Charge to Reviewers
NOAA Geophysical Fluid Dynamics Laboratory (GFDL)
5-Year Science Review
January 28-30, 2025

Purpose of the Review

The National Oceanic and Atmospheric Administration (NOAA)'s Office of Oceanic and Atmospheric Research (OAR) conducts independent peer reviews of each of its laboratories and programs every five years. The purpose of the reviews is:

- to evaluate the quality, relevance, and performance of the research conducted and sponsored by OAR laboratories and programs;
- to develop and implement recommendations to improve the quality, relevance and performance of OAR research;
- to strategically position GFDL in its planning for future research and development.

The reviews comply with the requirements of NOAA Administrative Order 216-115B: Research and Development in NOAA and OAR Circular 216-3: OAR Laboratory and Program Science Evaluations.

Criteria

The criteria for the review are quality, relevance, and performance, as defined below, consistent with NOAA Administrative Order 216-115B.

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.

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.

Performance is a measure of effectiveness and efficiency. It includes an assessment of the organization's leadership, management, organizational culture, diversity/equity/inclusion/access, strategic planning, progress towards performance targets and milestones, efficiency in resource utilization, and transition of research to operations.

Scope of the Review

The scope of the review covers the research and activities conducted or sponsored by GFDL over the last five years. OAR laboratories typically conduct research and development while OAR programs typically sponsor research and development, and conduct outreach and engagement.

Based on the findings from the review, OAR asks reviewers to look forward and provide recommendations to assist with strategic planning for work in the present and anticipated future environments. OAR also asks reviewers to identify tradeoffs - when recommending expansion of one or more activities or programs, reviewers should identify what activities or programs should OAR consider scaling back.

The criteria cover the quality of the research, its relevance to NOAA's mission and societal needs,

and how the research is performed (leadership, management, strategic planning, progress towards performance targets). As such, while the review is focused on science, it also includes the management of the science, as outlined in the performance criterion. However, reviewers should not stray into evaluating detailed operations such as accounting and day to day management or providing feedback on draft strategic plans, which are covered in separate, internal, annual Operations & Management Reviews and other processes.

The review agenda is structured around the review questions described later in this document.

Proposed Schedule and Time Commitment for Reviewers

The review will be held in-person January 28-30, 2025 in Princeton, NJ. OAR will hold two teleconferences for the review panel in advance of the review to discuss the review process and answer any questions you may have. To ensure there is ample time for discussion during the review, many presentations will be pre-recorded and posted on the review website at least two weeks prior to the review. Panelists are expected to have reviewed these presentations ahead of the review to fully engage in the interactive panel discussions with staff and scientists during the review.

Each reviewer is asked to independently prepare their written evaluations and ensure their write-ups are particularly thorough for the review questions that they are assigned. Each review question must be assessed by at least two panel members. Reviewers will provide their evaluations to the review panel chair. The chair, a federal employee, will create a report summarizing the individual evaluations, due within 45 days of the review to OAR. The chair will not seek a consensus of the reviewers. OAR will send any technical comments within 14 days of receiving the draft report and the panel chair will send a final report no later than 30 days after that. The report will be posted on the lab/program website. A vice-chair will be appointed to fill in if the chair becomes unavailable.

Brief Background on GFDL

GFDL is focused on comprehensive long-lead-time 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, and ice components and their interactions with the ecosystem. Scientists at GFDL develop and use Earth system models and computer simulations to improve our understanding and prediction of all aspects of the climate system. GFDL scientists focus on model-building relevant for society, for hurricane research, weather and ocean prediction, seasonal forecasting, understanding regional and global climate change, and more. GFDL has pioneered much of the world's research on the modeling of climate change since 1955.

GFDL's research encompasses the predictability and sensitivity of global and regional climate; the structure, variability, dynamics and interaction of the atmosphere, the ocean, sea ice, and land; and the ways that the atmosphere, oceans, and land influence, and are influenced by various trace constituents. This science incorporates a variety of disciplines including meteorology, oceanography, hydrology, classical physics, fluid dynamics, chemistry, applied mathematics, and numerical analysis.

Research at GFDL is facilitated by the Atmospheric and Oceanic Sciences Program, which is a

collaborative program with Princeton University. Under this program, Princeton faculty, research scientists, and graduate students participate in theoretical, analytical, numerical, and observational studies. The program is supported in part by NOAA funding.

Review Questions

1. Concerning GFDL's core strength of building and improving models of the weather, oceans, and climate for societal benefits, how can GFDL leverage advances in science and computational capabilities to improve its key models? Where are the strengths, gaps, and new frontiers?

   This question seeks responses to how the scientific rigor in the modeling of weather, oceans, and climate can be advanced towards generating improved information for societal benefit, leveraging opportunities to characterize the uncertainties.

2. Concerning NOAA's key mission element of understanding, predicting and projecting changes in the Earth System, how can GFDL drive further advances in these areas, including extremes and environmental hazards, through scientific innovation based on observations, theory, and modeling? Where are the strengths, gaps, and new frontiers?

   The question is concerned with the OAR aim of delivering world-class information about variability and changes in the Earth System. The question seeks responses regarding the levels of information currently generated, and how these can be improved with particular focus on early, reliable information on environmental hazards making use of observations and modeling.

3. How can GFDL research and modeling be further utilized to meet NOAA stakeholder needs?

   The question seeks responses on how the information on codes, models, simulations, and outputs, can be purposefully directed, disseminated, and interpreted to the diverse array of stakeholders ranging from academic, governmental, non-profit, and private sectors.

4. How can GFDL build on its work environment for the continued pursuit of world-class science? How can GFDL continue to ensure a skilled workforce for its future activities towards NOAA's goals through effective recruitment and retention?

   The question seeks responses to how this can be more rapidly developed to attain a greater level of fulfillment of the principles espoused by NOAA, OAR and GFDL, and address the gaps noted in the recent surveys and assessments.

Recommendations

OAR requires reviewers to provide recommendations for how to improve the quality, relevance, and performance of GFDL's science moving into the future. OAR encourages recommendations on research areas to pursue more strongly and research areas in which to scale back. Additionally, OAR welcomes recommendations on scientific approaches, strategies for pursuing opportunities or managing risks, data management, outreach, etc. OAR requests future-looking recommendations that are specific, actionable, concise, and reasonable in number. GFDL will develop a response plan with

actions to respond to the recommendations and will track progress. Past experience shows 5 to 20 recommendations to be a manageable number that can be implemented and tracked, so the review panel is encouraged to consider providing no more than approximately 20 recommendations total. Regardless of the number of recommendations, OAR is not seeking consensus advice from the reviewers, so individual reviewers do not need to agree with all of the recommendations.