



# RESEARCH

NATIONAL OCEANIC & ATMOSPHERIC ADMINISTRATION

## Overview of NOAA Research and Context for GFDL Review

John Cortinas, OAR Deputy Assistant Administrator for Science  
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# NOAA Mission

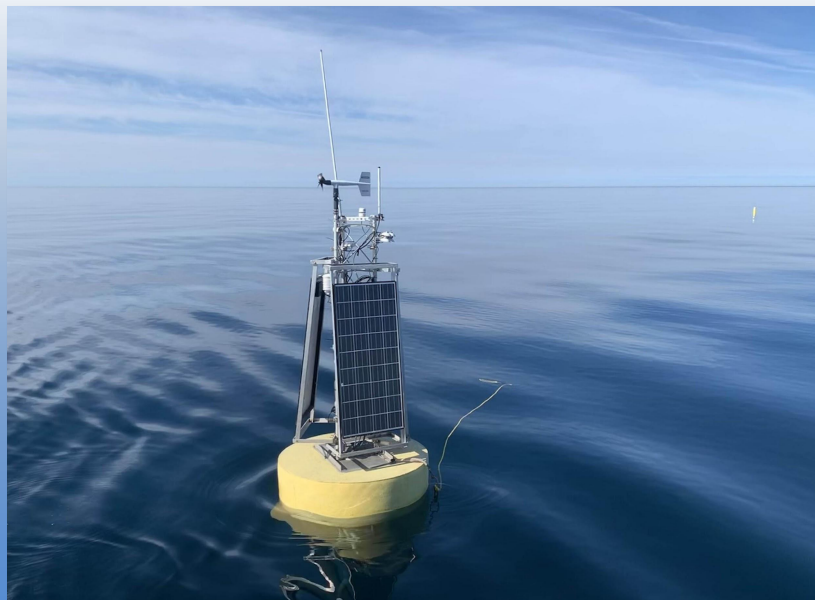


## NOAA's Mission: Science, Service and Stewardship:

1. To understand and predict changes in climate, weather, oceans and coasts;
2. To share that knowledge and information with others; and
3. To conserve and manage coastal and marine ecosystems and resources.



# NOAA's Office of Oceanic and Atmospheric Research (OAR)



Our Vision is to Deliver NOAA's  
Future  
**VISION**



Our Mission is to conduct research to  
understand and predict the Earth  
system; develop technology to improve  
NOAA science, service, and  
stewardship; and transition the results  
so they help us meet the challenges  
faced by society.

**MISSION**





# OAR Strategic Goals

1



Explore the Marine Environment

2



Detect Changes in the Ocean and Atmosphere

3



Make Forecasts Better

4



Drive Innovative Science



# Societal Challenges

- Confront the challenges from our changing climate that is impacting almost every aspect of our lives.
- Protect against extreme weather events and environmental hazards to save lives, livelihoods, property and support healthy ecosystems.
- Manage too much and too little water ensuring both access and safety with Earth's greatest resource.
- Sustain a healthy environment and economy together, helping people understand how their choices will impact their communities.





# Who We Are



Assistant Administrator  
Oceanic & Atmospheric Research  
& Performing the Duties of the Chief Scientist  
**Dr. Steven Thur**

Deputy Assistant Administrator  
Programs & Administration  
**Nancy Wallace**

Deputy Assistant Administrator  
Science  
**Dr. John Cortinas**

## HQ STAFF OFFICES

Chief Financial Officer  
& Chief Administrative  
Officer  
**David Holst**

EEO/Diversity  
**Nicole Mason**

International Activities  
**Staci Rijal**

Communications  
**Michael Murphy**

## PROGRAMS

Climate Program Office  
**Dr. Laura Petes**

Global Ocean Monitoring  
& Observing Program  
**Dr. David Legler**

National Sea Grant  
College Program  
**Dr. Jonathan  
Pennock**

Ocean Acidification  
Program  
**Dr. Sarah Cooley**

Weather Program Office  
**Dr. Gina Eosco**

Office of Ocean  
Exploration & Research  
**Jeremy Weirich**

## LABORATORIES

Air Resources Laboratory  
**Dr. Ariel Stein**

Atlantic Oceanographic &  
Meteorological  
Laboratory  
**Dr. Molly Baringer  
(A)**

Chemical Sciences  
Laboratory  
**Dr. David Fahey**

Global Monitoring  
Laboratory  
**Dr. Vanda Grubišić**

### OAR Boulder Laboratories

Global Systems  
Laboratory  
**Jennifer Mahoney**

Physical Sciences  
Laboratory  
**Dr. Robert Webb**

Great Lakes  
Environmental Research  
Laboratory  
**Deborah Lee**

Geophysical Fluid  
Dynamics Laboratory  
**Dr. Venkatachalam  
Ramaswamy**

National Severe Storms  
Laboratory  
**Dr. DaNa Carlis**

Pacific Marine &  
Environmental Laboratory  
**Dr. Michelle  
McClure**

## HQ OFFICES

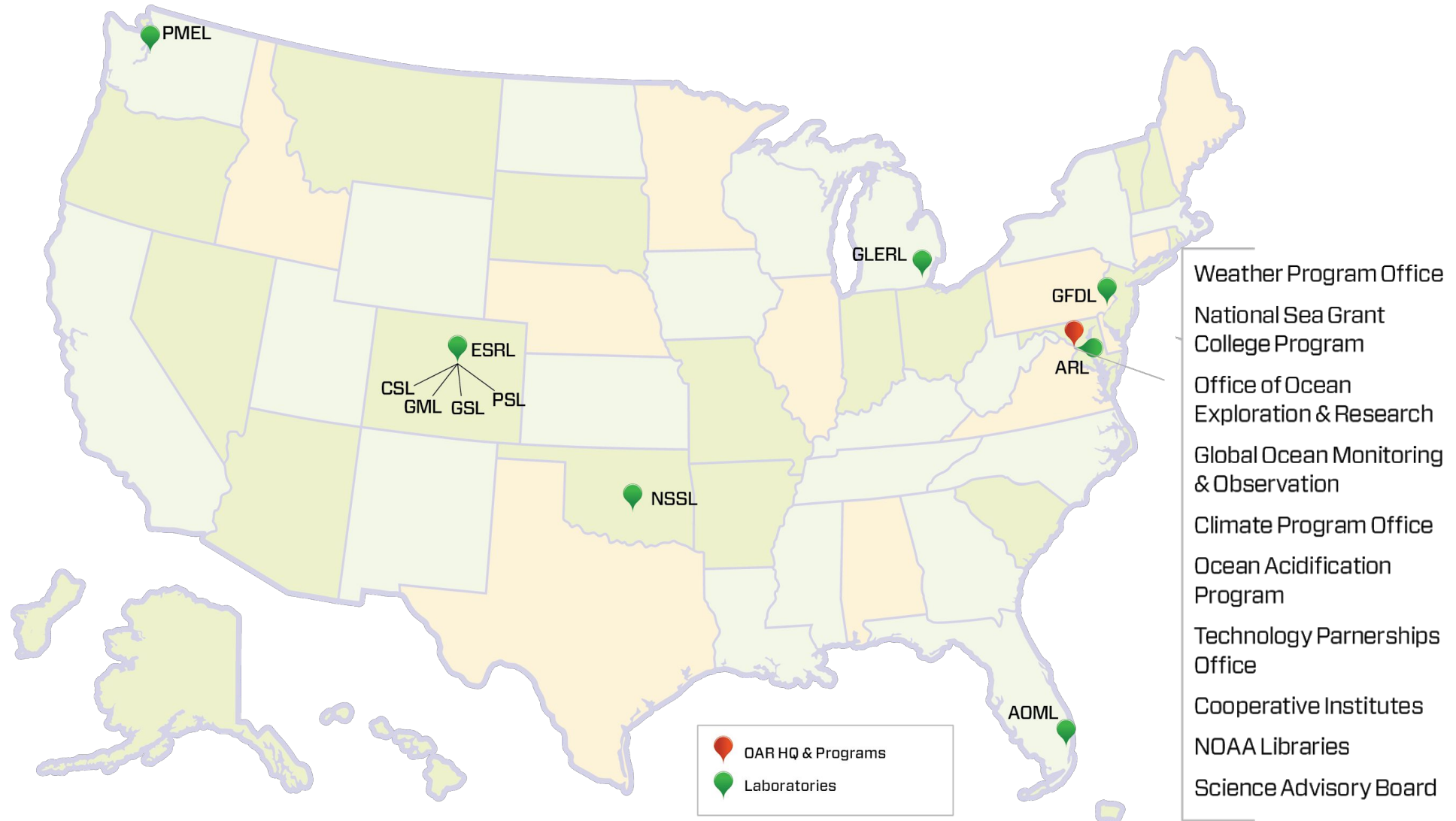
Office of Science Support  
**Dr. Terence Lynch**

Office of Research, Transition, &  
Application  
**Dr. Fiona Horsfall**

IT Management Office/Assistant  
CIO for Research  
**Jeremy Warren**



# OAR Labs and Programs



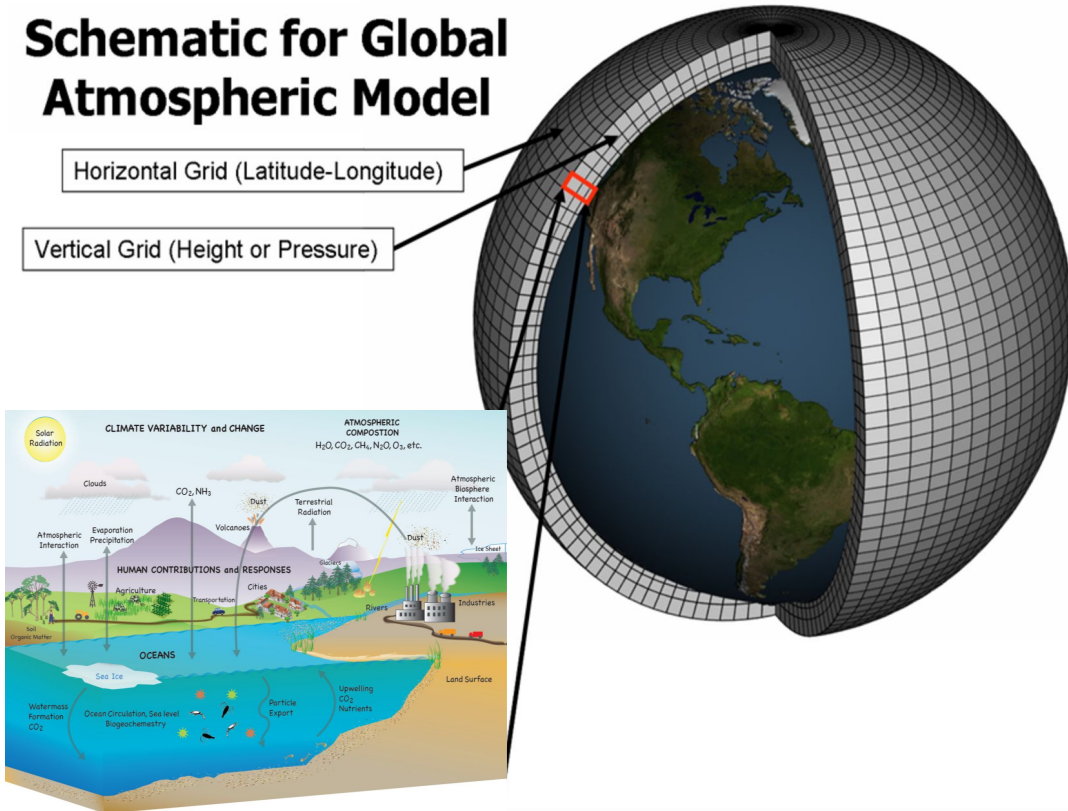
# Geophysical Fluid Dynamics Laboratory

GFDL is focused on comprehensive research that is fundamental to advancing the scientific understanding of the physical, dynamical, chemical and biogeochemical processes governing the behavior of the atmosphere, oceans, land, ice, and ecosystems. GFDL has been a pioneer since 1955 in the development and application of computational models of weather, oceans, and climate. The use-inspired research contributes to NOAA's seamless understanding, predictions and projections from weather to seasonal to centennial timescales, including extremes; quantification of regional and global climate; and Earth System variability and change.

## GFDL modeling and applications support NOAA innovations:

- FV3 atmospheric dynamic core for National Weather Service predictions
- MOM6, national ocean model for predictions of weather and climate
- Seasonal predictions: North American Multi-Model Ensemble (NMME)
- Operational Atlantic hurricane forecasts, and seasonal-decadal hurricane projections
- Earth System models for ocean, climate and ecosystems applications
- Predictions of severe storms, heat waves, floods/droughts, Arctic ice
- Contributions to World Climate Research Program Model Intercomparison Project and Intergovernmental Panel on Climate Change (*The Scientific Basis*)

## Schematic for Global Atmospheric Model



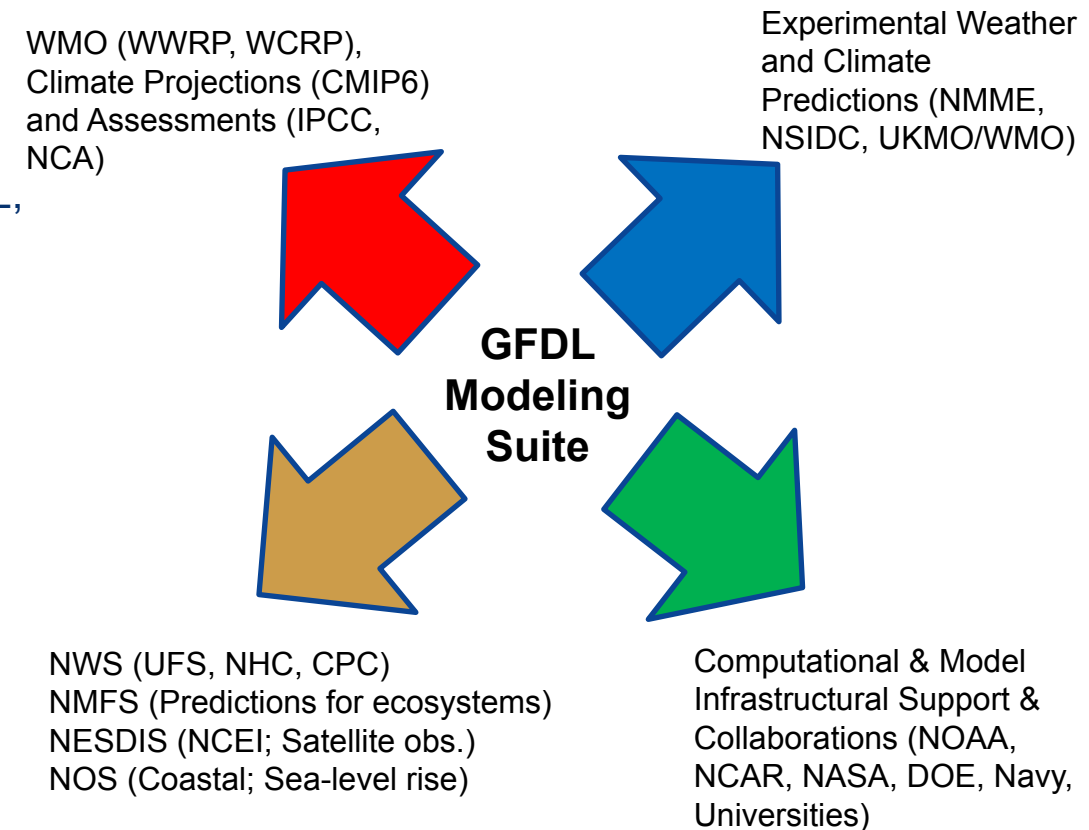


# Geophysical Fluid Dynamics Laboratory in OAR's Portfolio



- GFDL directly supports three of OAR's Strategy (2020-2026) Goals: 1) Detect Changes in the Oceans and the Atmosphere, 2) Make Forecasts Better and 3) Drive Innovative Science.
- GFDL closely collaborates with other OAR laboratories and programs:
  - Global nested, and Variable Resolution modeling (GSL, AOML, PSL, EMC))
  - Forward looking projections (also Climate Change Projections out to 2050) (CPO, NESDIS/NCEI)
  - Precipitation Prediction Grand Challenge (CPO)
  - Hurricane research and predictions (AOML, NWS/NHC)
  - Climate Ecosystem Fisheries Initiative (PSL, PMEL; NMFS)
  - Coastal Inundation (PSL; NWS; NOS)
  - Modeling of climate variability and change (WMO/WCRP,.....)
- GFDL also partners with programs across OAR, including CPO, GOMO, and OAP to *Confront the Challenges from our Changing Climate*, one of OAR's four Societal Challenges.

## Users of GFDL Models, Data, and Information



# Geophysical Fluid Dynamics Laboratory Leadership



## Dr. Venkatachalam “Ram” Ramaswamy, GFDL Director

Dr. Ramaswamy took the helm at GFDL in 2008, as the lab’s fourth director. His maxim has been use-inspired research (so-called Pasteur’s Quadrant) that emphasizes the imperative for fundamental cutting-edge research relevant for NOAA’s applications and operations. His leadership has enabled innovative science underpinned by a sustained lab research infrastructure that is continuously fulfilling NOAA’s mission objectives. While advances in basic sciences (e.g., processes, mechanisms) are pivotal for improvements in modeling, understanding, and predictions, the challenge is the support of basic research and development, and how to derive cutting-edge models of the weather, climate, and Earth System that deliver trustworthy and societally-relevant information to the Nation.



# Geophysical Fluid Dynamics Laboratory Leadership



## Dr. Whit Anderson, GFDL Deputy Director

Dr. Anderson's primary role is to coordinate between the scientific mission of the lab and its supporting assets and activities, such as administration and information technologies and high performance computing. He interacts with external entities from other NOAA line offices, federal agencies, legislative branch of government and universities in support of the lab's science.



## Lauren Koellermeier, GFDL Associate Director

In her role as Associate Director at GFDL, Lauren leads the development and implementation of science and administrative policies, and oversees communication and project management functions at GFDL. She oversees internal and external reporting, and the planning and execution of budget initiatives.



# NOAA Science Reviews

- NOAA Administrative Order (NAO) 216-115B requires that NOAA research and development activities be evaluated every five years by independent peer review.
- OAR Circular 216-3 implements the NOAA requirements within OAR.
- OAR conducts these science reviews at the laboratory and program level.



# Scope of Review

- Quality, relevance, and performance of research and activities sponsored or conducted by NOAA's GFDL over the last 5 years (2019).
- Recommendations for improvements moving forward.
- Progress on implementing strategic plans and insights for future planning.



**The GFDL 5-10 Year Strategic Science Plan**  
08/26/19  
Executive Summary

This Plan outlines GFDL's research strategies and priorities in the next 5-10 years, with the goal of supporting NOAA's mission by advancing scientific understanding and the prediction capability of the Earth System. The complete catalog of weather and climate observations and diagnostic reports serve as a for sustained development and application of state-of-the-art Earth System Models (ESM) across a wide range of temporal (hours to centuries) and spatial (regional to global) scales. This is consistent with observations and theories, will yield products, information, and services critical for decision- and policy-making.

The current-generation GFDL models, namely CM (physical climate), ESM (Earth System), SWELL (weather forecasting and sub-seasonal to seasonal predictions) and GPCAR (seasonal to multi-decadal predictions and projections), use common components including the atmosphere to dynamical core FV3, the Modular Ocean Model MOM, the SAM split model and the SISC sea ice model, the whole being built upon the Flexible Modeling System common infrastructure. They constitute major contributions to community-wide weather and climate modeling, and facilitate the sharing of many key components (atmosphere, ocean, sea ice and land). The unified modeling system concept provides the basis for understanding earth system phenomena, processes, variations and change, and for developing a seamless prediction capability across timescales. Future developments will focus on increasing model horizontal and vertical resolutions, improving the representations of unresolved processes, and exploring new data assimilation techniques.

GFDL's efforts to understand the Earth System, enabled by models and observations, can be broadly organized into four areas: atmospheric, oceanic, biogenic and geophysical processes; biogeochemical processes; weather and climate extremes and climate variability and change. The resulting peer-reviewed accomplishments contain far-reaching insights into many of the leading questions in the field. GFDL will continue to pursue cutting-edge research in national critical areas, such as: model-data-constrained model-to-observations climate connections, ocean dynamics and sub-grid scale parameterizations, interactions within and between Earth System components, internal climate variability and climate responses to external forcings, and diagnostics and projections covering a range of space and time scales.

By enhancing both the realism and computer efficiency of its production tools, GFDL has gained experience in using them to provide skillful, real-time predictions of weather and climate to federal partners and form their forecasts and seasonal outlooks. GFDL will continue to develop and build on collaborations across NOAA, and with the academic, private, and other sectors to address the societal needs. GFDL will continue to perform advanced research towards the goal of seamless predictions and projections by developing new Earth System modeling capabilities, improving predictors of high-impact events, and removing the gap between the seasonal predictability and beyond skill.

The underpinning of GFDL's scientific endeavors is a computational and software infrastructure built upon the unified modeling concept, which contributes to the NOAA's endeavors in understanding and prediction of the Earth System. GFDL will continue to explore innovative ways to support community model development, harness the power of Machine Learning, and adapt to the rapid evolution of high-performance computing.



# How Does OAR Define Success?

## Three Evaluation Criteria:

1. **Quality** is a measure of the novelty, soundness, accuracy, and reproducibility of a specific body of research. Indicators include publications, technology development, data contributions, and awards.
2. **Relevance** is a measure of how well a specific body of research supports NOAA's mission and the needs of users and the broader society.
3. **Performance** is a measure of effectiveness and efficiency. It includes an assessment of the organization's leadership, management, operations, workforce, organizational culture, strategic planning, progress towards performance targets and milestones, efficiency in resource utilization, and transition of research to operations.





# How OAR Uses Reviews

- Inform performance improvements and portfolio management
- Encourage innovative and collaborative approaches to meet goals and objectives
- Maintain consistency with NOAA strategic planning, budgeting, and execution
- Highlight directions for future strategic plans
- Identify common themes and priorities so that OAR can determine mechanisms, policies, or actions to address corporately





**Thank You!**

