

**NOAA Science Advisory Board
Hurricane Intensity Research Review Working Group
Terms of Reference**

Background

The National Oceanic and Atmospheric Administration (NOAA) has made substantial progress in recent years improving the accuracy of hurricane track forecasts. These improvements were one of the driving forces behind the decision to extend track forecasts to five days. To date, similar improvements have not been made in hurricane intensity forecasts.

As a result of improved hurricane track forecasts, in the last 50 years there has been a substantial reduction in the number of lives lost. However, there is a significant potential for a large loss of life in densely populated coastal areas if a Saffir-Simpson Scale category 1 or 2 storm suddenly intensifies into a category 4 or 5 storm as hurricane Charlie did last summer.

A goal of NOAA's research and development into tropical cyclones is to understand and describe the physical processes that lead to the extreme winds in a hurricane, and to use this knowledge to develop an integrated hurricane simulation and forecasting system that produces skillful forecast guidance of intensity change in hurricanes striking the United States. The benefits will include better warnings to the public of hurricane strength so appropriate disaster preparedness actions can be completed while minimizing unnecessary preparation costs and evacuations.

Advances in hurricane track forecasting occurred through research that has led to a better understanding of hurricane evolution and interaction with large-scale steering currents, and through continuous development and enhancement of numerical weather prediction modeling systems. Achieving improvements in intensity forecasts is a much more difficult problem, requiring understanding and simulation of the crucial physical and dynamical processes that determine the inner core structure and interactions with the environment. Significant improvements in the simulation and forecasting of hurricane intensity would represent a great leap in our ability to protect life and property from hurricanes.

The NOAA Weather and Water Goal Program Plan designates intensity forecast improvements as a high priority and the National Weather Service Science and Technology Infusion Plan describes the operational goals for intensity forecasts over the next 5-10 years. NOAA has put together a plan to address operational goals, and is developing a new hurricane model using the Weather Research and Forecasting (WRF) model infrastructure in concert with the tropical numerical modeling community. This model will be coupled with ocean and land surface models, which were developed in the

academic community. Simultaneously, NOAA is also working closely with NASA, the National Science Foundation, and the Department of Defense to collect and analyze critical ocean and atmospheric data for the purpose of developing improved model parameterization schemes as well as model forecast verification information.

NOAA also established the Joint Hurricane Testbed (JHT) as a way of accelerating the transition of promising research to operations. On a two-year cycle, this activity funds competitive grants and cooperative institutes to facilitate preparation and testing of promising forecasting techniques and numerical model improvements.

NOAA Science Advisory Board Charge

NOAA has requested the NOAA Science Advisory Board (SAB) to assemble a working group of external experts to conduct a review of NOAA's hurricane intensity research, development, and transition to operations. The working group should consist of not less than eight members whose expertise as a group covers tropical cyclone instrumentation; observations and modeling; atmospheric and ocean dynamics, data assimilation, and modeling; vortex dynamics; fluid mechanics; operational numerical environmental modeling; and forecast operations. The working group should include representation with socio-economic expertise that relates to this problem. The working group members should have the following qualifications:

1. National and international professional recognition;
2. Knowledge of and experience with the science that supports NOAA's tropical cyclone research and operations;
3. Knowledge of and experience with the organization and management of complex mission oriented research and development programs; and
4. No perceived or actual vested interest or conflict of interest that might undermine the credibility of the review.

Hurricane Intensity Research Review Working Group Charge

The Hurricane Intensity Research Review Working Group should conduct an independent review of NOAA's hurricane intensity research, development, and transition to operations. The Working Group should develop findings and recommendations to ensure that this work results in improved operational forecasts. This review is to address NOAA's approach to its research and development efforts in support of improved observations, numerical modeling and operational warnings and forecasts. Rather than continue with incremental improvements in understanding and in intensity forecasts, NOAA seeks advice to help answer fundamental questions on the dynamics and behavior of hurricanes that will lead to significant improvements in forecasting and service to the Nation. This review is to include NOAA's working arrangements with other Federal agencies and the academic community, and the level of effort and resources devoted to this work currently and planned.

Specifically:

Science and Science Planning

1. Is NOAA conducting/sponsoring hurricane intensity research in the right areas?
2. How should NOAA identify relevant new research opportunities? How should innovative and creative perspectives and theories be evaluated, incubated, and tested?
3. How should NOAA involve the larger research community in identifying promising lines of investigation?
4. Who are the NOAA tropical cyclone research and development customers?
5. Are the needs of these customers considered in shaping the research effort (for example, defining hurricane intensity metrics) and how can NOAA improve the process?
6. What formal procedures, if any, exist for joint planning with other agencies (e.g., U.S. Weather Research Program) and academia and how can they be improved?

Transition of Research to Operations

1. How should NOAA ensure it derives the maximum benefit from tropical cyclone research and development conducted by it and others?
2. Does the JHT adequately serve to link NOAA operational components (e.g., Environmental Modeling Center and Tropical Prediction Center) to NOAA research and the larger research community?
3. What operational needs are not being addressed by NOAA's research and development activities?

Resource Planning

1. Are current and planned hurricane intensity R&D resources (financial, institutional, and intellectual) adequate to make significant advances in improving hurricane intensity forecasts?
2. Are current and planned hurricane intensity R&D resources consistent with NOAA's plans, goals, and objectives as articulated in the NOAA Strategic Plan, NOAA 5-Year Research Plan, NOAA Goal and Program Plans, and science and technology infusion plans?
3. What is provided in the way of human resources development (recruitment, rewards, training)? Is it enough? Too much?

Term

The working group will carry out this review in approximately nine months once the working group is convened. The working group will prepare a preliminary report of its analysis and findings within six months of being established, and a final report, including recommendations, will be completed within nine months. The working group will be dissolved after completing any follow-on request regarding the final report by the SAB.