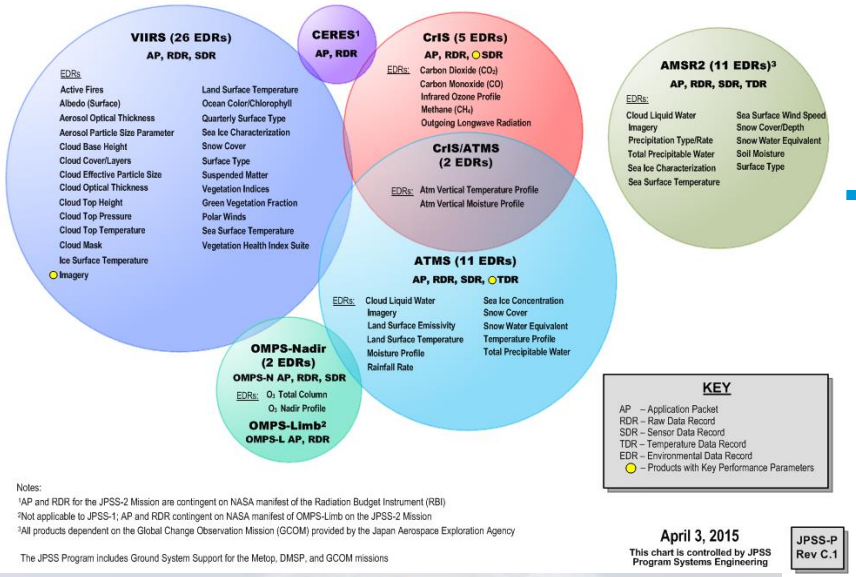
Proving Ground goals are to improve NOAA and partner services through optimizing the use of satellite data along with other sources of data & information

Observations/Products to Services to Stakeholders

JPSS Program Data Products

JPSS Level 1 Requirements Document, v1.8



Notes:
[1]AP and RDR for the JPSS-2 Mission are contingent on NASA manifest of the Radiation Budget Instrument (RBI)
[2]Not applicable to JPSS-1; AP and RDR contingent on NASA manifest of OMPS-Limb on the JPSS-2 Mission
[3]All products dependent on the Global Change Observation Mission (GCOM) provided by the Japan Aerospace Exploration Agency

The JPSS Program includes Ground System Support for the Metop, DMSP, and GCOM missions

April 3, 2015
This chart is controlled by JPSS Program Systems Engineering

JPSS-P Rev C.1

ADVANCED BASELINE IMAGER (ABI)
- Aerosol Detection (Including Smoke and Dust)
- Aerosol Optical Depth (AOD)
- Clear Sky Masks
- Cloud and Moisture Imagery
- Cloud Optical Depth
- Cloud Particle Size Distribution
- Cloud Top Height
- Cloud Top Phase
- Cloud Top Pressure
- Cloud Top Temperature
- Derived Motion Winds
- Derived Stability Indices
- Downward Shortwave Radiation: Surface
- Fire/Hot Spot Characterization
- Hurricane Intensity Estimation
- Land Surface Temperature (Skin)
- Legacy Vertical Moisture Profile
- Legacy Vertical Temperature Profile
- Radiances
- Rainfall Rate / QPE
- Reflected Shortwave Radiation: TOA
- Sea Surface Temperature (Skin)
- Snow Cover
- Total Precipitable Water
- Volcanic Ash: Detection and Height

GEOSTATIONARY LIGHTNING MAPPER (GLM)
- Lightning Detection: Events, Groups & Flashes

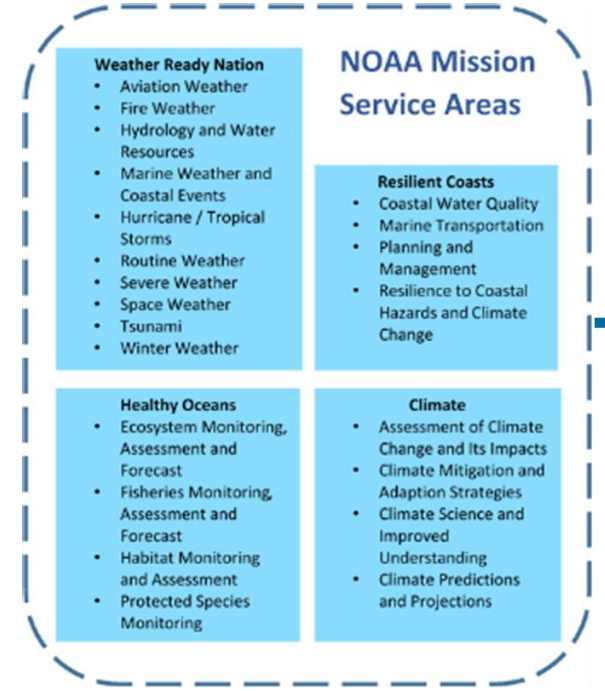
SPACE ENVIRONMENT IN-SITU SUITE (SEISS)
- Energetic Heavy Ions
- Magnetospheric Electrons & Protons: Low Energy
- Magnetospheric Electrons & Protons: Med & High Energy
- Solar & Galactic Protons

MAGNETOMETER (MAG)
- Geomagnetic Field

EXTREME ULTRAVIOLET AND X-RAY IRRADIANCE SUITE (EXIS)
- Solar Flux: EUV
- Solar Flux: X-ray Irradiance

SOLAR ULTRAVIOLET IMAGER (SUVI)
- Solar EUV Imagery

GOES-R Baseline Products



Addressing needs across NOAA

Purpose of the Summit:

Panel discussions for wide range of applications areas with users, developers and audience to discuss needs and capabilities

NATIONAL WEATHER SERVICE

A Holistic View of the Use of Satellite Data in the National Weather Service

Dr. Louis W. Uccellini, NWS Director

JPSS/GOES-R Proving Ground/Risk Reduction Summit

February 24, 2020

Outline

- NWS Mission and Vision
- GEO-LEO: Ongoing Historic Transition in Use of Satellite Data in Forecast Offices and Models.
- Ongoing and Upcoming Satellite Product Advancements
- Reflections

NWS Mission and Vision

The National Weather Service

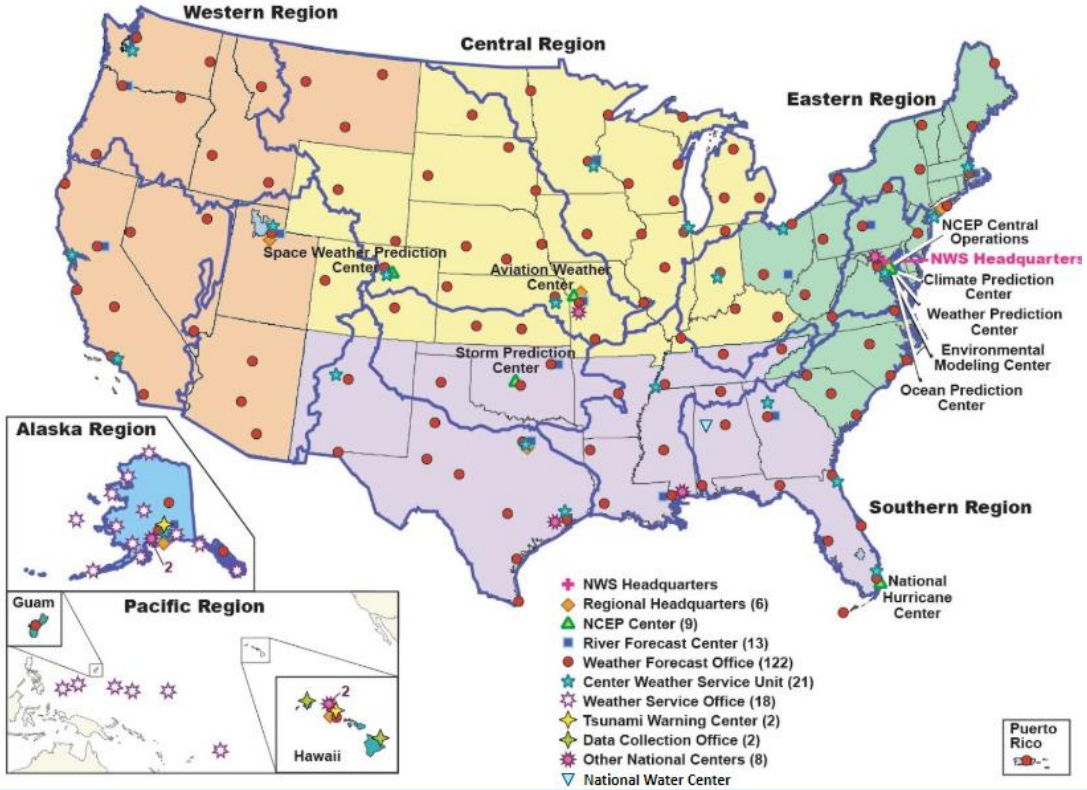
MISSION of Today

Provide weather, water, and seasonal data, forecasts and warnings for the protection of life and property and the enhancement of the national economy.

VISION for Tomorrow

A Weather-Ready Nation where society is prepared for and responds to weather and water events; where communities are “Ready, Responsive and Resilient”

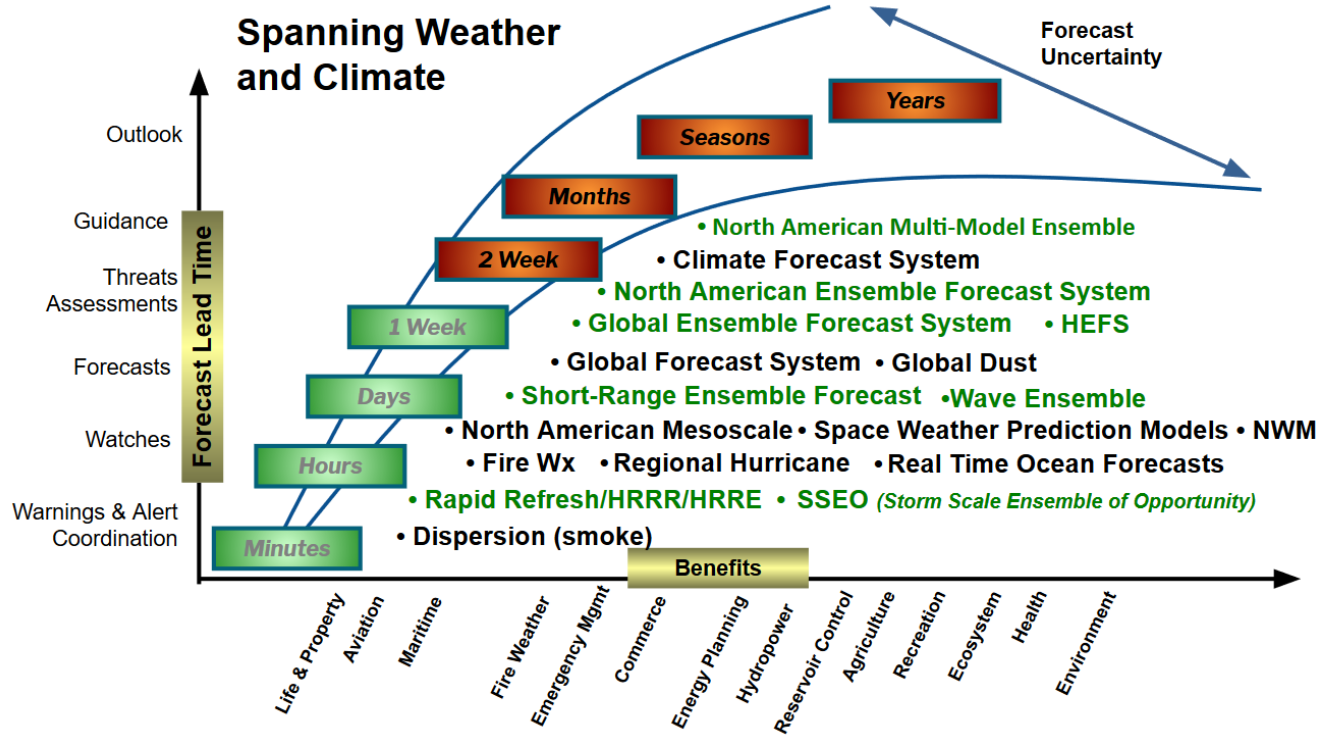
NWS Forecast Offices and National Centers



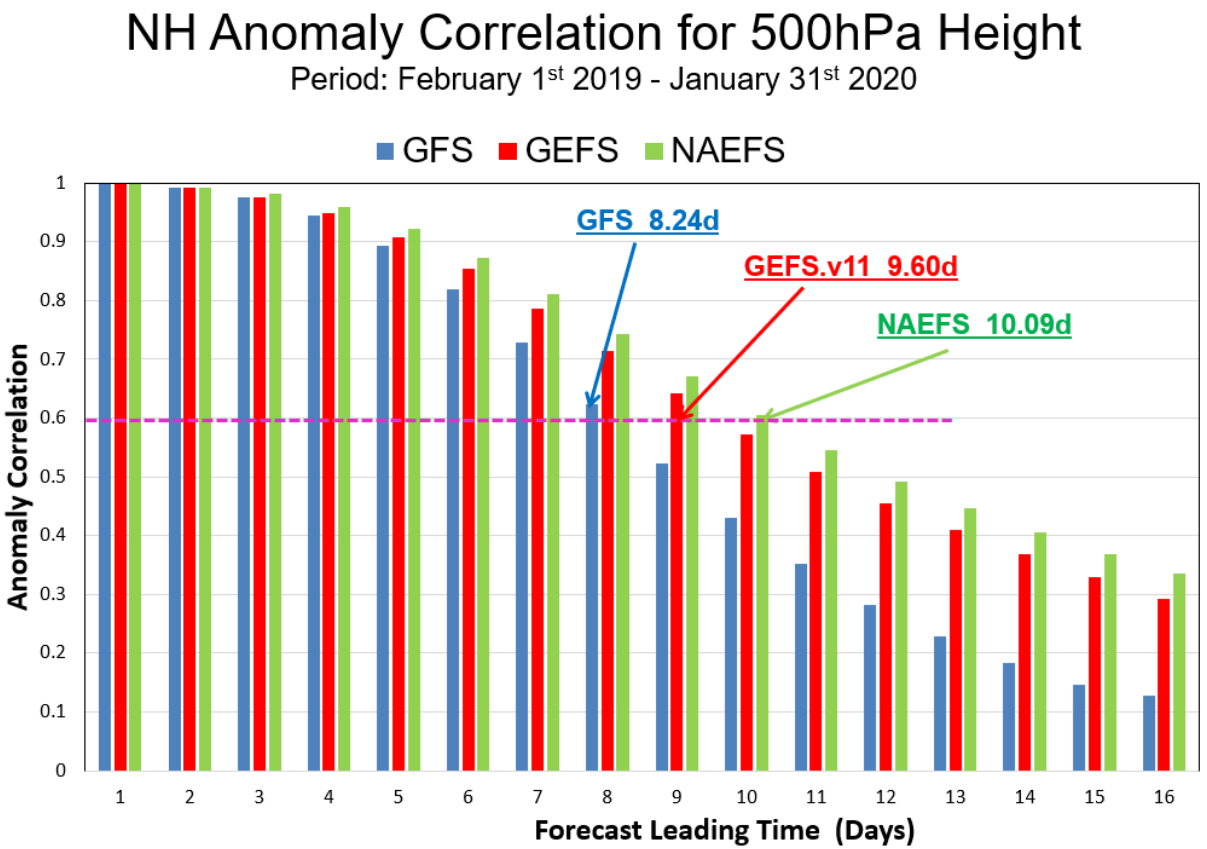
Seamless Suite of Model Forecasts

From Mesoscale to S2S

Increasingly Based on Multi-Model Ensembles



Most Recent Drop-off for GFS, GEFS, & NAEFS



GEO-LEO

Ongoing Historic Transition in Use of Satellite Data in Forecast Offices and Models.

Historically

GEO

- Situational awareness drives warning requirements.
- Data used in local forecast offices; national centers
- Low latency Required (Minutes)

LEO

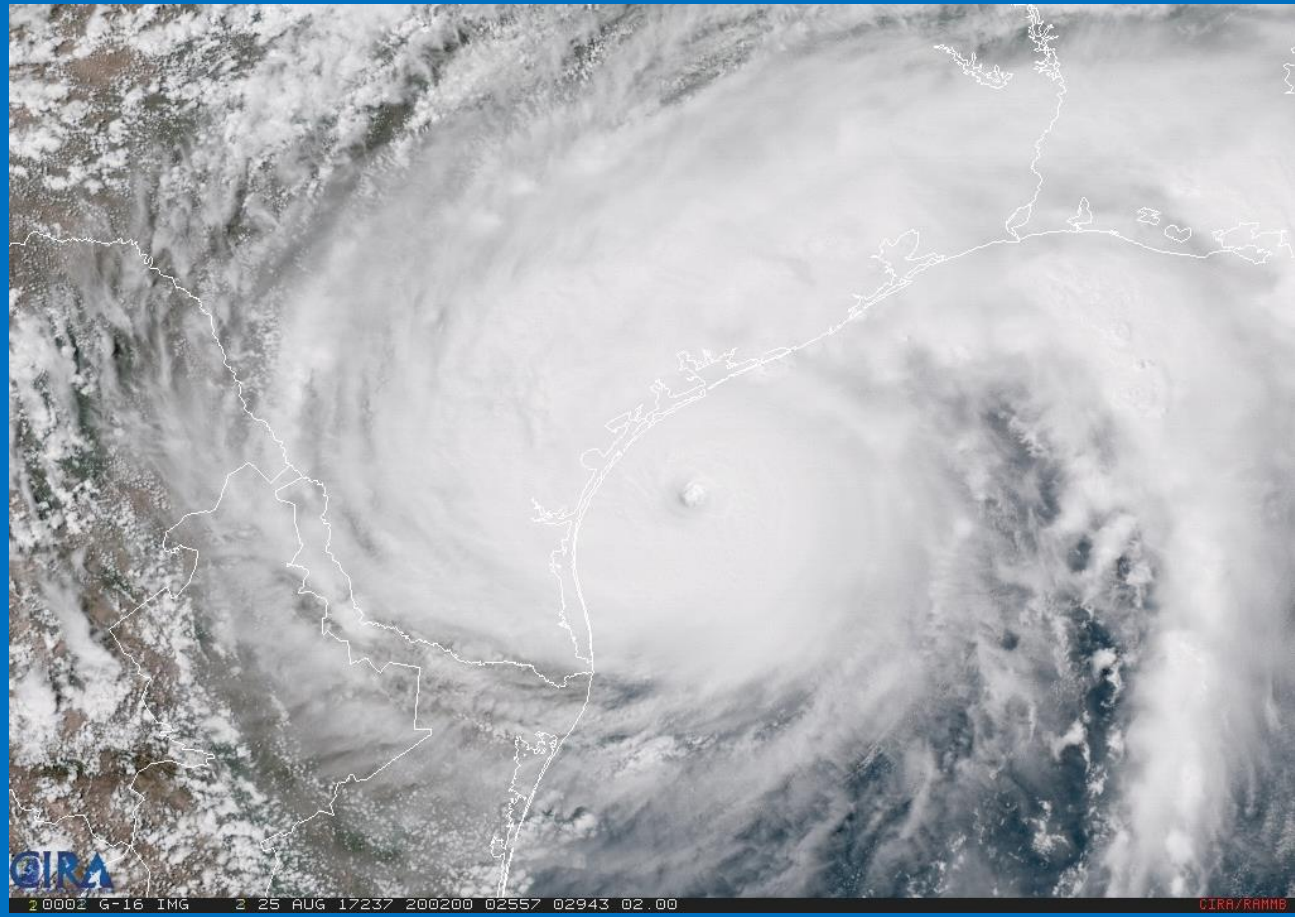
- Model initialization requirements drives primary use.
- Backbone of the global observing network
- Higher latency (1 to 1.5 hours); factored into 6 hr to 12 hr model cycles

Currently: These distinctions being blurred. GEO being used in models. LEO used by forecasters.

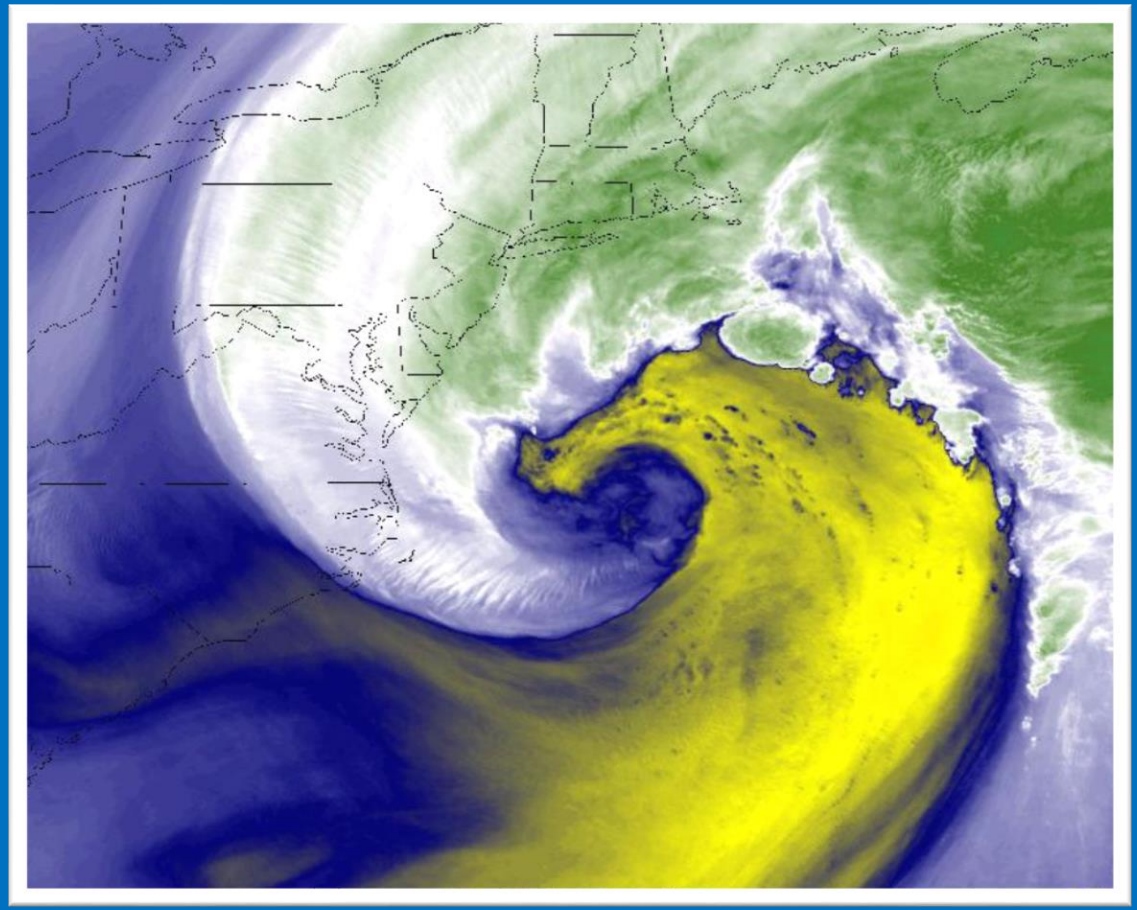
Recent Advances: Situational Awareness

GOES-R: Redefining Mesoscale Meteorology

GOES-East Geocolor Hurricane Harvey 25-26 August 2017



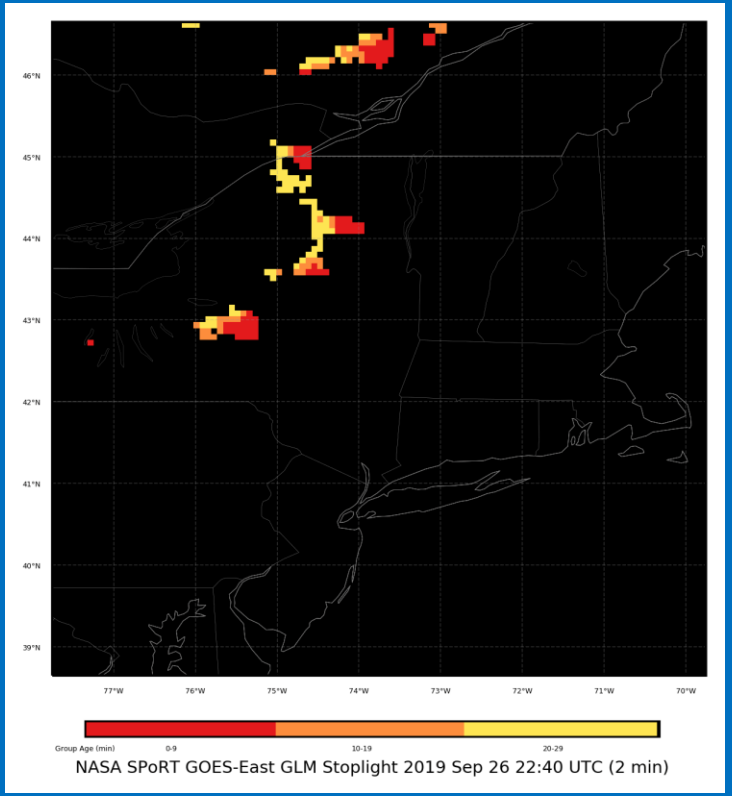
GOES-East Water Vapor 03-05 January 2018 Blizzard



Geostationary Lightning Mapper

NASA-SPoRT “Stoplight” Lightning Safety Product

- Red – 0-9 minutes since last flash
- Orange – 10-19 minutes since last flash
- Yellow – 20-29 minutes since last flash



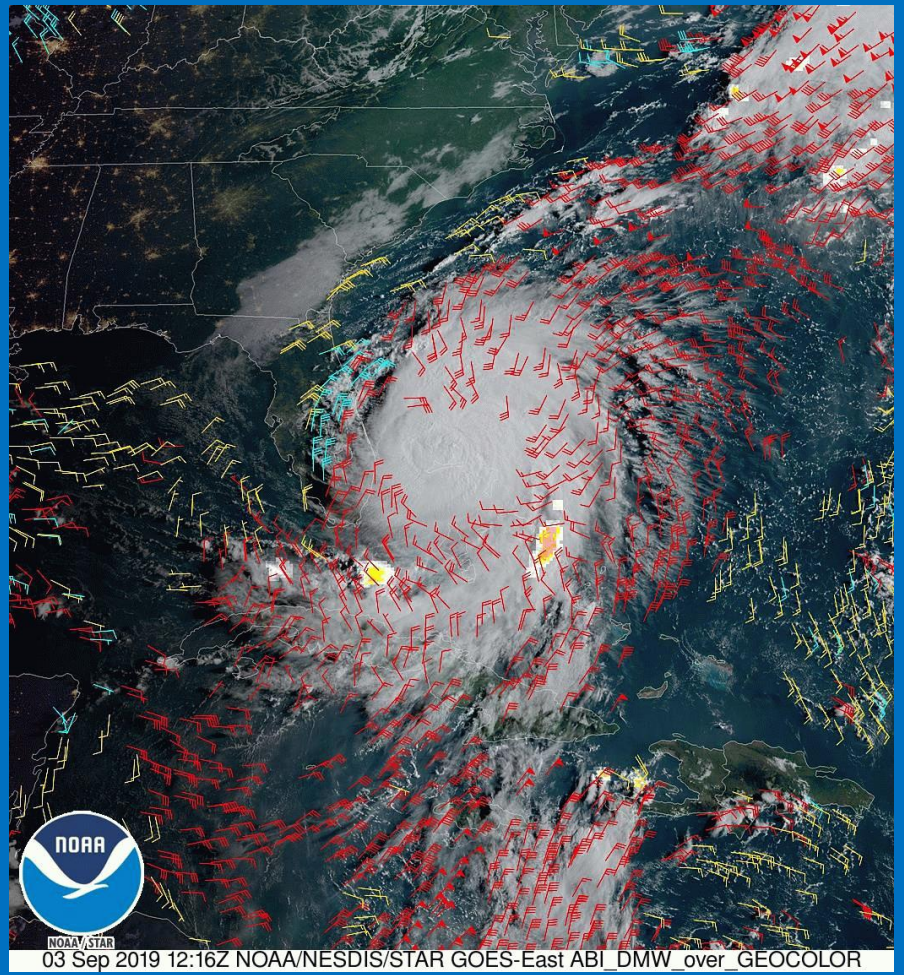
An example of the 30 minute lightning hazard product over New England on 26-27 September 2019 between 2240 and 0010 UTC.

GOES 16 Fire Temperature
06-07 March 2017

Hurricane Dorian

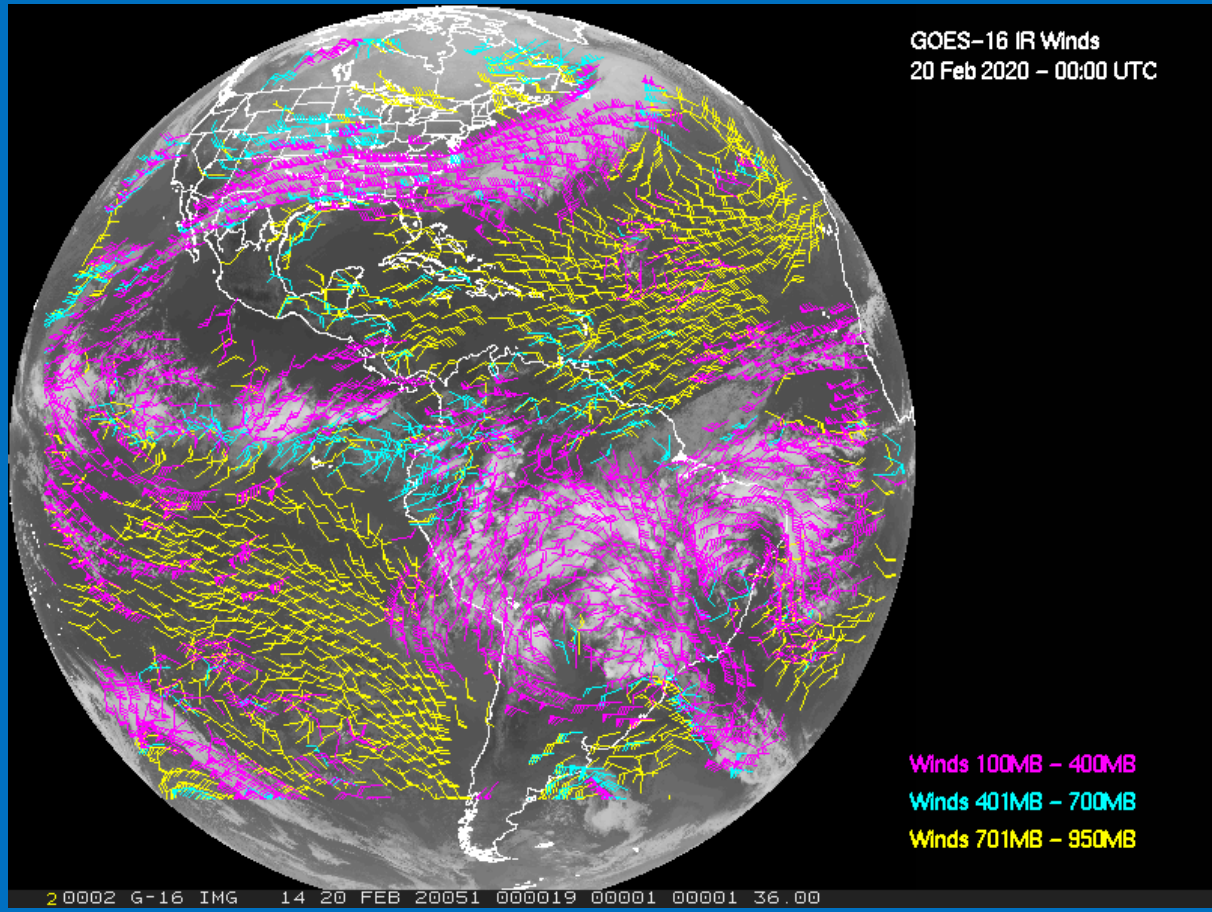
03 September 2019

- GOES-East ABI Geocolor Imagery
- GLM
- Winds
  - Upper level winds (100-400 hPa) shown in **red**
  - Mid level winds (400-700 hPa) in **cyan**
  - Low level (below 700mb) in **yellow**



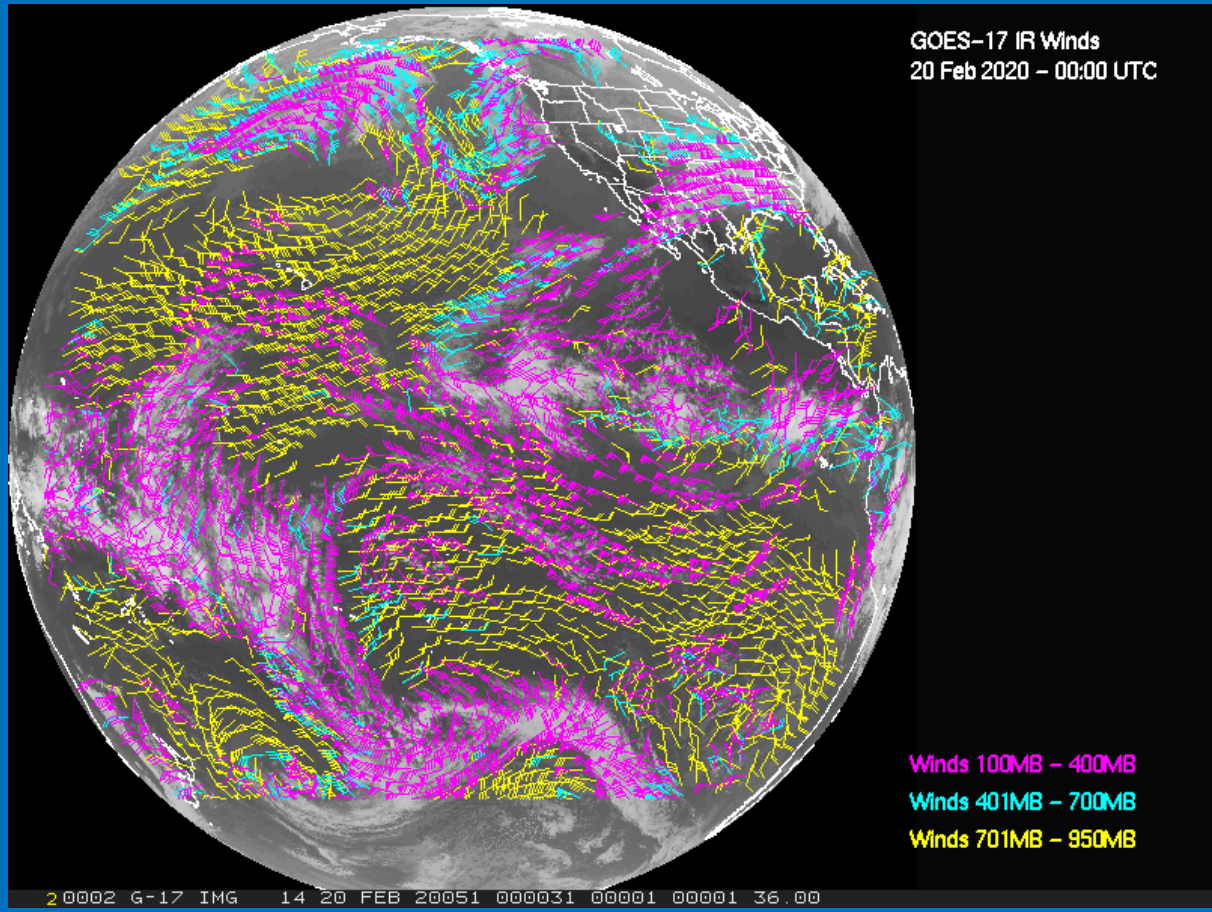
GOES East Full Disk Winds Derived from ABI Band 14 (11um)

00Z 20 February 2020



GOES West Full Disk Winds Derived from ABI Band 14 (11um)

00Z 20 February 2020



Recent Advances: LEO and GEO Satellite Data Used in Numerical Weather Prediction Models

Sensors/Satellite Data Assimilated into NWS Operational Models

- HIRS sounder radiances
- AMSU-A & B sounder radiances
- ATMS sounder radiances
- MHS sounder radiances
- AIRS* sounder radiances
- IASI sounder radiances
- CrIS sounder radiances
- GOES sounder radiances
- GOES, Meteosat, GMS winds
- GOES precipitation rate
- SSM/I precipitation rates
- ~~TRMM* precipitation rates~~
- SSM/I ocean surface wind speeds
- ~~Quikscat* ocean surface wind vectors~~
- ~~MT SAPHIR*~~
- JASON ocean surface altimetry
- AVHRR SST
- AVHRR vegetation fraction
- AVHRR surface type
- Multi-satellite snow cover
- Multi-satellite sea ice
- SBUV/2 ozone profile & total ozone
- MODIS* polar winds
- GPS Radio Occultation –COSMIC, METOP/GRAS, CNOFS, GRACE,* SAC-C*, TerraSAR-X*, KOMPSAT5, COSMIC2 (soon)
- SSMIS sounder radiances
- Aura/OMI*
- AMSR/E*
- MSG SEVIRI
- GOES—R/S, Himawari winds
- VIIRS Polar Winds

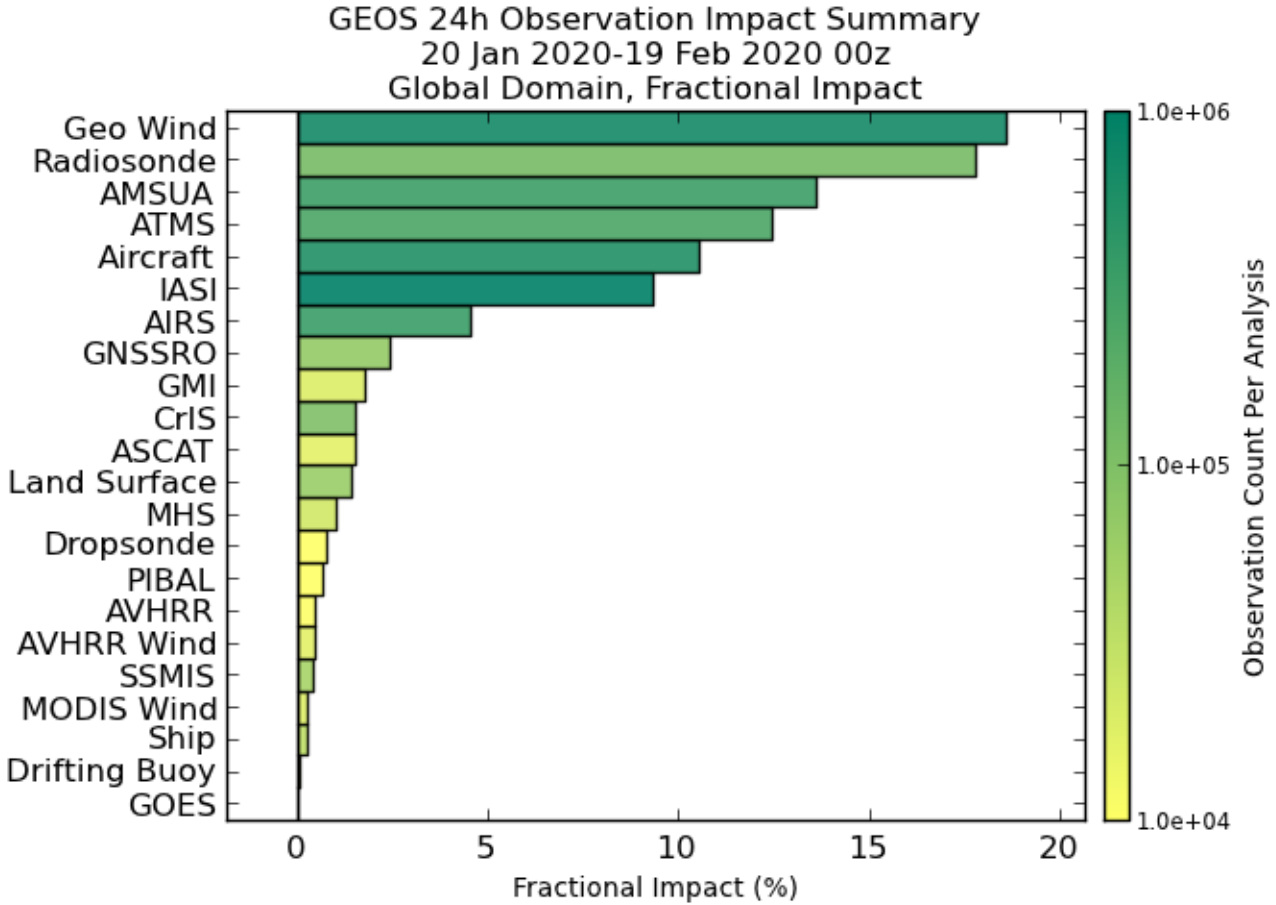
- In Development
  - VIIRS SST radiances
  - GOES-R ABI radiances
  - GPM/GMI*
  - SMAP*
  - ADM/Aeolus*
  - SSMIS imaging channels
  - ASCAT OSWV

Denotes Research Satellites *

Made possible through the Joint Center for Satellite Data Assimilation**. Accelerate** the use of research and operational satellite data in operational numerical weather predict modeling systems.

Dates for LEO Sounder Launch and Operational Assimilation

		Launch Date	Assimilation Date	Time Elapsed
Microwave Sounders	AMSU (POES)	Multiple	Multiple	2 Years +
	SNPP ATMS	28 Oct 2011	22 May 2012	207d
	NOAA 20 ATMS	18 Nov 2017	30 May 2018	193d
Hyperspectral IR Sounders	Aqua AIRS	04 May 2002	31 May 2005	2 Years +
	Metop 1 IASI	19 Oct 2006	24 Feb 2009	2 Years +
	SNPP CrIS	28 Oct 2011	20 Aug 2012	297d
	NOAA 20 CrIS	18 Nov 2017	30 May 2018	193d
GNSS Radio Occultation	COSMIC	15 April 2006	01 May 2007	382 days
	KOMPSAT-5	08 Aug 2013	10 Oct 2019	6 Years +
	COSMIC-2A	25 Jun 2019	~May 2020	~10 months
GOES-R Series AMVs	GOES-16 (East)	19 Nov 2016	05 Jan 2018	412 days
	GOES-17 (West)	01 Mar 2018	10 Oct 2019	588 days


GEOS 24h Observation Impact Summary
20 Jan 2020-19 Feb 2020 00z
Global Domain, Fractional Impact
Geo Wind
Radiosonde
AMSUA
ATMS
Aircraft
IASI
AIRS
GNSSRO
GMI
CrIS
ASCAT
Land Surface
MHS
Dropsonde
PIBAL
AVHRR
AVHRR Wind
SSMIS
MODIS Wind
Ship
Drifting Buoy
GOES
0
5
10
15
20
Fractional Impact (%)
1.0e+06
1.0e+05
1.0e+04
Observation Count Per Analysis

Example of LEO data used in forecast offices

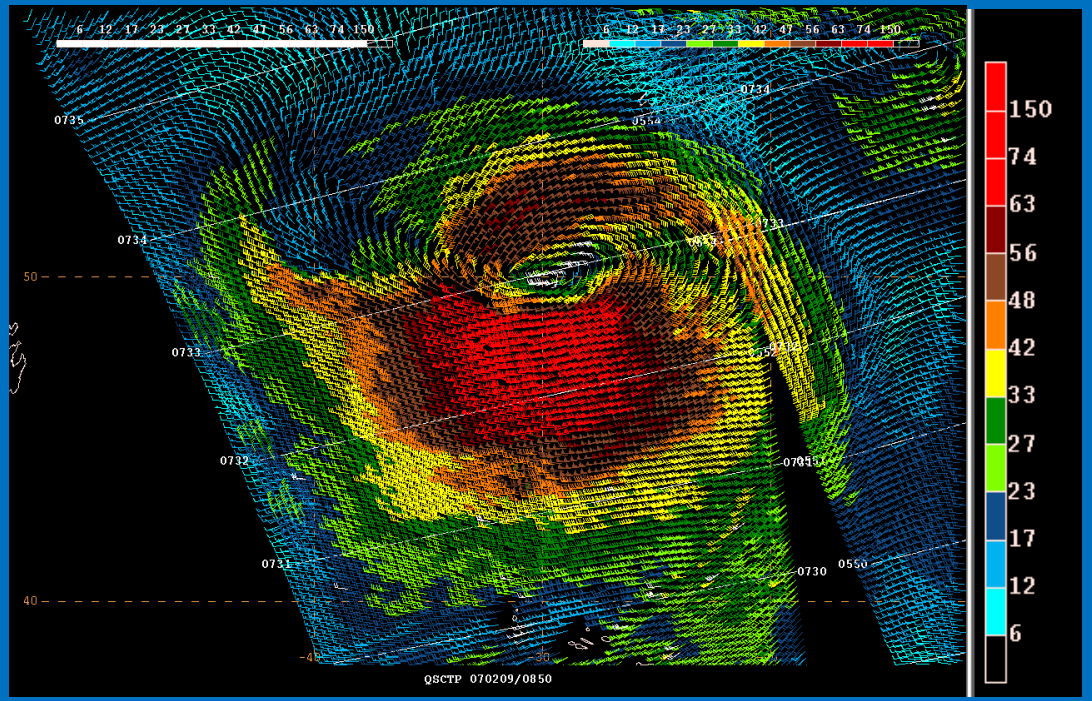
QuikSCAT > ASCAT

Introduced New Warning Category for Extratropical Ocean Storms

“Hurricane Force Winds”

QuikSCAT

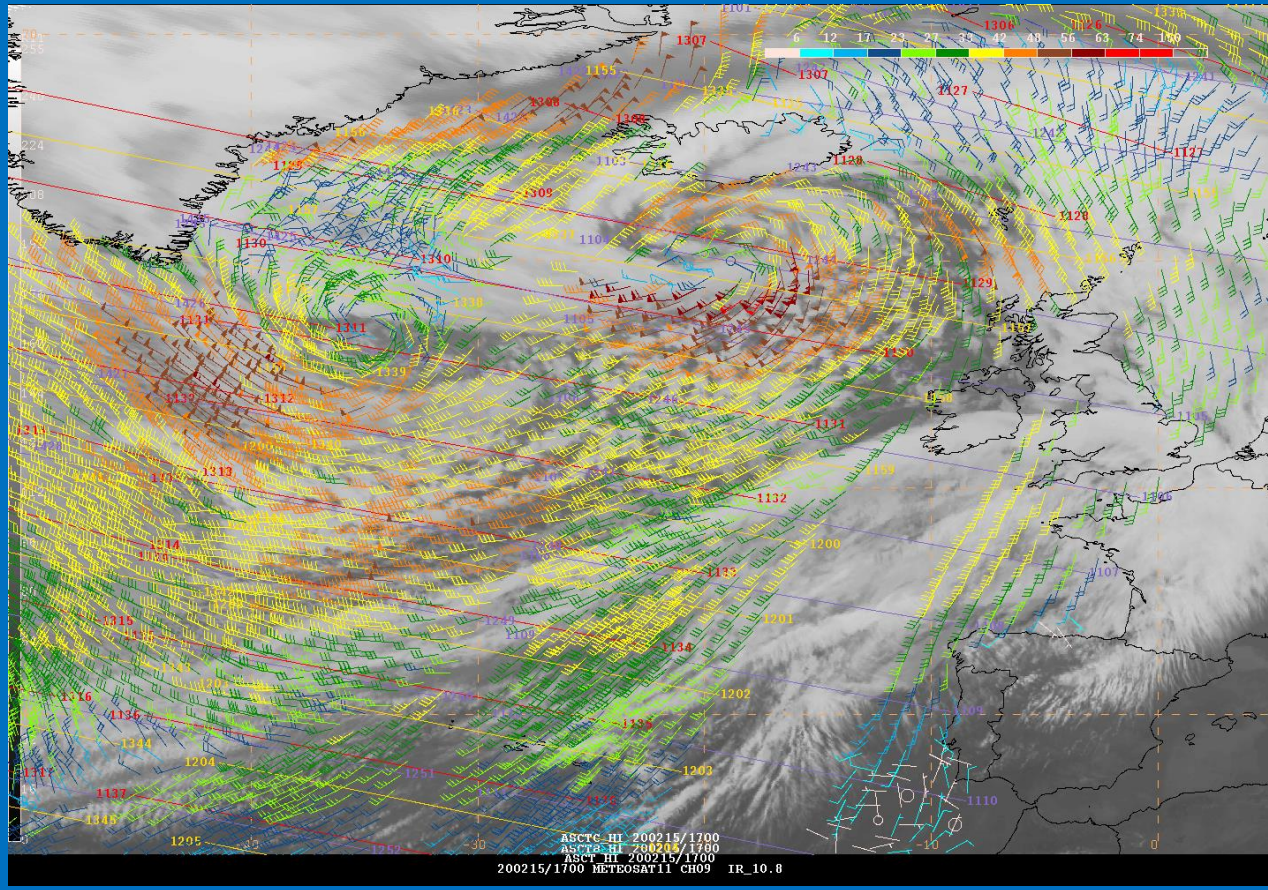
Intense, non-tropical cyclones with hurricane force winds
09 February 2007 North Atlantic



ASCAT

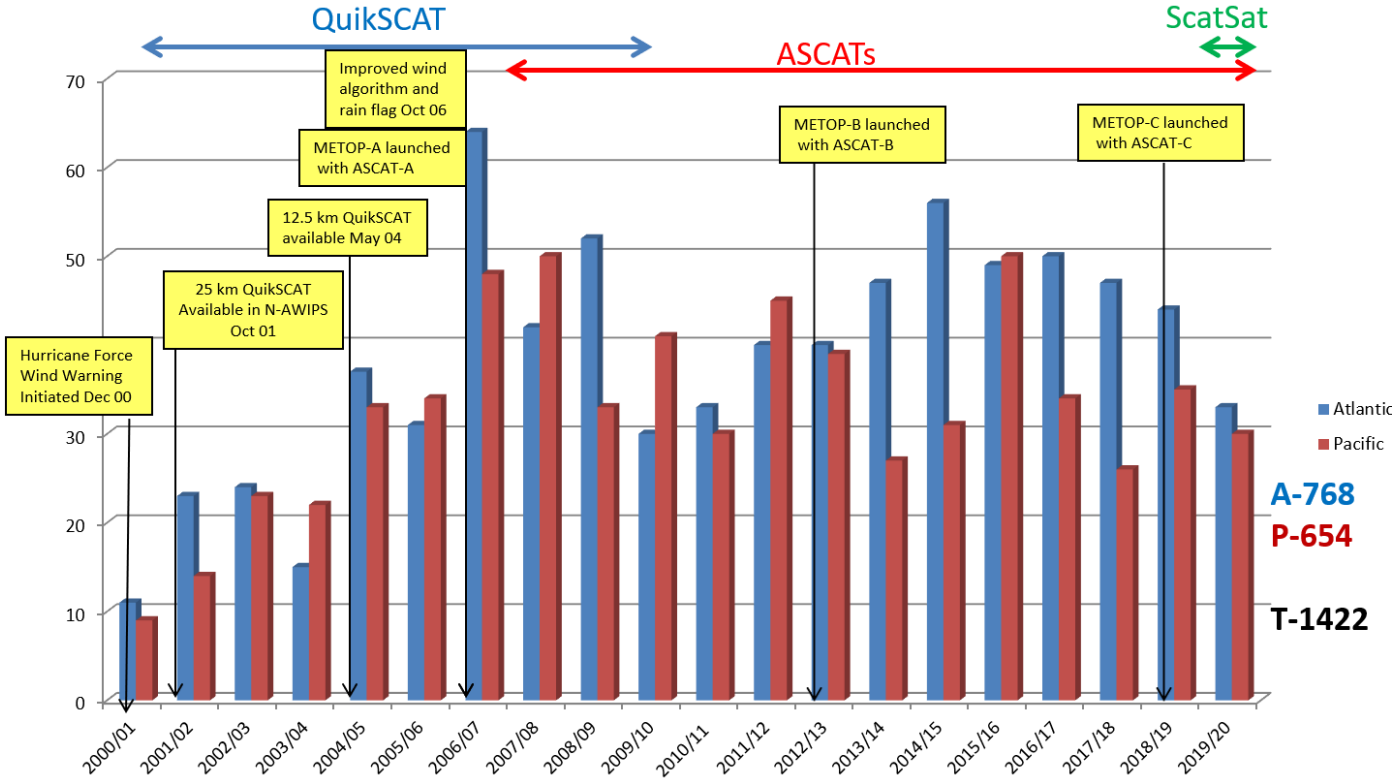
“Dennis”
~1700 UTC
15 February 2020

ASCAT A, B, and C overlaid on MSG-11 10.8 um infrared imagery



(Courtesy of Michael Folmer and James Kells)

Hurricane Force Extra-Tropical Cyclones 2001–2020



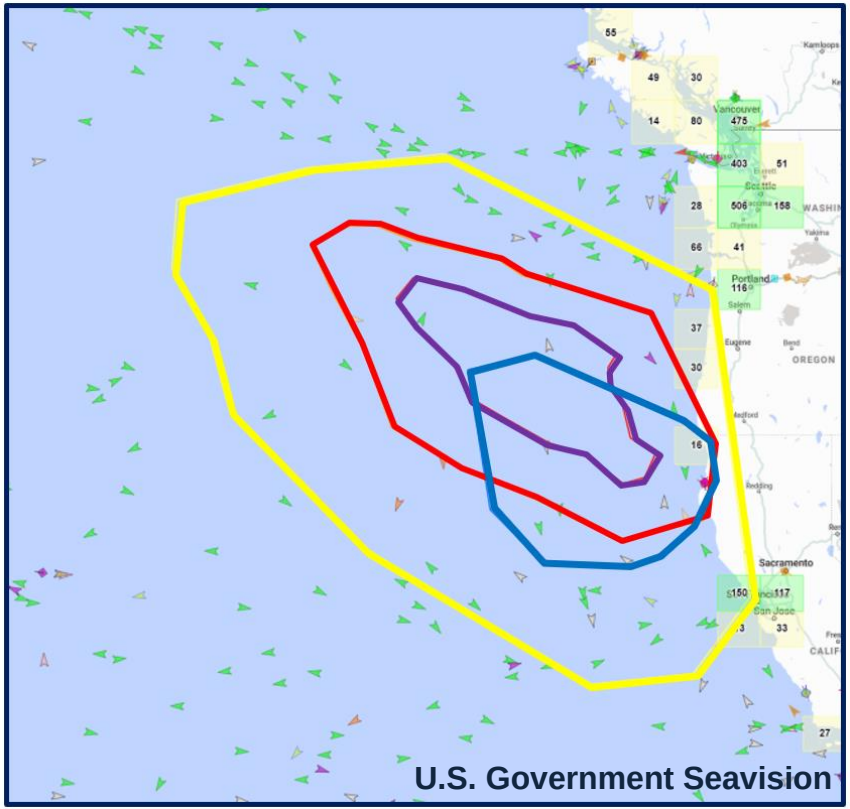
Warning Polygons for Extreme Maritime Weather

Nov 26 Eastern Pacific Hurricane Force Storm

- Ship positions at 1800 UTC 26 Nov
- Vessels heeding the warnings
- Coastal traffic minimal
- 2 vessels exiting Hurricane Force area

Warnings
1200 UTC 26-27 Nov 2019
GALE
STORM
HURRICANE FORCE
Sig Wave Heights ≥ 30 ft

Vessel Types
- Cargo
- Tanker
- Tow
- Cruise
- Pleasure
- Fishing



PROTOTYPE **- Warning Polygons**

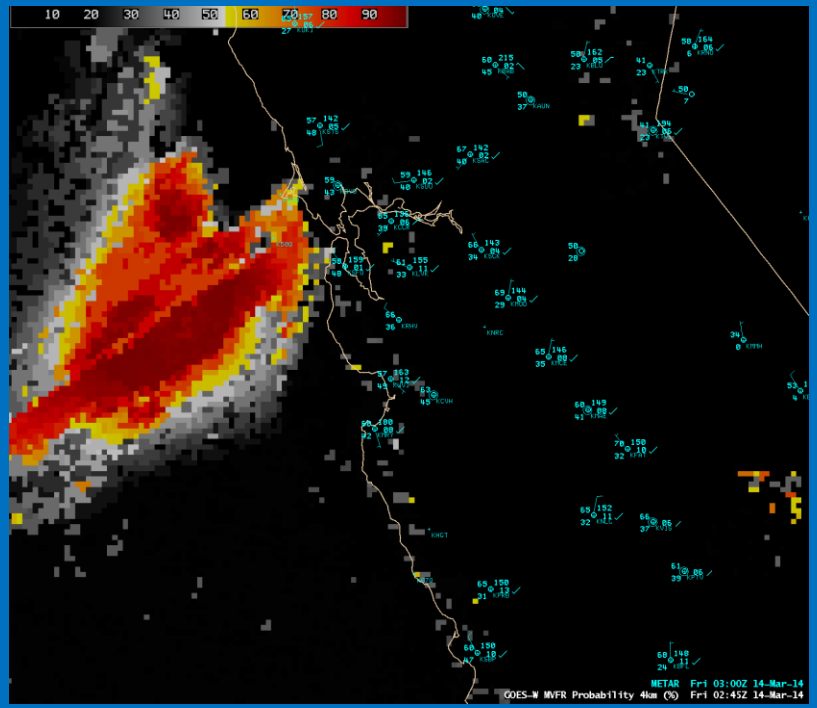
VIIRS, CrIS, OMPS, ATMS

Not just for numerical weather prediction model inputs!

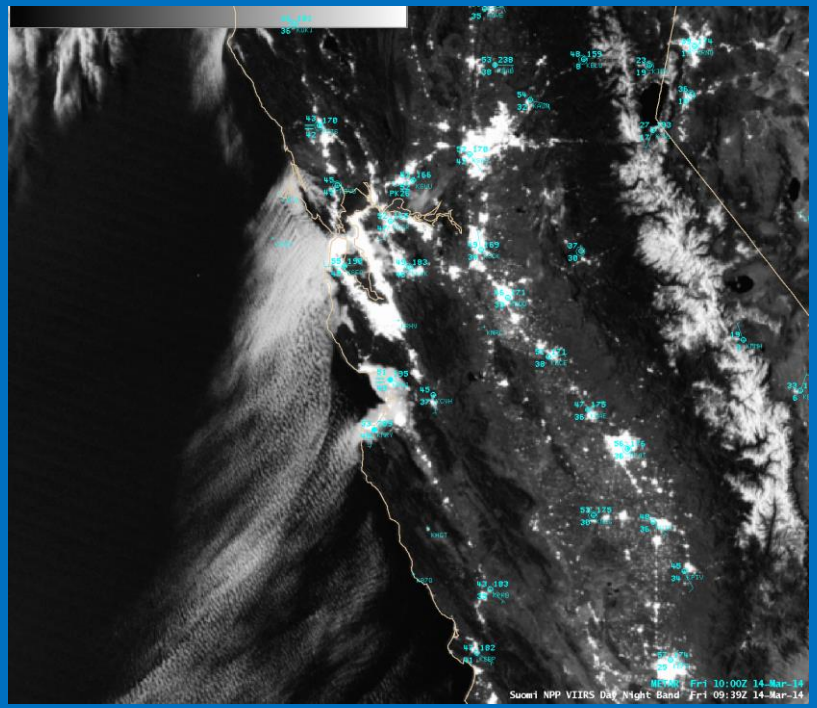
Enhancing the spectral and spatial resolution of the earth system with

- Satellite-derived soundings (convective destabilization)
- High-resolution nighttime visible imagery (fog)
- Ozone sensing of aerosols and volcanic emissions (air quality)
- Passive microwave cloud and precipitation detection (hurricanes)
- Improved monitoring of the arctic (river ice and flooding)

Monitoring San Francisco Fog



GOES-West MVFR Probability (Mike Pavolonis)



Suomi NPP VIIRS DNB / Fog Difference

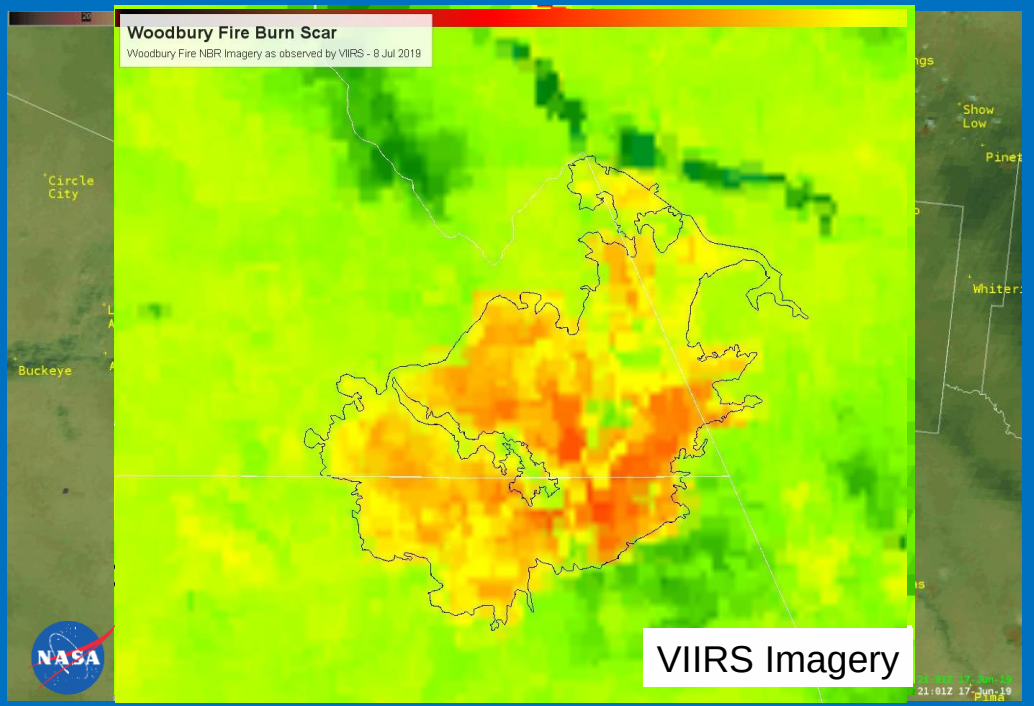
Alaska River Ice

Eagle, Alaska
7 April 2019

GEO and VIIRS Woodbury Burn Scar

Low-earth orbiting satellites add details

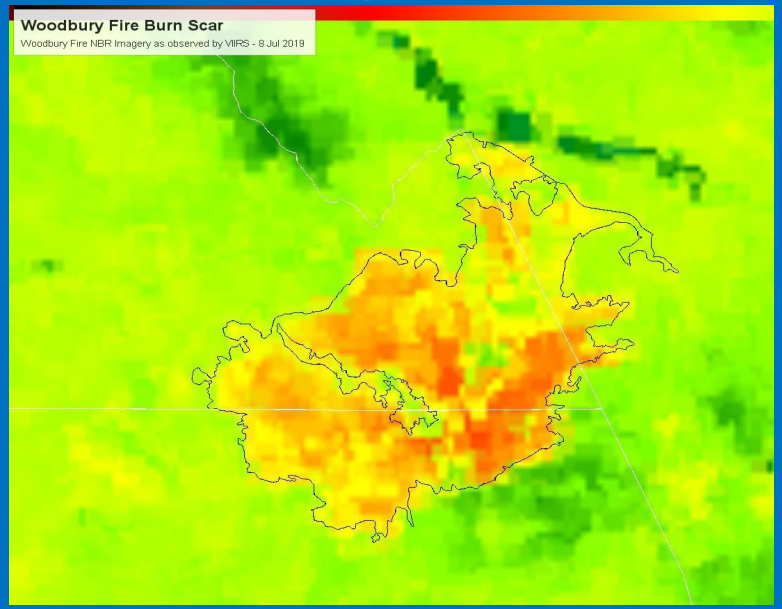
Burn scars present unique challenges during heavy rain events



Credit: NASA SPoRT

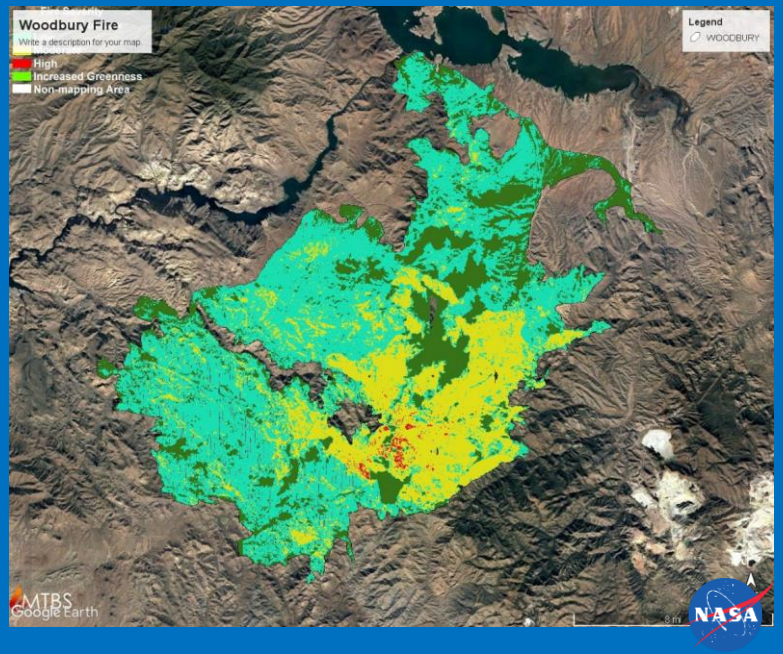
Normalized Burn Ratio from GOES/VIIRS

VIIRS Image
Woodbury Burn Scar
8 July 2019



Credit: NASA SPoRT

Soil Burn Severity Map
from BAER Team



Ongoing and Upcoming Advancements

1. COSMIC-2: 1800 T, Td between 30° N and S per day.
2. GOES ABI: quantitatives use in models
3. “Small Sats”: the commencement of the “Cube Sat” era
4. Use of AI to select data for real-time data assimilation
5. Broader use of LEO and GEO satellite data addressing the total Earth System (models and forecaster use)

Challenges

- **Latency in the transmission of all satellite data to the users**
  - The more that GEO & LEO satellites are used for situational awareness, the more the demand will be to reduce latency from hours/minutes to minutes/seconds.

Reflections

- I was at the UW when Professor Suomi and his team pioneered the use of satellites for meteorological research and real-time access for operational use.
- We continue to realize Suomi's vision.
- Even though this historic journey has been 60+ years in the making, we are just scratching the surface.
- **Biggest next step is the GEO hyperspectral sounder! Address the high resolution ΔT opportunity observed across the entire Earth System.**
  - Europe and Asia are leading the effort to launch and operate Geostationary Sounders.
  - We are now the followers… we should be reasserting our past leadership position.

Thank you!

Decision Support at Regional Scales: Connecting Products and Technologies to User Needs in a NOAA Services Framework

Ellen Mecray, NOAA Regional Climate Services Director- Eastern Region
NOAA/NESDIS/NCEI Regional Climate Services

Rising Demand for Information with Regional Perspectives

NOAA's Societal Challenge Areas

COASTS
Community Resilience

CLIMATE
Extremes

WATER
Drought and Flooding

S2S
Icing, wind, heat

Application of NOAA's Information by Sector

Agriculture

Energy

Health

Transportation

Sustainability of Marine Ecosystems

R2S- Lingo on the role of services

User-driven, use-oriented, use-inspired, problem-focused

Information for decision-makers

Partnerships, collaboration, can't do it alone

Environmental Intelligence

THE USER

Co-production of knowledge

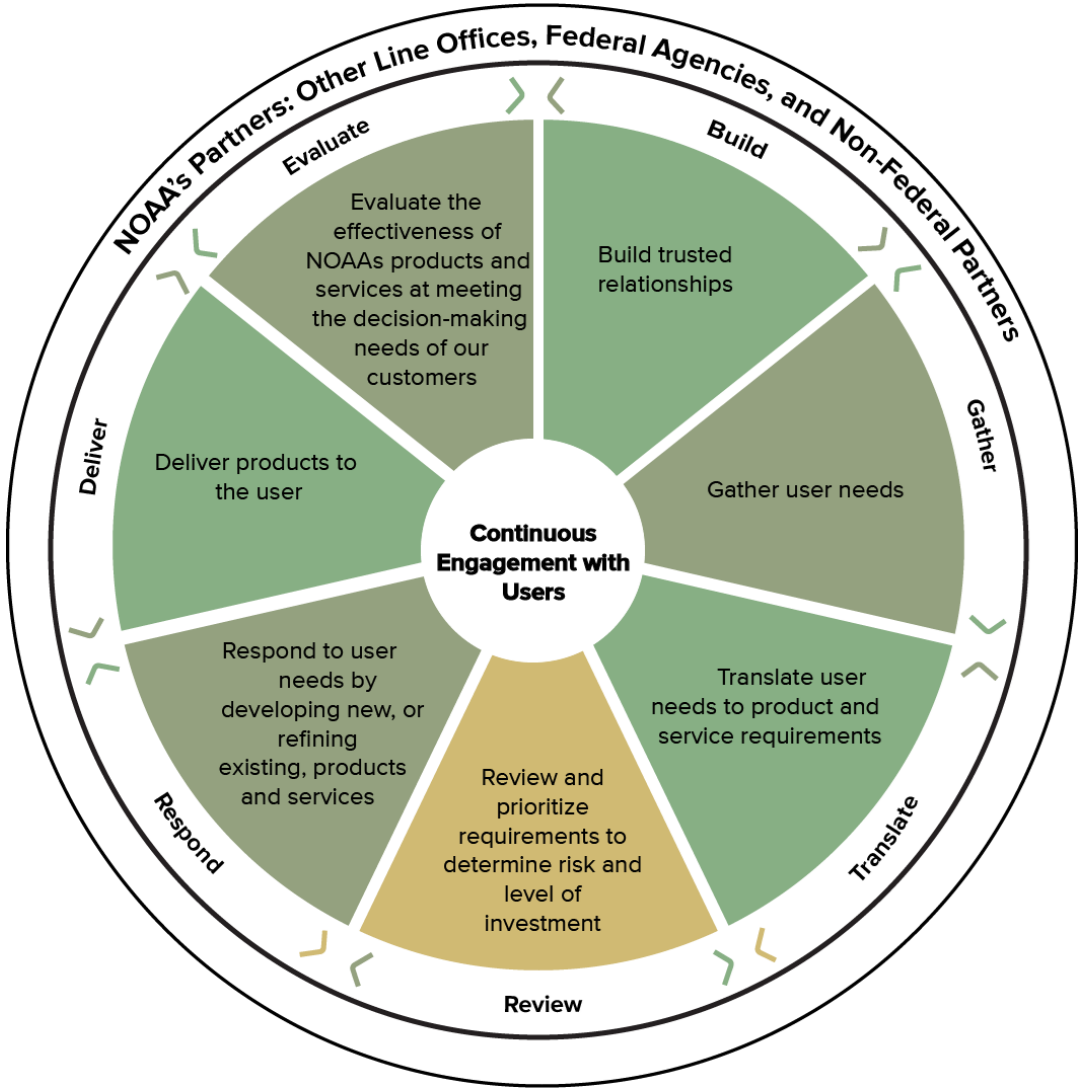
Actionable Science

DSS

Service Delivery Framework

Vision: U.S. residents understand and use the breadth of NOAA's information for their decisions

Mission: NOAA will build a network of trusted agents who engage internally and with partners to inform NOAA's product and service development to be useful, usable, and used.

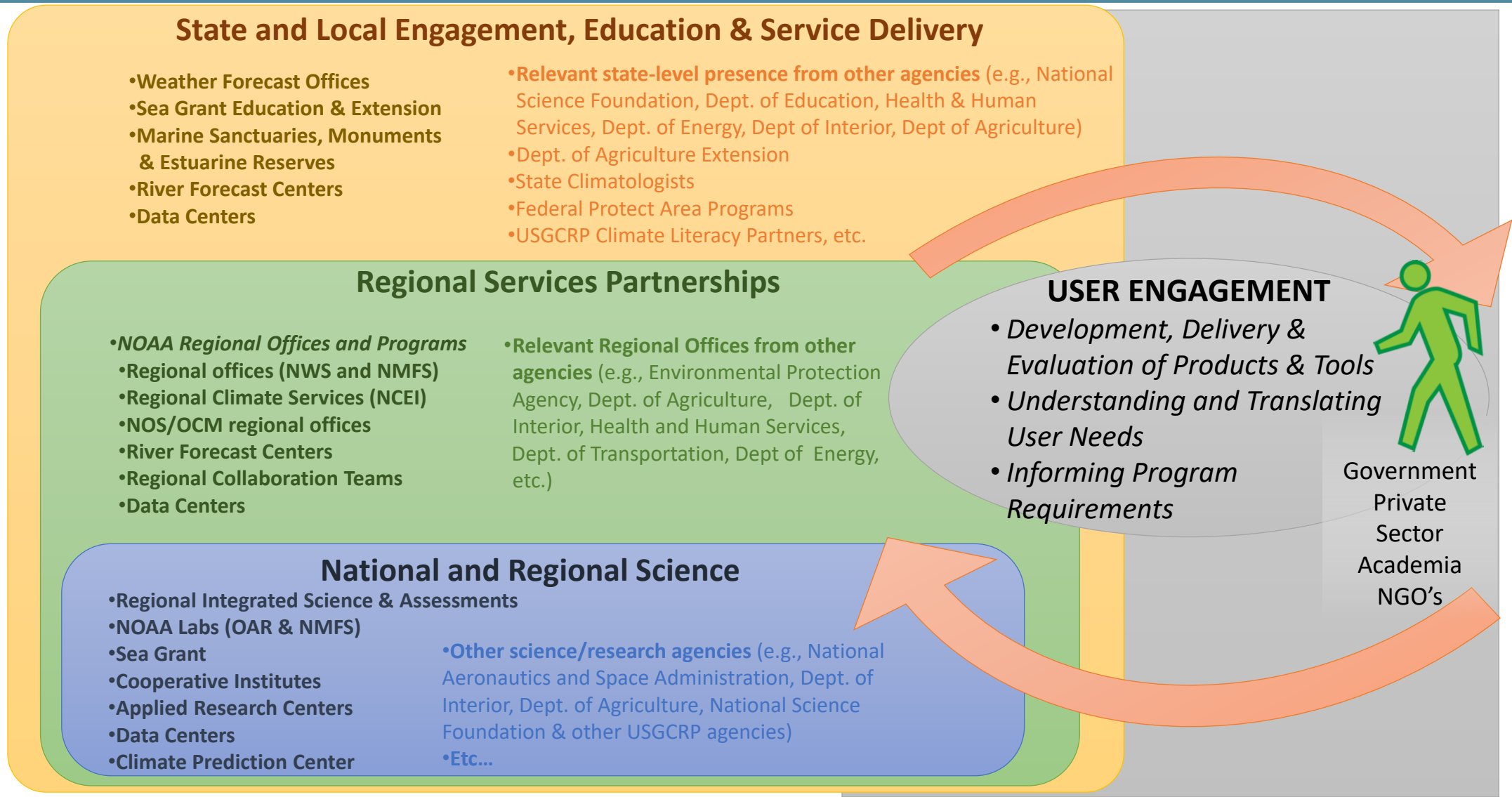


Assembled by a team across NOAA line offices, all services entities

User-focused, interconnected model

Two-way, ongoing communication

Connecting Science, Services and People:
NOAA's Services Enterprise



Services by Sector

Energy

Agriculture

Health

Sustainability of Marine Ecosystems

Transportation

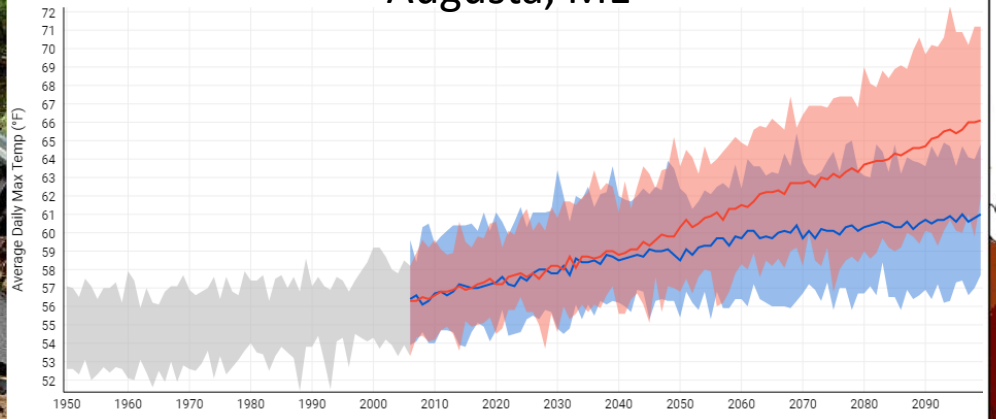
Transportation

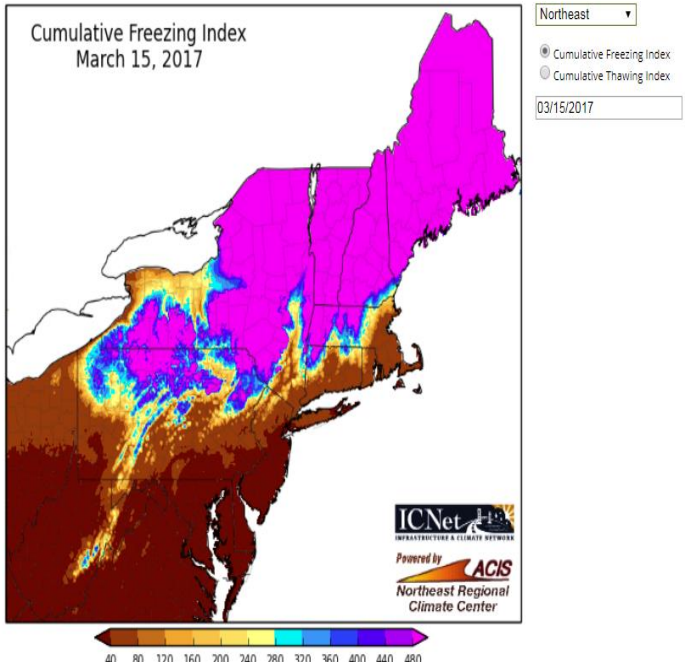
Climate Variables

- Precipitation frequency (design storms)
- Temperature projections (road salt, potholes)
- Accounting for extremes
- Seasonal road posting
- Research on wind and other variables

Infrastructure and Climate Network:
http://theicnet.org/

Average Annual Daily Max Temperature
Augusta, ME





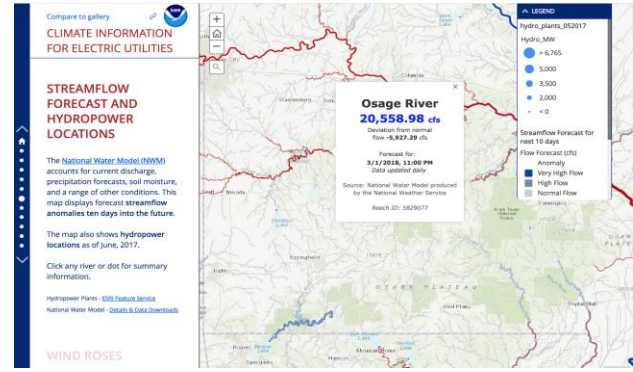
Energy

NOAA is working in a government to government relationship to offer weather and climate information to meet the requirements of DOE and its core partners

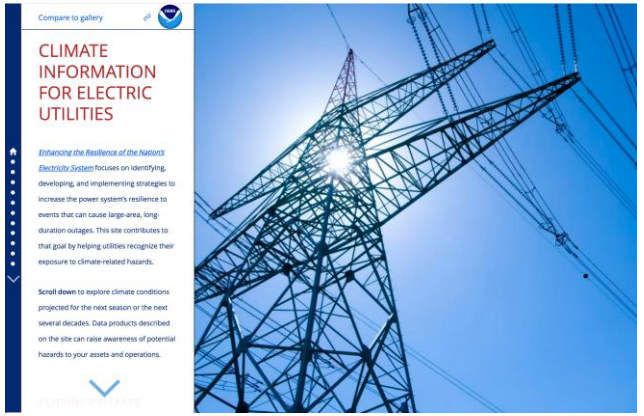
Mission Interests- Grid Sustainability and Critical Infrastructure Security

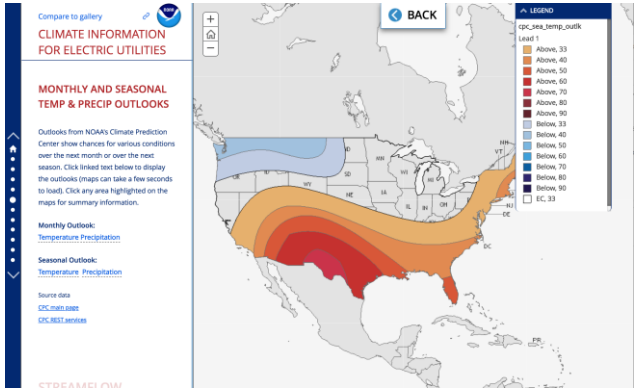
Weather and Climate Information Requirements:

- Icing events,
- temperature extremes,
- Wet bulb temperatures,
- Wind speed and duration
- Water availability (drought impacts)
- Sea level rise

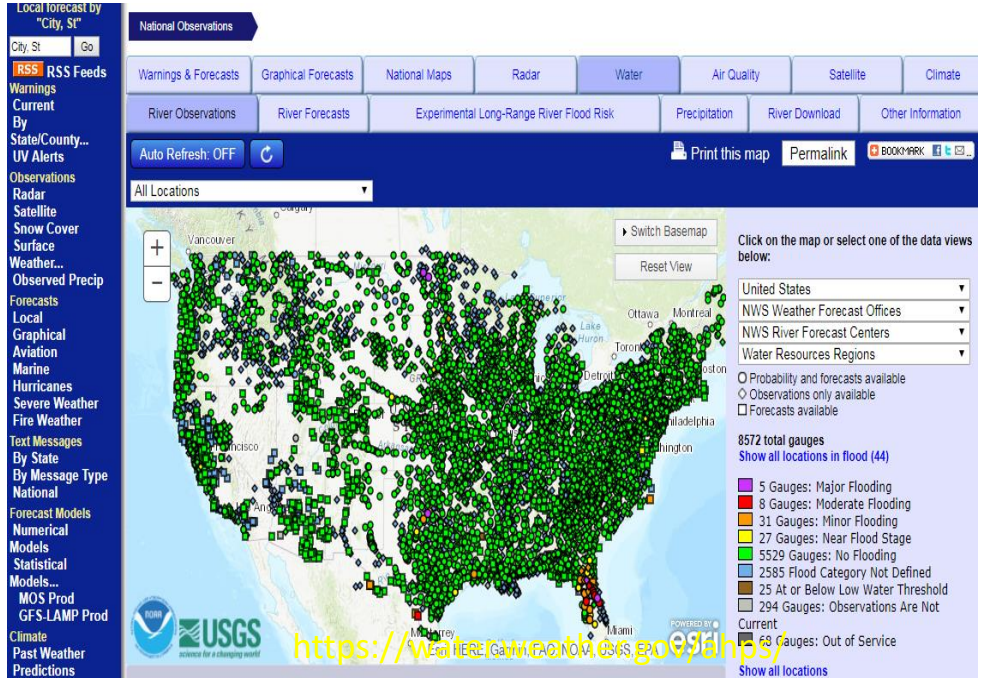


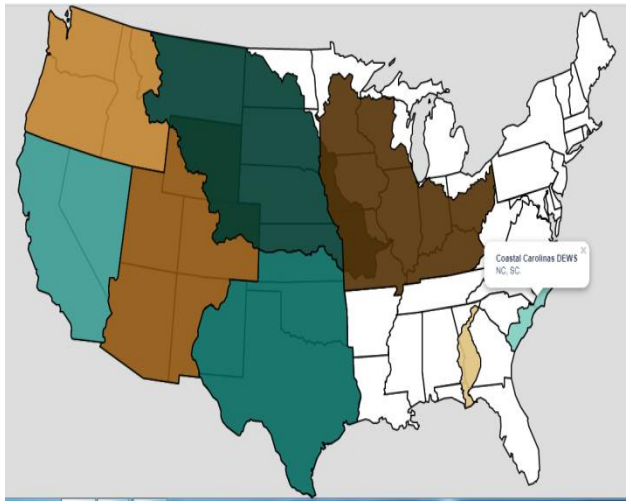
Sample frames from the Story Map - http://arcg.is/1jOLCb

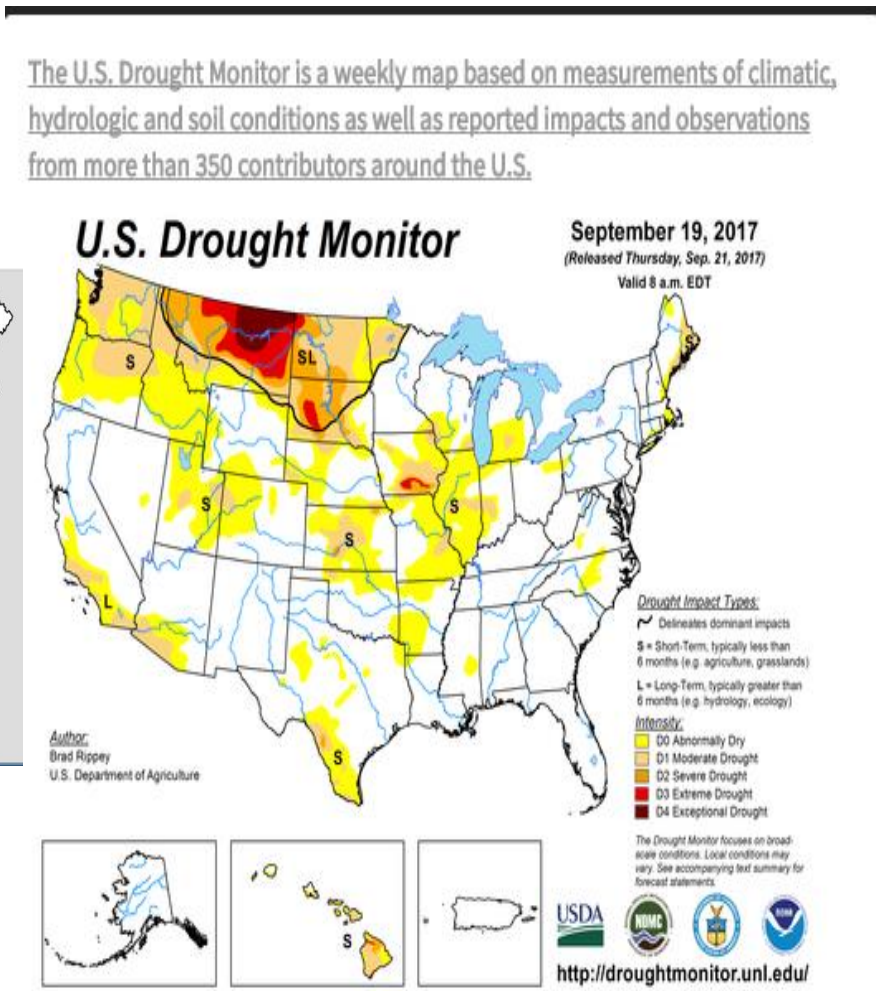




Water Resources- too much and too little







River observation and forecast information: https://water.weather.gov/ahps
Snow Information: https://www.nohrsc.noaa.gov
Precipitation Frequency Estimates: http://www.nws.noaa.gov/oh/hdsc

https://www.drought.gov/drought/

Readiness Levels

User Engagement as the Foundation—

Nurtured relationships based on a foundation of trust and mutual respect

User requirements are derived from an understanding of their decision challenges

Timely response to their requirements form the basis of ongoing engagement and use-inspired product improvement

- Include user engagement as the impetus for the idea
- Ensure co-production with the user community through each phase:
- Does it do what you need it to do? Do you need different features? Can you work it, or can we offer training?

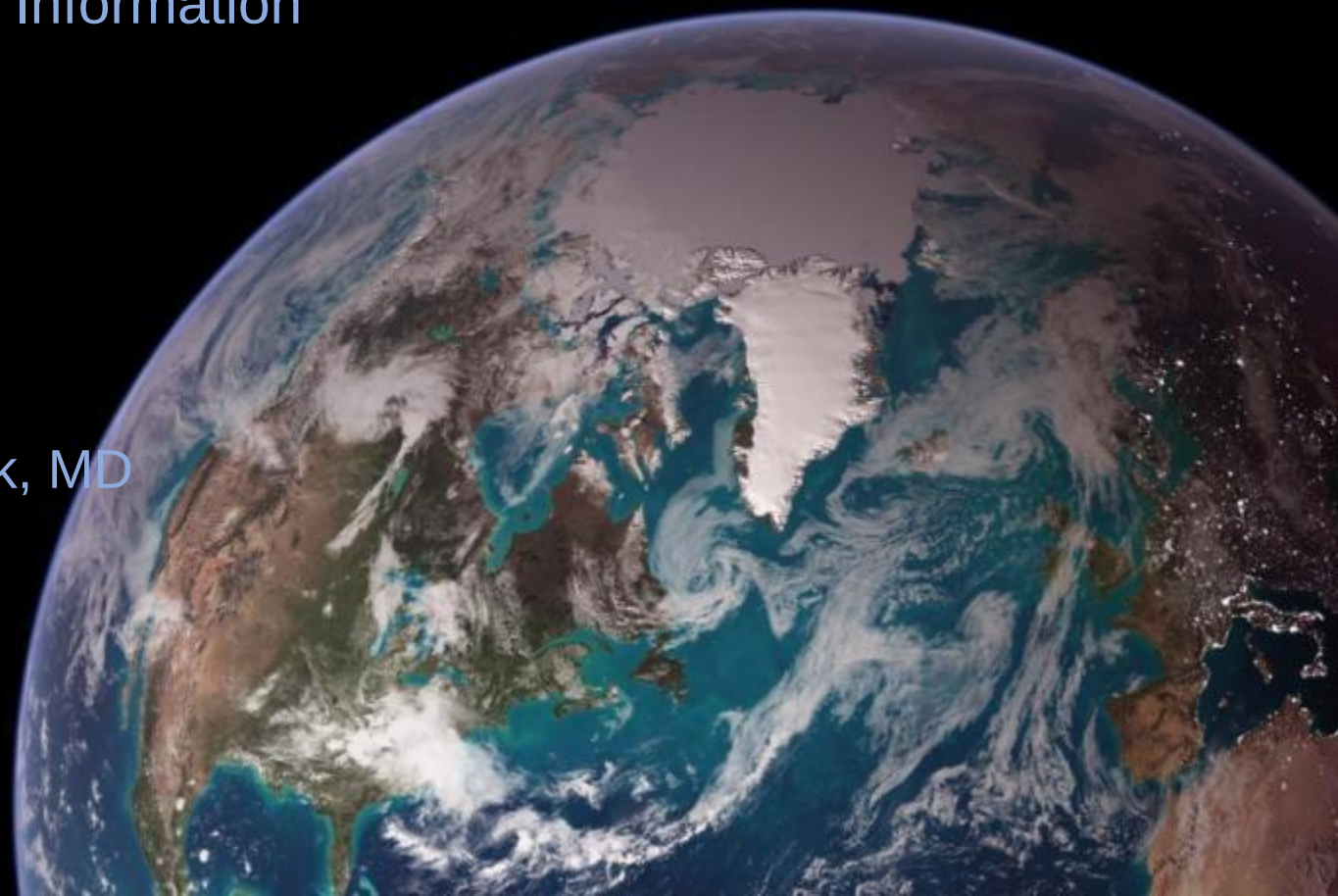
- Is it USEFUL?
- Is it USABLE?
- Will it be USED?

Questions?

Ellen L. Mecray
NOAA National Centers for Environmental Information
Eastern Region Climate Services Director
Ellen.L.Mecray@noaa.gov

http://www.ncdc.noaa.gov/rcsd/eastern

February 24, 2020
JPSS Proving Ground Meeting, College Park, MD
Invited Speaker



Backups

Why now?

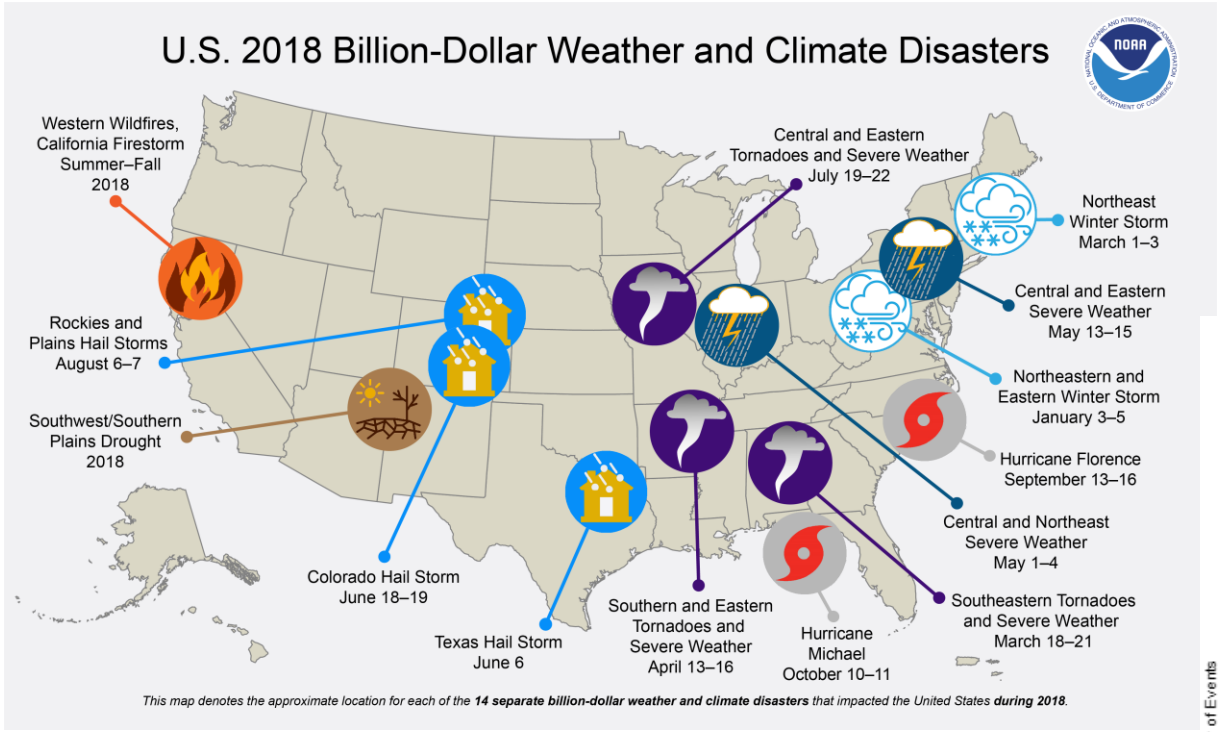
NOAA must coordinate a unified service delivery/decision support mechanism that carefully leverages partnerships and informs the development of use-inspired products and services. This mechanism is a timely effort meant to best serve our customers, particularly under changing weather, water, and climate conditions.

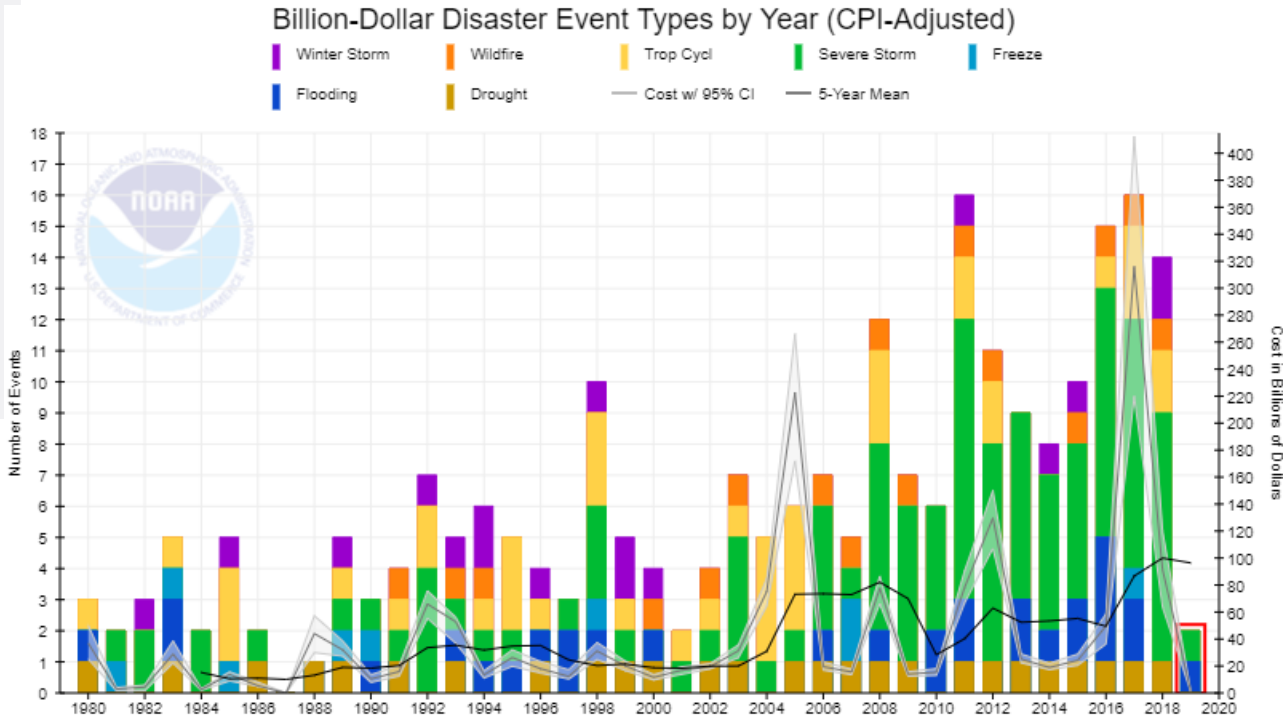
What will this plan mean for NOAA?

Effective implementation of our service delivery plan can transform how NOAA:

- Prioritizes its product lines (observations, data, and services);
- Develops new, and refines existing, products; and
- Transmits and translates information for decision-makers across multiple sectors

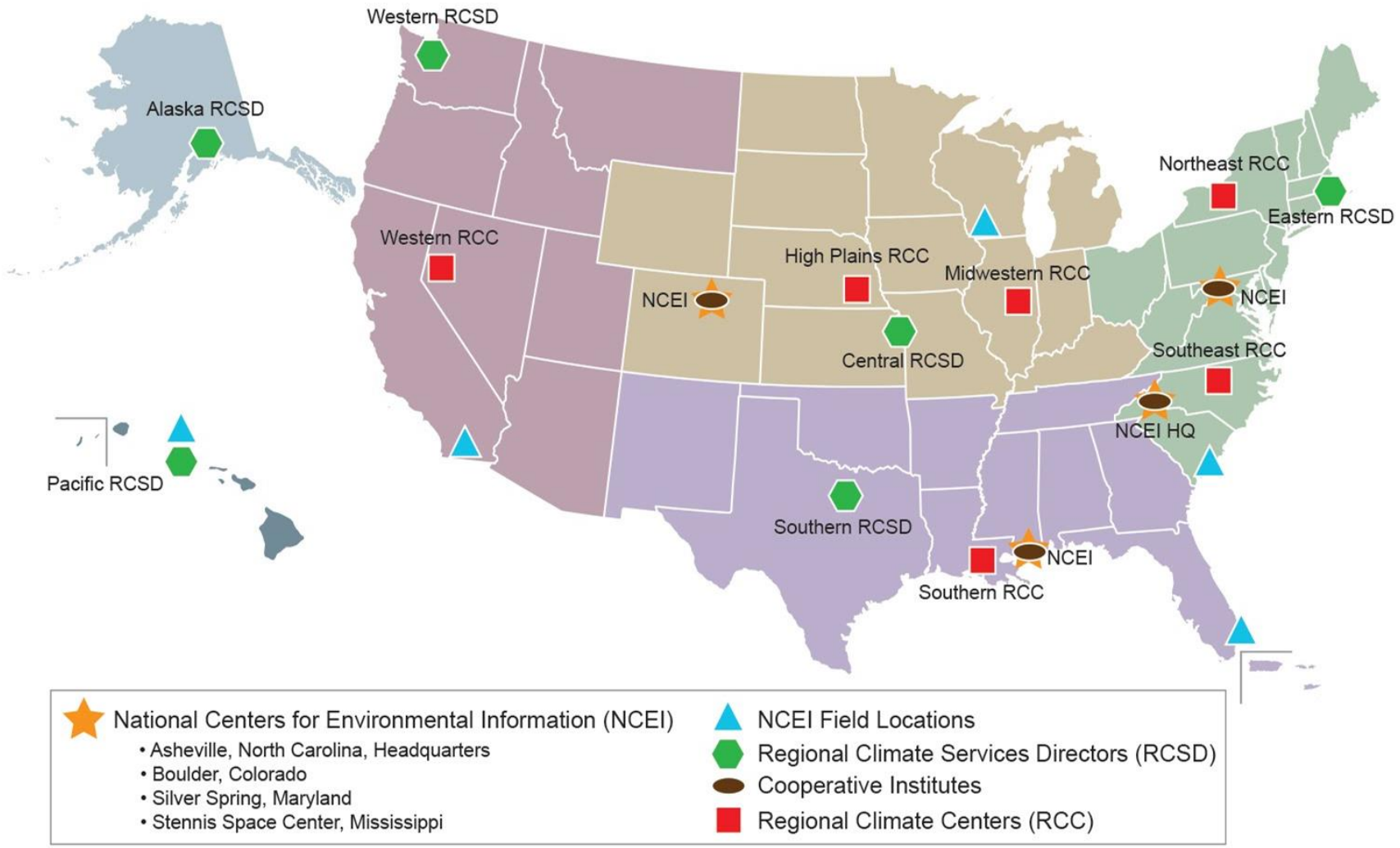
Billion Dollar Disasters



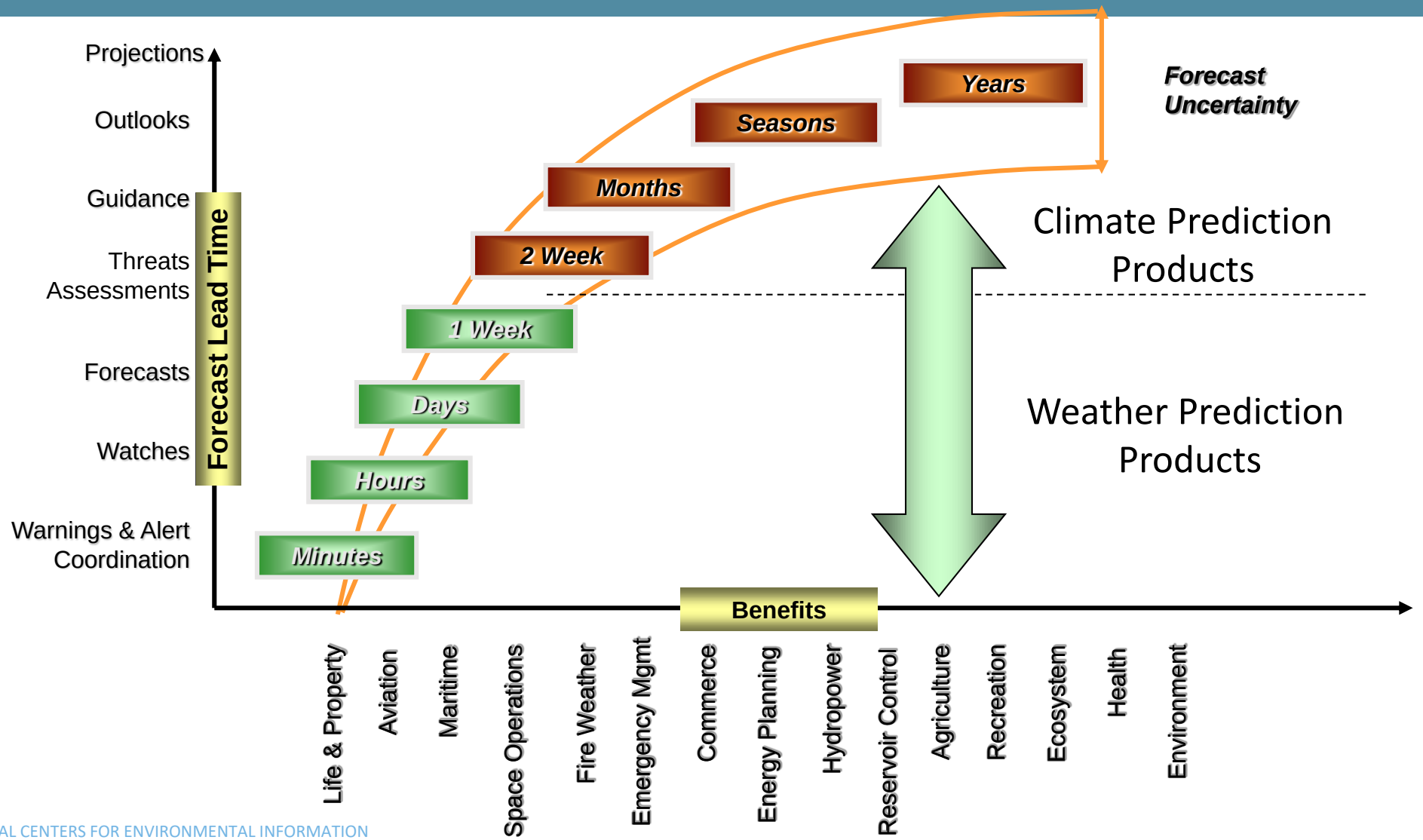


https://www.ncdc.noaa.gov/billions/

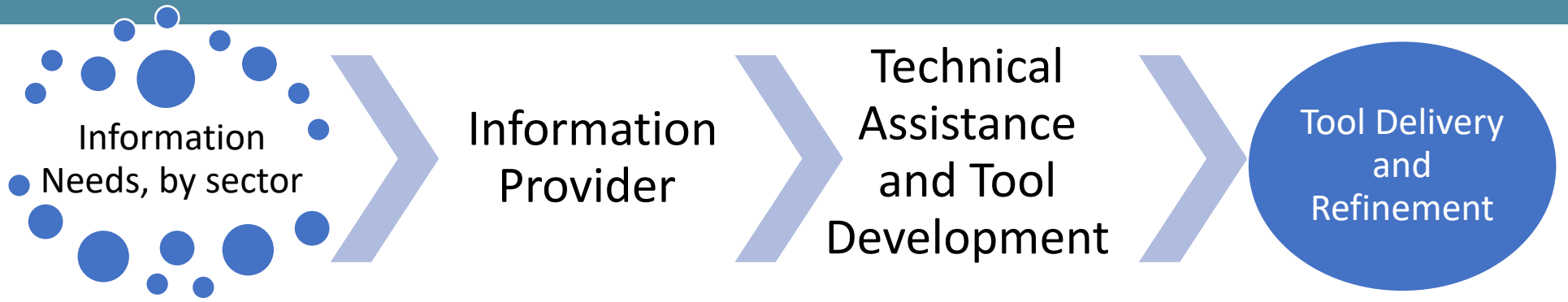
NCEI: A Nationwide Presence



Weather and Climate Timescales



The Continuum of Regional Services



RCSD, others

NOAA, Core Partners, Academia

Who's role?

Who's role?

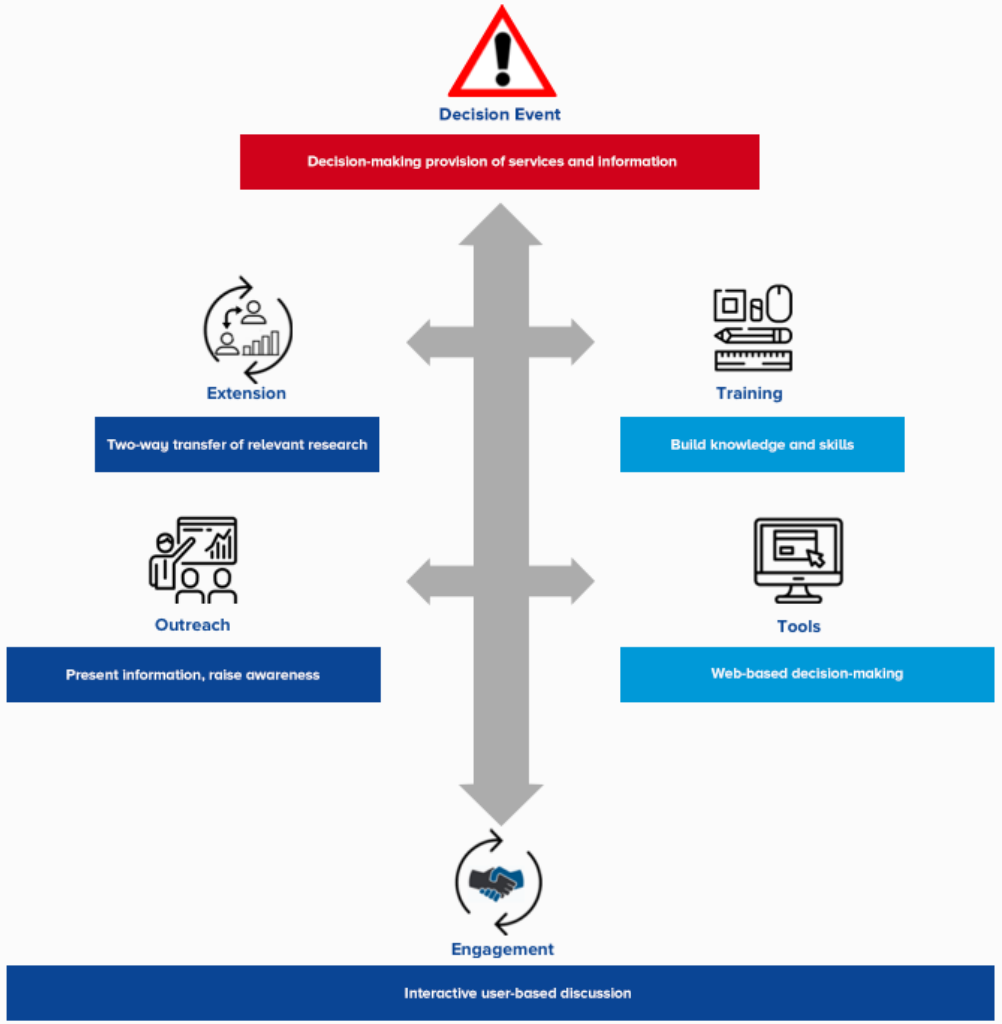
- Provision of information is highly dependent on the customer.
  - Government to government- technical assistance, user engagement, refinement of information products
  - Private sector enterprise- tailored tool development

User Engagement as the Foundation

Nurtured relationships based on a foundation of trust and mutual respect

User requirements are derived from an understanding of their decision challenges

Timely response to their requirements form the basis of ongoing engagement and use-inspired product improvement



The Value of Satellite Data

Chris J. Lauer, Ph.D

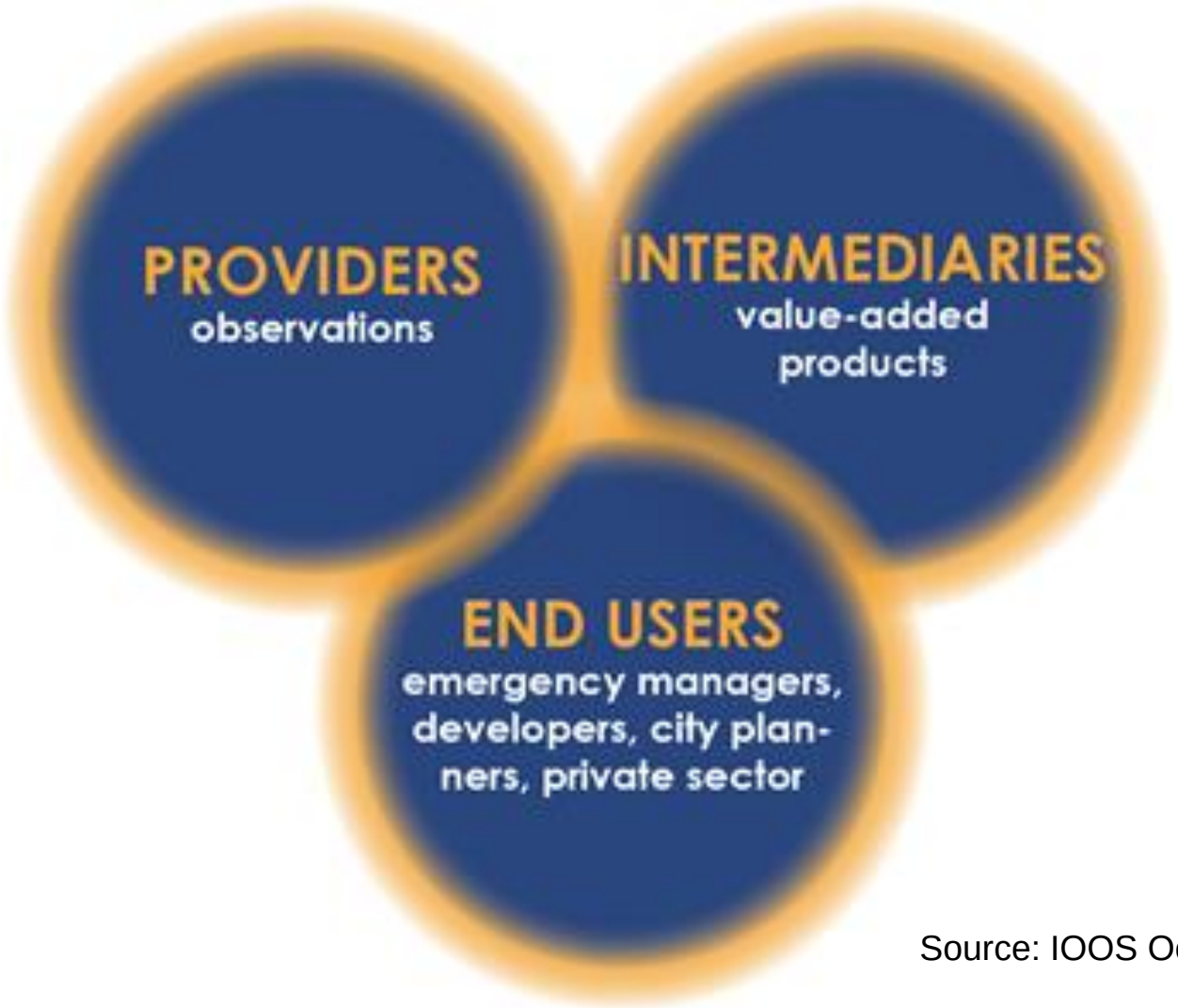
NOAA Chief Economist Team
Performance, Risk and Social Science
Office of the Chief Financial Officer

performance.noaa.gov/economics

24 February 2020
JPSS/GOES
PGRR Summit

Contents

Question for Audience?



Source: IOOS Ocean Enterprise Presentation

Why is Measuring Benefits Important?

Valuation is important in order to:

- Understand impact of past investments
- Justify budget requests for future investments
- Align agency operation and investments with public value

How Does Satellite Data Create Value?

- Cost effective ways to increase benefits of environmental data (Williamson et al 2002)
  - Investments in understanding our users
  - Improving the flow of information to these users

- Data have value when they are used in decision making. If not, then the economic value of such data/information is effectively zero

The Theory Of “Change”

Benefits = Outcomes for people and the environment **–** Outcomes for people and the environment

Courtesy: Y. Kuwayama, Resources for the Future

Key Questions

- What do we produce?
- Who uses it?
- What gets better? How much better?

Significant collaboration is required to answer these questions

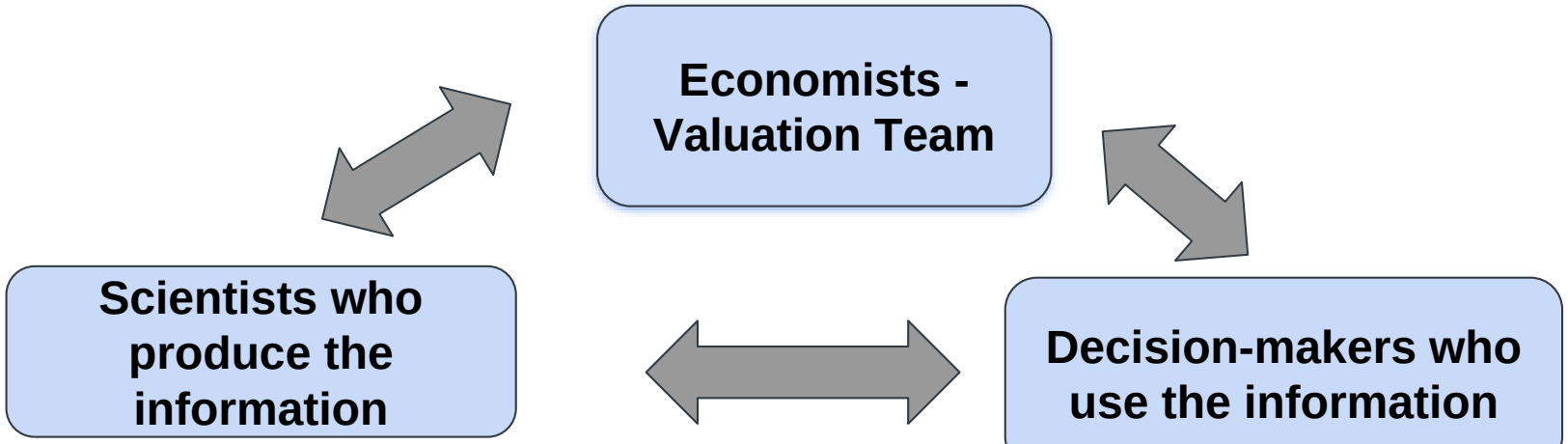
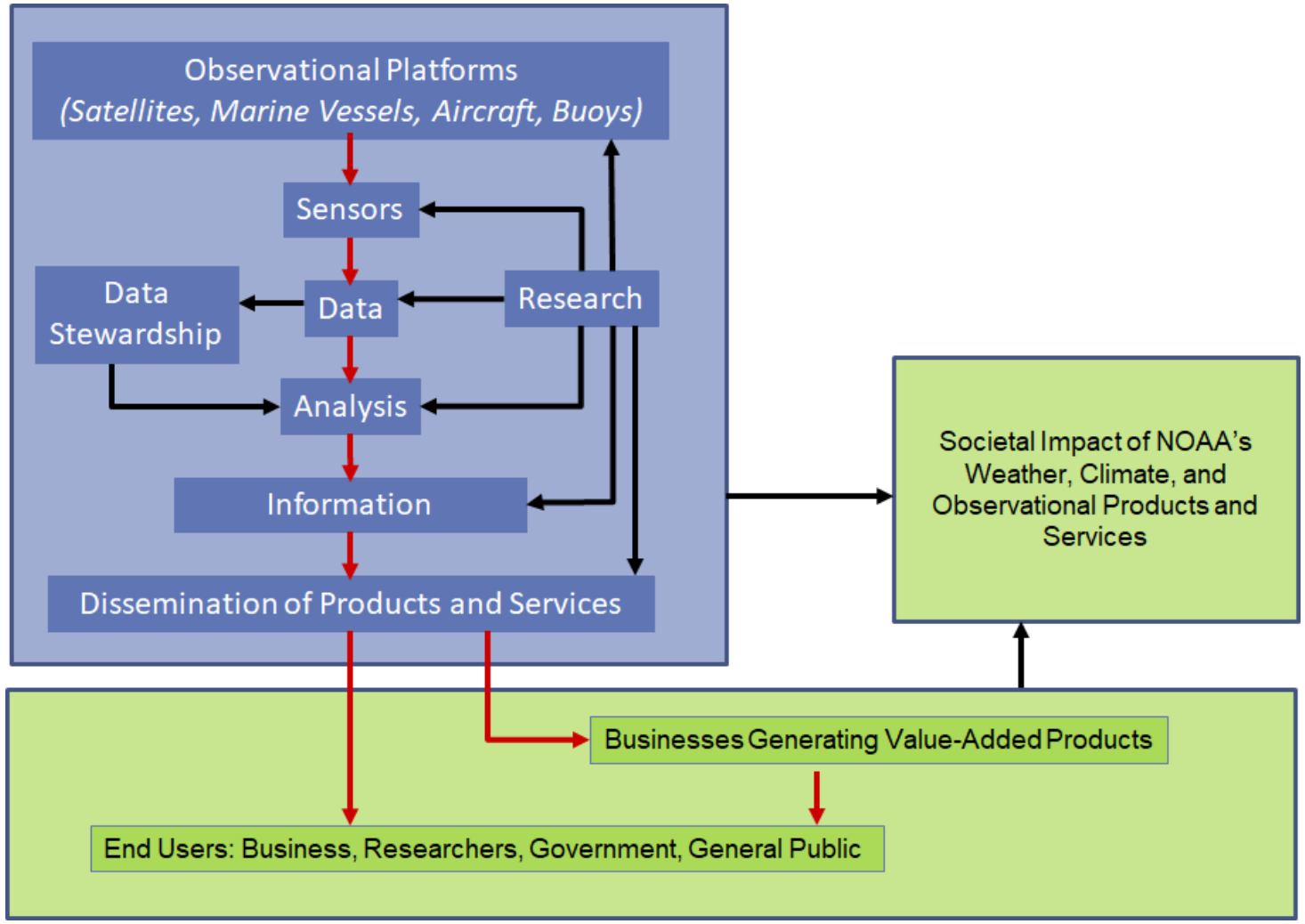


Figure Courtesy of RFF Valuables

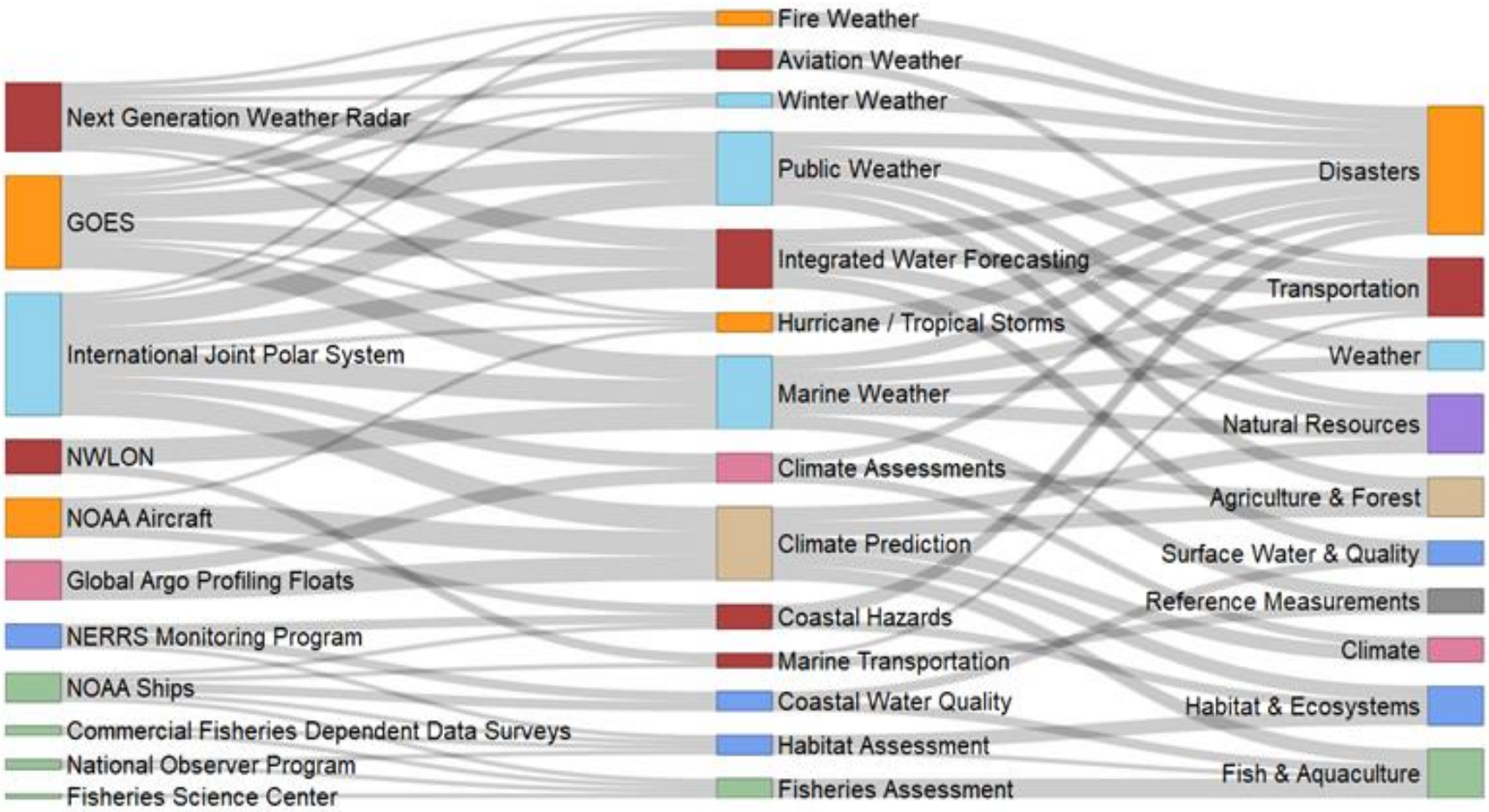
Value Chain

- Tool for analysis of linkage between all activities that lead to creation of value
- Useful as a communication tool
- Creates a common understanding of value creation process.

Value Chain


Observational Platforms
(Satellites, Marine Vessels, Aircraft, Buoys)
Sensors
Data Stewardship
Data
Research
Analysis
Information
Dissemination of Products and Services
Societal Impact of NOAA's Weather, Climate, and Observational Products and Services
Businesses Generating Value-Added Products
End Users: Business, Researchers, Government, General Public

NOAA Value Tree



+ 183 other observing systems

Current NOAA Valuation and Customer Engagement Efforts

NESDIS

- Space Weather Impact Study
- GOES-R Improvements Valuation Study
- Benefits of Hyperspectral Sounder
- GEO-XO Planning
- TPIO NOSIA refresh and user engagement
- NCEI Customer Engagement

Other Satellite related valuation work

- NWS IDSS study
- Social Coast valuation study
- IOOS user survey
- OAR funded studies of value for severe weather forecasts

NOAA Administrative Order for Chief Economist

NOAA Administrative Order 216-124

.02 To ensure agency-wide methodological standard and alignment in the following:

a. All Line/Staff Offices (LO/SO) should consult with the Chief Economist during the design phase and schedule follow up(s) as needed for the following analyses:

i. Regulatory Impact Analyses of significant rulemakings [as defined by Executive Order's 12866 (Regulatory Planning and Review) and 13563 (Improving Regulation and Regulatory Review)];

ii. Economic analyses developed for budget justification, such as economic impact analyses, cost-benefit analysis, and return on investment;

iii. Economic analyses requested by the Department of Commerce, Congress, or the Executive Office of the President;

iv. Economic analyses developed to support performance measures and the Foundations for Evidence-Based Policymaking Act of 2018; and

v. Any other significant studies, on a case-by-case basis, as determined by NOAA leadership.

Conclusions

- Valuation work can help you better serve your users
- This requires knowing your users and investing in collecting data about them.
- Value chains can help identify product inputs and user decisions
- Collaboration between information providers, users and economists is crucial for valuation efforts.

Contact Information

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