NOAA Global Systems Laboratory

2021 GSL Laboratory Review

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NOAA Global Systems Laboratory

GSL's Impact on Society

NOAA Global Systems Laboratory

GSL Introduction

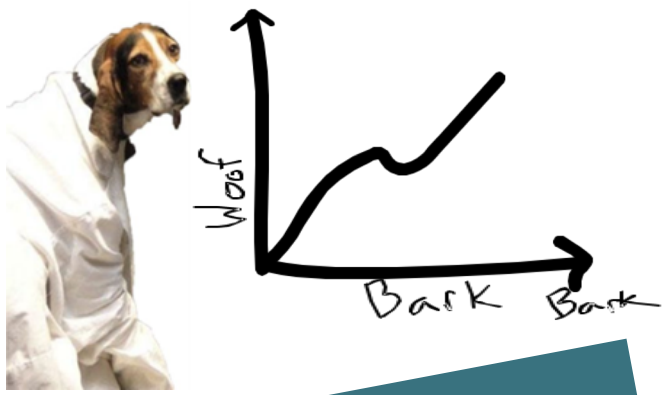
Global Systems Laboratory

Vision and Mission

Vision: Forecast systems that deliver solutions.

Mission: Lead applied research and directed development though the transition of environmental data, models, products, tools, and services to support commerce, protect life and property and promote a scientifically literate public.

GSL's Values



Science Driven

Diversity and Inclusion

Integrity

Public Service

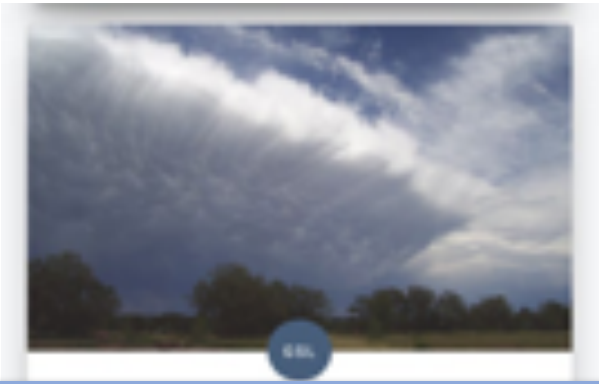
Innovation

Excellence

Agility

Organizational Structure

- National Environmental Satellite Data and Information Service
- National Marine Fisheries
- National Ocean Service
- National Weather Service
- Oceanic and Atmospheric Research
  - Earth System Research Laboratories
    - Chemical Sciences Laboratory
    - Global Monitoring Laboratory
    - **Global Systems Laboratory**



    - Physical Sciences Laboratory
- Office of Marine and Aviation Operations

Scientific Congressional Drivers

2017

Weather Research and Forecasting Innovation Act

Prioritize weather research to improve weather data, modeling, computing, forecasts, and warnings for the protection of life and property and the enhancement of the national economy.

- Earth System Modeling
- High-Resolution Weather Modeling
- Decision Support Systems
- High-Performance Computing

2018

National Integrated Drought Information System Act

Carry out weather and air chemistry research programs, advance weather modeling skill, reclaim and maintain international leadership in the area of numerical weather prediction, and create a community global weather research modeling system that is accessible by the public.

- Earth System Innovation Center (EPIC)
- Air Chemistry Modeling
- Unified Forecast Systems

2020

Floods Act

Requires NOAA to evaluate and improve flood watches and warnings and communication of information to support preparation and responses to floods

Requires NOAA to estimate and communicate the frequency of precipitation

- High-Resolution Weather Modeling
- Automated Quantitative Precipitation Information System
- Decision Support Systems

2021

Clean Future Act

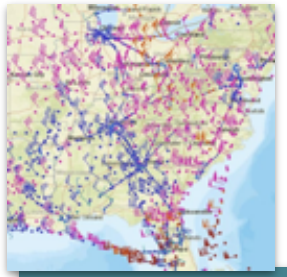
Improve public health, resilience, and environmental outcomes

- Air Chemistry Modeling
- Atmospheric Science for Renewable Energy

GSL Alignment

DOC's Strategic Goals										
Accelerate American Leadership		Enhance Job Creation		**Strengthen U.S. Economic and National Security**		Fulfill Constitutional Requirements and Support Economic Activity		Deliver Customer-Centric Service Excellence		
DOC's Strategic Objectives										
Expand Commercial Space Activities	**Advance Innovation**	Increase Aquaculture Production	Reduce and Streamline Regulations	Strengthen Domestic Commerce	Enhance the Nations Cyber-security	**Reduce Extreme Weather Impacts**	Provide accurate Data to Support Economic Activity	Engage Commerce Employees	Accelerate Information Technology Modernization	Consolidate Functions for Cost Savings
NESDIS	NMFS **OAR** NOS NESDIS OMAO	NMFS OAR NOS	NMFS	NMFS NOS	OCIO	NWS **OAR** OMAO NOS NESDIS	NOS OCFO	NOAA Staff Offices	NOAA Staff Offices	NOAA Staff Offices
NOAA Priorities										
Space Innovation			Maximizing Economic Contribution of Oceans and Coast Resource				**Extreme Weather and Water**			
OAR's Strategic Goals										
Drive Innovative Science			**Detect Changes in the Ocean and Atmosphere**				**Make Forecasts Better**			

GSL from End to End

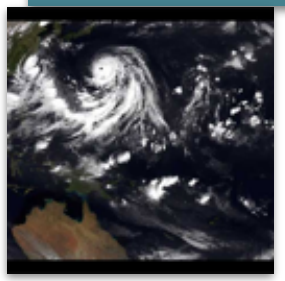


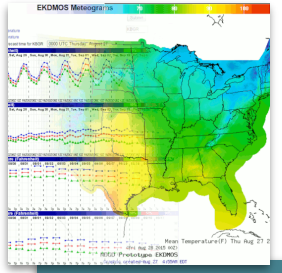
Data and Observations

Advanced Technologies

Data Assimilation

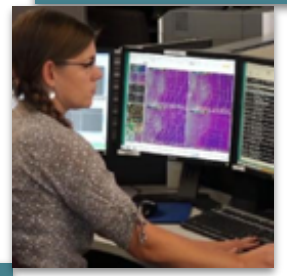
Modeling





Decision Support and Usable Output

Forecaster



Effective Response

Organizational Excellence and Information Technology

Grand Scientific Challenge

Provide actionable environmental information through the research and development of global storm-scale prediction and innovative decision support capabilities to serve society.

GOAL 1	GOAL 2	GOAL 3
Accelerate Earth-system prediction capabilities	Revolutionize how we communicate weather information and impacts to consumers	Invest in people, partnerships, and organizational performance

Blended Workforce

Cooperative Institute Partners

CIRA

CIRES

Contractor Partners

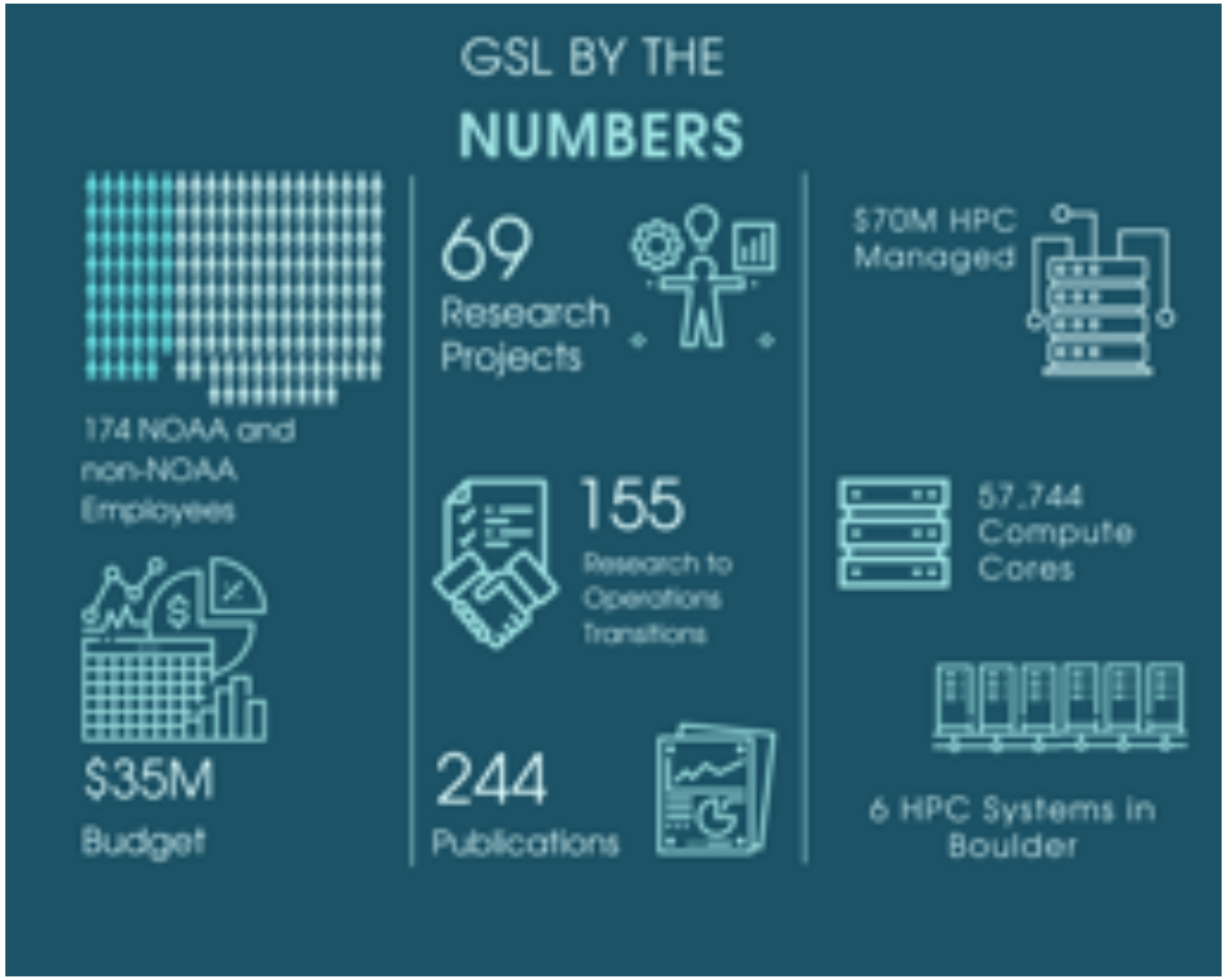
Cherokee FEDERAL

FedWriters

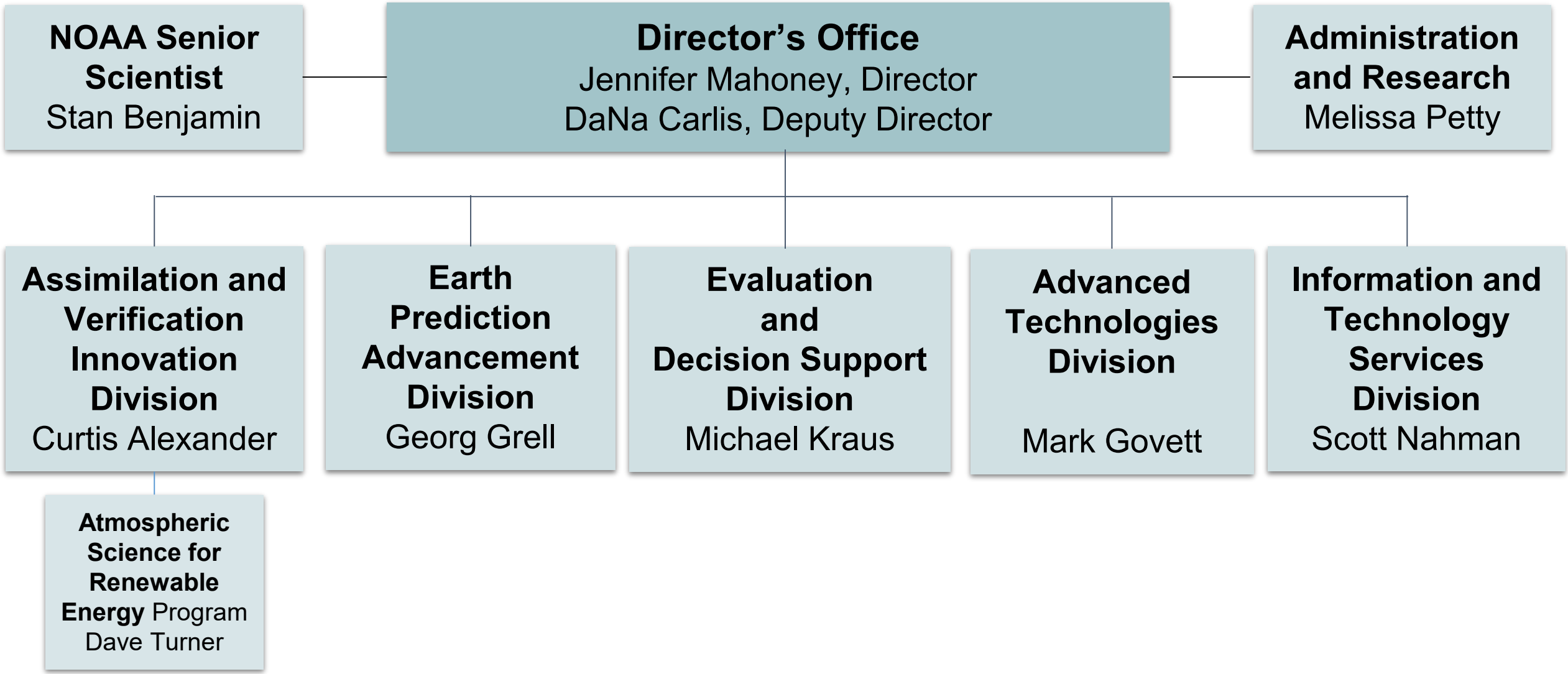
ACE INFO a Dovel company

GENERAL DYNAMICS Information Technology

GSL by the Numbers



Internal Organizational Structure



GSL Indicators of Excellence

Awards

International Awards

Haagen-Smit Prize for *"Fully Coupled 'online' chemistry within the WRF model"* (2471 Citations)

National Awards

12 (6 NOAA)

Colorado Awards

12

International Service and Societies

National Service and Societies

NOAA Global Systems Laboratory

GSL's Research and Development and Achievements

Global Systems Laboratory

Theme 1: ITS Excellence

State-of-the-art Facility

Data Center - provides data to researchers in and outside of GSL

Facility that supports HPC systems

- **Monitored 24x7x365**
- **State-of-the art cooling and fire systems**
- **Technician expertise**

One of the first HPC Systems in NOAA

JET was one of the fastest computers in the world in 2002

File systems adopted by other NOAA systems

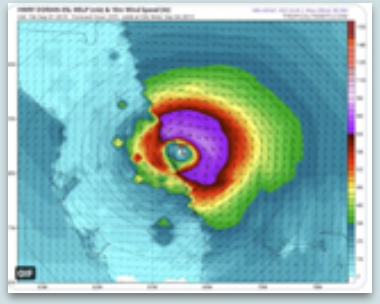
Manage Jet (Boulder) and Orion (MSU) systems

Virtual Computing Infrastructure

Implemented a GPU cluster (proof of concept)

Only cluster to run NOAA's experimental models in real-time

GSL's computing resources converted to virtual machines saving resources



Enable Research to Operations

Data, ingest, decoding, reformatting, and monitoring

Infrastructure to support Real-time 'operations' for research development and testing before delivery

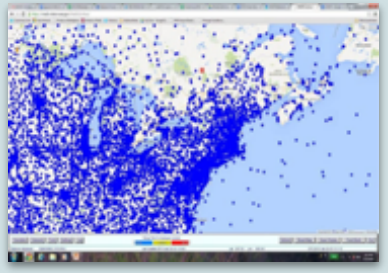
Leadership across NOAA

Theme 1: Advanced Computing Technologies

Visualization Technologies

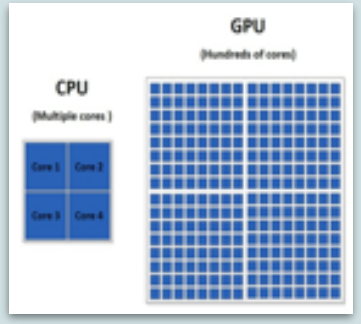
Demonstrated innovative way to view planetary data

Made available to everyone on smart phones and tablets



Meteorological Assimilation and Data Ingest System (MADIS)

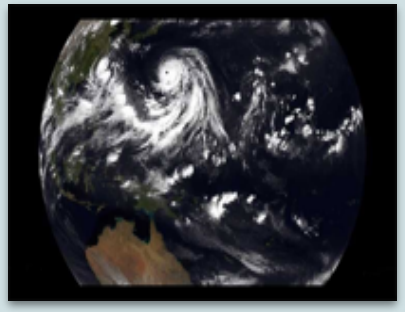
Framework for delivering observations to the international community



Computing Advances

From CPUs, to GPUs, to Exascale Computing

Technologies to advance our weather models

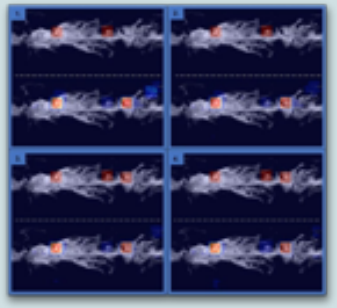


Cloud Computing

Leading OAR's Cloud Computing strategy and GSL's technology

Early advances:

- **Wx models**
- **AWIPs**



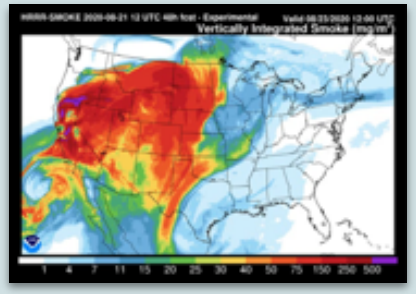
Deep Learning and AI

Leading NOAA AI strategy
Strong partnership with CSU/CIRA to advance use of AI

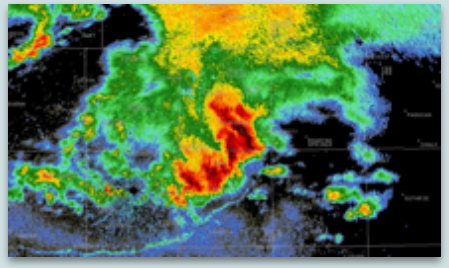
Early advances:
Identify Tropical Cyclones

Innovation and International Collaboration

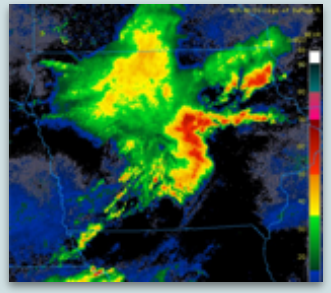
Theme 2: Earth System Prediction



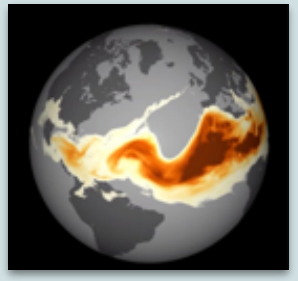
Rapidly Updating Models



Data assimilation to initialize models and physics



High Resolution Models



Extending from weather to the global Earth System

Community engagement, international expertise

Rapid Update Cycle (RUC) First hourly updated model

High-Resolution Rapid Refresh (HRRR) First hourly-updated CAM-scale model

First assimilation of aircraft data, radar reflectivity, GPS-met, and cloud data from METAR and satellite

Quick radar data assimilation and MRMS radar availability supports HRRR

Very high-res nests

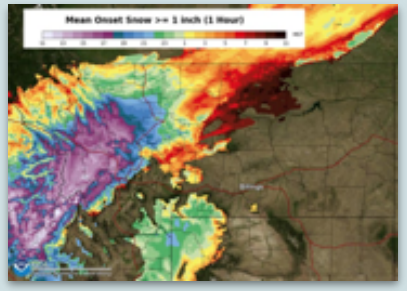
Global storm-scale prediction

Coupling to land, snow, aerosols, lakes

First treatment of wildfire smoke

Key contributors to the unified forecasting system

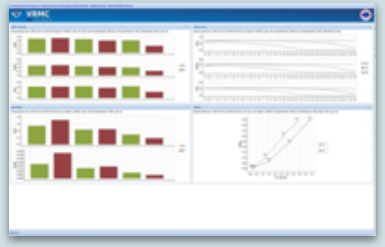
Theme 3: Decision Support Technology



Social Science and Model Ensembles

Targeted information for users

Uncertainty and confidence information



Verification

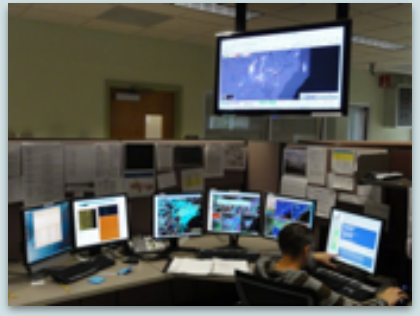
Improve the meteorology in a model

Improve the accuracy of a model to support weather-impact decisions

Forecast Assessments

Detailed analysis to uncover model limitations

Information that is foundational for model transitions



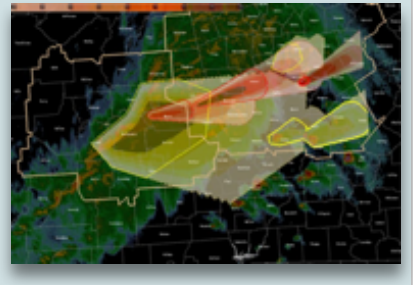
Forecast and Decision Support Systems

NWS forecast systems

- **AWIPS/Hazard Services**
- **Graphical Forecast Editor**

Advanced Decision Support

- **IDSS Engine**



FACETs

Forecasting a Continuum of Environmental Threats (FACETs)

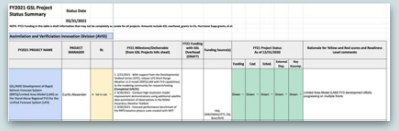
Probabilistic Hazard Information (PHI)

Threats-in-Motion

Pioneers in Verification, Evaluation, and User-Driven Decision Support

Theme 4: Organizational Excellence

Global Systems Laboratory



Organizational Excellence Towards the Grand Challenge

	Team Building	***Staff Inclusion***	***Diversity***	***Administration Advancements***

	• Lab achievement and recognition
	• GSL social gatherings
	• Awards and shout outs
	• Satisfaction surveys
	• Weekly briefings and newsletters
		• Mid-career leadership in lab
		• Yearly retreats for strategic planning
		• Division Duties involved in running the division
		• Mentoring and internships for staff
		• Professional development training
			• Members of 4 diversity committees
			• 1st African-American Lab Deputy Director in OAR
			• GSL leadership most diverse in ESRL
			• Diversity plan
			  ○ CSC partnership
			  ○ Early career
			  ○ Recruiting events
				• New structure
				  ○ Deputies
				  ○ Assoc. Dir Admin
				• Succession planning
				• Project management
				• Budget alignment
				• Workforce plan

NOAA Global Systems Laboratory

Agenda/Format for 2021 Review

Global Systems Laboratory

Format for the Review

- Review the overview videos for each Theme
- Google document for entering questions during the video review
- In-depth discussion of each Theme during the week of the review
- All 2015 Laboratory Review materials and final report can be found here: https://gsl.noaa.gov/about/science-review/science-review-2015

Presentation Outline

- GSL Overview (you are here)
- Organizational Excellence – deep dive week of review
- Advanced Technologies and IT for Scientific Advancement
  - Information Technology as the foundation
  - Advanced Technologies
- Earth System Prediction
  - Modeling
  - Data Assimilation
  - Improving Prediction Across Scales
  - Community Engagement
- Decision Support
  - User-driven Decision Support Projects
  - Verification and Evaluation

Thank you!