FY2019 Office of Weather and Air Quality Research Programs

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ANNOUNCEMENT OF FEDERAL FUNDING OPPORTUNITY

EXECUTIVE SUMMARY

Federal Agency Name(s): Oceanic and Atmospheric Research (OAR), National Oceanic and Atmospheric Administration (NOAA), Department of Commerce

Funding Opportunity Title: FY2019 Office of Weather and Air Quality Research Programs

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Dates: Each of the eight grant competitions within this Fiscal Year (FY) 2019 funding opportunity announcement will have its own staggered due dates for Letters of Intent and full applications. Please see Section IV.D "Submission Dates and Times" for these varying due dates. Grant period length and recommended start dates for the funded projects will also vary with each competition as listed in Section II.B "Project/Award Period".

Funding Opportunity Description: There will be eight grant competitions from this notification valued at approximately $16,200,000 as follows: 1) High Impact Weather Testbeds, 2) Joint Technology Transfer Initiative (JTTI), 3) Air Quality Research and Forecasting, 4) Verification of the Origins of Rotation in Tornadoes Experiment - Southeast U.S. (VORTEX-SE), 5) Infrasound Detection of Tornadoes and High Impact Weather, 6) Next Generation of Mesoscale Weather Observing Platforms, 7) Snowpack and Soil Moisture Observations and Data Assimilation to Improve the National Water Model (NWM), and 8) Subseasonal to Seasonal (S2S).

These eight competitions in this notification of funding opportunity reflect multiple science objectives spanning time scales from the very short-term (hours) to seasonal and from weather and water observations and modeling to social and behavioral science. It is focused on improving NOAA's understanding and ultimately its weather and water forecasting services through engagement with the external scientific community on key science gaps of mutual interest through funded grant opportunities.

One of the key themes is supporting applied research and development that leads to the demonstration in NOAA's testbeds during the project period of new high impact weather, water, and air quality observing and forecasting applications, including new data or products, improved analysis techniques, better statistical or dynamic forecast models and techniques, and

communication of that information to better inform the public. It is expected that NOAA's support of these new capabilities will speed the transition of this new research into operations in order to improve NOAA weather and water services for the public.

The subseasonal to seasonal objectives focus on baseline understanding of predictability, advancement of community-driven, NOAA modeling initiatives, and increasing the utility of multi-model ensembles for end users. By facilitating new capabilities on the subseasonal to seasonal range, NOAA seeks to increase resiliency of national infrastructure, support land- and marine-based economic vitality and mitigation efforts, advance month-to-month operational applications, and better position local, regional, and national decision-makers for successful responses to adverse weather events.

VORTEX-SE is a NOAA-led effort to understand the aspects of tornadoes in the Southeast U.S. that lead to an increased risk of death and injury in that region. The project emphasizes research, often interdisciplinary in nature, across the spectrum from meteorology to social, behavioral, economic, and engineering sciences. This year's funding opportunity continues the emphases of previous years.

Finally, this announcement includes three competitions focused on improving the critical observing system technologies needed to underpin improved forecasts. They are focused on improved snowpack and soil moisture observations, improved mesoscale observations, and innovation in infrasound technology for detection of severe weather.

NOAA's National Weather Service (NWS) is also announcing a companion Fiscal Year (FY) 2019 federal grant funding opportunity to this OAR opportunity through their Collaborative Science, Technology, and Applied Research (CSTAR) Program in early October 2018. Please search for funding opportunity number NOAA-NWS-NWSPO-2019-2005754 in https://www.grants.gov to learn more about this additional NOAA funding opportunity. CSTAR funds research that is often directed toward local forecasting applications at NWS Weather Forecast Offices, while OAR/OWAQ funds research that is often directed at national forecasting applications at NWS national forecast centers, though there can be overlap.

FULL ANNOUNCEMENT TEXT

I. Funding Opportunity Description

A. Program Objective

1. High Impact Weather Testbeds

Project proposals submitted to this competition will focus on applied research, development, and, in particular, the demonstration and testing of that research in NOAA's quasi-operational forecasting environment through engagement with one of NOAA's testbeds (http://www.testbeds.noaa.gov/) . The high impact weather focus areas included in this competition include tornadoes, severe wind and hail storms, tropical cyclones, heavy rainfall, winter weather such as heavy snow and ice, and flooding, including coastal, inland, and flash flooding. The three NOAA testbeds relevant to these focus areas and this competition are a) the Joint Hurricane Testbed (JHT), b) the Hazardous Weather Testbed (HWT), and c) the Hydrometeorology Testbed (HMT). Projects associated with other NOAA testbeds are not supported in this competition.

The High Impact Weather Testbed program, a component of the U.S. Weather Research Program (USWRP), supports projects that will transition applied research to NOAA's operations and services through close collaboration with NOAA testbeds. Close collaboration with the testbeds is critical and therefore required of all projects. The focus is on mature projects that are ready or nearly ready to be tested in a quasi-operational forecasting environment through one of the above testbeds. It is in these testbeds where project outcomes, such as new observing systems and data products, improved data analysis techniques, or better statistical or dynamic models and forecast techniques, will be presented to operational forecasters through the testbed and evaluated for potential future implementation in the National Weather Service (NWS) forecast offices at the local, regional, and/or national center levels to improve services to the public.

It is expected that NOAA's funding support of these new forecasting capabilities will speed the transition of this new research and technology into forecasting operations in the next three to five years in order to improve NOAA weather and water services for the public. Testbed projects that address improvements to NOAA's existing or near-term future technologies, e.g., numerical models or forecast techniques that NOAA already employs, are most appropriate for this funding opportunity as opposed to those that propose totally new revolutionary models or approaches that would not reasonably be expected to be operationally implementable within NOAA's existing operational framework in the next three to five years.

For additional testbed program information, please review the supplemental Information Sheet for the High Impact Weather Testbed competition in the grant package associated with this announcement at https://www.grants.gov.

2. Joint Technology Transfer Initiative

The U.S. faces a spectrum of high impact environmental hazards that cause havoc on people's lives and the nation's economy. Through improved forecasting of the events, better communication and preparedness, loss of lives and property damage can be reduced. While NOAA is the sole U.S. government authority for issuing official weather forecasts and warnings for life threatening events, the broader weather enterprise plays an important role in communication and dissemination of information tailored to specific customers.

Through this Joint Technology Transfer Initiative (JTTI) announcement, OWAQ/OAR/NOAA is seeking proposals to support further development, testing and evaluation of mature weather research that has potential for improving NOAA's NWS operational capabilities, particularly in the areas of advancing numerical weather prediction capabilities that seamlessly integrate in the NOAA Unified Forecast System (UFS), water prediction capabilities, and forecasting extreme precipitation and flooding events.

3. Air Quality Research and Forecasting

Air quality has improved significantly in recent decades following passage of the Clean Air Act in 1970. There are still many areas of the country, however, where the public is exposed to unhealthy levels of air pollutants and sensitive ecosystems are damaged by air pollution. This was especially evident this year when wildfires were numerous over large parts of Western North America and because of high surface ozone episodes during heat wave scenarios in the East. To help the nation mitigate these impacts, NOAA works with the Environmental Protection Agency (EPA), state and local air quality agencies, academia, and the private sector to provide sophisticated air quality forecast capability for the Nation called the National Air Quality Forecasting Capability (NAQFC).

The current NOAA operational forecast challenges for fine particulate matter (PM2.5) and ozone predictions include improving emissions from sources such as wildfire smoke and dust, chemical mechanisms (e.g., representation of secondary organic aerosols) that accounts for reactions from wildfire-associated species, accuracy of meteorological predictions for fields such as planetary boundary layer height and flows in complex terrain and near coasts, chemical boundary conditions, and tempo-spatially resolved trans-boundary influences.

These are among the challenges producing seasonal biases in air quality forecast guidance. Bias correction post-processing algorithms have been implemented operationally to reduce these biases.

For additional program information on the NAQFC and this competition, please review the supplemental Information Sheet for the Air Quality Research and Forecasting competition in the grant package associated with this announcement at https://www.grants.gov.

4. Verification of the Origins of Rotation in Tornadoes Experiment in the Southeast U.S. (VORTEX-SE)

VORTEX-SE is a research program intended to improve tornado forecasts and warnings in the southeastern U.S by obtaining new knowledge of atmospheric processes that are conducive to tornadoes, and of special importance, in the Southeast. This will be achieved through examination of historical data, special datasets collected in the field as supported by VORTEX-SE, and the application of state-of-the-art numerical weather prediction and data assimilation systems. Further, VORTEX-SE will explore avenues for more effectively communicating tornado forecasts to the public, and evaluate aspects of public vulnerability, risk perception and response to these forecasts in order to more effectively mitigate damage, injuries, and loss of life from tornadoes.

When examining measures of the threat posed by tornadoes to life and property, the southeastern U.S. has six of the eight most vulnerable states. Some of the vulnerability is due to issues such as a relatively large proportion of the population residing in mobile homes, which are known to be unsafe even in moderate strength tornadoes. Another above- normal risk in the Southeast is that many tornadoes occur during nighttime hours, associated with over half the deaths and injuries. Further, tornado casualties are disproportionately in the late fall and winter months, which are not typically associated with tornadoes according to conventional understanding or public perception, and they often occur under conditions of marginal thermodynamic instability but very strong vertical wind shear. Hence, there are many issues in the continuum spanning meteorological understanding to public awareness and perception that must be addressed in order to reduce the high tornado vulnerability in the Southeast.

For additional program information on VORTEX-SE and this competition, please review the supplemental Information Sheet for the VORTEX-SE competition in the grant package associated with this announcement at https://www.grants.gov.

5. Infrasound Detection of Tornadoes and High Impact Weather

This competition focuses on the specific technology of infrasound data collection and applications to the understanding, detection, and warning for tornadoes and high impact weather.

Innovative research over the past 40+ years has demonstrated the potential of infrasonic technology for the detection of a variety of geophysical phenomena, including tornadoes. Infrasound (specifically near-infrasound) is the range of acoustic frequencies just below the audible and approximately in the 0. 5 to 10 Hz frequency range. Infrasound can travel great distances with little atmospheric absorption (sometimes over 1000 km) but can take many minutes to an hour to travel these distances. It can take about five minutes for infrasound waves to travel only about 100 km.

Limited studies using Doppler radars and visual observations for verification have shown correspondence between the occurrence of tornadoes and the generation of infrasound from the same region as detected by specially-designed ground-based infrasonic observation networks deployed in the United States, mostly on the Colorado plains. Also there have been very limited studies addressing the potential of improved understanding of hurricanes, tornadoes associated with landfalling hurricanes, and related phenomena (e. g., land spouts) through infrasound data collection. There are many uncertainties due to the limited amount of data that has been collected to study the phenomena.

NOAA plans to support up to several studies under this program to improve our understanding of infrasound as it relates to the detection of tornadoes in the U. S., particularly the Southeast U.S., the potential operational forecasting and warning benefits, and the limits of temporal and spatial detectability with various infrasound observing network configurations (e. g., how precise can source locations be determined, measures of detectability and warning such as false alarm rate and probability of detection, etc.).

Because of limited available funding, NOAA will not support studies under this funding opportunity related to the engineering design and development of infrasonic observing sensor hardware. Infrasonic sensors in the desired frequency range have been developed and are available commercially. NOAA would support the deployment of sensor networks and collection of such data in the approximate 0. 5-10 Hz near-infrasound range from existing sensors. We are most interested in the follow up analysis of that data, through comparison with historic archived infrasonic data and other available coincident meteorological observation data leveraged from the concurrent VORTEX-SE field campaign or other available environmental data, that could produce meaningful practical results for NOAA’s mission and improved understanding with limited funding over a two year time span.

Projects appropriate for this competition would be at a Readiness Level (RL) ranging from RL 3 to RL 7 and have potential to transition to operations at NOAA or the weather and water enterprise within the next 3 to 7 years. NOAA Readiness Levels are defined later in this Section I.A.

6. Next Generation of Mesoscale Weather Observing Platforms

The National Academy of Science reports: Observing Weather and Climate From the Ground Up (2009), and The Future of Atmospheric Boundary Layer Observing, Understanding, and Modeling, Proceedings of a Workshop (2018) underscore the importance of improved observations of the lower atmosphere (a region that is not particularly well-sampled by satellites) to better understand and predict specific high impact weather events. Currently, the relative absence of high-resolution planetary boundary layer profiles impedes progress to meet this societal need. Therefore, this funding opportunity will focus on research and development to advance the next generation of operational mesoscale weather observing platforms needed by NOAA and its partners in the weather and water enterprise.

Projects appropriate for this competition should be at a Readiness Level (RL) ranging from RL 5 to RL 7 and have potential to transition to operations with proper life cycle considerations at NOAA or other components of the weather and water enterprise within the next 3 to 5 years.

7. Snowpack and Soil Moisture Observations and Data Assimilation to Improve the National Water Model (NWM)

In the United States and around the world, water security is increasingly in jeopardy. Too much water, too little water, or water of poor quality can endanger life, property, economies and ecosystems. The societal impacts are underscored by the 126 fatalities and $10.9 billion damage from flash floods and river floods in 2016 (http://www.nws.noaa.gov/om/hazstats/sum16.pdf). Data from 1980–2018 (as of July 9, 2018), shows there have been 29 flooding events with losses exceeding $1 billion (CPI-Adjusted) each across the United States. During this same period there have been 25 drought events with losses exceeding $1 billion.

In this context, NOAA is embarking on a comprehensive effort to give people, businesses, and governments better access to the water information they need for their unique circumstances, so that they may take appropriate actions to address water-related risks and manage their water resources more efficiently and effectively.

A cornerstone of this effort is the National Water Model (NWM) that was made operational in August 2016. The NWM is a collaborative effort among a number of academic and federal research partners. The basis for the NWM is the community-based Weather Research and Forecasting Model Hydrological modeling system (WRF-Hydro) framework developed by the National Center for Atmospheric Research (NCAR). The development and implementation of the NWM is the result of strong collaboration with NCAR and a partnership with the Consortium of Universities for the Advancement of Hydrologic Sciences, Inc., the National Science Foundation, and Federal Integrated Water Resources Science and Services partners. The NWM simulates the water cycle with mathematical representations of the different processes and how they fit together. This complex representation of physical processes such as snowmelt and infiltration and water movement through the soil layers varies significantly with changing elevations, soils, vegetation types and a host of other variables. Additional details on the NWM and WRF-Hydro can be found at http://water.noaa.gov/about/nwm and https://ral.ucar.edu/projects/wrf_hydro/overview.

Both snow depth (snow water equivalent) and soil moisture are important in the hydrologic cycle and as inputs to the NWM, but current measurements of both are spatially and temporally sparse and not well assimilated and parameterized into the physics of the NWM. Improving the efficiency, effectiveness, and accuracy of obtaining, and applying these measurements will improve the outputs of the NWM and the benefits to society. For example, the importance of snowpack to the nation's water budget cannot be overstated. In the Western U.S., 85% of freshwater runoff originates as snowmelt. In the Eastern U.S., nine of the most significant floods of the 20th century were directly related to snowmelt (https://www.weather.gov/news/162602-airborne).

Through this announcement, OAR's Office of Weather and Air Quality (OWAQ) is soliciting proposals to support research and development that has a strong potential to improve the observations of snow depth (snow water equivalent) and soil moisture data that can be used and assimilated to expand and improve the NWM and contribute directly to the mission of NOAA's National Water Center.

Projects appropriate for this competition would be at a Readiness Level (RL) ranging from RL 5 to RL 7 and have potential to transition to operations with proper life cycle considerations at NOAA or the weather and water enterprise within the next 3 to 5 years.

8. Subseasonal to Seasonal

OAR seeks to fulfill the subseasonal to seasonal (two weeks out to two years) requirements

of the Weather Research and Forecasting Innovation Act of 2017. The program will address a spectrum of issues on the subseasonal to seasonal time frame at various stages of research readiness, and will advance predictive capability and understanding of precipitation on the subseasonal to seasonal scale, via:
-improved data assimilation especially coupled data assimilation including new observation types,
-Earth system model processes for precipitation and high-impact events,
-ensemble techniques, composition, and post-processing, including multi-model ensembles.

The portfolio will emphasize models and components in NOAA's Unified Forecast System (UFS) and the North American Multi-Model Ensemble and ongoing multi-model ensemble efforts on the subseasonal to seasonal timescale. For proposals having equivalent scientific merit, preference will be given to projects working with NOAA's UFS.

For additional program information on Subseasonal to Seasonal prediction and this competition, please review the supplemental Information Sheet for the Subseasonal to Seasonal competition in the grant package associated with this announcement at https://www.grants.gov.

NOAA Readiness Levels

The above NOAA program objectives for each of the eight competitions describe overarching science gaps that we are targeting to address with our external partners in the next five years. More specific targeted program priorities are defined in the following section. To achieve success with these objectives in the end, we must advance this funded science and technology from the research stage all the way to practical applications, operations, and commercialization as appropriate. Readiness levels (RLs), as adopted by NOAA and other federal agencies, are a means to broadly classify the technical maturity of a project using a numerical scale from 1 to 9 and a corresponding progressive spectrum from research to development to demonstration to deployment. These RLs are defined in NOAA's Policy on Research and Development Transitions described in NOAA Administrative Order 216-105B at http://www.corporateservices.noaa.gov/ames/administrative_orders/chapter_216/216-105B.html in the context of NOAA's overall process for transitioning funded research into applications or operations or commercialization.

Regardless of whether your project outcomes are anticipated to be transitioned to NOAA applications, operations, or commercialization in the future, each proposal application submitted to one of the competitions listed above in this announcement must assess and

identify what is the current estimated RL for your proposed project and what will be the projected future RL upon project completion (see Sections IV.B.1(c) and IV.B.2(c)(4)). OAR routinely tracks the advancement of RLs of all funded projects as a measure of how successful we are in advancing research to practical benefits to the public. Readiness levels are defined below.

RL 1 (Basic Research): Basic research, experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundations of phenomena and observable facts, without any particular application or use in view. Basic research can be oriented or directed towards some broad fields of general interest, with the explicit goal of a range of future applications.

RL 2 (Applied Research): Applied research, original investigation undertaken in order to acquire new knowledge. It is, however, directed primarily towards a specific, practical aim or objective. Applied research is undertaken either to determine possible uses for the findings of basic research, or to determine new methods or ways of achieving specific and predetermined objectives.

RL 3 (Development): Proof-of-concept for system, process, product, service, or tool; this can be considered an early phase of experimental development; feasibility studies may be included.
RL 4 (Development): 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 (Development): Successful evaluation of system, subsystem process, product, service, or tool in relevant environment through testing and prototyping; this can be considered the final stage of development before demonstration begins.

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

RL 7 (Demonstration): 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 (Demonstration): 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.

RL 9 (Deployment): System, process, product, service or tool deployed and used routinely.

B. Program Priorities

NOAA's highest priorities for each of the eight separate competitions funded through this announcement are identified below. Applicants for a given competition below should clearly indicate and address in their proposal one or more of the associated priorities for that specific competition. Proposals not directly associated with one or more of these priorities are discouraged.

1. High Impact Weather Testbeds

The program priorities are listed below for each of the three testbeds funded through this testbed competition. Applicants should clearly indicate in their proposal the specific testbed(s) relevant to their proposal. Priorities that span multiple testbeds are listed below under the "Interdisciplinary Testbed Priorities" section.

Hydrometeorology Testbed (HMT) Priorities

HMT-1: Identify and validate new or improved methods, models, or decision support tools to improve probabilistic winter precipitation forecasts for snowfall amounts and/or ice accumulation, e.g., convection allowing models (CAMs) out to Day 3 and machine learning forecast tools. Improve the statistical reliability and spatial resolution of these probabilistic forecasts.

HMT-2: Identify and validate new or improved methods, models, or decision support tools to improve flash flood monitoring and forecasting, e.g. CAMs out to Day 3, machine learning forecast tools, or Weather Parameter in Context Tools. Improve the statistical reliability and spatial resolution of these probabilistic forecasts.

HMT-3: Identify and validate new or improved ways of enhancing forecaster use of probabilistic precipitation or ice accumulation short-range and medium-range forecasts, including 1) best practices for conveying the uncertainty inherent in these forecasts, including the possibility of different types of messaging for different time scales of meteorological phenomena and 2) assessing and communicating the likely impacts associated with these forecasts.

HMT-4: Identify and validate new or improved methods, observations, decision support tools, and models to improve understanding or evaluate forecast performance of extreme

precipitation events, from short-range forecasts extending into Week 2 forecasts.

HMT-5: Identify and validate new or improved methods, data assimilation, models, or decision support tools to improve utilization of precipitation forecasts and production of streamflow forecasts from NOAA's operational National Water Model (both deterministic and probabilistic). This could include evaluation of the existing NWM.

Hazardous Weather Testbed (HWT) Priorities

HWT-1: Identify and validate concepts and techniques to improve NOAA's convection-allowing/resolving ensemble forecast system performance from the rapidly updating, very short-term (next-few hours) through the next few days for tornado, large hail, damaging wind, lightning, and fire weather applications, including sensitivity to factors such as number of ensemble members, data assimilation methodology, experimental observation systems, scale-appropriate initial conditions and lateral boundary conditions perturbations, and physics diversity.

HWT-2: Identify and validate innovative post-processing and verification techniques for NOAA's deterministic models and ensembles across spatial and temporal scales to create skillful and reliable probabilistic thunderstorm and severe hazard threat guidance from the very short term (i.e., next hour) through the Day 8 forecast period in support of the FACETs (Forecasting a Continuum of Environmental Threats) concept. In addition to developing reliable techniques, projects may include assessment of the limits to predictability for these hazards.

Joint Hurricane Testbed (JHT) Priorities

JHT-1: Improved operational analysis of the surface wind field in tropical cyclones, including the analysis of center location, the maximum sustained winds, and winds affecting elevated terrain and high-rise buildings; as well as guidance for changes in tropical cyclone size/wind structure and related parameters, including combined sea heights. Maximum wind estimation enhancements could include improved utility of microwave satellite and radar data, modernization the satellite-based classification system for monitoring subtropical cyclones (e.g., the Herbert-Poteat Technique), and improved techniques for estimating the intensity of tropical cyclones passing over and north of sea-surface temperature gradients.

JHT-2: New applications of ensemble modeling systems for track, intensity and structure forecasting, including development of guidance on targeting supplemental observations (e.g., synoptic surveillance) that take into account hurricane forecaster use as well as data

assimilation needs and dynamically-based wind-speed probabilities. These could include techniques for day 6 and 7 forecasts.

JHT-3: Improved tropical cyclone intensity guidance including the onset, duration, and magnitude of rapid intensification events; over-water rapid weakening events; as well as statistically based real-time guidance on guidance for track and intensity, which could include multi-model consensus approaches provided in probabilistic and other formats, and estimation of intensity error bounds. These could include techniques for day 6 and 7 forecasts.

JHT-4: Guidance for tropical cyclone genesis including the following: techniques or products to support pre-genesis disturbance track, intensity, size, and wind speed probability forecasts; guidance for tropical cyclone genesis at both the short-range (0-48 hours) and the medium-range (48-120 hours) that exhibits a high probability of detection and a low false alarm rate for, and/or provides probability of, genesis; and techniques to diagnose and predict the formation of tropical cyclones via transition of non-classical disturbances, e.g. monsoon depressions, subtropicals, hybrids, etc., and to forecast track, intensity, and structure prior to tropical cyclone transition.

JHT-5: Advanced coastal inundation modeling and/or applications, visualization, or dissemination technology that enhances operational storm surge forecast accuracy or delivery.

JHT-6: Development of probabilistic wave height forecasts in tropical cyclones for a possible new public product geared toward the marine community.

Interdisciplinary Testbed (IT) Priorities

There are some priorities listed below that may span multiple testbeds among HMT, HWT, and/or JHT. If addressed in a proposal, it may benefit the proposed project if multiple testbeds were engaged where appropriate, though that is not required.

IT-1: (HMT and HWT) Identify and validate via quasi-operational testbed demonstrations new high temporal and spatial resolution in-situ and remotely-sensed observation datasets and dynamically consistent 3-D objective data analysis techniques to provide the best state of the current environment. This would lead to improve the detection, tracking, and analysis of severe convective and winter weather phenomena (tornado, hail, strong winds, precipitation type such as freezing rain, sleet, snow, etc.) and to support warning, nowcasts, and short-term forecasts for convective and winter weather hazards.

IT-2: (HMT, HWT, and JHT) Apply and integrate relevant social and behavioral science methodologies into the above testbed priority areas to improve forecasters' use of convection-allowing/resolving data, techniques, and guidance, as well as end-users' ability to receive, assess, understand, and respond to forecasts and warnings for convective, tropical, and winter weather hazards, including understanding and messaging of probabilistic hazard information.

2. Joint Technology Transfer Initiative (JTTI)

JTTI-1: Improving numerical weather prediction modeling through data assimilation (DA), post-processing, and verification capabilities to include:

JTTI-1(a): Efforts leading to improvement of forecasting through advancement of improved assimilation of new and current observations. The assimilation techniques preferably include development and testing of hybrid Gridpoint-Statistical-Interpolation-based ensemble data assimilation techniques for convective scale models and ensembles. The data assimilation efforts should be able to integrate in the Joint Center for Satellite Data Assimilation's Joint Effort for Data assimilation Integration (JEDI) system (http://www.jcsda.noaa.gov/). The new data sets may include in-situ data or remotely sensed data from ground-based, aircraft, unmanned aerial systems, space-based platforms, or high resolution cloud impacted radiances from current and future NOAA operational satellite such as GOES-16, GOES-17 and JPSS. Also solicited are DA efforts for ocean, sea ice and wind waves ("marine JEDI") both for initializing the corresponding model components, and for working toward coupled DA.

JTTI-1(b): Efforts leading to merging seamlessly the shorter and longer time scale modeling efforts in the Earth System Modeling Framework (ESMF) and Unified Forecast System (UFS) framework. The major presently-unaddressed gap identified in NOAA's capabilities is the assessment and development of high-resolution (10-13 km) global ensemble and DA capabilities. The central goal for NOAA to be addressed is to merge present 10-13 km operational models (GFS, RAP, NAM parent, SREF) into a coherent set of products and capabilities to enable convective scale modeling within the ESMF and UFS.

JTTI-1(c): Development, testing and evaluation of coupled model applications starting from presently-available coupled model prototypes for the UFS. Prototype coupled models presently available include various combinations of Atmosphere - Ocean - Ice - Wave coupling (FV3, MOM6, CICE5 and WW3), as well as wave-surge coupling (ADCIRC, WW3).

JTTI-1(d): Development, testing and evaluation of high resolution ensemble post processing and verification tools for the prediction of hazardous weather associated with convective storms, such as significant rainfall, flash flooding, hail, and strong winds. Also post-processing efforts leading to development of forecast verification techniques and tools for convective scale storms based on comparison of forecasts with analyses and observational data sets. These verification efforts associated with such techniques and tools must be compatible with or integrated in Developmental Testbed Center's (DTC) Model Evaluation tools (MET) (http://www.dtcenter.org/met/users/).

JTTI-2: Improving water prediction capabilities to include efforts to enhance hydrologic prediction through improved data assimilation and model extension for hydrological data sets into the NWS National Water Model (NWM) or other operational hydrologic model (e.g. HEFS) used at NOAA. These data sets include rainfall, snow, soil moisture, stream flow, and groundwater. Additionally, high RL capabilities to post-process model output in order to estimate flood extent and depth are encouraged.

JTTI-3: Improving extreme precipitation forecasting to include:

JTTI-3(a): Develop, test and evaluate improved methods, models, or decision support tools to advance prediction of extreme rainfall events, including the application of convection-allowing and ensemble modeling approaches, artificial intelligence, and statistical forecast tools.

JTTI-3(b): Develop, test, evaluate improved methods, models, or decision support tools to advance prediction of winter precipitation events (snow/ice accumulations, precipitation type transitions, cyclogenesis), including the application of convection-allowing and ensemble modeling approaches, artificial intelligence, and statistical forecast tools.

JTTI-3(c): Improved techniques to assess and quantify forecast uncertainty during the forecast process, and assess end user understanding of this uncertainty output.

3. Air Quality Research and Forecasting

A NOAA-sponsored workshop on the future direction of air quality forecasting research in November 2014 and other related workshops, publications, and operational forecasting experience over the past five years have identified the highest priority air quality forecasting science gaps that need to be addressed to improve NOAA air quality forecasting services over the next 5-10 years.

AQRF-1: Development and evaluation of high-resolution (1-4 km) air quality forecast capabilities that are consistent with NOAA weather forecast models at these resolutions, including two-way coupled models, for representation of local phenomena such as fine-scale processes in coastal region, over complex terrain, or in urban areas, especially those that take advantage of recent air quality field experiments.

AQRF-2: FV3 model-driven meteorological predictions will be used by NAQFC with on-line coupling in the near future. This future NAQFC system comprised of FV3 with an on-line EPA chemistry model should be developed and evaluated for both the warm and cool seasons for likely occurrence of poor air quality episodes. Investigations into the impact of use of the FV3 model with basic and advanced physics options are encouraged along with better understanding and improvement of model performance over urban, rural, mountainous and coastal areas.

AQRF-3: Improved spatial and temporal estimates of anthropogenic and natural pollutant emissions, including wildfire smoke and dust and other potential sources of model biases, using NOAA satellite remote sensing and other data sources

AQRF-4: Explore and quantify the potential value of ensemble model approaches and post processing to operational air quality forecasting

AQRF-5: Improved model representation in the FV3 model of physical/chemical processes for long range transport including lateral boundary conditions for regional models and regional/local phenomena for improvement in skill of ozone and fine PM forecast guidance

4. VORTEX-SE

Priorities for VORTEX-SE are established by considering input from a Scientific Steering Committee and through participation of the broader research and operational community in annual workshops and an online community forum. The forum can be joined at https://vlab.ncep.noaa.gov/web/vortexse, and the latest version of the Science Plan is available at http://www.nssl.noaa.gov/projects/vortexse/science2018.pdf. The VORTEX-SE program priorities, briefly described here, can be found in more detail in the competition Information Sheet in the grant package associated with this announcement at https://www.grants.gov.

VORTEX-SE-1: Storm processes affecting tornado potential. Processes that are associated with the occurrence of non-classical tornadoes (e.g., QLCS, convective clusters, embedded

supercells, etc.) continue to be of special interest in the VORTEX-SE. This topic includes radar-based climatology studies of these events and their signatures and precursors in conventional and polarimetric radar data. Observational studies utilizing already-collected VORTEX-SE data are encouraged, as are numerical simulation studies. No funds are available for new field observations via this competition; see the VORTEX-SE Information Sheet for details regarding possible future observing campaigns.

VORTEX-SE-2: Clarification of the scales and character of mesoscale processes that are associated with forecast uncertainty on all operational time scales. For example, 1) numerical studies using approaches such as Observing System Simulation Experiments (OSSE), Ensemble Sensitivity Analysis (ESA), data denial experiments, etc. to help inform future observation needs for both fundamental research and efforts to improve numerical prediction; 2) verification of the importance of variations in CAPE, thermodynamic stability, and vertical wind shear on scales of considerably smaller than 200 km in ways that locally enhance tornado potential in otherwise more benign-appearing environments. Use of data collected previously in VORTEX-SE, and during the November 2018 - April 2019 “Meso18-19” field campaign, is strongly encouraged.

VORTEX-SE-3: Studies of the interactions of the co-evolution of draft structure, radar and satellite signatures, and lightning flash character and frequency (e.g., using LDM and/or LNA data) in potentially tornadic storms.

VORTEX-SE-4: Tornadoes in landfalling tropical cyclones (LTC). To lay the groundwork for possible future field observations, we seek improved understanding of the antecedent environments that support tornadoes in the convective bands of LTCs and LTCs transitioning into extratropical cyclones.

VORTEX-SE-5: Understanding and reducing societal vulnerability to tornadoes. This topic has three main emphases that are of a strongly interdisciplinary nature: 1) investigating how physical, social, and economic factors interact to contribute to harm from tornadoes in the Southeast, and which intersections of factors are the most important contributors in different local and household circumstances; 2) understanding different populations’ capacities and current practices that can be utilized and leveraged to alleviate vulnerabilities and reduce harm from tornadoes in the Southeast; and 3) understanding the factors and decisions that enhance individual survival of tornadoes under different circumstances.

VORTEX-SE-6: Research on operational NWS and partners’ forecast and warning decision-making process, and public response. The two main emphases in this topic are 1) investigating forecasters’ interpretations and use of different types of information in

decisions about whether, when, and how to issue warnings and other products; and 2) understanding how probabilistic hazard and warning information affects the forecast and warning process and information gaps that contribute to uncertainty and challenges in decision making.

VORTEX-SE-7: Risk communication, risk perception, and information use in protective decision making (with a focus on members of the public and other end-users). This topic has three primary emphases: 1) understanding the interpretations and uses of probabilistic hazard information, warnings and other information by different members of the public in different circumstances; 2) understanding the perception, use, and interpretation of tornado information prior to and during the concurrent hazard scenarios of landfalling tropical cyclones; and 3) investigating intersections among information, vulnerabilities and capacities, and protective decision making.

5. Infrasound Detection of Tornadoes and High Impact Weather

The following program priorities are among the most important activities that NOAA would support to help demonstrate the potential value of infrasound technology for tornado understanding, detection, and warning, especially when applied to the Southeast U. S. Collection and analysis of new infrasonic data for strong and weak tornadoes in the Southeast U. S. during the project period are highly encouraged.

Infrasound-1: Demonstrate how infrasound information can enhance tornado threat predictive capability of the NWS (e. g., size, strength, lead time, location, etc.). The operational benefits to the NWS of infrasound for the detection and warning of tornadoes (including tornadoes from landfalling hurricanes) to improve warning lead time have been evaluated in the early 2000’s in coordination with NWS forecast offices in Colorado and Kansas but have not been fully studied. Working or partnering with NOAA or other meteorologists, in particular NWS Weather Forecast Office science personnel, is highly encouraged during the course of the project so that operational weather forecasters can evaluate the potential future benefits of this technology.

Infrasound-2: Measure infrasound from tornadic storms also scanned with Doppler and polarimetric radars and observed by lightning sensors and storm chasers and compare the data to relate the infrasound characteristic to the physical attributes of tornadoes deduced by these observations and to identify the radiating mechanisms responsible for infrasound generation. The physical mechanisms in tornadic thunderstorms that might generate these acoustic waves is uncertain but has been postulated to be caused by various sources, including radial vibration processes of the vortex core, flow instabilities, and corotating

multiple vortices. Past studies suggest some ability to determine vortex size and strength based on the frequency of the infrasound. Comparison with Doppler radar data is encouraged to confirm that infrasound signals attributed to tornadoes are indeed associated with radar-observed mesocyclone and/or tornado circulations and/or actual observed tornado tracks. How can the physical generating mechanism (e.g., tornadoes) be definitively identified, and how can false alarms from non-tornadic sources be identified and reduced to make sure that a tornado source is being isolated from other irrelevant sources?

Infrasound-3: Study infrasound propagation in complex atmospheric environments associated with severe weather (e.g., with outflow boundaries, mesocyclones, high shear) and in regions of complex terrain to determine detectability efficiency by ground networks. Past studies have focused on the high plains of Colorado and not in other diverse regions of the U. S. such as in the Southeast U. S where complex terrain and potentially complex ducting environments may have important effects on infrasound propagation and detection by ground-based observing networks.

Infrasound-4: Collect infrasonic data during VORTEX-SE observational field campaigns and other times and to leverage other existing ancillary environmental observations collected and funded through other sources.

Infrasound-5: Develop improved algorithms for real time processing of infrasonic data and subsequent display that present infrasonic data in quickly-accessible forms that can be easily interpreted by operational meteorologists.

6. Next Generation of Mesoscale Weather Observing Platforms

Mesoscale weather observing-1: Advancements in land-based remote sensing technologies and UAS based technologies are desired for mesoscale weather observing platforms. Specifically technologies that characterize boundary layer vertical profiles of water vapor, temperature, pressure, and winds, and the use of these observations with in-situ observations to obtain an optimal mix of observations to improve the detection and prediction of high-impact / disruptive weather events. Given that the relative absence of high-resolution planetary boundary layer profiles impedes progress in skillful predictions of high-impact / disruptive weather at the mesoscale, proposals should focus on technologies with the potential to improve the accuracy, reliability, spatial coverage, cost effectiveness, deployability, and sustainability of such observations for use by the National Mesonet Program and other federal and non-federal components of the weather and water operational enterprise. Example focus areas include advancements to networks of LiDARs and radio frequency profilers or the development and demonstration of emerging technologies for

distributed collaborative adaptive sensing that can be employed by observing networks such as radars and LiDARs. Other focus areas include advancements towards operationalizing UAS profiling of the lower atmosphere supporting mesoscale numerical weather prediction and other applications. Focus areas may also include advances in observing technologies for complex boundary layer environments (mountain, urban, and coastal).

7. Snowpack and Soil Moisture Observations and Data Assimilation to Improve the National Water Model (NWM)

Snow and Soil Moisture-1: Snowpack / Soil Moisture Sensor Technology

Advancements leading to improved surface-based or airborne-based observing capabilities of snow depth (snow water equivalent (SWE)) and soil moisture that can be used by or augment the National Mesonet Program, Airborne Snow Survey Program, SNOwpack TELemetry (SNOTEL), and other components of the weather and water operational enterprise to improve the initial conditions and/or validation of the NWM and WRF-Hydro.

This includes improvements in observing system accuracy and reliability, spatial and temporal coverage, cost effectiveness, data latency, deployment, safety, and sustainability. New satellite sensors are out of scope of this initiative. Example focus areas include advancements to snowpack / soil moisture observing technologies using: airborne (manned or unmanned) LiDAR survey technologies; and surface-based systems leveraging signals transmitted by Global Navigation Satellite Systems (GNSS).

Snow and Soil Moisture-2: Snowpack / Soil Moisture Data Assimilation and Physics Parameterization

Advancements leading to improved hydrologic data assimilation and physics parameterization of snow depth (SWE) and soil moisture into the NWM and WRF-Hydro. Example focus areas include: assimilation of data from the National Mesonet Program; automatic quality control methods for SWE and soil moisture observations; observation operators and observation error characterization for assimilation of SWE and soil moisture observations; and ensemble modeling of background error covariance for assimilation of SWE and soil moisture into NWM using Joint Effort for Data assimilation Integration (JEDI).

8. Subseasonal to Seasonal

The Office of Oceanic and Atmospheric Research (OAR) seeks to support resiliency of the

nation's economy, infrastructure, and security by fulfilling the subseasonal to seasonal (two weeks out to two years) requirements of the Weather Research and Forecasting Innovation Act of 2017. Through the Office of Weather and Air Quality, NOAA and OAR will address a spectrum of issues on the subseasonal to seasonal time frame at various stages of research readiness. The subseasonal to seasonal temporal range covers a wide range of phenomena with significant global and regional impacts on economies and human safety. The portfolio will emphasize models and components in NOAA's community-based Unified Forecast System (UFS) and ongoing multi-model ensemble efforts on the subseasonal to seasonal timescale within the North American Multi-Model Ensemble or its related subseasonal ensemble effort.

A particular focus will be on projects that support an increased understanding and predictive capability of precipitation on the subseasonal to seasonal scale via the following three areas. Applicants to this competition should clearly identify and address one or more of the following priorities in their proposal.

S2S-1: Improved data assimilation (DA) for individual Earth components (e.g. cryosphere, ocean, waves, land surface, and atmospheric composition) and the incorporation of new observation types on the subseasonal to seasonal scale. Foci include strongly coupled DA techniques, where observations in one component of the Earth system are allowed to directly impact the state estimation in other components, and subsequent post-processing of derived model output and analysis of DA schema impacting precipitation forecasts within the community-based Joint Effort for DA Integration (JEDI) project, which is central to the UFS DA strategy. Prospective projects are encouraged to leverage existing NOAA, WMO, and publicly available datasets.

S2S-2: Community-based approaches to improve Earth system models via development and evaluation of individual sub-elements within model components, single column modeling, limited area modeling, and more within the community-based UFS. Development and evaluation may focus on processes occurring within one component of the Earth system models, or on characterizing the component-to-component interactions, i.e. land-atmosphere, ocean-atmosphere, ocean-ice. Fundamental research may address attribution, implicit model bias, and progression of models participating in community ensembles that contribute to the predictive capability. Areas of focus may include a range of phenomena but projects addressing advances to precipitation prediction are prioritized.

S2S:3 Improving existing ensembles, via techniques to determine the optimal construction of those ensembles, leading to improved prediction skill and assessments of uncertainty for various phenomena, particularly precipitation and precursors to anomalous precipitation

events. Sophisticated ensemble methodologies might utilize various statistical regression, error reduction, and bias correction schema while incorporating other advanced, modern reanalysis and postprocessing techniques within the NMME or its related subseasonal ensemble effort. Prospective projects are encouraged to leverage existing NOAA, WMO, and publicly available datasets.

For proposals having equivalent scientific merit, preference will be given to projects working with NOAA's UFS, in particular with the community-based Joint Effort for DA Integration (JEDI) project, which is central to the UFS DA strategy.

C. Program Authority

Public Law 115-25 Weather Research and Forecasting Innovation Act of 2017

II. Award Information

A. Funding Availability

Based on anticipated or actual funding availability, it is expected that NOAA will fund projects with approximate numbers identified below for each competition. The total available funding and total per-project or per-project-per-year funding limits for each project for each competition are identified below and will vary from competition to competition. Please double-check that the requested funding amounts in your application's budget satisfy these stated maximum limits before submitting your application to a particular competition. Any proposal that exceeds the stated per-project or per-project-per-year funding limit below for the competition to which it is submitted will be rejected and not reviewed. For the case of collaborative multi-institution projects, the amounts identified below are total per-project (or per-project-per-year) amounts and NOT per-institution amounts. For information on the maximum project time period for each competition, please see Section II.B "Project/Award Period" below.

Funds allocated for each competition may be altered depending on the number and quality of proposals submitted within each competition. Funding of any proposal is contingent upon availability of these NOAA funds. "M" refers to millions of dollars. "K" refers to thousands of dollars.

1. High Impact Weather Testbeds
   Approximate total grant funding: $2.1M
   Expected number of funded projects: 7-9
   Maximum funding limit per project per year: $250K

2. Joint Technology Transfer Initiative
   Approximate total grant funding: $2.0M
   Expected number of funded projects: 7
   Maximum funding limit per project per year: $300K

3. Air Quality Research and Forecasting
   Approximate total grant funding: $0.7M
   Expected number of funded projects: 3
   Maximum funding limit per project per year: $250K

4. VORTEX-SE
   Approximate total grant funding: $3.0M
   Expected number of funded projects: 8
   Maximum funding limit per project over total project duration: $400K (please refer to the VORTEX-SE Information Sheet for information regarding appropriate budgets)

5. Infrasound Detection of Tornadoes and High Impact Weather
   Approximate total grant funding: $2.0M
   Expected number of funded projects: 4
   Maximum funding limit per project over total project duration: $500K

6. Next Generation of Mesoscale Weather Observing Platforms
   Approximate total grant funding: $2.9M
   Expected number of funded projects: 6
   Maximum funding limit per project over total project duration: $500K

7. Snowpack and Soil Moisture Observations and Data Assimilation to Improve the National Water Model (NWM)
   Approximate total grant funding: $2.0M
   Expected number of funded projects: 4
   Maximum funding limit per project over total project duration: $500K

8. Subseasonal to Seasonal
   Approximate total grant funding: $1.5M
   Expected number of funded projects: 7
   Maximum funding limit per project per year: $300K

B. Project/Award Period

The maximum time period of awards is identified below for each competition. Any proposal that exceeds the stated duration below for the competition to which it is submitted will be rejected and not reviewed. Also the recommended project start date is defined below for each competition. We recommend that you use this date as your project start date in your proposal. It is possible that in some cases NOAA may need to delay the start of some grant awards due to Congressional budget appropriations delays or other circumstances that would prevent formal grant award by the start date defined by the Principal Investigator (PI) in the proposal package.

1. High Impact Weather Testbeds
   3 years
   1 July 2019

2. Joint Technology Transfer Initiative
   2 years
   1 September 2019

3. Air Quality Research and Forecasting
   3 years
   1 June 2019

4. VORTEX-SE
   2 years
   1 September 2019

5. Infrasound Detection of Tornadoes and High Impact Weather
   2 years
   1 September 2019

6. Next Generation of Mesoscale Weather Observing Platforms
   2 years
   1 September 2019

7. Snowpack and Soil Moisture Observations and Data Assimilation to Improve the National Water Model (NWM)
   2 years
   8 September 2019

8. Subseasonal to Seasonal

3 Years
1 September 2019

C. Type of Funding Instrument

The funding instrument for these awards will be either a grant or a cooperative agreement. If it is proposed or anticipated that NOAA employees will be substantially involved in the research or implementation of the project, the funding instrument will be a cooperative agreement. Examples of substantial involvement may include, but are not limited to, applications for collaboration between NOAA scientists and a recipient scientist or contemplation by NOAA of detailing Federal personnel to work on proposed projects. NOAA will make decisions regarding the use of a cooperative agreement or grant on a case-by-case basis based on the nature of the work proposed in the application package. Projects submitted to the High Impact Weather Testbed competition or otherwise planning to utilize one of NOAA's testbeds are expected to be awarded as a cooperative agreement due to the expected substantial involvement of NOAA staff in the testbed demonstration testing.

For collaborative projects involving investigators from multiple separate institutions, separate awards will be issued to each institution that submits a winning proposal for those projects.

Proposals from NOAA federal employee scientists (where eligible) selected for funding shall be awarded by an intra-agency fund transfer. Proposals from a non-NOAA federal agency (where eligible) selected for funding will be funded through an inter-agency transfer. PLEASE NOTE: Before non-NOAA federal applicants may be funded, they must demonstrate that they have legal authority to receive funds from another federal agency in excess of their appropriation. The only exception to this is governmental research facilities for awards issued under the authority of 49 USC 44720(b). Because this announcement is not proposing to procure goods or services from applicants, the Economy Act (31 USC 1535) is not an appropriate legal basis.

III. Eligibility Information

A. Eligible Applicants

Eligible applicants are U.S. institutions of higher education; other nonprofits; commercial organizations; state, local and Indian tribal governments; and U.S. Federal Government agencies except in the VORTEX-SE, JTTI, and S2S competitions in which case U.S. Federal Government employees are ineligible. In those three competitions, U.S. Federal Government employees may serve as unfunded co-Is on applications where

substantial federal involvement is proposed.

Federal Government employees (including NOAA federal employees) may serve as PIs, co-PIs, or co-Is (if eligible as defined above) but are required to partner with one or more eligible non-federal institution(s) who would submit the application for the competition through https://www.grants.gov per instructions in Section IV.G “Other Submission Requirements”.

For those competitions where Federal Government employees are eligible, please be aware of the restrictions on requesting federal salary and other costs as described below in Section IV.F “Funding Restrictions”.

Applicants must ensure that they are eligible for the competition for which they are applying. Otherwise the application(s) will be rejected. Applications from non-Federal and Federal Government applicants, when eligible, will be competed against each other.

Any NOAA federal employee 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 lead PI(s) to be identified as a contributor to the proposed project prior to submission of the application. Do not add them without their explicit agreement to participate in your project.

B. Cost Sharing or Matching Requirement

No cost sharing is required under this announcement.

C. Other Criteria that Affect Eligibility

None.

IV. Application and Submission Information

A. Address to Request Application Package

Application packages for full proposals are available at: https://www.https://www.grants.gov/web/grants/applicants/apply-for-grants.html. There is no similar official application package for Letters of Intent (LOIs) other than the requirements identified below in Sect. IV.B.1.

B. Content and Form of Application

The instructions for preparation of LOIs and full proposals provided below are mandatory. Failure to adhere to these requirements will result in LOIs and/or full proposals

being rejected and returned without review.

1. Letters of Intent

Prior to submitting a full application package (proposal) for the competitions identified in this announcement, all PIs are strongly encouraged (but not required) to submit a pre-application to NOAA in the form of an LOI for each planned project (one single LOI only for joint projects from multiple institutions). The LOI should provide a concise description of the proposed work and a brief budget. The purpose of the LOI review process is to provide feedback to PIs regarding whether NOAA encourages them to submit a full application by assessing relevance and value of their proposed project to NOAA in advance of preparing a more lengthy full application. Full applications will be encouraged only for LOIs deemed most relevant to this announcement's priorities and potentially valuable to NOAA. However, PIs who do not submit an LOI or who are not encouraged by NOAA to submit a proposal after review of their LOI will not be precluded from submitting a full proposal.

(a) The LOI must be no more than two pages in length, using a 12-point font and one inch margins, and it must include a project header at the top with the following information: title, the name(s) of all PI(s) and co-PIs, their home institution(s), and the name of the specific funding competition identified in Section I to which they are applying.

(b) The LOI must contain a brief description of the intended project, methodology, timelines, and deliverables or project outcomes and its relevance to one or more of the specified priorities identified in Section I.B. Identify which specific NOAA organization is expected to be the recipient beneficiary of the project outcomes (e.g., a specific local weather forecast office, river forecast office, national forecast service center, etc.).

(c) Briefly describe the current technology Readiness Level (see Section I.A) of the proposed project at start-up and the expected readiness level at project completion.

(d) The LOI must include a brief budget which summarizes how resources will be allocated (e.g., salaries, computing and communications, indirect charges, and travel) along with a brief budget justification.

(e) For LOIs that include a request for NOAA high performance computing resources, PIs must include an estimate of needed processing and storage requirements.

(f) 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.

(g) All PIs who submit an LOI will be notified by NOAA whether a full proposal is encouraged or discouraged after the review of their LOI. Even though a full proposal may be discouraged, a PI is not precluded from submitting a full proposal. PIs will be provided upon request a short synthesis of the factors from the review that led to the recommendation.

2. Full Proposal

(a) The full application (proposal) must be dated and display page numbers. It must include a title page that identifies all of the following information: each PI and the respective institutional representative by full name, title, organization, telephone number, mailing address, e-mail address, the total requested funds for each annual period for each institution, and the desired competition from section I.A that it is being submitted to. If there are several institutions submitting separate applications for the same joint project, the names of ALL institutions along with their lead PI information and total requested funding for each annual period for each institution MUST appear on the title page of each of the separate joint applications.

(b) A one-page abstract must be included and must contain a brief summary of the proposed work to be completed. The abstract must appear on a separate page, headed with the proposal title and the name(s) of all PI(s) and collaborators and their institution(s).

(c) All proposals must provide a Statement of Work that includes:

(1) The proposed duration of the project (must be compliant with Section II.B limits);
(2) The proposed work must be completely described, including: identification of the problem to be addressed and its relevance to one or more of the specific NOAA science priorities identified in Section I.B; the conceptual framework; scientific hypotheses and objectives; results from prior research; proposed methodology and work plan; and operational applicability and past collaborations with the operational community. Proposals that involve testing in one of the NOAA testbeds must include a brief plan to evaluate the capability in the testbed. Include a reference list with the most important references (this list may be excluded from the maximum page limit count defined below).
(3) Project technology transfer outcomes and/or advancement in Readiness Level, and your performance measures of success. The benefits of the proposed project to the general public and the scientific community should also be discussed. Identify which NWS or weather enterprise group or organization is expected to be the ultimate recipient beneficiary of these project outcomes (e.g., local weather or river forecast offices, a national operational forecast

center, etc.). Be specific.
(4) Describe briefly the current technology Readiness Level of the project at start-up as well as projected end-state readiness level at project end (see Section I.A for definitions). There should be adequate description to justify why these RLs were selected. Per NOAA policy, development of a more comprehensive research-to-operations transition plan in coordination with NOAA will be required within 6 months after the project start date if the project is selected for an award and has a start-up or end-point RL of 5 or above.
(5) A timeline with key milestones for conducting the project and delivering the scientific and technical results throughout the course of the project;
(6) A brief description of travel associated with data collection, project meetings, testbed planning meetings, testbed experiments, and the presentation of results at scientific conferences as appropriate.
(7) If the proposed project is a continuation of a previously-funded OAR project, please reference the project grant award number, title, and period of performance.

The above Statement of Work items in IV.B.2.(c).1-7 must be fully contained within no more than TEN PAGES using a 12-point font and one-inch margins (the exception is the journal reference list in section IV.B.2.(c).2 above). For separate applications from multiple institutions for the same joint project, identical SOWs should be submitted in each separate institution's application, but they must clearly describe the work contributions of each funded PI. Additional required application content described below is not included in the page count defined above.

(d) Data Management Plan: 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.

(e) A Curriculum Vitae (CV) for all PIs and co-PIs with a reference list of all publications within at least the last three years must be included. CV's are optional for collaborator partners.

(f) Current and pending financial assistance support: Each investigator requesting funding support must submit a list that includes project title, supporting agency, investigator months, total dollar value and duration. Requested amounts should be listed for pending support. All investigators must verify that they will not be funded at greater than 100% of their time should their proposal be selected for funding, and NOAA will verify this requirement if funding is recommended.

(g) All applicants must submit a detailed itemized Budget Table broken out by year (in addition to the SF424A) and a Budget Justification that demonstrates cost effectiveness. It should include the PI's scientific and technical support staff salaries and fringe benefits, facility requirements, computing and communications, supplies and travel. The information on the SF-424A and this separate budget table must be consistent and should include only the amount of funding that will be provided to the institution submitting the proposal. It should not include budget information for PIs or co-PIs at other institutions who may be contributing to a joint project. However, in cases of multiple applications from different institutions associated with the same project, the Lead PI for the joint project should additionally include a separate Summary Budget Table in his/her application that displays the total SUMMARY budget for all partners on a joint project in addition to the detailed budget for his/her own institution. The summary budget table may be included on the proposal's title page as described in section IV.B.2.a.

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 Modified Total Direct Cost (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 Office
NOAA Grants Management Division
1325 East West Highway
9th Floor
Silver Spring, Maryland 20910
lamar.revis@noaa.gov

(h) For applications that are requesting use of NOAA's high performance computing platform, PIs must detail the needed processing and storage requirements.

(i) The full proposal package includes the information described above as well as the required federal forms: (1) Application for Federal Assistance (SF-424), (2) Budget Information - Non-Construction Programs (SF-424A), (3) Certifications (CD-511), (4) Assurances - Non-Construction Program (SF-424B), and (5) Disclosure of Lobbying Activities (Standard Form LLL). Applicants must use the Standard Form SF 424A Budget Information-Non Construction Programs that is contained in the standard NOAA Grants and Cooperative Agreement Package. Pay careful attention to show the yearly budget breakout

on the SF-424A for multi-year proposals.

(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.

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

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.

D. Submission Dates and Times

LOIs must be received by NOAA via e-mail no later than 5:00 p.m. Eastern Time (ET) on the date identified below. NOAA determines whether an LOI has been submitted before the deadline by the date and time on the e-mail. LOIs received after the deadline will not be reviewed, but in such cases PIs are still permitted to submit a full proposal. It is expected that NOAA response letters to all PIs who submitted LOIs by the due date will be sent via e-mail by NOAA on or near the dates listed below for each competition.

Full application packages must be submitted via https://www.grants.gov no later than 5:00 p.m. ET on the date identified below for each competition. Applications received after that time will be rejected and will not be reviewed. The date and time receipt indication from https://www.grants.gov will be the basis of determining acceptance for review processing by NOAA.

1. High Impact Weather Testbeds
   LOI due date: 9 November 2018
   Expected NOAA response date on LOIs: 30 November 2018
   Full application package due date: 14 January 2019

2. Joint Technology Transfer Initiative
   LOI due date: 26 October 2018
   Expected NOAA response date on LOIs: 16 November 2018
   Full application package due date: 21 December 2018
3. Air Quality Research and Forecasting
   LOI due date: 29 October 2018
   Expected NOAA response date on LOIs: 16 November 2018
   Full application package due date: 19 December 2018
4. VORTEX-SE
   LOI due date: 2 November 2018
   Expected NOAA response date on LOIs: 16 November 2018
   Full application package due date: 15 January 2019
5. Infrasound
   LOI due date: 18 December 2018
   Expected NOAA response date on LOIs: 23 January 2019
   Full application package due date: 20 March 2019
6. Next Generation of Mesoscale Weather Observing Platforms
   LOI due date: 15 November 2018
   Expected NOAA response date on LOIs: 18 December 2018
   Full application package due date: 20 February 2018
7. Snowpack and Soil Moisture Observations and Data Assimilation to Improve the National Water Model (NWM)
   LOI due date: 29 October 2018
   Expected NOAA response date on LOIs: 15 November 2018
   Full application package due date: 23 January 2019
8. Subseasonal to Seasonal
   LOI due date: 26 October 2018
   Expected NOAA response date on LOIs: 16 November 2018
   Full application package due date: 22 January 2019

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. NOAA is not responsible for proposal preparation costs.

NOAA will not accept proposals under the VORTEX-SE and Infrasound competitions for

projects predominantly related to the engineering development of new or improved infrasonic, radar, or other meteorological observational sensor hardware. Existing or off-the-shelf hardware or field experiment equipment is expected to be used where appropriate.

Proposals under the VORTEX-SE competition for obtaining new field observations (e.g. mobile Doppler, soundings, disdrometers, mesonets) will not be considered for funding in this competition.

Due to NOAA's shortage of high performance computing for research, investigators are strongly encouraged to seek computing resources from other sources and must realize that these resources may not be available for their project.

NOAA cannot, by federal regulation (31 U.S.C 6303), fund any research work through a federal grant or cooperative agreement in which the grantee proposes to develop or deliver to NOAA any tangible product deliverable beyond standard semi-annual progress reports and final reports, including software modules that the recipient might wish that NOAA would use for its operational forecasting mission. NOAA cannot fund nor accept any such award deliverables 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.

NOAA will not accept more than one proposal for any one or more of these NOAA competitions in Section I with identical (or effectively identical) statements of work (i.e., institutions or PIs cannot submit or be considered for more than one funded award among all eight competitions for the same or predominantly similar project and must abide by the per-project total funding limits specified in Sect. II.A). If NOAA determines that identical or predominantly identical proposals have been submitted to one or more than one competition, the one that is submitted first to https://www.grants.gov will be accepted by NOAA for consideration and all others will be rejected without review. Multiple proposals on different topics submitted to one or more competitions from the same PI or institution are permitted.

NOAA will not accept separate related proposals for collaborative projects among multiple PIs and/or institutions that are critically dependent on successful funding of another separate proposal from the same or another PI at the same or different institution to accomplish the respective proposed project objectives. In other words, NOAA funding decisions for any given submitted proposal should not and will not be contingent upon funding decisions of any other separate submitted proposal unless it is collaborative project with all contributing funded PIs identified on the title page and with funding requested in each respective

institution's application that satisfies the maximum per-project (or per-project per-year) funding limits defined in Sect. II.A. For these collaborative projects, a single project proposal must identify all funded PIs and co-PIs from all partnering funded institutions on the title page that will contribute toward a portion of that project proposal's collaborative objectives or outcomes.

For federal government employees (NOAA or otherwise) who may propose to serve as PIs or co-PIs assuming Sect. III.A eligibility, NOAA will not fund their federal salary costs. However travel costs or other reasonable and justified costs for eligible federal employee PIs or co-PIs may be requested to be funded as eligible costs. In these approved cases, funds will be transferred directly from NOAA to the federal employee's organization through either an inter-agency fund transfer (if statutory authority allows) or an intra-agency fund transfer from NOAA (see Section II.C). Any and all eligible costs associated with supporting a federal employee 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.

For projects desiring to use one of the NOAA testbeds, funding requests for NWS forecaster travel to any of the three NOAA testbeds to support the evaluation and demonstration testing of those testbed projects should not be included in the proposed budgets. However, the need for any such support should be coordinated off-line with the relevant testbed manager(s) who will request this funding for their testbed through a separate OWAQ proposal process for those grant projects that are ultimately funded. This coordination must occur as soon after the award recommendation decision as possible so the testbed managers can plan for the PI's needs in the coming year.

Proposal packages that do not satisfy the above restrictions will be rejected and will not be reviewed.

G. Other Submission Requirements

LOIs must be sent electronically to NOAA by e-mail to oar.owaq.competition@noaa.gov by the due date identified above. Complete application (proposal) packages from applicants must only be submitted electronically through the https://www.grants.gov website by the due date for the specific competition to which it is being submitted.

For multi-institution collaborative projects, separate proposal packages with identical Project Titles, identical Statements of Work, and identical project start dates must be submitted to

https://www.grants.gov by each collaborative partner or co-PI who wishes to be funded by NOAA. [An exception would be if the proposal's lead institution prefers instead to do a sub-award arrangement from that institution to their funded co-PIs, in which case only one project proposal would be submitted by the lead institution to https://www.grants.gov for that project.] All funded (and un-funded) co-PIs and their institutional affiliation, even if from a separate funded institution, must be clearly listed on the identical title page of all submitted proposals for a given collaborative project. The only differences between these multiple submitted proposal packages for a given joint collaborative project will be 1) each institution's separate budget information tables and justification which will apply just to their own institution's portion of the collaborative project, not the budgets for any other funded institution, and 2) any other institution-specific documents. Otherwise, all other proposal package components must be identical among all separate proposal submissions to https://www.grants.gov for a multi-institution collaborative project.

If a NOAA organization will be hosting a non-federal government PI or co-PI at a NOAA federal facility, e.g., a NOAA Cooperative Institute employee, the proposal must include a signed letter of commitment from that NOAA host organization's director if there is additional funding that they require to support the non-federal investigator(s) at their facility, such as costs for federal office space or computer access. These costs should be clearly identified and justified in the letter but not included in the non-federal PI's budget documents. These funds would be provided directly to the NOAA organization if the proposal is selected.

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 the CI 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 Specific Award Condition (SAC) that evidences the link between it and the CI award. The SAC would provide (1) that the university has submitted the proposal on behalf of the CI; (2) that the existing University/NOAA Memorandum of Agreement will be incorporated by reference into the terms of the competitive award, and (3) that any progress report(s) for the competitive award must follow the timetable of the funding program and be submitted by the CI directly to the funding program. Copies of these progress reports will be attached to the CI's performance report as an appendix.

Applicants are strongly encouraged not to wait until the application deadline data to begin

the application process through https://www.grants.gov. It can take between 3-5 business days or as long as 3 weeks to register with https://www.grants.gov if all steps are not completed in a timely manner, and registration is required only once. Users of https://www.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 https://www.grants.gov site. If an applicant has problems downloading the application forms from https://www.grants.gov, contact Customer Support at 1-800-518-4726 or support@grants.gov. To use https://www.grants.gov, applicants must have a Dun and Bradstreet Universal Numbering System (DUNS) number and current registration in the System for Award Management (SAM) system. Applicants should allow a minimum of five days to complete the SAM registration. Registration is required only once, but must be renewed periodically. In all, there are approximately eight steps needed to set up your organization's https://www.grants.gov account (see https://www.grants.gov/web/grants/applicants/registration.html).

V. Application Review Information

A. Evaluation Criteria

1. Importance/Relevance and Applicability of 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. The reviewers will consider the following questions in their assessment of this criterion:

(1) Does the proposal identify a clear problem or opportunity to be addressed that is highly relevant to the NOAA Program Objective and Priorities identified in Section I?
(2) Does the proposal identify and quantify the benefit or impact to the Program Priorities?
(3) Does the proposal identify an appropriate degree of collaboration with one or more potential NOAA or other operational units throughout the project? Are the proposed end-users identified and appropriate to the Program Priorities?
For the competitions that are focused on transitioning research outcomes to NWS or weather/water enterprise applications and operations (excludes VORTEX-SE, S2S, and Infrasound competitions), this additional review question must be considered:
(4) Is the proposed work both relevant to and feasible to transition to an NWS or weather/water enterprise operational forecasting service capability within 2-5 years? Is the proposed start-up Readiness Level in the appropriate range for the specific competition to which it is applying? Is the proposed path to operations realistic and achievable within the framework of existing NWS infrastructure and concepts of operations?

2. Technical/Scientific Merit (35 points)

This criterion assesses whether the approach is technically sound and/or innovative, if the methods are appropriate, and whether there is clear project schedule and deliverables. The reviewers will consider the following questions in their assessment of this criterion:

(1) Are the proposal methods and proposed solution technically sound and achievable?
(2) Will the proposed project improve technology, concepts, or methods that advance the field of study and eventually improve NOAA operations?
(3) Does the proposal employ novel concepts, approaches, or methods?
(4) Does the proposal include a clear schedule for milestones, deliverables, and advancing Readiness Levels?
(5) Does the proposal identify metrics for evaluating the success or failure?
(6) Does the proposal include a Data Management Plan as described in Section VI.B that adequately describes plans for data sharing?

3. Overall Qualifications of Applicants (20 points)

This ascertains whether the applicant possesses the necessary education, experience, training, facilities, collaboration environment, and administrative resources to accomplish the project. The reviewers will consider the following questions in their assessment of this criterion:

(1) Does the applicant have the necessary education, experience, training, facilities, and resources to accomplish the project?
(2) Does the applicant propose effective collaborative arrangements and partnerships to accomplish the project?
(3) Has the applicant demonstrated the ability to conduct successful research and research-to-operations transition programs related to the NOAA priorities in Section I.B and publish peer reviewed articles?

4. Project Costs (10 points)

This criterion evaluates the budget to determine if it is realistic, efficient, and commensurate with the project needs and time-frame. The reviewers will consider the following questions in their assessment of this criterion:

(1) Are the requested costs realistic, reasonable, allowable, allocable, necessary and

commensurate with the project benefits, deliverables, and time period?
(2) Has the applicant proposed cost-efficient ways of accomplishing the project?

5. Outreach and Education (5 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 reviewers will consider the following questions in their assessment of this criterion:

(1) Does the proposal include a plan for sharing project progress and results with the general public through a web site?
(2) Does the proposal include the publication of the results in a peer-reviewed publication and presenting results at a national conference or workshop?
(3) Does the proposal promote the education and field experience of undergraduate and graduate students, and/or are opportunities developed to share with K-12 educators?

B. Review and Selection Process

Once a full application package has been received, an administrative review will first be conducted to determine compliance with all submission requirements, completeness of the application, and general responsiveness to the NOAA priorities in Section I.B. If all requirements are satisfied and the application is responsive to at least one of the NOAA 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 eight competition category pools to which it was submitted. All proposals within a given competition category pool will be competed and ranked against each other. Independent peer reviews consisting of at least three subject matter experts per proposal who may be Federal and non-Federal Government employees will evaluate applications using the evaluation criteria specified in section V.A.

In the JTTI and S2S competitions only, there will be one independent peer review panel of at least 3 reviewers per proposal for Evaluation Criterion #1 in section V.A and a separate independent peer review panel of at least 3 other reviewers for Evaluation Criteria #2-5. For the other six competitions in this announcement, the same independent peer review panel of at least 3 reviewers will review all the evaluation criteria for a given proposal. In both cases, the independent reviewers' scores will be averaged for each evaluation criteria and summed to obtain the average total score for each application. These final scores for each application will be used to determine the rank order of the proposals for each of the competitions. The

OWAQ Director, who is the designated Selection Official for all competitions in this announcement, will make the final selection recommendations to the NOAA Grants Officer.

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

The merit review ratings shall provide a rank order to the Selecting Official for final funding recommendations. He shall recommend awards in the rank order of the review unless the applications are 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:
a. Geographically
b. By type of institutions
c. By type of partners
d. By research areas
e. By project types

3. Whether this 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 and/or 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

Applications should use the recommended date defined in Sect. II.B for a given competition as the start date for their proposed project. Review of applications will occur during the 2-3

months following the full applications due date for each competition. OWAQ anticipates that funding recommendation decisions on applications will be made during spring 2019 on a staggered schedule based on the proposal due date. Such decisions are contingent upon the final FY 2019 appropriation to NOAA by Congress and the final allocation of funds to OAR by NOAA and actions by the NOAA Grants Officer. NOAA's Grants Management Division will normally make award offers approximately a month before the planned start date for each of the competitions. Significant Congressional funding delays after the fiscal year begins may result in delays in the dates of both award recommendation decisions and the awards themselves and could result in awards offers not being distributed until after the proposed project start dates.

VI. Award Administration Information

A. Award Notices

Applicants will receive notification from OWAQ that their application has either been recommended or not recommended for funding to the NOAA Grants Management Division after completion of the review process. All applicants will receive their average scores for their application and overarching reviewer comments. Notices of recommendation for funding are not an authorization to initiate the project. Official notification of funding of the grant award, signed by a NOAA Grants Officer, will come typically two to three months later if approved and is the only official document that authorizes the project to begin.

B. Administrative and National Policy Requirements

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

LIMITATION OF LIABILITY. Funding for programs listed in this notice is contingent upon the availability of continuing Congressional appropriations. Applicants are hereby given notice that funds have not yet been appropriated 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.

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.

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 the National Environmental Policy Act (NEPA), for each project which seeks NOAA funding. Detailed information on NEPA can be found at the following NOAA NEPA web site: http://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.html and the Council on Environmental Quality implementation regulations.

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.

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. The form must be completed and submitted with grant applications for: (a) all for-profit and non-profit organization applicants (Part I, and if required, Part II); and (b) all non-Federal entity applicants anticipating receipt of $5 million or more in the current Federal Fiscal Year appropriated funding (Part II only). The form can be found at http://www.ago.noaa.gov/grants/forms.html.

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.

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.jpf and at http://go.usa.gov/hKbj.

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, 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.

DATA SHARING 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. Applicants 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.

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.

C. Reporting

Award recipients will be required to submit project performance (technical) and financial reports via NOAA’s Grants Online system. Performance reports must follow a

content template and guidance provided by NOAA/OAR. Collaborative project PIs should provide an identical report from each of the separate collaborating institutions that clearly identifies what work each institution did. All reports will be submitted on a semi-annual 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. The 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.

The Federal Funding Accountability and Transparency Act, 31 U.S.C. 6101, 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 general questions about this announcement, please contact Richard Fulton at NOAA-OAR-OWAQ at richard.fulton@noaa.gov. For specific questions about a specific competition, please contact the designated Federal Program Office identified below for each competition:

1. High Impact Weather Testbeds: Richard Fulton, richard.fulton@noaa.gov
2. Joint Technology Transfer Initiative: Chandra Kondragunta, chandra.kondragunta@noaa.gov
3. Air Quality Research and Forecasting: Richard Fulton, richard.fulton@noaa.gov
4. VORTEX-SE: Richard Fulton, richard.fulton@noaa.gov
5. Infrasound Detection of Tornadoes and High Impact Weather: Mark Vincent, mark.vincent@noaa.gov
6. Next Generation of Mesoscale Weather Observing Platforms: Mark Vincent, mark.vincent@noaa.gov
7. Snowpack and Soil Moisture Observations and Data Assimilation to Improve the National Water Model (NWM): Mark Vincent, mark.vincent@noaa.gov
8. Subseasonal to Seasonal: Jessie Carman, jessie.carman@noaa.gov

VIII. Other Information

None.