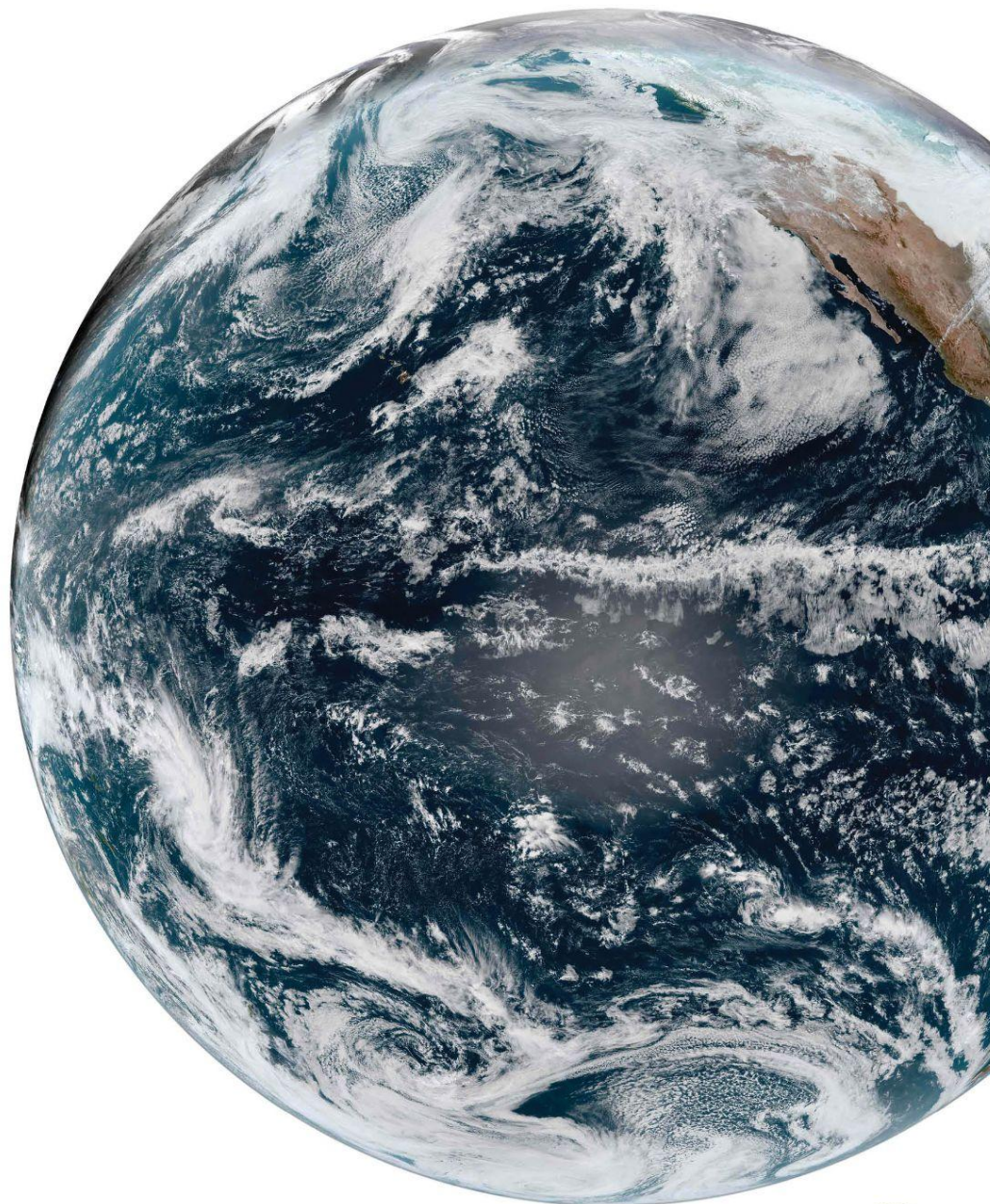


NOAA Global Systems Laboratory

2021 Charter



Jennifer Mahoney
Director
Global Systems Laboratory



NOAA/Global Systems Laboratory Charter

325 Broadway – R/GSD, Boulder, CO 80305 / 303-497-6818

Jennifer.Mahoney@noaa.gov

Vision Statement

“Forecast systems that deliver solutions”

Mission Statement

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

GSL Core Values

- Science-Driven - stewards of science
- Diversity - committed to creating a diverse workforce
- Innovation - encouraging new ideas, creativity, and future vision
- Inclusion - interacting and collaborating with others to achieve our shared goals
- Public Service - responsive to the public and society for the greater good
- Agility - ability, and willingness to change as conditions and requirements change
- Excellence - striving to be the best at what we do in our research and public service
- Integrity - Adhering to moral and ethical principles

GSL Grand Scientific Challenge

Provide actionable environmental information through the research and development of rapidly updating global storm-scale prediction and innovative decision support capabilities to reduce societal impacts from hazardous weather and other environmental phenomena.

Statutory Authority and/or Charge Under NOAA Strategic Plan

GSL is aligned under Weather Research and Forecasting Innovation Act of 2017 15 U.S.C. § 8501, air chemistry and air quality research: Clean Air Act as amended, 42 U.S.C. §§ 7401-7431, Tsunami Warning, Education, and Research Act of 2017, Title V, 33 U.S.C. § 3201 note, NOAA’s Weather-Ready Nation goal, and the NOAA Ocean and Atmospheric Science Education Program (33 USC 893a).

GSL’s research specifically addresses several objectives of this guidance:

- Reduce loss of life, property, and disruption from high-impact events
- Improve transportation efficiency and safety
- Improve freshwater resource management
- Create a more productive and efficient economy through environmental information relevant to key sectors of the U.S. economy

- Advance air and water quality services to the public
- Improve public literacy in Science, Technology, Engineering, and Math (STEM)

GSL is also excited to partner with the upcoming Earth Prediction Innovation Center (EPIC) to fulfill the authorization in the National Integrated Drought Information System Reauthorization Act of 2018 (Public Law (P.L.) 115-423) to improve the transition of research into operations by creating a community global weather research modeling system.

GSL is aligned with the following organizational goals:

- DOC: Evolve the NWS to deliver better weather forecasts
- NOAA: Implement the Weather Act and Accelerate Research to Operations (R2O)
- OAR: Make Forecasts Better

Science Themes and Research Areas

Organizational Excellence

GSL strives to advance its workforce scientifically, technically, and professionally. GSL is committed to increased diversity and inclusion as well as a strong foundation for succession planning and career growth. GSL hosts team-building and workshops, conducts annual retreats and employee satisfaction surveys, and provides leadership opportunities to early- and mid-career staff to contribute to GSL and develop professionally. GSL also values long-term research continuity across research areas. While GSL's Grand Challenge is a scientific and technical goal, a [healthy organization](#) invested in GSL's mission will enable the collaboration and innovation needed to achieve this goal.

Earth System Prediction

GSL is a world leader in the development of storm-scale to global-scale weather prediction models. GSL research is aligned with [NOAA's](#) objectives to build a holistic understanding of the Earth system and an integrated environmental modeling system while contributing to the Unified Forecast System. Recent successes are NOAA's hourly-updating [Rapid Refresh \(RAP\)](#) and the [High-Resolution Rapid Refresh \(HRRR\)](#) high-impact weather prediction models. The RAP and HRRR predict atmospheric variables relevant to severe weather, aviation weather, the wind energy industry, and fire weather.

Advanced Technologies

GSL is a world leader in advancing new technologies and methods in computing, modeling, visualization, data access, and information delivery to support NOAA's Earth system prediction and decision support capabilities. GSL research includes using innovative numerical methods and software design that improve the performance, portability, and scientific accuracy of models

running on next-generation exascale computers. The advanced computing efforts in GSL are the foundation of virtually all High-Performance Computing methods used in NOAA operations and research.

Decision Support

GSL's history was forged in developing tools that support the weather decision-making process. Decision support tool development began in the early 1980s with the Advanced Weather Interactive Processing System (AWIPS), and is continuing now with incremental deployments of GSL's [Hazard Services](#) system to [NWS](#) offices. [Hazard Services](#) streamlines NWS watch, warning, and advisory-related services into one interface and can be customized for each office, region, or type of weather. Advancing decision support tools and technologies is a primary goal for GSL. Advanced technologies such as the IDSS (Integrated Decision Support System) Engine will provide better forecast uncertainty information for improved IDSS services for forecasters, emergency managers, and other core partners.

Products and Results

Among the list of technologies such as numerical weather models, data assimilation techniques physics parameterizations, high-performance computing system tools, information systems, and decision support and verification systems that are transferred from GSL to operations or applications in NOAA, other agencies, and the private sector, include:

Earth System Prediction

- Regional: Rapid Refresh (RAP) and High-Resolution Rapid Refresh (HRRR) models, modeling for renewable energy
- Global models: GEFS-Aerosols, WRF-Chem
- Physics packages: Convection (Grell-Freitas), boundary layer, land surface
- Atmospheric Chemistry
- Data assimilation: Radar, satellite, surface, and other observations into forecast models
- Fire Weather and the grand precipitation challenge
- Model evaluation and verification

Decision Support

- Advanced Weather Information Processing System (AWIPS) Critical hardware, software, and science innovations for the Advanced Weather Information Processing System (AWIPS)
- Hazard Services
- Data processing: Meteorological Assimilation Data Ingest System (MADIS), Advanced Quantitative Precipitation Information System
- Assessments and Verification

Advanced Technologies

- High-performance computing science
- Machine Learning/Artificial Intelligence

- Science On a Sphere suite of tools

Customers

As one of NOAA's premier research laboratories, the GSL enables operational weather forecasters to produce the best forecasts using state-of-the-art technology that incorporates the latest science. GSL has a history of successfully transitioning research into advanced products and services for operations. GSL values its strong relationships with the following organizations:

- National Weather Service (NWS) researchers and forecasters
- NOAA Research laboratories
- NOAA National Centers for Environmental Prediction
- Federal Aviation Administration (FAA)
- National Center for Atmospheric Research (NCAR)
- University of Colorado and the Cooperative Institute for Research in Environmental Sciences (CIRES)
- Colorado State University and the Cooperative Institute for Research in the Atmosphere (CIRA)
- Joint Center for Satellite Data Assimilation (JCSDA)
- NOAA testbeds: Developmental Testbed Center (DTC), Hazardous Weather Testbed (HWT), and Hydrometeorology Testbed (HMT)
- Private sector

Future Directions

Invest in people, partnerships, and organizational performance.

- Balance portfolio funding toward long-term research and short-term development.
- Build collaboration across the laboratory.
- Champion a healthy organizational environment.
- Develop plans for career growth and succession of employees.
- Modernize the Information Technology infrastructure.
- Nurture, develop and expand strategic partnerships.

Develop state-of-the-art Earth-system prediction capabilities.

- Advance data assimilation concepts and techniques.
- Advance research of physical and atmospheric composition processes in Earth-system models that affect such things as air quality, human health, and weather systems.
- Research and develop short-range to subseasonal prediction capabilities.
- Develop leading-edge forecast verification and validation techniques and tools.
- Develop next-generation Earth-system models in concert with advances in high-performance computing technologies.

Revolutionize communications, products, and services to enable informed decision-making.

- Improve ways to discover, distill, store, and provide access to diverse, high-volume environmental data and observations.
- Develop applications with improved analysis, visualization, verification, and decision support capabilities for the NWS and other entities.
- Research and develop techniques to improve understanding and effectively communicate weather impacts to educate society.
- Ensure that investments improve the skill, efficiency, and delivery of products, tools, and applications to operations