Round 3 of Research to Operations Initiative: NGGPS and HFIP

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ANNOUNCEMENT OF FEDERAL FUNDING OPPORTUNITY

EXECUTIVE SUMMARY

Federal Agency Name(s): National Weather Service (NWS), National Oceanic and Atmospheric Administration (NOAA), Department of Commerce

Funding Opportunity Title: Round 3 of Research to Operations Initiative: NGGPS and HFIP

Announcement Type: Initial

Funding Opportunity Number: NOAA-NWS-NWSPO-2018-2005325

Catalog of Federal Domestic Assistance (CFDA) Number: 11.468, Applied Meteorological Research

Dates: Letters of Intent (LOI) submitted by Principal Investigators (PIs) are strongly encouraged and must be received by 5:00 PM EST on December 8, 2017. LOI's should be submitted by email to christopher.hedge@noaa.gov.
Full application packages must be received by www.grants.gov no later than 5:00 PM EST February 7, 2018. Email applications will only be accepted from federally funded educational institutions such as the Naval Postgraduate School. Please note: Validation or rejection of your application by grants.gov may take up to 2 business days after submission. Please consider this process in developing your submission timeline.
Expected project start date is September 1, 2018.

Funding Opportunity Description: This program announcement is for projects to be conducted for a two-year period with an anticipated start date of September 1, 2018 unless otherwise directed. Eligible applicants are institutions of higher education, private organizations (profit and non-profit), and federally funded educational institutions such as the Naval Postgraduate School.
The purpose of the NOAA Research to Operations (R2O) Initiative is to expand and accelerate critical weather forecasting research to operations to address growing service demands and increase the accuracy of weather forecasts. This will be achieved through: (1) accelerated development and implementation of improved global weather prediction models and inclusion of the coupling among atmosphere, ocean, land surface and ice system components; (2) improved data assimilation techniques; (3) nested regional prediction capabilities; (4) improved hurricane and tropical cyclone modeling techniques; (5) improved ensemble techniques; (6) post-processing forecast tools and techniques; and (7) improved software architecture and system engineering.
The R2O Initiative is soliciting proposals for projects involving applied science, modeling and/or data assimilation that support development of the Next Generation Global Prediction System (NGGPS) at global and regional scales. The NOAA R2O Initiative is also soliciting proposals

for the Hurricane Forecast Improvement Project (HFIP) initiative to engage and coordinate hurricane research required to improve operational hurricane forecasts and meet societal requirements to effectively mitigate economic disruption. This notice provides guidelines for submission of proposals. This notice also describes opportunities and application procedures to demonstrate capabilities that have the potential to be incorporated into operational NWS numerical weather prediction (NWP) analyses and forecasts. The R2O Initiative addresses NOAA's Weather Ready Nation (WRN) strategic goal and supporting objectives.

FULL ANNOUNCEMENT TEXT

I. Funding Opportunity Description

A. Program Objective

NOAA's Weather-Ready Nation (WRN) initiative seeks to ensure a society that is able to prepare for and respond to environmental events that affect safety, health, the environment, the economy, and homeland security. Recent record-breaking flooding, hurricanes, snowfall, temperatures, drought and tornadoes have combined to inflict the greatest number of multi-billion dollar weather disasters in the Nation's history. Devastating impacts of extreme events can be reduced through improved readiness, which is why NOAA's National Weather Service (NWS) has established the WRN initiative to further reduce the Nation's weather-related vulnerabilities.

Despite NWS' consistent and solid performance, further efforts are required to mitigate the loss of life and property resulting from extreme and other high-impact weather events. Investment into an integrated, holistic, and probabilistic approach to service delivery with improved accuracy, lead time and confidence will strengthen our ability to mitigate the effects of significant weather events. Incorporation of targeted scientific developments and state-of-the-art technology into service delivery will allow stakeholders to better understand the likelihood of severe environmental events and improve their ability to effectively respond.

The purpose of the NOAA Research to Operations (R2O) Initiative is to expand and accelerate critical weather forecasting research to operations to address growing service demands and increase the accuracy of weather forecasts. This will be achieved through: (1) accelerated development and implementation of improved global weather prediction models and inclusion of the coupling among atmosphere, ocean, land surface and ice system components; (2) improved data assimilation techniques; (3) nested regional prediction capabilities; (4) improved hurricane and tropical cyclone modeling techniques; (5) improved ensemble techniques; (6) post-processing forecast tools and techniques; and (7) improved software architecture and system engineering.

The R2O Initiative supports the expansion and acceleration of R2O activities associated with improving weather forecasts through advancements to NOAA's operational environmental prediction suite. Targeted improvements in the suite will result in multiple weather forecast service improvements. NWS has established the following objectives to accelerate weather forecasting skill:

- A Next Generation Global Prediction System (NGGPS) that meets the evolving national prediction requirements
- Effective assimilation of environmental observations at global and regional scales
- A software architecture and engineered system that maximizes the benefit from high

performance computing (HPC) and enabling quicker transition of internal and external research to operations

- Hurricane forecast models, such as the Hurricane Weather Research and Forecast System (HWRF), that meet societal requirements to effectively mitigate economic disruption
- High-impact and storm-scale weather forecast models to meet WRN objectives to effectively mitigate impacts of severe weather, flash floods, winter weather, severe convection, aviation weather and fire weather

To achieve a world class global prediction system, NOAA plans to:

- Advance physical parameterizations for multiple scales to improve deterministic and probabilistic forecast guidance and explicitly account for uncertainty in parameterization formulation and in sub grid-scale quantities to enable physically-based diversity formulation in ensemble prediction
- Increase resolution of key environmental models to improve the specificity of forecasts
- Improve coupling between component models such as atmosphere, ocean, land surface, sea ice, and coastal prediction systems
- Enhance ensemble prediction systems through the development of more physically based stochastic parameterizations, and through the development of methods that facilitate the extension of NOAA's global ensemble prediction system to 30 days (e.g., treatments of the effects of land- and ocean-surface uncertainty)
- Develop advanced data assimilation methods for increased usefulness of observations of large and vortex scale circulations at global and regional scales, especially for specific storms such as hurricanes in both global and high resolution (e.g., regional) hurricane modeling systems
- Develop effective nested modeling capabilities for storm-scale forecasts, with post-processing tools and techniques to provide effective decision support for high-impact weather
- Implement advanced scale-aware and stochastic physical parameterization schemes for accurate representation of multi-scale interactions in variable resolution global-to-local scale models
- Develop advanced high resolution ensemble based hurricane prediction systems and post-processing techniques to increase utility of numerical hurricane guidance for forecast applications
- Conduct data impact studies of new and future observing systems, such as the next-generation satellites to enable rapid incorporation of new and future observing system data, and to guide observing system strategies and requirements
- Build a high-performance, flexible software infrastructure to increase ease of use, performance, and interoperability
- Investigate effective use of emerging HPC technologies; simplification of software structure; and a community-based model infrastructure which will streamline the

incorporation of proven research advances into operations

- Develop, test, and apply methods for improving next-generation global reanalyses
- Refine post-processing methods for key variables such as surface temperature, winds, precipitation and precipitation type
- Develop post-processing methods for the 15-30 day period and the data sets needed to support them (retrospective surface analyses and re-forecasts)
- Develop effective diagnostic packages that can be used as tools for model development, model evaluation, and model inter-comparison

Successful projects are expected to demonstrate capabilities that have the potential to provide promising near term improvements to NOAA's operational environmental prediction suite and forecaster applications. This would be accomplished by NOAA personnel through transition of applicable and transferable research modeling and data assimilation applications into development of NGGPS, operational hurricane forecast models and/or operational assimilation of environmental observations within two-three years after completion of the funding period.

Projects to be funded will involve both research and operational environmental models and data assimilation techniques. Proposals that involve model or data assimilation development should include a plan for testing and evaluating the new capabilities. A hierarchy of testing should be proposed, ranging from demonstration of at least comparable performance to existing model capabilities, to case studies and/or multi-season tests to demonstrate achievement of benchmarks in objective, subjective and engineering readiness required for a transition to operations. The latter comprehensive tests can be conducted by NWS in collaboration with the Principal Investigator (PI).

B. Program Priorities

Through this announcement, applications are sought for two individual competitions: NGGPS and HFIP. Preference will be given to those proposals that include interactions with NCEP modeling centers, demonstrate adequacy of the metrics proposed for testing and evaluation, and quantify the potential impact of the project on NCEP's operational predictions (see Section V.A. Evaluation Criteria).

1. NGGPS competition priorities

A companion Federal Funding Opportunity (FFO: NOAA-NWS-NWSPO-2018-2005317) includes a specific call for proposals in collaboration with NOAA Testbeds http://www.testbeds.noaa.gov/. The companion FFO includes priorities for testing service impacts of proposed model advances for prediction of high-impact weather over several key time frames for decision support.

Priorities under the NGGPS competition of this FFO are for the following specific topics which are the highest priorities related to the broader themes stated in Section A. The priorities for the NGGPS competition include:

a. Data assimilation: Includes advancements in data assimilation techniques for atmosphere, land surface, ocean and waves including hybrid (3D- or 4D-Var + EnKF) techniques suitable for global and regional models and incorporation of appropriate dynamical balances, preferably in the context of the Joint Effort for Data assimilation Integration (JEDI) effort of the Joint Center for Satellite Data Assimilation (JCSDA). Priority work will focus on the advancement of techniques for remotely sensed observations (e.g. cloud-impacted radiances, generation of high quality cloud analysis), improvement of forward observation models in data assimilation, observation impact studies, contributions to the development of eddy-resolving global ocean data assimilation to support coupled ocean forecasts, and techniques for dealing with position errors of coherent features such as hurricanes. In addition, priority work will focus on improved quality control methods and ocean forecasts, higher-resolution land-use (vegetation) and soil type data sets, and increased use of near-real time land data sets, e.g. green vegetation fraction, surface albedo, emissivity and skin temperature, snow cover/depth, soil moisture, surface freeze-thaw condition, with formal land data assimilation of e.g. soil moisture and snow data; corresponding Noah land model physics upgrades will accompany the use of these land data sets.
b. Prediction: The priorities for improved numerical prediction will focus on the advancement in representation of atmospheric model physical processes through coupling with land surface, ocean, waves, sea ice and aerosols. Development is expected to be concurrent with the Common Community Physics Package (CCPP), and ideally would be performed in this framework. Development of physically-based parameterizations will be a priority, particularly using scale aware, non-local, stochastic, and/or PDF-based approaches to represent clouds, radiation, shallow and deep convection, boundary layer, surface fluxes, and include representation of aerosols and their interactions with radiation and precipitation. Parameterizations will need to be computationally efficient and amenable for applications that span a wide range of spatial scales from cloud and convective permitting resolutions (~1 km) to horizontal resolutions used in climate applications (~100 km). Parameterizations should explicitly account for uncertainty in their formulation and in subgrid-scale quantities to enable physically-based diversity formulation in ensemble prediction. Interactions between physical and dynamical processes near grid-scale resolution should be evaluated regarding their impact on prediction of convective systems and improved algorithms developed. Development and testing of advanced parameterizations is encouraged, e.g. higher order turbulence parameterizations and microphysics schemes accounting for cloud distribution or additional predictive variables, such as second moment schemes. Priority efforts in ocean prediction will contribute to the development of a coupled atmosphere-ocean-wave-sea ice forecast system for 1-30 day weather and extended-weather forecasts. This includes globally-distributed hurricanes, global and regional surface fluxes, and atmosphere-ocean coupling. Priority efforts in wave prediction will contribute to coupling of waves with atmosphere and ocean boundary layer. Additional priorities for advancements to

be included in NGGPS include representation of sea ice concentration and thickness and representation of land surface.

c. Advances in ensemble development: Priority efforts will include a focus on appropriate, physically-based methods for ensemble initialization and treatment of model uncertainty in ensembles including physically-based stochastic parameterizations, and treatment of the uncertainty in the coupling of the atmosphere to the land, ocean, and cryosphere. Development of ensembles of higher resolution (global ca. 10 km, regional ca. 3km) with realistic ensemble properties is essential for the unification of the production suite and is considered a high priority.

d. Advances in post-processing: Priority efforts will include extending the current development of techniques for post-processing and downscaling model guidance of key variables, extreme events, and the development of methods of post-processing particularly suited to the 15-30 day time range.

e. Advances in verification methods: Model forecast verification is based on comparisons of forecasts with analyses and observational data sets. Priority efforts will explicitly include the uncertainties of these analyses and observational data sets in model forecast verification methods. There is also interest in developing and applying process-based metrics. The NWS is unifying its validation and verifications efforts around the NCAR/DTC/Model Evaluation Toolkit (MET, http://www.dtcenter.org/met/users). Efforts using or expanding MET will be given priority.

f. Weeks 3 and 4 products: Forecasts for this range lie at the intersection between possible enhancements in forecast skill due to the representation of atmosphere-ocean coupling and possible degradation due to biases associated with the coupling between atmospheric and oceanic models. Model development work is expected to be done within the NOAA unified coupled modeling framework. Further, forecasts at this time range lie at the limit of predictability for initial value weather problems and are characterized as having a small signal and large noise. All of these factors lead to the need to employ a multi-tool approach in order to maximize predictive skill. Other priorities for this focus area include development of: (1) post-processing techniques for ensembles of dynamical models; (2) novel statistical forecast techniques; (3) hybrid dynamical-statistical techniques, where observed occurrence of large scale meteorological patterns (LSMPs) and their connection with probabilities for near-surface sensible weather elements is first developed and then forecasts of the LSMPs from dynamical or statistical forecast tools are used to derive forecast probabilities of these near-surface weather elements; and (4) interactions of tropical dynamics with land and marine boundary layer processes leading to enhanced predictability at these time scales. The focus will be on improving forecasts of precipitation and near-surface air temperature over the U.S. including studies that target the potential for outlooks of temperature and precipitation extremes. Successful proposals will provide a testing plan that covers a period of at least 20 years of retrospective forecasts, with a length at least 30

days and issued at least once per week in order to enable adequate evaluation of the proposed methodologies. Principal investigators funded for this program priority area are expected to coordinate their work with the NCEP Environmental Modeling Center and the Climate Prediction Center early in the process to ensure a viable path to operations.

2. HFIP competition priorities

The following specific topics are the highest priorities related to the broader themes stated in Section A. The areas for focused attention will be relevant to both coupled and uncoupled air-sea hurricane prediction systems, and will apply for use in global or regional modeling systems or both. Much of the operational community is focused on improvements to the HWRF model system. Developers are strongly encouraged to avail themselves to the HWRF code management through the subversion based (i.e. tracking of current and historical versions of source code, web pages, and documentation) repository at the Developmental Testbed Center (DTC) by visiting http://www.dtcenter.org/HurrWRF/users. Accordingly, proposals with a strong promise of results providing improvements to the HWRF model system will receive more favorable reviews.

Priorities under the HFIP competition of this FFO are for the following specific topics which are the highest priorities related to the broader themes stated in Section A. The priorities for the HFIP competition include:

a. Advances in data assimilation techniques for hurricane NWP including hybrid (3D- or 4D-Var + EnKF) techniques using in-situ data (e.g., airborne Doppler radar data, Lidar, Stepped-Frequency Microwave Radiometer (SFMR), dropsonde) to supplement next-generation satellite data for accurate three-dimensional description of the tropical cyclone circulation in advanced high-resolution hurricane initialization procedures.

b. Advances in the hurricane and tropical storm prediction subsystem, especially reducing hurricane intensity and/or track errors, and improving the predictions for rapid changes in intensity. Priority work will include new and/or enhanced techniques suitable for: (1) high resolution (e.g., scales less than 3 km) model physics focused on microphysical improvements that can more accurately represent moist processes in the hurricane core, land-air-sea-wave-aerosol interactions, and boundary layer processes; (2) high resolution vortex initialization techniques; and (3) downstream applications for landfalling storms for improved forecast and communication of size, structure, rainfall, storm surge and inundation.

c. Development of high resolution ensembles to improve hurricane forecast track and/or intensity guidance. This effort should demonstrate the value of high resolution single model or multi-model ensemble approaches or a combination of both techniques.

d. Development of post-processing techniques that increase hurricane forecaster utility of tropical cyclone forecast guidance. This includes: (1) techniques for genesis, track, intensity, surface wind structure and estimating forecast uncertainty; and (2) risk communication research to create more effective watch and warning products.

C. Program Authority

Authority for this program is provided by the following: 15 U.S.C. 313; 49 U.S.C. 44720 (b); 33 U.S.C. 883d; 15 U.S.C. 2904; 15 U.S.C. 2934

II. Award Information

A. Funding Availability

Funding amounts and duration are subject to change based on budgetary and performance considerations. Only one proposal per principal investigator at a given institution may be funded. The Federal Program Officer can reduce, in consultation with the R2O Project Officer, the amount allocated for any award due to budgetary or programmatic considerations.
Proposals will be supported by a partnership between the NOAA Research to Operations (R2O) Initiative, the national Earth System Prediction Capability (ESPC) project, and the Navy Office of Naval Research. Some proposals that have not been selected for funding under this announcement of opportunity may be asked to re-submit their applications via grants.gov to partner agency programs for funding. Selected investigators are expected to contribute to national ESPC activities.
1. NGGPS
For the NGGPS competition, the total funding amount available for all proposals is anticipated to be approximately $2,500,000. Funding is subject to availability. The maximum award that can be requested is $200,000 total cost per year per proposal. Proposals over $200,000 per year will be rejected. Individual award amounts are expected to range from $100,000 to $200,000 per year with a maximum funding request of two years. Approximately 14 awards are expected.
2. HFIP
For the HFIP competition, the total funding amount available for all proposals is anticipated to be approximately $1,000,000. Funding is subject to availability. The maximum award that can be requested is $200,000 total cost per year per proposal. Proposals over $200,000 per year will be rejected. Individual award amounts are expected to range from $100,000 to $200,000 per year with a maximum funding request of two years. Approximately 6 awards are expected.

B. Project/Award Period

This program announcement is for projects to be conducted for a two-year period with an anticipated start date of September 1, 2018 unless otherwise directed. When a proposal is approved, funding will initially be provided for only the first year of the project. If an application is selected for initial funding, the R2O Initiative has no obligation to provide

additional funding in connection with that award for the following year. Funding for the following year is at the discretion of the program managers, and can be adjusted (increased or decreased) individually. It will be also be contingent upon satisfactory progress in relation to the stated goals of the proposal to address specific science needs and priorities of the R2O Initiative, and subject to the availability of funds. Applications must include a sufficiently detailed scope of work and a detailed budget for the entire multi-year award period. Semi-annual progress reports will be required from the PI's as well as a final closeout report. The Program Office may also request yearly reports. Selected projects may be reviewed by the Program Office yearly to assess progress, funding constraints, and impact on the R2O priorities listed in this announcement of opportunity.

Continuation review is based on the following criteria: (1) degree of progress toward meeting the original milestones in the proposal timeline; and, (2) the potential for completing testing and evaluation or providing evidence of potential contribution to the progress of reaching HFIP goals and/or development of NGGPS by the end of the second year. Given a favorable review, each project may be funded for a second year. In certain situations, circumstances material to the stated objectives of the proposal may change sufficiently to require a modification to some aspect of the original proposal. The awardee may be asked by the program office to address these concerns, and the Program Office will evaluate the adequacy of the awardees' response.

A project reaches its completion in one of two ways: A multi-year project may end after approximately one year if the program manager (with input from technical monitors) decides, as described above, that insufficient progress has been made to justify continuation of the project into year two. A funded project would end successfully with the submission by the principal investigator(s) of a final report at the conclusion of the original agreed-upon project duration that convincingly shows the potential of research to contribute to the progress of NGGPS or HFIP goals, and be described in a manuscript for a peer-reviewed publication within two to three years after the end of funding.

C. Type of Funding Instrument

The funding instrument for non-Federal applicants will be a Cooperative Agreement. NOAA cooperative research activities provide financial support to enhance the public benefits to be derived from these research activities and engage NOAA scientists and other personnel for frequent consultation and advice.

NOAA envisions that project testing and evaluation will involve close collaboration, facilitated by the NWS staff, between program-funded researchers, operational center forecasters and other point(s) of contact. For example, operational forecasters may actually run or utilize output from the experimental technique during their operational shifts or at other times, and they may then provide direct feedback to the researchers for possible modifications.

If the applicant is a university that has a NOAA Joint or Cooperative Institute (CI), the institution is encouraged to submit a proposal on behalf of the CI. The proposal must specify the name of the CI, its award number, and the NOAA-approved research theme applicable to the work to be performed in the proposal's project narrative. The proposal will use the facilities and administrative rate (F&A or Indirect cost rate) associated with the main CI award. If such a proposal is selected for funding, NOAA will notify the university that a separate competitive award will be issued with its own award number. However, the competitive award will include a Special Award Condition (SAC) that evidences the link between this new award and the CI award. The SAC would provide that (1) the university has submitted the proposal on behalf of the CI; (2) the existing university/NOAA Memorandum of Agreement (MOA) will be incorporated by reference into the terms of the competitive award; and (3) any progress report(s) for the competitive award must follow the timetable of and be submitted by the CI directly to the funding program. Copies of these progress reports may be attached to the CI's performance report as an appendix.

III. Eligibility Information

A. Eligible Applicants

Eligible applicants are institutions of higher education, private organizations (profit and non-profit), and federally funded educational institutions such as the Naval Postgraduate School. This restriction is needed because the results of the collaboration are to be incorporated in processes which ensure academic multidisciplinary peer review as well as federal review of scientific validity for use in operations. Federal applicants from federally funded educational institutions must demonstrate that they have legal authority to receive funds from another federal agency in excess of their appropriation. All other federal government employees (including federal contractors) are not eligible to be funded through this announcement.

B. Cost Sharing or Matching Requirement

No cost sharing is required under this program.

C. Other Criteria that Affect Eligibility

Collaboration with PIs at different universities is allowed, but there must be a single application from a lead university with subawards to the participants from other institutions. Other arrangements will not be considered. Proposals should clearly state the role of each PI in the proposal. Except for researchers who are associate, assistant, or full professors at the Naval Postgraduate School or other federally funded educational institutions, federal government employees (and government contractors) are not allowed to be listed as PIs or receive funding, although collaboration between the academic community and NOAA within

the project is required. While an eligible organization may submit more than one application (from different principal investigators per II.A.), the Selecting Official may require that proposals be combined to increase the cost-benefit to the public.

IV. Application and Submission Information

A. Address to Request Application Package

The standard application package is available at http://www.grants.gov.

B. Content and Form of Application

1. Letters of Intent (LOI)

The purpose of the LOI process is to provide information to potential applicants on the relevance of their proposed project in advance of preparing a full application. For this announcement, PIs are strongly encouraged, but not required, to submit a pre-application in the form of a LOI for each planned project. The LOI should identify the Competition being targeted, the principal investigator's and co-investigator's names and institutions, summarize anticipated project scope and yearly budget, and be no more than 2 pages in length. LOI's will be reviewed by the Program Office. All PIs will be notified through email by the Federal Program Officer whether a full proposal is encouraged or discouraged about 2 weeks after the LOI due date. Even though a proposal may be discouraged, a PI is not precluded from submitting a full proposal.

2. Applications

Proposals should total no more than 25 pages in length, single spaced including the title page and abstract. The description of the project should total no more than 15 pages in length. Descriptions exceeding the 15 page limit will only be reviewed up to the page limit. Excess material will not be reviewed and may result in the proposal receiving a lower score. It is strongly recommended that Times New Roman 12 point font, or an equivalent size, be used. Federally mandated forms, tables of contents, and any letters of support are not included within the page count, but all other information is. Each proposal must be dated and contain page numbers.

Multi-year proposals up to a maximum of two years will be considered; however, funding beyond the first year will be strictly dependent upon satisfactory performance and the availability of funds. The starting date is expected to be September 1, 2018 on all proposals unless otherwise directed by the program manager. The program manager may delay the start of selected awards due to budgetary or other exigent circumstances.

The application elements listed below are required before an award can be made. Failure to submit elements a, d, and e by the deadline will result in the application not being reviewed if the omissions are not corrected prior to the deadline. The Program Office will make an

effort to notify the applicant of any omissions, but there is no guarantee this can occur prior to the application deadline. Proposals not meeting the content requirements listed in this section may be rejected and returned to the applicant. The aforementioned application elements are as follows:

a. Title Page. The title page must be officially authorized by the institutional representative. The PIs and institutional representative(s) should be identified by full name, title, organization, telephone number, and address. Please include the correct email for the principal investigator and any other proposal manager. The title page should clearly indicate which priority area(s) are being addressed and the total amount of requested funding per year. The Program Office will assign a priority area if it is not stated in the application, of if the Program Office believes it fits better into a different category.

b. Abstract Page. An abstract should be included and should contain an introduction of the problem, rationale, and a brief summary of work to be completed. The abstract should appear on a separate page, headed with the proposal title, institution's investigators, targeted program priority area(s) in Section I. B., total proposed cost, and budget period as well as the NOAA organizations sought for collaboration.

c. Results from Prior Research. The results of relevant projects supported by NOAA and other agencies should be described, including their relation to the currently proposed work. Prior research that demonstrated the potential to favorably impact and/or successfully transition operational environmental modeling and data assimilation system(s) should be emphasized. Reference to each prior research award should include the title, agency, award number, PIs, period of award, and total award. This section should be a brief summary and should not exceed two pages total.

d. Project description. The proposed project must be completely described in a statement of work including identification of the problem, scientific objectives, proposed methodology that includes a testing and evaluation approach, metric(s) for success, project deliverables and a timeline with key milestones. The statement of work should also include relevance to the priorities of the R2O Initiative; maturity of science and operational applicability as described Sections I. A. and I. B.; scientific merit; proposed technology transfer if any and cost effectiveness of research. Benefits of the proposed project to improve operational environmental forecasts should be discussed. A year-by-year summary of proposed work milestones must be included. Specific collaborations with NOAA scientists and technical personnel should be detailed.

e. Budget and Proposed Budget Justification. Applicants must submit a Standard Form (SF) 424, Application for Federal Assistance, including a detailed budget using the SF-424A, Budget Information-Non-Construction Programs. (The forms are available on grants.gov.) Please pay careful attention to show the yearly budget breakout on the SF-424A for two-year proposals. In addition, the body of the proposal should include a separate table showing total and annual budgets (if multi-year) corresponding with the project description. In order

to fully evaluate the appropriateness of costs, all applications must include a detailed budget narrative and justification to support all proposed budget categories for each of the funding periods anticipated. The budget narrative must be consistent with the SF-424A budget and should be broken out and detailed using the same budget categories as the SF-424A budget form. Personnel costs should be broken out by named PI and time requested per PI per year. Any unnamed personnel (graduate students, post-doctoral researchers, technicians) should be identified by job title, and their personnel costs explained similar to PI personnel costs above. The contribution of personnel to the project goals should be explained. Please reference the Grants Management Division budget narrative guidance for further information and examples for each budget category. The guidance can be found at http://www.ago.noaa.gov/grants/training.html. PIs are strongly encouraged to plan and budget for travel during each year of the project for attendance to a PI meeting to present an update on the status and progress of their work. Applicants requesting an approved Federal indirect cost rate are required to submit a copy of their current and signed indirect cost rate agreement with the application package. See B. Administrative and National Policy Requirements, 9. Indirect Cost Rate for more information on indirect cost rates.
Additionally, at the time of submission, each competitive proposal application package submitted by a NOAA Cooperative Institute (CI) PI that has been approved by the university must include a cover letter describing the intent to incorporate the terms of the CI Memorandum of Agreement (MOA). The cover letter will specify the name of the Cooperative Institute, the current CI cooperative agreement number, and the NOAA-approved research theme and task that applies to the proposal.
f. Vitae. Abbreviated curriculum vitae are sought with each proposal. Reference lists should be limited to all publications in the last three years with up to five other relevant papers.
g. Current and Pending Support. For each investigator, submit a list which includes project title, supporting agency with grant number, investigator months, dollar value, and duration. Requested values should be listed for pending support.
h. No reference to the National Environmental Policy Act (NEPA) questionnaire is required in the proposal.
i. Proposals submitted in response to this Announcement must include a Data Management Plan (up to 2 pages). See Section VI.B., Administrative and National Policy Requirements, below for additional information on what the plan should contain. If your proposed activities do not generate any environmental data, such a data sharing plan could include the statement "this project will not generate any environmental data". The data sharing plan does not count towards the 4-page maximum for the project description.
j. Also required as part of the NOAA Standard Non-Construction Application Package: Standard Form 424B (Assurances - Non-Construction Programs), and Form CD-511 (Certification Regarding Lobbying). Standard Form LLL (Disclosure of Lobbying Activities) should be submitted as applicable.

C. Unique Entity Identifier and System for Award Management (SAM)

Unique Entity Identifier and System for Award Management (SAM): To enable the use of a universal identifier and to enhance the quality of information available to the public as required by the Federal Funding Accountability and Transparency Act, 31 U.S.C. 6101 note, to the extent applicable, any proposal awarded in response to this announcement will be required to use the System for Award Management (SAM), which may be accessed online at https://www.sam.gov/portal/public/SAM/ . Applicants are also required to use the Dun and Bradstreet Universal Numbering System, as identified in OMB guidance published at 2 CFR Parts 25, which may be accessed at:
http://www.ecfr.gov/cgi-bin/text-idx?SID=2dae4a7dcd5848a6364bb94d2d7786dd&mc=true&tpl=/ecfrbrowse/Title02/2subtitleA.tpl
Each applicant is required to:
a. Register in SAM before submitting an application
b. Provide a valid unique entity identifier in the application
c. Continue to maintain an active SAM registration with current information at all times during which it has an active Federal award or an application or plan under consideration by NOAA (or any other Federal agency)
NOAA may not make a Federal award to an applicant until the applicant has complied with all applicable unique entity identifier and SAM requirements. If an applicant has not fully complied with the requirements by the time NOAA is ready to make a Federal award, NOAA may determine that the applicant is not qualified to receive a Federal award and use that determination as a basis for making a Federal award to another applicant.

D. Submission Dates and Times

The deadline for receipt of proposals at the NOAA/NWS office is 5:00 PM EST, February 7, 2018. When proposals are submitted through grants.gov, a date and time receipt indication is included and will be the basis of determining timeliness. Proposals received after the deadline will be rejected and returned to the sender without further consideration. LOIs are strongly encouraged and must be received by email to christopher.hedge@noaa.gov by 5:00 PM EST on December 8, 2017. Full applications will be encouraged only for LOIs deemed relevant; however, the final decision to submit a full application is made by the investigator.

E. Intergovernmental Review

Applications under this program are not subject to Executive Order 12372, Intergovernmental Review of Federal Programs.

F. Funding Restrictions

Funding beyond the first year will be dependent upon satisfactory performance and the continued availability of funds. No more than one award per Principal Investigator will be awarded under this competition.

G. Other Submission Requirements

The standard application package is submitted through http://www.grants.gov. Federally funded education institutions such as the Naval Postgraduate School must submit proposals by email to christopher.hedge@noaa.gov.

V. Application Review Information

A. Evaluation Criteria

The R2O proposal reviewers will base their recommendations regarding each proposal upon the extent to which the following criteria (listed with assigned weights) are satisfied:
1. Importance and/or relevance and applicability of the proposed project to program goals (30 points): This criterion ascertains whether there is intrinsic value in the proposed work and/or relevance to NOAA, Federal, regional, State or local activities. For the NGGPS and HFIP competitions, this includes the following questions:
a. What is the likelihood of the proposed science activities to improve operational environmental analyses and/or forecasts?
b. Are proposed research activities easily transitioned to development of NGGPS (for the NGGPS competition), to improvement of the operational hurricane prediction subsystem (for the HFIP competition) or to enabling of effective operational assimilation of environmental observations in a reasonable time frame, e.g., within two to three years upon completion of funding?
c. What is the degree of collaboration with NCEP, NOAA research labs, and other NOAA personnel throughout the project?
d. What is the level of planning by researchers to test and evaluate proposed modeling advancements to meet operational model and/or data assimilation skill standards for potential transition into operations successfully and efficiently?
2. Technical/Scientific Merit (30 points): This criterion assesses whether the approach is technically sound and innovative, if the methods are appropriate, and whether there are clear project goals and objectives. For the NGGPS and HFIP competitions, this includes:
a. What is the intrinsic scientific value and maturity of the subject and the study proposed as they relate to the specific science priorities?
b. Were focused scientific objectives and strategies, including project milestones used?
c. Is there a sufficient Data Management Plan (if applicable) to share data and information that is collected or created?

3. Overall Qualification of Applicants (25 points): This criterion ascertains whether the applicant possesses the necessary education, experience, training, facilities and administrative resources to accomplish the project. For the NGGPS and HFIP competitions, this includes:
a. Do PIs have the required expertise and experience to carry out proposed work?
b. Do PIs clearly document past scientific collaborations with operational modeling scientists or operational weather forecasters that contained potential to improve operational forecasts?
c. Have past interactions with NOAA been successful?
d. Are researchers likely to maintain effective and consistent interactions with NCEP and other NOAA modeling scientists or operational weather forecasters throughout the course of the proposed research program?
e. Have researchers demonstrated the ability to conduct successful research?
4. Project Costs (15 points): This criterion evaluates the budget to determine if it is realistic and commensurate with the project needs and time-frame. For the NGGPS and HFIP competitions, this includes:
a. Do researchers demonstrate the ability to build upon existing expertise/capabilities?
b. Is there a high ratio of operationally useful results versus proposed costs?
5. Outreach and Education (0 points):
This criterion assesses whether the project provides a focused and effective education and outreach strategy regarding NOAA's mission to protect the Nation's natural resources. The NGGPS and HFIP competitions do not use this criterion.

B. Review and Selection Process

An initial administrative review/screening is conducted to determine compliance with requirements and for completeness. All proposals will be evaluated and scored individually by a group of at least three professionally and technically qualified reviewers in accordance with the assigned weights of the above criteria. Reviews will be conducted by scientific experts, primarily representing operational environmental modeling, data assimilation, service improvement and forecast communities. The merit reviewers' ratings and comments are used to produce a rank order of the proposals for final consideration by the Program Office. A separate rank order will be produced for each competition: NGGPS and HFIP. The Selecting Official selects proposals after considering the qualified reviews and selection factors listed below. In making the final selections, the Selecting Official will award in rank order unless the proposal is justified to be selected out of rank order based upon one or more of the selection factors that can be influenced by strategic imperatives of the R2O initiative.

C. Selection Factors

Merit review ratings shall provide a rank order to the Selecting Official for final funding recommendations. The Selecting Official shall award in the rank order unless the proposal is

justified to be selected out of rank order based upon one or more of the following factors:
1. Availability of funding
2. Balance/distribution of funds by (a) geographical balance; (b) type of institutions; (c) type of partners; (d) research areas; and (e) project types
3. Duplication of other projects funded or considered for funding by NOAA/Federal agencies
4. Program priorities and policy factors
5. Applicant's prior award performance
6. Partnerships with and participation of targeted groups
7. Adequacy of information necessary for NOAA staff to make a NEPA determination and draft necessary documentation before recommendations for funding are made to the Grants Officer

D. Anticipated Announcement and Award Dates

Subject to the availability of funds, review of proposals will occur during mid-February to April 2018, and funding should begin by September 2018 for most approved projects. The assumed start date for funded projects will be September 1, 2018 unless otherwise directed by the Program Office.

VI. Award Administration Information

A. Award Notices

Successful applicants will receive notification that their application has been recommended for funding by the NOAA Grants Management Division. This notification is not an authorization to begin performance of the project. Official notification of funding from the NOAA Grants Officer is the authorization that allows the project to begin. Notification will be issued to the Authorizing Official of the project either electronically or in hard copy. Unsuccessful applicants will be notified that their proposals were not selected for recommendation by the Program Office.

B. Administrative and National Policy Requirements

1. DEPARTMENT OF COMMERCE PRE-AWARD NOTIFICATION REQUIREMENTS FOR GRANTS AND COOPERATIVE AGREEMENTS. The Department of Commerce Pre-Award Notification Requirements for Grants and Cooperative Agreements contained in the Federal Register notice of December 30, 2014 (79 FR 78390) are applicable to this solicitation and may be accessed online at: http://www.gpo.gov/fdsys/pkg/FR-2014-12-30/pdf/2014-30297.pdf.
2. UNIFORM ADMINISTRATIVE REQUIREMENTS, COST PRINCIPLES, AND AUDIT

REQUIREMENTS. Through 2 C.F.R. § 1327.101, the Department of Commerce adopted Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards at 2 C.F.R. Part 200, which apply to awards in this program. Refer to: http://go.usa.gov/SBYh and http://go.usa.gov/SBg4.

3. DOC TERMS AND CONDITIONS. Successful applicants who accept a NOAA award under this solicitation will be bound by Department of Commerce Financial Assistance Standard Terms and Conditions. This document will be provided in the award package in NOAA's Grants Online system at http://www.ago.noaa.gov and at http://go.usa.gov/hKbj.

4. LIMITATION OF LIABILITY. Funding for programs listed in this notice is contingent upon the availability of appropriations. Applicants are hereby given notice that funds may not have been appropriated yet for the programs listed in this notice. In no event will NOAA or the Department of Commerce be responsible for proposal preparation costs. Publication of this announcement does not oblige NOAA to award any specific project or to obligate any available funds.

5. NATIONAL ENVIRONMENTAL POLICY ACT (NEPA): NOAA must analyze the potential environmental impacts, as required by the National Environmental Policy Act (NEPA), for applicant projects or proposals which are seeking NOAA federal funding opportunities. Detailed information on NOAA compliance with NEPA can be found at the following NOAA NEPA website: http://www.nepa.noaa.gov/ , including our NOAA Administrative Order 216-6 for NEPA, http://www.nepa.noaa.gov/NAO216_6.pdf , and the Council on Environmental Quality implementation regulations, http://energy.gov/sites/prod/files/NEPA-40CFR1500_1508.pdf. Consequently, as part of an applicant's package, and under their description of their program activities, applicants are required to provide detailed information on the activities to be conducted, locations, sites, species and habitat to be affected, possible construction activities, and any environmental concerns that may exist (e.g., the use and disposal of hazardous or toxic chemicals, introduction of non- indigenous species, impacts to endangered and threatened species, aquaculture projects, and impacts to coral reef systems). In addition to providing specific information that will serve as the basis for any required impact analyses, applicants may also be requested to assist NOAA in drafting an environmental assessment, if NOAA determines an assessment is required. Applicants will also be required to cooperate with NOAA in identifying feasible measures to reduce or avoid any identified adverse environmental impacts of their proposal. Failure to do so shall be grounds for not selecting an application. In some cases if additional information is required after an application is selected, funds can be withheld by the Grants Officer under a special award condition requiring the recipient to submit additional environmental compliance information sufficient to enable NOAA to make an assessment on any impacts that a project may have on the environment.

6. DATA MANAGEMENT PLAN. 1. Environmental data and information collected or

created under NOAA grants or cooperative agreements must be made discoverable by and accessible to the general public, in a timely fashion (typically within two years), free of charge or at no more than the cost of reproduction, unless an exemption is granted by the NOAA Program. Data should be available in at least one machine-readable format, preferably a widely-used or open-standard format, and should also be accompanied by machine-readable documentation (metadata), preferably based on widely used or international standards. 2. Proposals submitted in response to this Announcement must include a Data Management Plan of up to two pages describing how these requirements will be satisfied. The Data Management Plan should be aligned with the Data Management Guidance provided by NOAA in the Announcement. The contents of the Data Management Plan (or absence thereof), and past performance regarding such plans, will be considered as part of proposal review. A typical plan should include descriptions of the types of environmental data and information expected to be created during the course of the project; the tentative date by which data will be shared; the standards to be used for data/metadata format and content; methods for providing data access; approximate total volume of data to be collected; and prior experience in making such data accessible. The costs of data preparation, accessibility, or archiving may be included in the proposal budget unless otherwise stated in the Guidance. Accepted submission of data to the NOAA National Centers for Environmental Information (NCEI) is one way to satisfy data sharing requirements; however, NCEI is not obligated to accept all submissions and may charge a fee, particularly for large or unusual datasets. 3. NOAA may, at its own discretion, make publicly visible the Data Management Plan from funded proposals, or use information from the Data Management Plan to produce a formal metadata record and include that metadata in a Catalog to indicate the pending availability of new data. 4. Proposal submitters are hereby advised that the final pre-publication manuscripts of scholarly articles produced entirely or primarily with NOAA funding will be required to be submitted to NOAA Institutional Repository after acceptance, and no later than upon publication. Such manuscripts shall be made publicly available by NOAA one year after publication by the journal.

7. UNPAID OR DELINQUENT TAX LIABILITY. Certifications Regarding Federal Felony and Federal Criminal Tax Convictions, Unpaid Federal Tax Assessments and Delinquent Federal Tax Returns. In accordance with Federal appropriations law, an authorized representative of the selected applicant(s) may be required to provide certain pre-award certifications regarding federal felony and federal criminal tax convictions, unpaid federal tax assessments, and delinquent federal tax returns.

8. UNIQUE ENTITY IDENTIFIER AND SYSTEM FOR AWARD MANAGEMENT (SAM). To enable the use of a universal identifier and to enhance the quality of information available to the public as required by the Federal Funding Accountability and Transparency Act, 31 U.S.C. 6101 note, to the extent applicable, any proposal awarded in response to this announcement will be required to use the System for Award Management (SAM), which

may be accessed online at https://www.sam.gov/portal/public/SAM/. Applicants are also required to use the Dun and Bradstreet Universal Numbering System, as identified in OMB guidance published at 2 CFR Parts 25, which may be accessed at: http://www.ecfr.gov/cgi-bin/text-idx?SID=2dae4a7dcd5848a6364bb94d2d7786dd&mc=true&tpl=/ecfrbrowse/Title02/2subtitleA.tpl.

9. REVIEW OF RISK. After applications are proposed for funding by the Selecting Official, the Grants Office will perform administrative reviews, including an assessment of risk posed by the applicant under 2 C.F.R. 200.205. These may include assessments of the financial stability of an applicant and the quality of the applicant's management systems, history of performance, and the applicant's ability to effectively implement statutory, regulatory, or other requirements imposed on non-Federal entities. Special conditions that address any risks determined to exist may be applied. Applicants may submit comments to the Federal Awardee Performance and Integrity Information System (FAPIIS) about any information included in the system about their organization for consideration by the awarding agency.

10. FREEDOM OF INFORMATION ACT (FOIA). In the event that an application contains information or data that you do not want disclosed prior to award for purposes other than the evaluation of the application, mark each page containing such information or data with the words "Privileged, Confidential, Commercial, or Financial Information - Limited Use" at the top of the page to assist NOAA in making disclosure determinations. DOC regulations implementing the Freedom of Information Act (FOIA), 5 U.S.C 552, are found at 15 C.F.R. Part 4, which sets forth rules for DOC to make requested materials, information, and records publicly available under FOIA. The contents of funded applications may be subject to requests for release under the FOIA. Based on the information provided by the applicant, the confidentiality of the content of funded applications will be maintained to the maximum extent permitted by law.

11. INDIRECT COST RATE. If an applicant has not previously established an indirect cost rate with a Federal agency they may choose to negotiate a rate with the Department of Commerce or use the de minimis indirect cost rate of 10% of MTDC (as allowable under 2 C.F.R. §200.414). The negotiation and approval of a rate is subject to the procedures required by NOAA and the Department of Commerce Standard Terms and Conditions. The NOAA contact for indirect or facilities and administrative costs is:

Lamar Revis, Grants Officer
NOAA Grants Management Division
1325 East West Highway
9th Floor
Silver Spring, Maryland 20910
lamar.revis@noaa.gov

12. MINORITY SERVING INSTITUTIONS. The Department of Commerce/National Oceanic and Atmospheric Administration (DOC/NOAA) is strongly committed to increasing

the participation of Minority Serving Institutions (MSIs), i.e., Historically Black Colleges and Universities, Hispanic-serving institutions, Tribal colleges and universities, Alaskan Native and Native Hawaiian institutions, and institutions that work in underserved communities.

C. Reporting

Financial reports are to be submitted to the NOAA Grants Officer identified in the award and Performance (technical) reports are to be submitted to the Program Officer. Unless otherwise specified by terms of the award, program and financial reports are to be submitted semi-annually and must be submitted no later than 30 days following the end of each 6-month period. The comprehensive final report is due 90 days after the award expiration. Program reports should include progress on identified milestones. Unless otherwise specified by the terms of the award, reports must be submitted electronically through NOAA Grants Online (https://grantsonline.rdc.noaa.gov). During the award period, PI's or co-PI's are expected to present an update on the progress and status of their project during the annual NGGPS or HFIP Principal Investigator's Meeting. Travel may be budgeted to attend this meeting in person.
The Federal Funding Accountability and transparency Act, 31 U.S.C. 6101 note, includes a requirement for awardees of applicable Federal grants to report information about first-tier subawards and executive compensation under Federal assistance awards. All awardees of applicable grants and cooperative agreements are required to report to the Federal Sub-award Reporting System (FSRS) available at https://www.fsrs.gov/ on all sub-awards over $25,000. Refer to 2 CFR Parts 170.

VII. Agency Contacts

For questions about this announcement, contact Christopher Hedge, Federal Program Officer, via email at christopher.hedge@noaa.gov.

VIII. Other Information

To use grants.gov, applicants must have a Dun and Bradstreet Data Universal Numbering System (DUNS) number and be registered in the Central Contractor Registry (CCR). Allow a minimum of five days to complete the CCR registration. [Note: Your organization's Employer Identification Number (EIN) will be needed on the application form.] Applicants are strongly encouraged not to wait until the application deadline date to begin the application process through grants.gov.