

Joint Hurricane Testbed

Supplemental information for new projects

A. Overview

The Joint Hurricane Testbed (JHT) mission is to facilitate the rapid and smooth transfer of new technology, research results, and observational advances of agencies, the academic community, and other groups into improved tropical cyclone analysis and prediction at operational centers. The operational forecast centers where JHT projects could be tested and evaluated include the NOAA National Hurricane Center (NHC), the NOAA Central Pacific Hurricane Center (CPHC), and the Joint Typhoon Warning Center (JTWC) operated by the United States Navy and Air Force. These will collectively be known as "operational centers" for brevity. Use of other facilities is possible depending on requirements, workload, and opportunity. This mission will be accomplished by funded PIs and their support staffs, in collaboration with operational center forecasters and other staff, and facilitated by JHT staff, via the following activities (as relevant to each project):

- (1) Using a (quasi-operational) experimental environment to facilitate the testing and evaluation by operational center forecasters and support staff of research products and techniques provided by the PIs, subject to metrics that mandate good scientific performance while meeting forecaster ease-of-use needs and time constraints;
- (2) Preparing scientific and technical documentation that is sufficient to facilitate the testing and evaluation of the new product or technique;
- (3) Utilizing advanced statistical and numerical model output and stimulating improvement in tropical cyclone analysis and forecast applications;
- (4) Completing tests of codes provided by the PIs that preferably follow established and open programming standards for ease of portability; and
- (5) Facilitating the transfer of tested and evaluated forecast guidance products, research codes, and observations into the computing, communication, and display systems of the operational forecast center, while incorporating adjustments necessary to generate forecast guidance products that are forecaster-friendly and time-efficient.

Upon selection of a proposal for funding, JHT staff will provide project administration and facilitation. The JHT Director will coordinate with each project PI, as soon as possible after selection, a time line and well-defined operational metric(s) for success in terms of scientific performance, ease of use, and time constraints. Note that meeting the metric(s) for success does not, after the project is concluded, ensure acceptance for operational implementation, which is at the sole discretion of the operational center(s). The time line and progress toward success will be monitored and updated during the project.

Additionally, the appropriate operational center Director will designate for each project the forecaster and/or technical point(s) of contact from their staff.

The JHT will provide to the funded projects access to the JHT information technology (IT) infrastructure (computer hardware, software, and data) to facilitate the testing and evaluation in an environment that closely matches that of the operational center. An overview of the JHT and NHC operational IT environments can be found in the Appendix to this document. 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) experimental environment. In preparation for testing and evaluation, if necessary, the funded researcher must provide documentation and instructions to the JHT staff and operational center forecasters and technical point(s) of contact that are sufficient 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, the proposed system is to be configured for (quasi-operational) experimental, real-time testing and evaluation during the hurricane season(s) in the JHT environment. Researchers should anticipate that their funded work period will include their involvement during (quasi-operational) experimental testing where tuning and adjustment may be required. Given the 1 July 2017 starting date, it is not expected that PIs will immediately have their project ready for quasi-operational testing for the peak of the 2017 hurricane season. Instead, PIs should plan on the first quasi-operational tests to begin during the 2018 hurricane season starting in June.

Experience gained from current and previous 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 operational center forecasters and technical points of contact remain flexible and collaborate closely.

A successful JHT project will result in one or both of the following: (1) A guidance product or technique leading to improved tropical cyclone analyses and/or forecasts; and/or (2) operational availability of data from a new observational system that has provided documented evidence of positive diagnostic or forecast impact.

Final testing, validation, and decision on acceptance for operational implementation of the new product will be the responsibility of, and at the sole discretion of, the operational forecast center(s); for example, see section C. of this document for the criteria used by the NHC Director in making operational implementation decisions at that operational center. If the project is accepted for operational implementation by an operational center, the JHT staff will then provide materials for the operational center to develop its own documentation and training for the new technique or product. PIs may be required to provide to the JHT the steps required for maintenance of their projects. Long-term

maintenance and support of the new technique or product will then become the responsibility of the operational forecast center.

B) Project Timeline and Completion:

The period of awards is from one to two years. All funded PIs are required to submit written semiannual reports during the project to describe the progress made toward the goals and deliverables established in the original proposal and agreed-upon time line. A final report must also be submitted at the conclusion of the project. The due dates for these reports will be coordinated with the JHT Director upon project initiation and will be consistent with the Department of Commerce requirements for the submission of performance reports by award recipients. Two-year projects will be reviewed by the JHT Steering Committee, the JHT Director, and the OWAQ Director near the end of the first year for suitability for continuation into the second year. The due date for renewal proposals will be established by the JHT Director and will usually be soon after the date for the first semiannual report. The renewal proposal must provide updates to the project work plan, deliverables, time line, IT requirements, budget, documentation and training plans, etc. This review is also based upon the semiannual reports and upon feedback received from the operational center's point(s) of contact. The criteria upon which the renewal review are based are the following: (1) The progress toward milestones in the original time line, (2) the potential for completing the testing and evaluation process and providing the stated deliverables by the end of the second year, and (3) appropriateness and reasonableness of the budget with respect to available JHT funds. Given a favorable review, each project may be funded for a second year.

A JHT project reaches its completion in one of two ways. A two-year project may end after approximately one year, if the JHT and the OWAQ Directors decide, as described above, that insufficient progress has been made to justify continuation of the project into year two. A JHT project ends more conventionally with the submission by the PI(s) of a final report at the conclusion of the original agreed-upon project duration. Note that with the 1 July 2017 start date precluding significant quasi operational testing during the 2017 season and an official 30 June 2019 ending date, this would encompass only one hurricane season (2018) for real-time testing of projects. Because of this, PIs will be encouraged to ask for a no-cost extension option for their final report to facilitate quasi operational testing during the entire 2019 hurricane season.

Based upon this final report, and reports from the JHT staff and from project points of contact at the operational center, the operational center director will subsequently make a decision on whether or not operational implementation of the project deliverables will occur. Decisions on operational implementation are at the sole discretion of the operational center director. Operational implementation may or may not occur, irrespective of whether metrics for success defined during the USWRP-funded project period have been met. For example, the NHC Director's decision to implement the new science or technology at the end of the operational demonstration period is based on a cost-benefit analysis that includes consideration of the following four criteria:

1. Forecast or analysis benefit: expected improvement in operational forecast and/or analysis accuracy
2. Efficiency: adherence to forecaster time constraints and ease of use needs
3. Compatibility: IT compatibility with operational hardware, software, data, communications, etc.
4. Sustainability: availability of resources to operate, upgrade, and/or provide support

Note that these criteria are not identical to those used in the evaluation of the proposals.

C) Business Practices

PIs are strongly encouraged to plan and budget during each year of the project to describe their work at the annual Interdepartmental Hurricane Conference (IHC), which typically occurs in March, sponsored by the Office of the Federal Coordinator for Meteorological Services and Supporting Research. Additionally, visits by PIs and/or their support staff to the operational center(s) as necessary, may be beneficial for training JHT staff and the forecaster and technical point(s) of contact in preparation for project testing and evaluation.

PIs will need to provide estimates of JHT staff requirements in terms of on-site (or off- site) JHT facilitator efforts, and estimated computational, communication, and/or display requirements at the researcher's home institution and/or at JHT via remote access and data transfer.

Note that JHT funding for secretarial support, journal publications and IT improvements at the PI's home institution is not generally available. The limited JHT funding available is to be maximized in helping to facilitate research-to-operations, not for this peripheral activities.

D) Contact Information

For more information about the Joint Hurricane Testbed, please see: <http://www.nhc.noaa.gov/jht/> . For questions about the Joint Hurricane Testbed, please contact Chris Landsea, the Joint Hurricane Testbed Director at the National Hurricane Center at 305-229-4446 or by email at chris.landsea@noaa.gov. Questions and answers will be made available on the JHT website. The JHT Director cannot assist in the conceptual design of a project and cannot recommend specific elements for inclusion in a proposal.

E) Appendix: JHT and NHC Operational Information Technology Environments

This document summarizes the data that is available in NHC's operational environment and the software that is used for operational processes. PIs should use this as a guideline for their development. Algorithms that use data formats and software that are significantly different than those available in NHC's operational environment will be much more difficult to transition. For certain projects there may be an option to work with the JHT facilitator to test algorithms inside NHC's firewall on the JHT workstation using NHC's real time data feeds.

NHC SATELLITE IMAGERY DATA FEED

SATELLITE	FORMAT	FREQUENCY
GOES-E	McIDAS	Full disk: every 3 hours N. hemi: every 30 min. Conus: every 15 min. RSO: every 7 min. SRSO: every 1 min.
GOES-W	McIDAS	Same as GOES-E
METEOSAT-8	McIDAS	IR: every 15-30 min. WV: 30 min. VIS: every 15 min. During daytime

NHC OBSERVATIONS DATA FEED

FOS data of METAR, radiosonde, synoptic, ship, buoy, C-man,

DATA TYPE	FORMAT	COMMENTS
FOS	GEMPAK(N-AWIPS) NetCDF(AWIPS)	metar, radiosonde, synoptic, ship, buoys, C-man
Aircraft	GEMPAK, ASCII	recon, vortex, GPS dropsondes
Satellite high Density winds	GEMPAK, NetCDF	Hourly
Satellite Surface winds	Binary,GEMPAK	Hourly

MODEL DATA

MODEL	FORMAT	FORECAST PERIOD	FIELDS
GFS	GRID (GEMPAK)	f000-f018 every 3 hours, f018-f180 every 6 hours, f180-f384 every 12 hours for 00Z, 06Z, 12Z and 18Z runs	wind,temp,relh,omeg,avor,hght,cape,ins,lift,pmsl,pr06,p06m,wxtr06,wxtz06,wxtp06,wxts06,lwrd06,lwru06,swru06,swrd06,ghfx06,ice,albd06,vwsh,swem,fxsh06,fxlh06
GFS	GRIB	f00-f180 every 6 hrs	same as above
GEFS	GRID	f00-f240 every 6 hours for 00Z, 06Z, 12Z,18Z	surface-wind, temp, pmsl,p12m,tmxk12, tmnk12 1000mb-hght 850mb-temp,wind 700mb-relh 500mb-hght,wind 250mb-wind
NAM	GRID/GRIB	f00-f18 every 3 hours, f18-f84 every 6 hours for 00Z,06Z,12Z,18Z	temp,spfh,wind,omeg,lift,cape,cins,relh,pwtr,frzl,mcnv,hley,avor,hght,vwsh
GFDL	GRID	f00-f126 every 6 hours for 00Z, 06Z, 12Z,18Z	Basic Parameters
GFDN (nested)	GRID	f00-f126 every 6 hours for 00Z, 06Z, 12Z, 18Z	Basic Parameters

NAVGEM	GRID/GRIB	f00-f180 every 6 hours for 00Z,12Z	wind,htsgw,wvper,wvdir,perpw,dirpw,persw,dirsw
CMC	GRID/GRIB	f00-f240 every 6 hours for 00Z, 12Z	Basic Parameters
HWRF	GRID/GRIB	f00-f126 every 6 hours for 00Z, 06Z, 12Z, 18Z	Basic Parameters
UKMET	GRID/GRIB	f00-f144 every 6 hours for 00Z, 12Z	Basic Parameters
ECMWF	GRID/GRIB	f00-f240 every 6 hours for 00Z, 12Z	Basic Parameters
ECMWF Ensemble	GRID/GRIB	f00-f240 every 6 hours for 00Z, 12Z	Basic Parameters
RAP32 Regional Model	GRID/GRIB	f00-f03, f06, f12 run hourly	Basic Parameters
GWES Wave Ensemble	GRID	f00-f48 every 3 hours, f48-f180 every 6 hours for 00Z, 06Z, 12Z, 18Z	Wave dir, hgts, period
WW3 Wave Models	GRID	f00-f180 every 3 hours for 00Z, 06Z, 12Z, 18Z	Wave dir, hgts, period, winds
ECMWF Wave	GRID/GRIB	f00-f240 every 6 hours for 00Z, 12Z	Wave dir, hgts, period, winds

Misc Model Products	GRID/GRIB	Various	NCOM/RTOFS, GFS fog/vis, ltng density, SST, psurge, ESTOFS, ETSS, TC WSP, RCLIPER
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JOINT HURRICANE TESTBED EQUIPMENT SPECIFICATIONS

The JHT workstation described below is inside NHC's firewall and has access to NHC's real time model and data. PIs will not have direct access to this workstation, but can coordinate with the JHT facilitator to test algorithms on this system. Algorithms running on the JHT workstation will be much easier to transition to NHC operations if accepted.

JHT Workstation Specifications

DELL 6350 Power edge Server
 Operating System: RHE AS 4.0
 24x7 DELL System Support

2 – 3.60GHz Xeon Processors
 SMP Kerenel

400 GB Ultra SCSI RAID Storage
 4 GB Memory

Dual Port Ultra 2 SCSI Adapter
 PCI FWD SCSI 2 Card
 1000 Base SXPCILan Adapter (GIGE Card) CDROM

JHT SOFTWARE GUIDELINES

The NHC operational environment is fairly restrictive. The majority of NHC's GUI and CPU-intensive applications are written in Fortran, C/C++, and Java. Processing and data flow are usually performed by Linux shell, Perl and Python scripts. NCAR Control Language is also permitted. Data I/O and graphical capabilities should be separated from the main processing as much as possible so that they can be replaced by standard data readers and by N-AWIPS and AWIPS displays, if appropriate. Many commonly available software

packages are not supported in the NHC environment. To ease operational transition, developers should avoid the use of programs such as Matlab and IDL and other software packages requiring a license. Grads and the R language are also discouraged.