

**ADDRESSES** section following the **SUMMARY** of this notice. Copies of operational codes may be made available to prospective applicants as needed, but without guaranteed support.

The PI and his/her research staff, working with JHT personnel, will modify (if necessary) their proposed system so that it may be run during the hurricane season, utilized by the operational center forecasters, and tested and evaluated quantitatively and qualitatively in a quasi-operational environment. In preparation for testing and evaluation, the funded researcher must provide sufficient documentation and instructions to the JHT staff and TPC/NHC forecasters and technical point(s) of contact to enable them to conduct the tests and evaluations. Following any necessary modifications to make the researcher's proposed system functional in the JHT environment, initial testing and evaluation will be conducted, but not necessarily in real-time or during hurricane season. When the results of these initial tests and evaluations show sufficient progress, the TPC/NHC and JHT Directors, with input from the TPC/NHC point(s) of contact, may make the decision for the proposed system to be configured for quasi-operational, real-time testing and evaluation during hurricane season in the JHT environment. Researchers should anticipate that their funded work period will include their involvement during quasi-operational testing where tuning and adjustment may be required. Experience gained from current JHT projects indicates that the process of testing and evaluation often uncovers opportunities to make modest improvements to a project during its lifetime, and a project advances most rapidly when researchers, the JHT staff, and TPC/NHC forecasters and technical points of contact remain flexible and collaborate closely.

A successful JHT project will result in one or more of the following: (1) A forecast guidance product or technique leading to improved tropical cyclone analyses and/or forecasts; (2) operational availability of data from a new observational system that has provided documented evidence of positive diagnostic or forecast impact; and/or (3) a converted research code that, running with an operational data stream on forecast center computers and display systems, is effectively utilized by the operational forecasters to improve products and services. Final testing, validation, and acceptance of the new product will be the responsibility of, and at the discretion

of, the operational forecast center. When the operationally capable system is demonstrated to provide improved forecast guidance according to the agreed-upon metric(s) for success and meets operational constraints, the operational forecast center Director may make the decision for full operational implementation. The JHT-funded researcher and the JHT staff will then provide materials for the operational center to develop its own documentation and training for the new technique or product. Long-term maintenance and support of the new technique or product will then become the responsibility of the operational forecast center. Codes resulting from JHT work accepted for operational implementation will be the property of the U.S. government and will be in the public domain, which will readily facilitate cooperative work between research, educational, governmental, and other organizations.

*Program Priorities:* The USWRP has established the following goals for its Hurricane Landfall program:

A. Reduce landfall track and intensity errors by 20 percent.

B. Extend track forecasts to 120 hours with an average error less than 250 nautical miles.

C. Increase warning lead time to 24 hours and beyond with 95% confidence.

D. Make skillful forecasts (compared to persistence) of gale- and hurricane-force wind radii out to 48 hours with 95% confidence.

E. Extend quantitative precipitation forecasts to three days and improve skill of day-three forecasts to improve inland flooding forecasts.

The Tropical Prediction Center/National Hurricane Center (TPC/NHC) of the National Centers for Environmental Prediction (NCEP) has identified its operational forecast improvement needs, which are closely related to the USWRP goals. The highest TPC/NHC hurricane forecaster priorities involve the following six areas of need:

(TPC A-1) Improve guidance for tropical cyclone intensity change, with highest priority on the onset, duration, and magnitude of rapid intensification events.

(TPC A-2) Develop statistically-based real-time "guidance on guidance" for track, intensity and precipitation (e.g., multi-model consensus approaches) and provide guidance to forecasters in probabilistic and other formats.

(TPC A-3) Improve guidance for tropical cyclone precipitation amount and distribution.

(TPC A-4) Identify and then reduce the occurrence of guidance and official track outliers, focusing on both large

speed errors (e.g., accelerating "recurvers" and stalling storms) and large direction errors (e.g., loops and tropical cyclone tracks such as those of Mitch (1998) and Keith (2000)).

(TPC A-5) Implement improved observational systems in the storm and its environment that provide data for forecaster analysis and model initialization.

(TPC A-6) Develop guidance for changes in tropical cyclone size and related parameters, including combined sea heights.

Additional TPC/NHC areas of need include, but are not limited to:

(TPC B-1) Improve operational analysis and forecast guidance for the surface wind field, including maximum sustained winds, during tropical cyclone landfall.

(TPC B-2) Develop probabilistic forecast guidance for tropical cyclone surface wind speed.

(TPC B-3) Develop guidance for tropical cyclone genesis that exhibits a high probability of detection and a low false alarm rate.

(TPC B-4) Improve numerical and statistical guidance on specific forecast problems, including the following: interactions between upper-level troughs and tropical cyclones, track forecasts near mountainous areas, and extratropical transition.

(TPC B-5) Develop analysis techniques, which improve upon the Dvorak technique, for surface winds in tropical cyclones passing over and north of the sea-surface temperature gradient in the eastern North Pacific Ocean.

(TPC B-6) Develop generalized strike probability programs applicable to all tropical cyclone basins for which the TPC/NHC, CPHC, and JTWC are responsible.

(TPC B-7) Develop improved storm surge guidance models, including guidance on breaking waves and featuring high resolution input and output.

(TPC B-8) Improve the utility of microwave satellite and radar data in tropical cyclone analysis.

Much of the improvement in tropical cyclone forecasting is attributed to advances in numerical weather prediction (NWP). These advances are mainly the result of improvements in observations, data assimilation techniques, and improved model physics in global forecast systems and high resolution regional models, in addition to the development of ensemble-based model guidance. Individual proposals directed toward the NWP issues will be expected to be closely coordinated with the Environmental Modeling Center (EMC)