

NWS Office of Science and Technology Integration: Unified Forecast System

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NOTICE OF FUNDING OPPORTUNITY

EXECUTIVE SUMMARY

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

Funding Opportunity Title: NWS Office of Science and Technology Integration: Unified Forecast System

Announcement Type: Initial

Funding Opportunity Number: NOAA-NWS-NWSPO-2020-2006290

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

Dates: Full applications must be received by 5:00 PM Eastern Time (ET) on February 7, 2020. Applications received after this deadline will not be considered. Pre-proposal Letters of Intent (LOIs) are strongly encouraged and must be received by 5:00 PM Eastern Time (ET) on December 6, 2019. Expected project start date is September 1, 2020.

Funding Opportunity Description: NOAA's National Weather Service (NWS) Office of Science and Technology Integration (OSTI) is soliciting research proposals to support NOAA's development of the community-based, coupled, comprehensive earth modeling system, the Unified Forecast System (UFS). The UFS is designed to provide more accurate forecast guidance through operational numerical weather prediction applications. These applications span local and global domains, and predictive time scales from sub-hourly to seasonal. This solicitation favors projects at specific stages of maturity as signified by their readiness level as described in Section 1.A.

There are three competitions from this notification valued at approximately \$2,800,000 for the first year of multi-year (2-year) projects that will advance development of the UFS: 1) Next Generation Global Prediction System (NGGPS); 2) Weeks 3-4 Program; and 3) Hurricane Forecast Improvement Program (HFIP).

Research projects to advance NGGPS will propose accelerating development of improved global weather prediction models; coupling among atmosphere, ocean, land surface and ice system model components; improving data assimilation techniques; improving ensemble techniques; developing post-processing forecast tools and techniques; or improving software architecture, computational performance and system engineering.

Proposals pertaining to the advancement of the Weeks 3-4 program will focus on the development of a coupled UFS system including data assimilation approaches, extending the forecast of the UFS from 3 weeks to seasonal timescales, and developing metrics including validation and verification.

Proposals for the HFIP initiative will relate to research required to improve operational tropical cyclone forecasting to meet societal requirements to effectively mitigate economic disruption.

FULL ANNOUNCEMENT TEXT

I. Funding Opportunity Description

A. Program Objective

The focus of this funding opportunity is to seek research projects and application of modeling procedures that have the potential to be incorporated into NOAA's operational Numerical Weather Prediction (NWP) analyses and forecasts. Efforts to expand and accelerate critical weather forecasting research to operations will address growing service demands, increase the accuracy of weather forecasts, and contribute to a newly developed Unified Forecast System (UFS). The UFS provides a framework to engage the extensive research community and creates an environment for NOAA to more efficiently and effectively translate research advances into operational outcomes. Detailed information regarding UFS can be found on the UFS portal: <https://ufscommunity.org/>. Targeted improvements in the three competitions will result in multiple weather forecast service improvements.

As part of the UFS, NOAA's Research to Operations (R2O) Initiative to upgrade the operational numerical weather prediction system to a unified, fully coupled Next Generation Global Prediction System (NGGPS) within the NOAA Environmental Modeling System (NEMS) infrastructure is underway. On June 12, 2019, NOAA upgraded the Global Forecast System (GFS) to GFS v15, with a newly selected finite-volume cubed-sphere (FV3) dynamical core and new microphysics scheme. Using advanced high performance computing architectures, the system incorporated recent advances in weather prediction modeling from NOAA and the research community.

Continued NWP advances and the development of a coupled UFS will be achieved through: (1) accelerated development and implementation of improved global weather prediction models and inclusion of coupling among atmosphere, ocean, land surface and ice system components; (2) improved data assimilation techniques; (3) enhanced regional prediction capabilities; (4) improved hurricane and tropical cyclone modeling techniques; (5) improved ensemble techniques; (6) development of post-processing forecast tools and techniques; and (7) improved software architecture and system engineering.

NOAA is seeking projects with the potential to provide promising near term improvements to NOAA's operational numerical prediction suite and forecaster applications. The selection of projects will focus on those associated with Readiness Levels (RL) 4 through 8 as described below, and on the NAO 216-105B Policy on Research and Development Transitions website:

https://www.corporateservices.noaa.gov/ames/administrative_orders/chapter_216/216-105B.html.

RL 4: Successful evaluation of system, subsystem, process, product, service, or tool in a laboratory or other experimental environment; this can be considered an intermediate phase of development.

RL 5: Successful evaluation of system, subsystem process, product, service, or tool in a relevant environment through testing and prototyping; this can be considered the final stage of development before demonstration begins.

RL 6: Demonstration of a prototype system, subsystem, process, product, service, or tool in a relevant or test environment (potential demonstrated).

RL 7: Prototype system, process, product, service or tool demonstrated in an operational or other relevant environment (functionality demonstrated in near-real world environment; subsystem components fully integrated into system).

RL 8: Finalized system, process, product, service or tool tested, and shown to operate or function as expected within user's environment; user training and documentation completed; operator or user approval given.

The R2O Initiative effort to implement a weather-scale, fully-coupled NWP system includes extending forecast skill beyond 8 to 10 days, improving hurricane track and intensity forecasts, and extending weather forecasting to 30 days. NOAA has established objectives to accelerate weather forecasting skill, including: 1) maximizing the benefits of high performance computing; 2) increasing the resolution of key environmental models to improve the specificity of forecast; 3) developing effective assimilation of environmental observations at global and regional scales; 4) advancing model component coupling; 5) developing advanced data assimilation (DA) methods at both global and regional scales; 6) advancing physical parameterizations; 7) refining post-processing methods for key variables including methods for the 15-30 day period and the data sets needed to support them (retrospective surface analyses and re-forecasts); and 8) developing diagnostic packages that can be used as tools for model development, model evaluation and model inter-comparison. The UFS is designed to serve both the research, development and operational communities engaged in the numerical prediction of the Earth System.

Proposals should adhere to advanced software practices such as documentation of code and testing for the ease of transition to operations. In order for NOAA to successfully transition new technology to operations following the completion of selected projects, proposals should specify work with UFS codes. Proposals should include a plan for testing and evaluating 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 the objective, subjective and engineering readiness required for transition to operations.

Applicants are encouraged to visit the UFS Portal (<https://ufsccommunity.org/>) to learn more about the UFS, plans for the coupled system, information pertaining to the UFS Working Groups and Application Teams (<https://ufsccommunity.org/#/science/workinggroups>), and key documents (<https://ufsccommunity.org/#/documents/keydocs>) such as the Strategic Implementation Plan (SIP), supporting and describing UFS development. For questions and points of contact related to the working groups, please email nws.sti.modeling.team@noaa.gov. NOAA's Environmental Modeling Center (EMC) capabilities are described on EMC's website (<http://www.emc.ncep.noaa.gov/mmb/.php>) and FV3GFS code repositories are available through Github (<https://github.com/NOAA-EMC>).

B. Program Priorities

There are 3 competitions under this announcement: NGGPS, Weeks 3-4 and HFIP. Applicants should clearly indicate the competition to which they are applying.

NGGPS competition: Research proposals to advance NGGPS with the FV3 dynamical core will focus on accelerating coupled model development to improve forecast accuracy. This includes coupling among the weather prediction model components (atmosphere, ocean, land surface and ice system), advancing data assimilation and ensemble techniques, and developing post-processing forecast tools and improving deterministic forecast skill by improving computational efficiency. Additional information on NGGPS can be found at: https://www.weather.gov/sti/stimodeling_nggps.

Weeks 3-4 competition: Proposals pertaining to the advancement of the Weeks 3-4 Program will contribute to the development of coupled data assimilation approaches; extending the forecast of the UFS from 3 weeks to seasonal timescales; process-based diagnostic tools and seasonal to subseasonal validation/verification metrics for the coupled system; and addressing challenges in subseasonal to seasonal (S2S) prediction that project onto NOAA requirements for weeks 3-4 forecast products. Additional information can be found at: https://www.weather.gov/sti/stimodeling_nggps_weeks3-4.

HFIP competition: Proposals for the HFIP initiative will support hurricane research required to improve operational hurricane forecasts of higher accuracy and greater reliability to meet societal requirements to effectively mitigate economic disruption. This includes specific goals to reduce the average errors of hurricane track and intensity forecasts by 20% within five years and 50% in ten years with a forecast period out to 7 days. Additional information regarding the HFIP program can be found at: <http://www.hfip.org/>.

Applicants for a given competition should clearly indicate and address in their proposal one or more of the associated priorities listed below. Proposals not directly associated with one or more of these priorities are discouraged.

1. Advances in verification and validation:

The goal is to construct optimal verification methods and tools to evaluate the performance of the newly coupled UFS applications for medium-range, seasonal, and regional forecasts including hurricane models at both global and mesoscales. This includes a consideration of the spectrum of user needs, including applications in aviation, severe storms, space weather, tropical storms, air quality, and subseasonal to seasonal forecasting. New verification and validation tools should be integrated into existing packages (e.g. METplus). Ultimately, it is intended that this system will lead the way towards unifying verification across the user community and create common metrics for multiple applications with consistent verification approaches. NOAA is seeking projects that will:

- a) Develop testing strategies for the coupled system with particular focus on predictions in the 3 to 6 week range
- b) Develop process-based diagnostics designed to improve forecasting across various scales
- c) Improve post-processing, including bias correction, calibration, and statistically post-processed output
 - i) Optimize post-processing such as ensemble statistics calculations
 - ii) Develop post-processing algorithms that extract environmental features needed by the user community
- d) Develop post-processing techniques that increase hurricane forecaster utility of tropical cyclone forecast guidance. This includes techniques for genesis, track, intensity, surface wind structure and estimating forecast uncertainty and Artificial Intelligence (AI). Use of AI diagnostic techniques for hurricane model guidance to estimate hurricane trajectory and intensity, by creating algorithms that can process input data (eg. observations, satellite imagery) without relying on human experts and represent the complexity and non-linearity of the atmospheric systems

2. Computational and numerical advances:

Improve the computational efficiency and accuracy of the UFS numerical systems for conventional or cloud computing platforms, by improving code efficiency or by using AI methods. Projects will need to include metrics and a testing plan that demonstrates improved accuracy. Projects in this area will address one or more of the following:

- a) Improve the computational performance or efficiency of the UFS with focus on the slowest elements
- b) Evaluate and improve convergence and stability of physics-dynamics coupling for the

UFS atmosphere

c) Develop cloud computing capability for computationally expensive UFS applications, such as subseasonal to seasonal, high resolution configurations, ensemble data assimilation experiments, historical reanalysis and reforecast in the extended range

3. Coupled model development and advances in data assimilation:

Improve methodologies for coupling and initializing the UFS applications, including hybrid (3D- or 4D-Var + EnKF) techniques. Applications will include one or more of the following:

a) Test and improve coupled UFS applications, identifying and addressing significant biases and coupling “shocks”

b) For the coupled UFS, develop computationally efficient and effective DA strategies to extend predictability beyond week 2

c) For the coupled UFS, develop ensemble generation techniques that not only improve the deterministic forecast skill but also the ensemble spread/forecast skill relationship

d) Develop the coupled UFS land data assimilation system, and investigate how land processes influence weather phenomena at various timescales

e) Explore the use of native resolution ensembles for DA, that can be used both for DA and ensemble forecasting, particularly for global models. Proposals should include a clear computing resource plan

f) For hurricane forecasting, use of in-situ data (e.g., airborne Doppler radar data, Doppler wind Lidar, Stepped-Frequency Microwave Radiometer (SFMR), GPS dropwindsonde) to supplement next-generation satellite data for accurate three-dimensional depictions of the tropical cyclone circulation. The development of this DA capability should be targeted for the Hurricane Analysis and Forecast System (HAFS) and aligned with the Joint Effort for Data Assimilation Integration (JEDI)

g) Focus on improving simulation of the Arctic in the coupled UFS, including clouds, boundary layer, sea-ice, ocean, model initialization, validation and verification

4. Hurricane and tropical cyclone prediction subsystem advances:

Develop improvements for tropical cyclone predictions, especially reducing hurricane intensity errors and improving the predictions for rapid changes in intensity. Priority work will include improved techniques suitable for:

a) 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

b) High resolution vortex initialization techniques

c) Downstream applications for landfalling storms for improved size, structure, rainfall, surge and inundation forecasts

5. University partners on UFS SIP (Strategic Implementation Plan) projects:

This includes university components of projects submitted in partnership with UFS teams to the UFS SIP-based proposal describing multi-year development and implementation plans, and documenting the effort of the community working together to evolve the UFS modeling system for operations and research.

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

The total funding amount available under this announcement is estimated to be approximately \$2,800,000 per year. It is anticipated that approximately 12 to 15 awards will be provided. Funding of any proposal is contingent upon the availability of these funds. The funding estimates allocated for each competition may be altered depending on the number and quality of proposals submitted within each competition.

1. NGGPS competition:

The total funding amount available for proposals in the NGGPS competition is anticipated to be approximately \$1,000,000 for year 1. The maximum award that can be requested is \$250,000 total cost per year per proposal. Proposals over \$250,000 per year will be rejected. Individual award amounts are expected to range from \$100,000 to \$250,000 per year with a maximum funding request of two years.

2. Weeks 3-4 competition:

The total funding amount available for proposals in the Weeks 3-4 competition is anticipated to be approximately \$1,000,000 for year 1. The maximum award that can be requested is \$250,000 total cost per year per proposal. Proposals over \$250,000 per year will be rejected. Individual award amounts are expected to range from \$100,000 to \$250,000 per year with a maximum funding request of two years.

3. HFIP competition:

The total funding amount available for proposals in the HFIP competition is anticipated to be approximately \$800,000 for year 1. The maximum award that can be requested is \$250,000 total cost per year per proposal. Proposals over \$250,000 per year will be rejected. Individual award amounts are expected to range from \$100,000 to \$250,000 per year with a maximum

funding request of two years.

B. Project/Award Period

This announcement is for multi-year projects to be conducted for a maximum two-year period with an anticipated start date of September 1, 2020 unless otherwise directed. September 1, 2020 should be indicated as the project start date in the proposal. When a proposal is approved, funding may initially be provided for only the first year of the project. If a proposal is selected for initial funding, the NWS OSTI-Modeling Program Office 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 may be adjusted (increased or decreased) individually. Second year funding may also be contingent upon satisfactory progress in relation to the stated goals of the proposal to address specific science needs and priorities of the NWS OSTI-Modeling Program Office, and subject to the availability of funds.

C. Type of Funding Instrument

The funding instrument for these awards 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 who are substantially involved in the project for frequent consultation and advice.

III. Eligibility Information

A. Eligible Applicants

Eligible applicants are U.S. institutions of higher education; U.S.-based commercial organizations; state, local and Indian tribal governments in the U.S.; and other U.S. non-profit organizations and federally funded educational institutions such as the Naval Postgraduate School.

Any federal employee or federal contractor listed as a co-PI, co-I, or collaborator on the title page of a proposal (if eligible) must have provided explicit pre-approval to the PI to be identified as a contributor to the proposed project prior to submission of the application. A letter of support or email acknowledging participation in the proposed project by the federal employee or federal contractor must be included within the application.

All funded investigators must assure and verify, if requested, that they will not be allocated for greater than 100% of their annual employment time should their proposal be selected for funding. NOAA will verify this requirement if funding is recommended.

B. Cost Sharing or Matching Requirement

No cost sharing is required under this announcement.

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. While an eligible organization may submit more than one application, the Selecting Official may require that proposals be combined to increase the cost-benefit to the public. Only one proposal per principal investigator at a given institution may be funded.

IV. Application and Submission Information

A. Address to Request Application Package

The standard application package is available at <http://www.grants.gov>. There is no similar official application package for Letters of Intent (LOIs) other than the requirements identified below in Section IV.B.1.

B. Content and Form of Application

Applicants are required to submit a full proposal and are strongly encouraged (but not required) to submit an LOI. The requirements for preparation of full applications provided below are mandatory. Failure to adhere to these instructions will result in LOIs and/or full proposals being rejected and returned without review.

1. Letter 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, it is strongly recommended that PIs submit a pre-application in the form of a LOI for each planned project. LOIs will be reviewed by the Program Office following the criteria specified in Section V.A to assess the potential value of the proposed research to NOAA. All PIs will be notified through email by the Federal Program Officer whether a proposal is encouraged or discouraged about two weeks after the LOI due date. Even though a proposal may be discouraged, a PI is not precluded from submitting a full proposal. The LOI must be submitted via email to nws.sti.modeling.team@noaa.gov by 5:00 PM Eastern Time (ET) on Friday, December 6, 2019. Refer to Section IV.D for LOI submission information.

The LOI is expected to contain the following information, and be no more than 2 pages in length:

(a) The principal investigator's and co-investigator's names and institutions, yearly and total budget.

(b) The competition (NGGPS, Weeks 3-4 or HFIP) and priority areas being targeted (as indicated in Section I.B).

(c) A brief description of the intended project, methodology, scope, general timeline, and expected project outcomes, in addition to its relevance to the specified competition and priorities of the announcement.

(d) The LOI must briefly describe the current Readiness Level (see Section I.A) of the proposed project at start-up and the expected Readiness Level at project completion. It should also briefly describe any future steps recommended to advance the project output(s) to its ultimate application, operationalization (by NOAA), or commercialization.

(e) Due to NOAA's shortage of high performance computing and storage for research, investigators are strongly encouraged to seek computing resources, including cloud computing resources, from other sources and should be aware that NOAA resources will most likely not be available for their project. Clearly state whether the project intends to leverage resources from NOAA. NOAA's Environmental Modeling Center (EMC) has the codes available through Github (<https://github.com/NOAA-EMC>).

2. Full Proposal

Proposals may total no more than 25 pages in length, single spaced including the title page and abstract with one-inch margins on 8 ½ x 11 inch paper. It is strongly recommended that Times New Roman 12 point font, or an equivalent size, be used. The proposal should be submitted as a PDF file. Each proposal must be dated and contain page numbers. Federally mandated forms, tables of contents, and any letters of support (or statement acknowledging intention to collaborate by federal participants) are not included within the page counts, but all other information is. The project description should total no more than 15 pages in length. Project 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.

The application elements are as follows:

(a) Title Page: The title page must be officially authorized by the institutional representative. All PIs and institutional representative(s) should be identified by full name, title, organization, telephone number, email address and mailing address. The title page should clearly indicate which competition (NGGPS, Weeks 3-4 or HFIP) and priority area(s) are being addressed. Indicate the proposed year 1, year 2 (if multi-year), and total budget (for each institution as applicable).

(b) Abstract Page: A one-page abstract must be included and contain an introduction of the problem, rationale, and a brief summary of research 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 any NOAA collaborating organization(s) (e.g., EMC). Any NOAA collaborating organization indicated in the proposal must have provided explicit pre-approval to the PI to be identified as a contributor to the proposed project prior to submission of the application.

(c) Results from Prior Research: The results of relevant projects supported by NOAA and other agencies must 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 (15-page limit as indicated above): The proposed project must be completely described to include identification of the problem, scientific objectives, proposed methodology with a testing and evaluation approach, metric(s) for success, and a timeline with key milestones. The project description must also include relevance to the priorities of the UFS initiative; relevance to the program priorities outlined in Section 1.B; maturity of science and operational applicability as related to the proposed project readiness levels described Section I.A; scientific merit, including the benefits of the proposed project to improve operational forecasts; and cost effectiveness of research. A year-by-year summary of proposed milestones must be included. Specific collaborations with NOAA scientists and technical personnel should also be detailed.

Due to NOAA's shortage of high performance computing and storage for research, investigators are strongly encouraged to seek computing resources, including cloud computing resources, from other sources and should be aware that NOAA resources will most likely not be available for their project. The project description should clearly state whether the project intends to leverage computing resources from NOAA.

(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 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 project year. The budget narrative must be consistent with the budget table and must be broken out and detailed using the same budget categories as the SF-424A budget form.

In addition, the body of the proposal must include a separate table showing total and annual budgets (if multi-year) corresponding with the project description. The table must also include multiple lines corresponding to multiple institutes, as applicable. Additional text to justify expenses should be included as necessary. PIs are strongly encouraged to plan and budget for travel during each year of the project for attendance at a PI and/or SIP planning meeting to present an update on the status and progress of their work and to communicate with SIP Working Groups.

Please take note of the important requirements included in Section IV.2.F., “Funding Restrictions”.

(f) Data Management Plan (up to 2 pages): See Section VI.B.4, Administrative and National Policy Requirements, for additional information on what the plan should contain.

(g) Letters of Support: For any participation or collaboration by federal employees or federal contractors indicated in the proposal, a letter of support (or statement acknowledging intent to collaborate by the federal participant) is required. Any other letters of support are permitted but not required.

(h) Curriculum Vitae (CV): A CV of 3 pages maximum for all PIs, co-PIs, and co-Is. The CV should include a reference list of all publications and conference presentations relevant to the proposed work within at least the last three years. CVs are not required for collaborator partners.

(i) Current and Pending Support: For each investigator, it is required to submit a list of pending support which includes project title, supporting agency with grant number, investigator months, dollar value, and duration. Requested values should be listed for pending support.

(j) This announcement does not require any National Environmental Policy Act (NEPA) questions to be answered as part of the application. This will be done after project selection if NOAA needs additional information beyond what is described in the proposal package. For additional information on NEPA, see Section VI.B.3.

(k) The full proposal package includes the information described above as well the following required federal forms: (1) Application for Federal Assistance (SF-424); (2) Budget Information--Non-Construction Programs (SF-424A): For multi-year proposals, pay careful attention to show the yearly budget breakout on the SF-424A; (3) Certification Regarding Lobbying (CD-511); (4) Assurances - Non Construction Programs (SF-424B); (5) Disclosure of Lobbying Activities (SF-LLL). Current versions of these forms are available on Grants.gov.

C. 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: https://www.ecfr.gov/cgi-bin/text-idx?tpl=/ecfrbrowse/Title02/2cfr25_main_02.tpl.

Applicants should allow a minimum of five days to complete the SAM registration. Registration is required only once, but must be renewed periodically. Each applicant is required to:

- (i) Register in SAM before submitting an application;
- (ii) Provide a valid unique entity identifier in the application; and
- (iii) 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.

In all, there are approximately eight steps needed to set up your organization's Grants.gov account. It can take between 3-5 business days or as long as 3 weeks to register if all steps are not completed in a timely manner. Organizations already registered with Grants.gov are not required to re-register but should ensure their Grants.gov password is up to date. Additional information about the Grants.gov registration process can be found online at <https://www.grants.gov/web/grants/applicants/registration.html>.

Users of Grants.gov will be able to download a copy of the application package, complete it offline, and then upload and submit the application via the Grants.gov site. If an applicant has problems downloading the application forms from Grants.gov, contact Customer Support at 1-800-518-4726 or support@grants.gov.

D. Submission Dates and Times

LOIs are strongly encouraged (but not required) and must be received by email to nws.sti.modeling.team@noaa.gov by 5:00 PM Eastern Time (ET) on December 6, 2019. Full application packages for all competitions must be submitted via Grants.gov no later than 5:00 PM Eastern Time (ET) on February 7, 2020 unless directed otherwise through a change to this announcement on Grants.gov. 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.

E. Intergovernmental Review

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

F. Funding Restrictions

NOAA will not fund federal employee salary costs for federal government employees. Other federal expenditures such as travel or contract support can be requested, but must be specified in the proposal as an expense separately from the amount that would be provided directly to the grantee. In approved cases of support for federal expenditures, funds will be transferred directly from NOAA to the associated federal organization through either an inter-agency fund transfer (if statutory authority allows) or an intra-agency fund transfer from NOAA. This funding request must be coordinated with the affiliated federal organization. Any and all eligible costs associated with supporting federal employees or contractors for a given project must be clearly identified in a separate federal budget table to be included with the application and be justified in an associated federal budget justification section but excluded from the non-federal applicant's budget tables and budget forms.

Applicants are encouraged to budget up to, but not more than 20% of the proposed budget in support for NOAA laboratory or NCEP modeling center collaborators, as needed to ensure successful research to operations. For a collaboration that includes some funding for federal offices, the actual amount to be awarded through Grants Online would only be the portion for the non-government recipient and would be less than the \$250,000 maximum project cost. The total cost of a proposal, including any costs associated with supporting federal employees or contractors, cannot exceed \$250,000 per year.

Funding beyond the first year may be dependent upon satisfactory performance and continued availability of funds. NOAA is not responsible for proposal preparation costs. NOAA cannot, by federal regulation (31 U.S.C 6303), fund any research work through a federal grant or cooperative agreement in which the awardee proposes to develop or deliver to NOAA any tangible product deliverable beyond research results as reported in standard semi-annual progress reports and final reports, including, for example, software modules that the recipient might wish that NOAA would use for its operational forecasting mission. NOAA cannot fund or accept any such award deliverable that would be more appropriately funded through a procurement mechanism. However, NOAA may possibly pursue such follow-on contract mechanisms with the recipient after the award ends if the project is successful and follow-on contractual work is warranted. Do not propose to provide NOAA any deliverable other than the semi-annual progress reports and final reports.

No more than one award per Principal Investigator will be awarded under this announcement.

G. Other Submission Requirements

If the applicant is at a university that has a NOAA Joint or Cooperative Institute (CI), the applicant 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 the 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 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.

V. Application Review Information

A. Evaluation Criteria

Applicants are required to address in their proposal the criteria described in this section, which serves as the fundamental basis for reviewing, scoring, and ranking of the proposals. The reviewers for each competition will base their recommendations regarding each proposal upon the extent to which the following criteria (listed with assigned weights) are satisfied. The evaluation criteria and weighting of the criteria are as follows (for a total of 100 points):

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. 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 UFS and a coupled system (for the NGGPS competition), to improvement of the operational hurricane prediction subsystem (for the HFIP competition), or extended prediction and development of Weeks 3-4 products (for Weeks 3-4 competition)?
 - c. Is there sufficient collaboration with NCEP modeling centers, NOAA research labs, and other NOAA personnel throughout the project to ensure likely transition of proposed research into operations?
 - 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?
 - e. Is the proposed work responsive to the topics identified in the funding opportunity?
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. This includes:
 - a. What is the intrinsic scientific or technical value and maturity of the subject and the study proposed as they relate to the specific science priorities?
 - b. Does the proposal demonstrate adequacy of the metrics proposed for testing and evaluation, and quantify the potential impact of the project on NCEP's operations?
 - c. Are focused scientific objectives and strategies, including data management considerations and project milestones used?
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. This includes:

- a. Do PIs have the necessary education, experience/expertise, training, facilities, and resources (including the availability of computing resources) to accomplish the project?
- 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. This includes:

- a. Are the requested costs realistic, reasonable, allowable, allocable, necessary and commensurate with the project benefits, deliverables, and time period?
- b. Is there a high ratio of operationally useful results versus proposed costs?

B. Review and Selection Process

Once a full application package has been received, an initial administrative review will first be conducted to determine compliance with all submission requirements, completeness of the application, and responsiveness to the NOAA priorities in Section I.B. If all requirements are satisfied and the application is responsive to the priorities, the application will move to the next stage of review. If not, the application will be rejected and the PIs will be notified.

All compliant applications (proposals) will then receive an objective peer review within one of the three competition category pools to which it was submitted. All proposals within a given competition category pool will be competed and ranked against each other. 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 evaluation criteria by independent peer mail review and/or by independent peer panel reviews. 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, Weeks 3-4 and HFIP. The Selecting Official selects proposals after considering the peer panel 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 UFS effort. Any application considered for funding may be required to address the issues raised in the evaluation of the application by the reviewers, program officer, selecting official, and/or grants officer before a selection recommendation decision is made and/or before an award is made.

C. Selection Factors

Merit review ratings shall provide a rank order to the Selecting Official for final funding recommendations. The Selecting Official shall recommend awards 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) geographic area; (b) type of institutions; (c) type of partners; (d) research areas; and (e) project types
3. Whether a project duplicates other projects funded or considered for funding by NOAA or other 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

Review of applications will occur from approximately mid-February to early-April 2020. NWS/OSTI estimates that funding recommendation decisions on applications will be made in May 2020. NOAA's Grants Management Division will normally make official award offers approximately one month before the planned project start date. The assumed start date for funded projects will be September 1, 2020 unless otherwise directed by the Program Office.

VI. Award Administration Information

A. Award Notices

Applicants will receive notification from NWS that their application has either been recommended or not recommended for funding to the NOAA Grants Management Division after completion of the review process. Notice of recommendation for funding is not an authorization to initiate the project. Official notification of funding of the grant award, signed by a NOAA Grants Officer, is the authorization that allows the project to begin.

NOAA's Grants Management Division will normally make award offers approximately one month before the planned start date. This notification will be issued to the Authorizing Official of the project after approval and is the official document that authorizes the project to begin.

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. LIMITATION OF LIABILITY: Funding for programs listed in this notice is contingent upon the availability of Congressional appropriations. In no event will NOAA or the Department of Commerce be responsible for the application preparation costs. Publication of this notice does not oblige NOAA to award any specific project or to obligate any available funds. If one incurs any costs prior to receiving an award agreement signed by an authorized NOAA official, one would do so solely at one's own risk of these costs not being included under the award or of not receiving an award.

3. NATIONAL ENVIRONMENTAL POLICY ACT (NEPA): If recommended for funding, applicants whose proposed projects may have an environmental impact will be asked to furnish sufficient information to assist NOAA in assessing the potential environmental consequences of supporting the project. NOAA must analyze the potential environmental impacts, as required by NEPA, for each project which seeks NOAA funding. Detailed information on NEPA can be found at the following NOAA NEPA web site: www.nepa.noaa.gov, including our NOAA Administrative Order 216-6A for NEPA, http://www.corporateservices.noaa.gov/ames/administrative_orders/chapter_216/216-6A, and the Council on Environmental Quality implementation regulations, https://ceq.doe.gov/ceq_regulations/regulations.html.

If needed by NOAA for NEPA assessment, applicants will be asked 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. The 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.

4. DATA SHARING PLAN:

a) 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 must 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.

b) 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 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.

c) 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.

d) 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.

5. UNPAID OR DELINQUENT TAX LIABILITY: In accordance with Section 523 of Division B and Sections 744 and 745 of Division E of the Consolidated and Further Continuing Appropriations Act, 2015 (Pub. L. 113-235) or a future public law, an authorized representative of the selected applicant(s) will be required to provide certain pre-award

representations regarding federal felony and federal criminal tax convictions, unpaid federal tax assessments, and delinquent federal tax returns.

6. REVIEW OF RISK: After applications are recommended for funding by the Selecting Official, the Grants Management Division will perform administrative reviews, including an assessment of risk posed by the applicant under 2 C.F.R. 200.205. The reviews may include assessments of the financial stability of an applicant, 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. Upon review of these factors, if appropriate, special conditions that correspond to the degree of risk 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.

7. 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, 5 U.S.C 552, are found at 15 C.F.R. Notice of Federal Funding Page 15 of 17 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.

8. INDIRECT COST RATE: If indirect charges are included in the budget, the applicant must have an approved negotiated Indirect Cost Rate Agreement and must include it as a part of the application package. 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 Section B.06. 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. email: lamar.revis@noaa.gov

9. 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.

10. NOAA SEXUAL ASSAULT AND SEXUAL HARASSMENT PREVENTION AND RESPONSE POLICY: If NOAA-operated, leased, or owned facilities are involved in any awards funded under this announcement, such awards are subject to the NOAA Sexual Assault and Sexual Harassment Prevention and Response Policy Applicable to Financial Assistance Awards Involving NOAA-Operated Facilities (May 2018) found at:

http://www.ago.noaa.gov/grants/facilities_assault_policy.html.

11. 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://www.osec.doc.gov/oam/grants_management/policy/.

12. 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

<https://grantsonline.rdc.noaa.gov/flows/home/Login/LoginController.jspf> and at

<http://go.usa.gov/hKbj>.

C. Reporting

Award recipients will be required to submit project performance (technical) and financial reports via NOAA's Grants Online system. Progress reports and financial reports are required on a semiannual schedule and must be submitted no later than 30 days following the end of each 6-month period from the start date of the award. A comprehensive final report is due 90 days after the award expiration. Copies of all submitted reports will become the property of the U.S. Government.

All dissemination of results, including publications and written or oral presentations supported by this funding opportunity, should acknowledge NOAA/NWS and the specific NGGPS/Weeks 3-4/HFIP Program supporting the project.

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 UFS. 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 NWS OSTI Modeling 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 the review panel) 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 UFS and/or NGGPS, Weeks 3-4 or HFIP goals, and be described in a manuscript for a peer-reviewed publication within two to three years after the end of funding.

VII. Agency Contacts

For questions about this announcement, contact the NWS OSTI Modeling Program Office via email at nws.sti.modeling.team@noaa.gov.

VIII. Other Information

None.