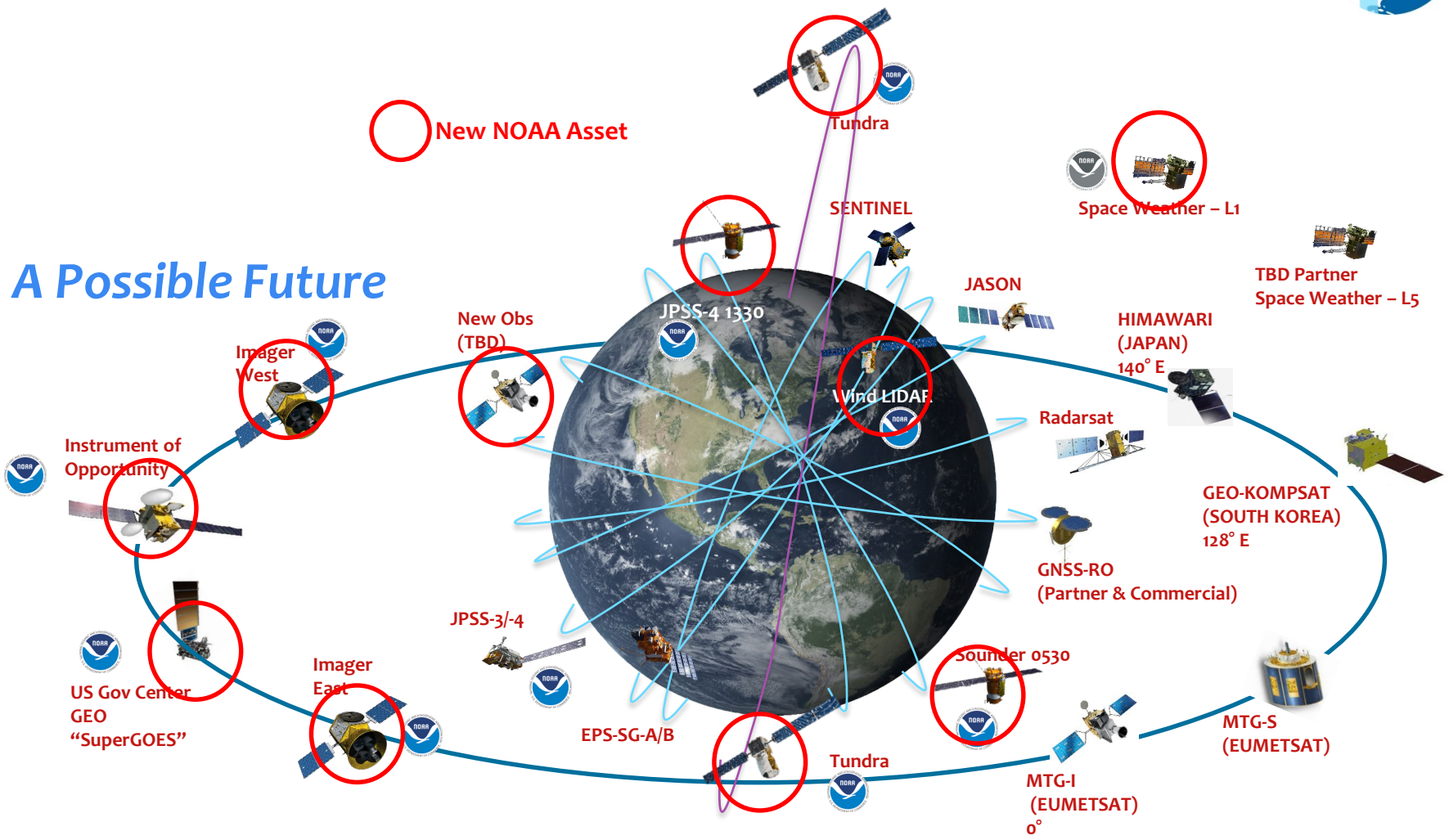
2. Evolve LEO architecture to enterprise system of systems that exploits and deploys new observational capabilities

3. Develop agile, scalable ground capability to improve efficiency of service deliverables and ingest of data from all sources

4. Provide consistent ongoing enterprise-wide user engagement to ensure timely response to user needs

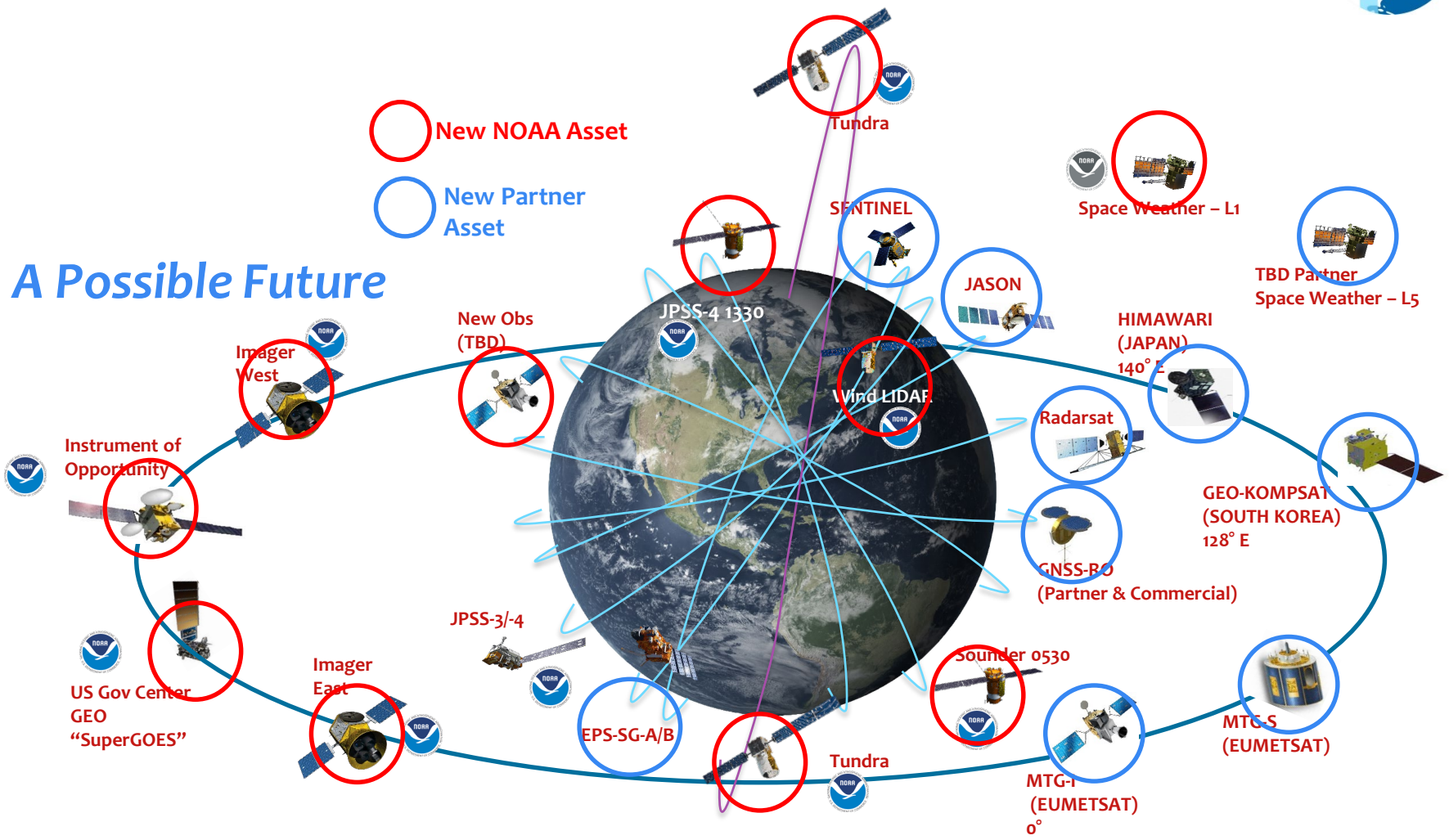
5. Deliver integrated program development to provide a suite of products and services

Tomorrow's Space Architecture:



Sample Future Architecture, ~2032

Tomorrow's Space Architecture:

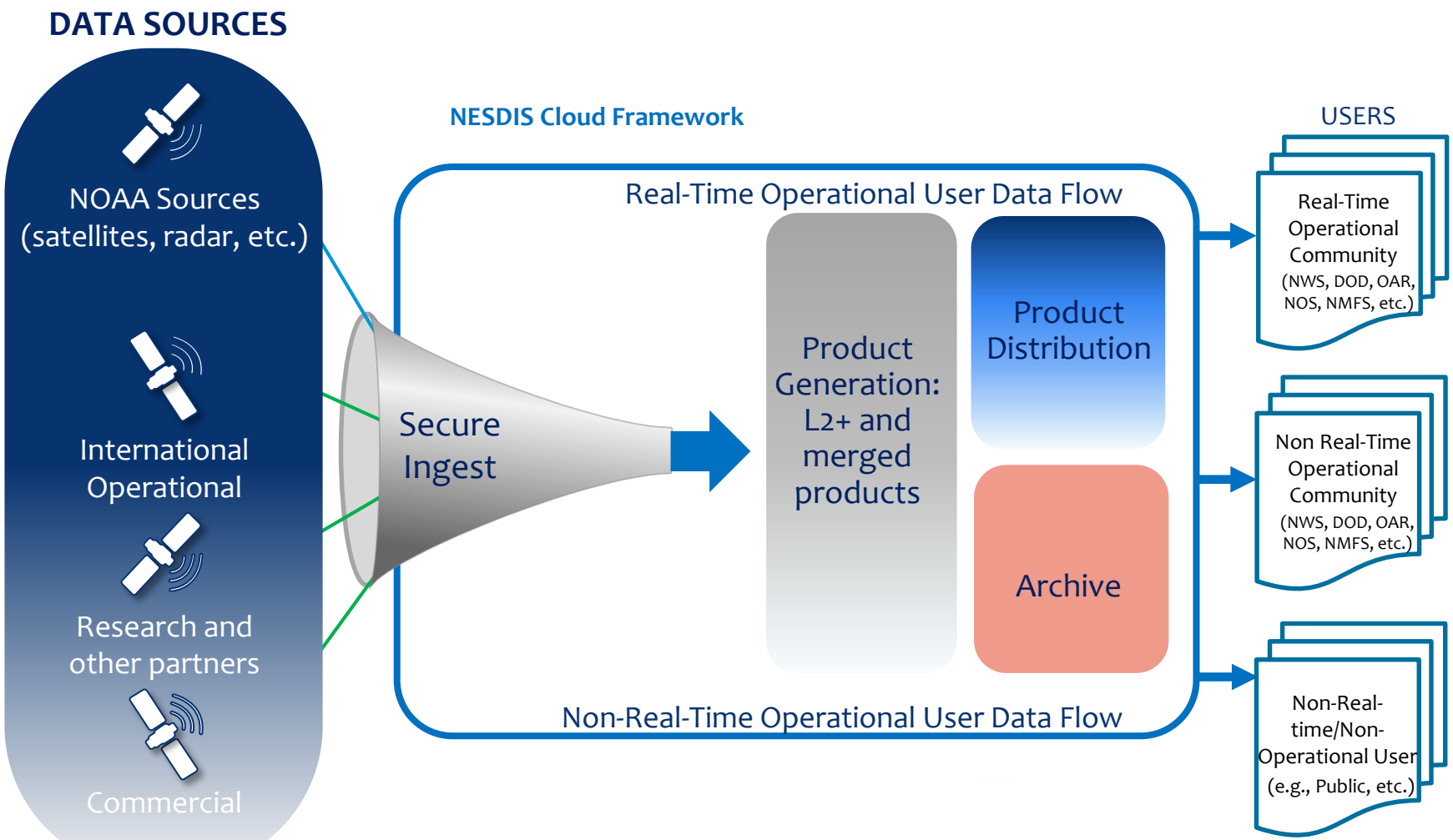


Sample Future Architecture, ~2032

It's the *Information* that matters, not just the Observations!

- We must make our data and information available with minimal barriers to a broadest community of users
  - We are moving many of our historically on premises IT functions into the **cloud**, including dissemination, data ingestion, product processing, among others;
  - We are developing **AI/ML applications** for operations, starting with data processing and assessment, end user applications, and expanding to all other parts of the data value chain;
  - We are redesigning our ground systems to be **flexible & scalable**, including cooperative capacity development with our established government partners and new commercial players – AWS, Google, Azure, …
  - Designing the next generation archives and integrated data center (NCEI), ensuring all relevant observations are included, satellite, in situ, airborne, ocean observations, acoustic and imagery, etc., coordinated with NASA, USGS, and our multiple international partners

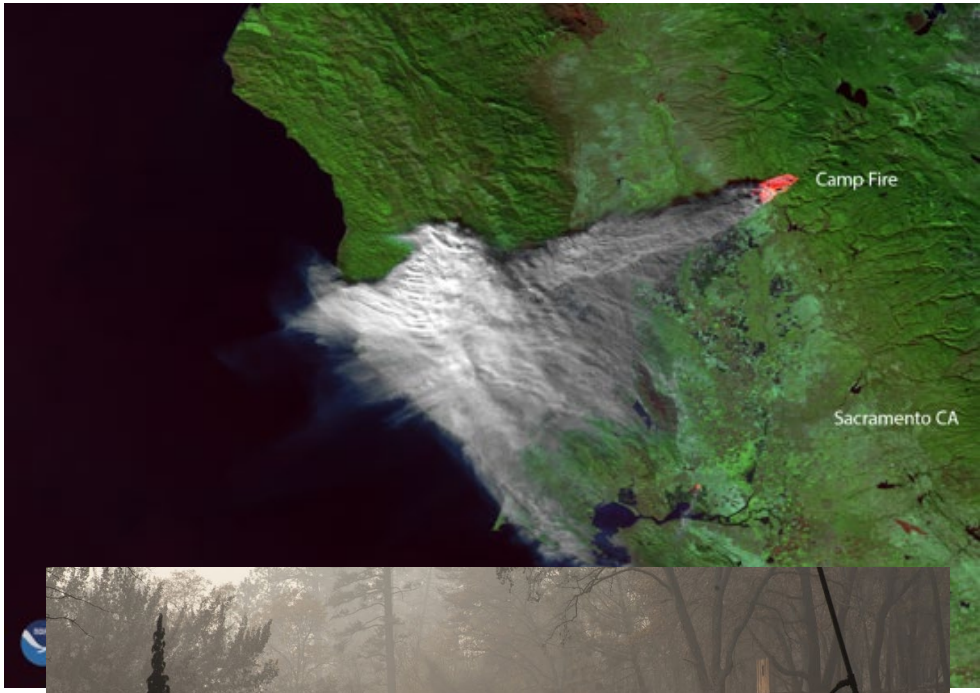
End-to-end System Evolution to Support the integrated observing system



Contributions from All Disciplines and Communities

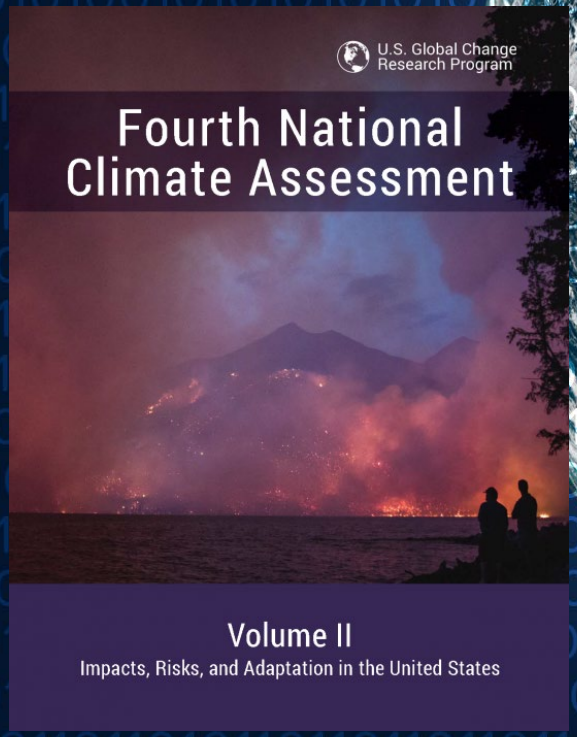
- Climate and environmental change is impacting all nations, ecosystems, and people – and the changes themselves are unprecedented
- Rapid technological advances in satellites allow us to observe more than ever before
- Advances in data science make possible unexpected discoveries
- The scale and diversity of the solutions must mirror those challenges
- We need a workforce diverse is every way, ready to tackle these problems, and to understand and improve our world

The VIIRS sensor on NOAA-20 captured this image of the destructive California Camp Fire in November 2018.



Aftermath

We are beginning to understand the Earth as an integrated system for the first time, at just the right time, and maybe just in time.



With great knowledge comes great responsibility …

Speak up
Inform
Act

THANK YOU

NOAA

Satellite and Information Service

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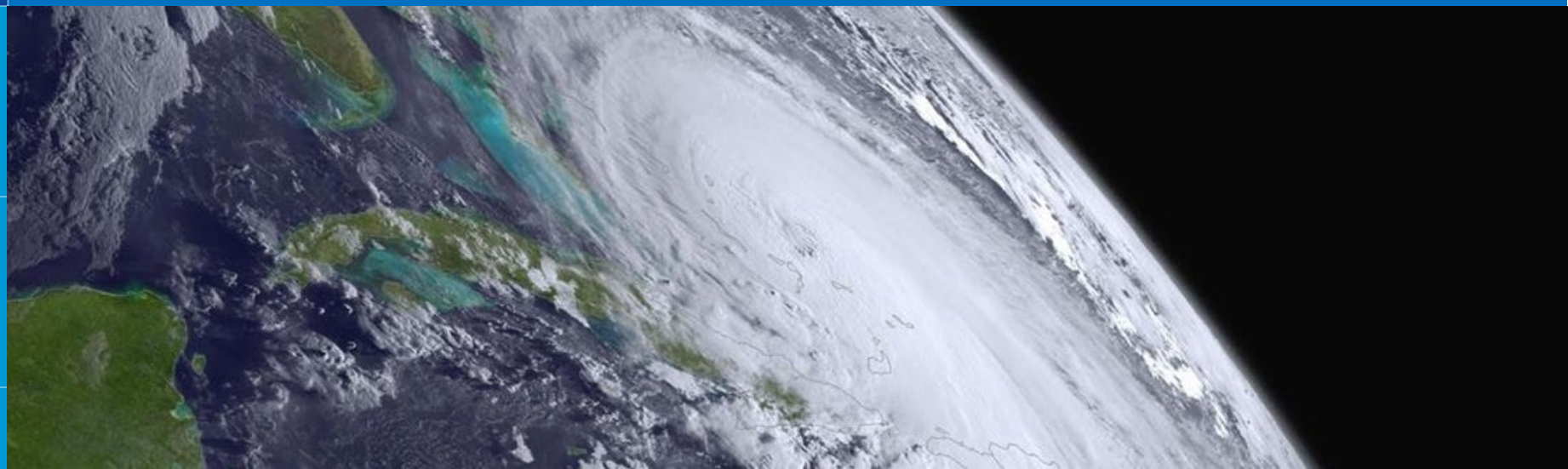
Questions? Email nesdis.executive.affairs@noaa.gov



Our Operating Principles