

Charge to Reviewers

NOAA Physical Sciences Laboratory
5-Year Laboratory Review
16-20 November 2020

Purpose of the Review

Laboratory science reviews are conducted every five years to evaluate the quality, relevance, and performance of research conducted in the National Oceanic and Atmospheric Administration (NOAA) Office of Oceanic and Atmospheric Research (OAR) laboratories. This review is for both internal OAR/NOAA use for planning, programming, and budgeting, and external interests. It helps the Laboratory in its strategic planning of its future science. These reviews are also intended to ensure that OAR laboratory research is linked to the NOAA Research mission and priorities, and other relevant strategic plans, is of high quality as judged by preeminence criteria, and is carried out with a high level of performance.

Each reviewer will independently prepare his or her written evaluations of at least one research area. The Chair, a Federal employee, will create a report summarizing the individual evaluations. The Chair will not analyze individual comments or seek a consensus of the reviewers.

Scope of the Review

This review will cover the research of the Physical Sciences Laboratory (PSL) over the last five years. The research areas and related topics for the review are: 1) Physical Science for Water Resource Management; 2) Physical Science for Marine Resource Management; and 3) Physical Science for Predicting Extremes.

Description of PSL Research Areas

PSL activities are organized under three themes:

- Physical Science for Water Resource Management
- Physical Science for Marine Resource Management
- Physical Science for Predicting Extremes

1. [Physical Science for Water Resource Management](#)

The stress of too little and too much water can be destabilizing at local, regional and national scales. Accurate water monitoring and predictions are critical for a variety of societal needs including agriculture, water supply, energy, water security, and public safety. Stakeholders need information ranging from current conditions to hours to seasons and beyond. The NOAA Water Initiative and development of the National Water Model (NWM) provided an opportunity to

improve water prediction at unprecedented time and space scales. PSL research has addressed significant challenges in characterizing uncertainty in hydrologic forcings, the coupling between atmosphere-terrestrial-coastal systems, and tailoring information products to inform risk management. PSL researchers have applied expertise in understanding, predicting, and assessing severity of water-related extreme events such as droughts and floods (including linkages between them), and coastal inundation. Research has focused on using observations to improve physical process understanding and guide model development for improved predictions; analyzing atmosphere, cryosphere, land surface, and air-sea interface processes; identifying the sources of forecast errors in the coupled meteorological and hydrological forecast system; developing land and coupled land-atmosphere data assimilation capabilities; and applying targeted observations, observation-based understanding, and modeling capabilities to develop experimental guidance for hydrologic extremes critical to manage water resources.

2. [Physical Science for Marine Resource Management](#)

U.S. coastal regions, including the U.S. territories in the Pacific and Caribbean, host a rich diversity of marine resources spanning warm tropical waters to Arctic sea ice-covered waters. Marine resources and ecosystems are critical to commerce, human health, and coastal tourism. As pressures on marine resources continue to rise, there is a concomitant need for improved monitoring and prediction of weather, climate, and water conditions impacting the marine environment. PSL researchers have applied expertise in using targeted observations to advance process understanding and prediction of environmental conditions impacting marine resources. Research has focused on developing and evaluating sub-seasonal and seasonal forecast systems for the Arctic, coastal environments and ocean-bound rivers; developing end-to-end forecast systems that span ocean dynamics, ecosystem responses, and management decision making; developing empirical forecast methods to predict and forecast environmental conditions impacting marine resources; delineating the effects of climate variability and change on environmental conditions impacting marine resources; investigating and explaining ocean extremes, such as ocean heat waves and rapid changes in sea ice; and developing experimental products and services in support of marine resource management decision making by NMFS, NOS, and external government agencies.

3. [Physical Science for Predicting Extremes](#):

Given the impacts of serious risk to health, economic development, and food security, improved prediction of subseasonal-to-seasonal (S2S) extreme weather and climate is a high priority to help NOAA meet mission responsibilities to provide early warning and informed preparedness. Subseasonal-to-seasonal forecasting bridges the gap between the more-mature weather forecast and seasonal prediction. S2S remains a challenging forecast time range with lead times too long for significant influence of atmospheric initial conditions, but too short for the variability of the ocean to have a strong influence. Yet, the S2S time range is critical for proactive disaster mitigation efforts. PSL researchers have applied expertise in characterizing and advancing prediction of subseasonal-to-seasonal (S2S) extreme weather and climate to improve NOAA's ability to forecast, provide early warning and inform preparedness. Research has focused on advancing observationally-based physical process understanding; using field

observations of air-sea-ice-land interactions to characterize surface fluxes, boundary-layer clouds, and energy balance to inform parameterization development and improve representation of stochastic and subgrid scale processes; enhancing ensemble-based data assimilation methods; applying statistical post-processing using reforecasts; developing and applying linear inverse and other models to diagnose and predict changes in extremes; exploring the influence of land surface conditions on predictability and development of reliable forecasts; and conducting attribution and predictability assessments of high-impact weather, water, and climate extreme events.

Evaluation Guidelines

NOAA guidance asks reviewers to consider the quality, relevance, and performance of the PSL and to provide an overall rating for *each* research area reviewed. For each research area reviewed, each reviewer will provide one of the following overall ratings:

- *Highest Performance*: In general, Laboratory greatly exceeds the satisfactory level and is outstanding in almost all areas.
- *Exceeds Expectations*: In general, Laboratory goes well beyond the satisfactory level and is outstanding in many areas.
- *Satisfactory*—In general, Laboratory meets expectations and the criteria for a Satisfactory rating.
- *Needs Improvement*—In general, Laboratory does not reach expectations and does not meet the criteria for a Satisfactory rating. The reviewer will identify specific problem areas that need to be addressed.

In addition to the overall ratings for each research area, if possible, also assign one of these ratings for the subcategories of Quality, Relevance, and Performance within the research area reviewed.

1. **Quality**: Evaluate the quality of the Laboratory’s research and development. Assess whether appropriate approaches are in place to ensure that high quality work will be performed in the future. Assess progress toward meeting OAR’s goal to conduct preeminent research as listed in the “Indicators of Preeminence.” Please note that the rating criteria for each research area is relative to the *Satisfactory* definition shown below.

■ Quality Rating Criteria:

- *Satisfactory* rating – Laboratory scientists and leadership are often recognized for excellence through collaborations, research accomplishments, and national and international leadership positions. While good work is done, Laboratory scientists are not usually recognized for leadership in their fields.
- *Needs Improvement*—In general, Laboratory does not reach expectations and does not meet the criteria for a *Satisfactory* rating. The reviewer will identify specific problem areas that need to be addressed.

■ **Evaluation Questions to consider:**

- Does the Laboratory conduct preeminent research? Are the scientific products and/or technological advancements meritorious and significant contributions to the scientific community?
- How does the quality of the Laboratory's research and development rank among Research and Development (R&D) programs in other U.S. federal agencies? Other science agencies/institutions?
- Are appropriate approaches in place to ensure that high quality work will be done in the future?
- Do Laboratory researchers demonstrate scientific leadership and excellence in their respective fields (e.g., through collaborations, research accomplishments, externally funded grants, awards, membership and fellowship in societies)?

■ **Indicators of Quality:** Indicators can include, but not be limited to the following (note: not all may be relevant to each Laboratory)

- A Laboratory's total number of refereed publications per unit time and/or per scientific Full Time Equivalent scientific staff (FTE).
- A list of technologies (e.g., observing systems, information technology, numerical modeling algorithms) transferred to operations/application and an assessment of their significance/impact on operations.
- The number of citations for a lab's scientific staff by individual or some aggregate.
- A list of awards won by groups and individuals for research, development, and/or application.
- Elected positions on boards or executive level offices in prestigious organizations (e.g., the National Academy of Sciences, National Academy of Engineering, or fellowship in the American Meteorological Society, American Geophysical Union or the American Association for the Advancement of Science, etc.).
- Service of individuals in technical and scientific societies such as journal editorships, service on U.S. interagency groups, service of individuals on boards and committees of international research-coordination organizations.
- A measure (often in the form of an index) that represents the value of either an individual scientist or the Laboratory's integrated contribution of refereed publications to the advancement of knowledge (e.g., Hirsch Index).
- Evidence of collaboration with other national and international research groups, both inside and outside of NOAA including Cooperative Institutes and universities, as well as reimbursable support from non-NOAA sponsors.
- Significance and impact of involvement with patents, invention disclosures, Cooperative Research and Development Agreements and other activities with industry.
- Other forms of recognition from NOAA information customers such as decision-makers in government, private industry, the media, education communities, and the public.

- Contributions of data to national and international research, databases, and programs, and involvement in international quality-control activities to ensure accuracy, precision, inter-comparability, and accessibility of global data sets.
2. **Relevance:** Evaluate the degree to which the research and development is relevant to NOAA’s mission and of value to the Nation. Please note that the rating criteria for each research area is relative to the *Satisfactory* definition shown below.
- **Relevance Rating Criteria:**
 - *Satisfactory* rating – The R&D enterprise of the Laboratory shows linkages to NOAA’s mission, Research Plan, and other relevant strategic plans, and is of value to the Nation. There are some efforts to work with customer needs but these are not consistent throughout the research area.
 - *Needs Improvement*—In general, Laboratory does not reach expectations and does not meet the criteria for a *Satisfactory* rating. The reviewer will identify specific problem areas that need to be addressed.
 - **Evaluation Questions to consider:**
 - Does the research address existing (or future) societally relevant needs (national and international)?
 - How well does it address issues identified in NOAA’s research plans or other policy or guiding documents?
 - Are customers engaged to ensure relevance of the research? How does the Laboratory foster an environmentally literate society and the future environmental workforce? What is the quality of outreach and education programming and products?
 - Are there R&D topics relevant to national needs that the Laboratory should be pursuing but is not? Are there R&D topics in NOAA and OAR plans that the Laboratory should be pursuing but is not?
 - **Indicators of Relevance:** Indicators can include, but not be limited to the following (note: not all may be relevant to each Laboratory)
 - Results of written customer survey and interviews
 - A list of research products, information and services, models and model simulations, and an assessment of their impact by end users, including participation or leadership in national and international state-of-science assessments.
3. **Performance:** Evaluate the overall effectiveness with which the Laboratory plans and conducts its research and development, given the resources provided, to meet NOAA’s mission and priorities, and the needs of the Nation. The evaluation will be conducted within the context of three sub-categories: **a) Research Leadership and Planning, b) Efficiency and Effectiveness, c) Transition of Research to Applications (when applicable)**

and/or appropriate). Please note that the rating criteria for each research area is relative to the Satisfactory definition shown below.

■ **Performance Rating Criteria:**

- *Satisfactory* rating –
 - The Laboratory generally has documented scientific objectives and strategies through strategic and implementation plans (e.g., Annual Operating Plan) and a process for evaluating and prioritizing activities.
 - The Laboratory management generally functions as a team and works to improve the operation of the Laboratory.
 - The Laboratory usually demonstrates effectiveness in completing its established objectives, milestones, and products.
 - The Laboratory often works to increase efficiency (e.g., through leveraging partnerships).
 - The Laboratory is generally effective and efficient in delivering most of its products/outputs to applications, operations or users.
- *Needs Improvement*—In general, Laboratory does not reach expectations and does not meet the criteria for a *Satisfactory* rating. The reviewer will identify specific problem areas that need to be addressed.

A. Research Leadership and Planning: Assess whether the Laboratory has clearly defined objectives, scope, and methodologies for its key projects.

■ **Evaluation Questions to consider:**

- Does the Laboratory have clearly defined and documented scientific objectives, rationale and methodologies for key projects?
- Does the Laboratory have an evaluation process for projects: selecting/continuing those projects with consistently high marks for merit, application, and priority fit; ending projects; or transitioning projects?
- Does the laboratory have the leadership and flexibility (i.e., time and resources) to respond to unanticipated events or opportunities that require new research and development activities?
- Does the Laboratory provide effective scientific leadership to and interaction with NOAA and the external community on issues within its purview?
- Does Laboratory management function as a team and strive to improve operations? Are there institutional, managerial, resource, or other barriers to the team working effectively?
- Has the Laboratory effectively responded to and/or implemented recommendations from previous science reviews?

- **Indicators of Leadership and Planning:** Indicators can include, but not be limited to, the following (Note: Not all may be relevant to each Laboratory).

- Laboratory Strategic Plan
- Program/Project Implementation Plans
- Active involvement in NOAA planning and budgeting process
- Final report of implementation of recommendations from previous Laboratory review

B. Efficiency and Effectiveness: Assess the efficiency and effectiveness of the Laboratory's research and development, given the Laboratory's goals, resources, and constraints and how effective the Laboratory is in obtaining needed resources through NOAA and other sources.

- **Evaluation Questions to consider:**

- Does the Laboratory execute its research in an efficient and effective manner given the Laboratory goals, resources, and constraints?
- Is the Laboratory organized and managed to optimize the conduct and planning of research, including the support of creativity? How well integrated is the work with NOAA's and OAR's planning and execution activities? Are there adequate inputs to NOAA's and OAR's planning and budgeting processes?
- Is the proportion of the external funding appropriate relative to its NOAA base funding?
- Is the Laboratory leveraging relationships with internal and external collaborators and stakeholders to maximize research outputs?
- Are human resources adequate to meet current and future needs? Is the Laboratory organized and managed to ensure diversity in its workforce? Does the Laboratory provide professional development opportunities for staff?
- Are appropriate resources and support services available? Are investments being made in the right places?
- Is infrastructure sufficient to support high quality research and development?
- Are projects on track and meeting appropriate milestones and targets? What processes does management employ to monitor the execution of projects?

- **Indicators of Efficiency and Effectiveness:** Indicators can include, but not be limited to, the following (Note: Not all may be relevant to each Laboratory).

- List of active collaborations
- Funding breakout by source
- Lab demographics

C. Transition of Research to Applications: How well has the Laboratory delivered products and communicated the results of their research? Evaluate the Laboratory's effectiveness in transitioning and/or disseminating its research and development into applications (operations and/or information services).

■ **Evaluation Questions to consider:**

- How well is the transition of research to applications and/or dissemination of knowledge planned and executed?
- Are end users of the research and development involved in the planning and delivery of applications and/or information services? Are they satisfied?
- Are the research results communicated to stakeholders and the public?

■ **Indicators of Transition:** Indicators can include, but not be limited to, the following (Note: Not all may be relevant to each Laboratory).

- A list of technologies (e.g., observing systems, information technology, numerical modeling algorithms) transferred to operations/application and an assessment of their significance/impact on operations/applications
- Significance and impact of involvement with patents, Cooperative Research and Development Agreements (CRADAs) and other activities with industry, other sectors, etc.
- Discussions or documentation from Laboratory stakeholders

Proposed Schedule and Time Commitment for Reviewers

The virtual review will be conducted 16-20 November 2020. Two teleconferences will be planned prior to the review, the first will be with the Deputy Assistant Administrator for OAR, who will be the liaison with the review team and for the completion of the report. The goal of the first teleconference will be to discuss the charge to you, the reviewer, as well as the scope of the review, focus areas for the review questions to be addressed, and initial information provided to reviewers that addresses the questions. In the second phone teleconference we will discuss the draft review agenda and the reporting form for reviewers to use for their evaluations. During both teleconferences, we ask that you as a reviewer identify any additional information needs. All relevant information requested by the review team will be provided to the review team as soon as the information is available and will also be posted on the review website at least two weeks before the review. As this is a virtual review, pre-recorded presentations of the work being conducted by the PSL will be shared with the review panel members prior to the review.

Each reviewer is asked to independently prepare their written evaluations on each research theme, including an overall rating for the theme and provide these to the Chair. The Chair, a Federal employee, will create a report summarizing the individual evaluations. The Chair will not analyze individual comments or seek a consensus of the reviewers. We request that within

45 days of the review, the review team provide the draft summary report to the OAR Deputy Assistant Administrator for Science with a copy to the OAR Strategic Management Team (oar.hq.smt@noaa.gov). Once the report is received, OAR staff will review the report to identify any factual errors and will send corrections to the review team. Once corrections are accepted by reviewers, we ask that the final summary report be submitted to the OAR Assistant Administrator, OAR Deputy Assistant Administrator for Science, and PSL Director, with a copy to the OAR Strategic Management Team.

Review Team Resources:

OAR will provide resources necessary for the review team to complete its work. Information to address each of the Laboratory's research themes to be reviewed will be prepared and posted on a public review website. Preliminary information will be compiled and posted before the first teleconference meeting and the second major update, which includes final review presentations and materials, will be provided prior to the second teleconference. A copy of all the information on the website will also be provided to reviewers at the review.