

FY25 COM, ERB, AC4 Program Information Sheet: Leveraging Uncrewed Systems Data for Climate Applications

Program Name

Climate Observations and Monitoring (COM) Program

Earth's Radiation Budget (ERB) Program

Atmospheric Chemistry, Carbon Cycle and Climate (AC4) Program

Program Missions

The COM, ERB, and AC4 grants programs are managed as part of the Earth System Science and Modeling (ESSM) Division of the NOAA Office of Oceanic and Atmospheric Research (OAR) Climate Program Office (CPO; see <https://cpo.noaa.gov>).

NOAA and its national and international partners invest significantly in developing global climate observing systems to address the needs of the research, forecasting, and assessment communities, as well as enable stakeholders and decision-makers to monitor and respond to changes in the Earth system. The COM program supports continuing, focused activities that leverage NOAA's large volume of in-situ and remotely-sensed observations to develop data products of essential climate variables and processes needed to understand the climate system on time scales ranging from days to a century, and longer. Primary objectives are to support work that 1) provides usable and findable datasets to enable further monitoring and modeling efforts by research and operational communities and 2) builds authoritative, long-term datasets and analyses for assessment activities.

The ERB program in CPO is the competitive research arm of NOAA's ERB Initiative to investigate natural and human activities that might alter the reflectivity of the stratosphere and the marine boundary layer, and the potential impact of those activities on the Earth system. ERB seeks to improve the understanding of aerosol impacts on Earth's energy balance through: establishing a capability to observe and monitor stratospheric conditions; detecting and accurately simulating the impacts of natural and human-caused aerosol injections in the stratosphere and troposphere; and deriving co-benefits for Earth system prediction through a better understanding of aerosols and clouds.

AC4 is a competitive research program in CPO that incorporates research on atmospheric chemistry and the carbon cycle. In collaboration with the NOAA Laboratories and the academic community, the AC4 program supports research to determine the processes governing atmospheric concentrations of trace gases and aerosols in the context of the Earth System. The

program aims to contribute a process-level understanding of the Earth System through observation, modeling, analysis and field studies to support the development and improvement of models and to inform carbon and air pollution management efforts.

Focus for FY25

In FY 2025, the COM, ERB, and AC4 programs are jointly soliciting proposals that leverage observational data from uncrewed aircraft, terrestrial, and marine systems, collectively known as uncrewed systems (UxS), for climate applications.

Funding for FY25

Pending funding availability in FY 2025, we expect to fund 7 to 8 proposals. Proposals should budget for up to \$200K per year over 2-3 years (total project costs should not exceed \$600K over 3 years).

Competition Information

Background

The [fifth National Climate Assessment \(NCA5\)](#)¹ report highlights the importance of *recently deployed observing systems for providing deep insights into recent changes in the Earth system, a deeper understanding of Earth's physical systems, and reduced uncertainty in climate projections*. According to the NCA5 report, “observations of the Earth system have been essential for constraining climate models” and “improvements in the number and quality of observational data products have also enabled new process-oriented metrics and diagnostics, which in turn enhance the validation of Earth system models (ESMs).”

Since the last assessment in 2018, recent rapid expansion in the availability of uncrewed aircraft and marine systems, collectively known as uncrewed systems (UxS), has expanded their innovative use for data collection across NOAA programs. Uncrewed systems are aerial, terrestrial, or marine vehicles and associated elements, such as sensors and communications software, that can execute data-collection missions without a human presence aboard. Congress directed the [NOAA Office of Marine and Aviation Operations \(OMAO\)](#) in Fiscal Year 2020 to improve and expand UxS operations across the agency, including creating an

¹[The Fifth National Climate Assessment](#). Leung, L.R., A. Terando, R. Joseph, G. Tselioudis, L.M. Bruhwiler, B. Cook, C. Deser, A. Hall, B.D. Hamlington, A. Hoell, F.M. Hoffman, S. Klein, V. Naik, A.G. Pendergrass, C. Tebaldi, P.A. Ullrich, and M.F. Wehner, 2023: Ch. 3. Earth systems processes. In: *Fifth National Climate Assessment*. Crimmins, A.R., C.W. Avery, D.R. Easterling, K.E. Kunkel, B.C. Stewart, and T.K. Maycock, Eds. U.S. Global Change Research Program, Washington, DC, USA. <https://doi.org/10.7930/NCA5.2023.CH3>.

[Uncrewed Systems Operations Center \(UxSOC\)](#) to help meet the objectives of the bipartisan [Commercial Engagement Through Ocean Technology Act of 2018](#) (CENOTE, P.L. 115-394)². NOAA uses UxS to sample diverse environments, such as the upper limits of the atmosphere, at the air-sea boundary, and in the depths of the ocean, ranging from the Arctic to Antarctica, and across the United States. Examples of UxS applications across NOAA include hydrographic and habitat mapping, ocean exploration, marine mammal and fishery stock assessment, emergency response, including tornado-damage assessment, and at-sea observations that improve forecasting of extreme events, such as hurricanes, harmful algal blooms, and hypoxia.

While existing UxS datasets are mostly limited to field campaigns with finite observing periods, NOAA is considering a variety of UxS platforms for operational use³. Therefore, it is important to assess the utility of UxS data for climate applications. For example, the [U.S. Argo Program](#), which is part of a larger international effort, showcases how autonomous, *in situ* observations can be used for climate monitoring and modeling efforts. According to a [National Academies of Sciences, Engineering, and Medicine Consensus Report Cross-Cutting Themes for U.S. Contributions to the UN Ocean Decade](#)⁴, “the global Argo profiling float program now gives scientists the ability to track critical climate parameters - temperature, salinity, and circulation - through the top 2,000 m of the ocean”, providing a quantitative description of the evolving state of the upper ocean. Argo data are also assimilated in ocean and coupled forecast models, improving weather and climate forecasts.

With the growing UxS portfolio across NOAA, there remains a fundamental need to synthesize existing UxS observations and develop climate-quality datasets for use by the broader scientific community. According to the [NOAA Uncrewed Aircraft Systems \(UAS\) FY22 Use Report](#)⁵, in 2022 alone, “over 1800 flights were conducted using over 30 UAS platform types...occurring in the upper reaches of the atmosphere and at the air-sea boundary.” The [2023 U.S. CLIVAR Report A New Paradigm for Observing and Modeling of Air-Sea Interactions to Advance Earth System Prediction](#)⁶ on the air-sea transition zone (ASTZ) found that “monitoring of the entire atmospheric column, including ASTZ through the troposphere, has been vital for improving forecast skill” and that “analyses are needed that combine, to a consistent grid...observations made at different times and places on satellite swaths, at fixed sites, and by drifting assets.”

To tackle the issues mentioned above, this competition is intended to facilitate interactions between NOAA science teams and the external research community involved in UxS-related research and operations, as well as NOAA data managers. **The focus of this competition is**

²[115th Congress \(2017-2018\): CENOTE Act of 2018](#). *Congress.gov*, Library of Congress, 21 December 2018, <https://www.congress.gov/bill/115th-congress/senate-bill/2511/text>.

³[NOAA Uncrewed Systems Focus Area: Strategic Plan](#)

⁴National Academies of Sciences, Engineering, and Medicine. 2022. *Cross-Cutting Themes for U.S. Contributions to the UN Ocean Decade*. Washington, DC: The National Academies Press. <https://doi.org/10.17226/26363>

⁵[NOAA Uncrewed Aircraft Systems \(UAS\) FY22 Use Report](#)

⁶Clayson, C.A., C.A. DeMott, S.P. de Szoeki, P. Chang, G.R. Foltz, R. Krishnamurthy, T. Lee, A. Molod, D.G. Ortiz-Suslow, J. Pullen, D.H. Richter, H. Seo, P.C. Taylor, E. Thompson, B.V. Boas, C.J. Zappa, and P. Zuidema, 2023: A New Paradigm for Observing and Modeling of Air-Sea Interactions to Advance Earth System Prediction. A US CLIVAR Report, US CLIVAR Project Office, 86 pp., <https://doi.org/10.5065/24j7-w583>

to fully synthesize and optimize the use of existing UxS observations for climate applications, with the overarching goal of developing climate-quality UxS datasets and improving data management and accessibility of UxS data across NOAA.

Details for Proposals

In Fiscal Year 2025, the COM, AC4, and ERB programs solicit proposals that will optimize the use of NOAA's (and other Federal or publicly available) existing uncrewed systems (i.e., UxS) related observation-based data (inclusive of aerial, terrestrial, and marine data) for climate applications.

Proposed projects should include a strong observation-based dataset/product development and/or observation-based analysis component. Examples of *dataset development and analysis* include, but are not limited to: data synthesis, integration of multiple variables and/or platforms, data rescue, data curation or compilation, and development of databases. Global and regional studies (atmospheric, oceanic, and terrestrial) are both eligible under this funding announcement. Collection of new observations and instrumentation development are not eligible under this funding announcement.

Project outcomes should demonstrate the utility of UxS datasets for climate purposes, including (but not limited to) verifying/evaluating reanalysis and satellite products (both short- and long-term products), ground-truthing satellite retrievals, validating results from high-resolution numerical simulations, testing parameterizations and processes in climate models, initializing climate forecast models, and UxS-related decision support (e.g., identifying space/time scales most important for data collection, planning sampling strategies, etc.).

In the context of climate applications, projects proposing to use UxS data are encouraged to consider one or more:

- Analyses of co-located UxS observations, both horizontally (e.g., across land and ocean regions) and vertically (e.g., spanning the air and water columns) from two or more types of uncrewed platforms (i.e., marine, terrestrial, aerial) in conjunction with gridded reanalysis or satellite products
- Well-documented synthesis studies, accessible archives, and/or tools to better access existing archives that would optimize the usage of multiple data types (e.g., field campaigns, observational in situ networks, satellite data)
- Improved QA/QC procedures for UxS data, such as standardizing file format and type, as well as targeted metadata information for contextualizing data and adjusting for biases
- Uncertainty quantification and assessment of errors or inconsistencies where observation-based datasets, reanalysis products, or observations and models disagree
- Improvements to existing datasets/products including improving the data's findability, accessibility, interoperability, and reusability, and/or the dataset's "analysis-ready" or "AI-ready" state

- Advancement of the responsible application of Artificial Intelligence and Machine Learning for earth system and climate science dataset development and analysis advancing [NOAA's Artificial Intelligence Science and Technology Strategy](#)⁷ and relevant reports (e.g., [National Academies report](#)⁸), within the context of the competition

NOAA Engagement

Proposal Stage: Applicants are not required to have a NOAA collaboration at the proposal stage. NOAA collaborators may be more relevant to some proposals than others. However, for proposals that aim to transition non-static products, datasets, and tools to NOAA during or after the duration of the project, collaborations are strongly encouraged at the proposal stage and should **include a statement (1 page or less) on the potential for the data product/set to be produced/maintained past the duration of the project (exclude from page count)**. In these cases, *applicants should demonstrate that the NOAA or NOAA partner operational host is integrated (aware, supportive of, and committed to planning for) into transition activities.*

Award Stage: Funded PIs from this solicitation will be expected to work together in a working group (frequency: bi-monthly meetings) overseen by the COM program manager that is focused on UxS-related data. The working group will provide a forum for PIs to collaborate on UxS-related projects, exchange science knowledge, and work collectively to improve data governance and management of UxS datasets in collaboration with data coordinators from NOAA's National Centers for Environmental Information (NCEI). Applicants should budget time for PI meetings. Those interested in leading or co-leading the working group are encouraged to indicate their interest in the Project Narrative.

Data Information/Sharing Plan Guidance

Analysis Ready Data

Applicants are strongly encouraged to follow F.A.I.R.⁹ guiding principles. Applicants are encouraged to use the [Earth Science Information Partners](#) multi-agency "AI analysis ready" [data checklist and guidance](#)¹⁰ as a tool to self-assess the extent to which project data are intended to be analysis-ready for future use by the broader scientific community. **Note: all checklist items may not be relevant to every project, and there is not a requirement or expectation that every dataset perfectly meet all checklist items.* Applicants are encouraged to outline how they plan to address "analysis-ready" data needs, if relevant to the project, in the data information/sharing

⁷[NOAA Science and Technology Focus Area: Artificial Intelligence](#)

⁸[National Academies of Sciences, Engineering, and Medicine. 2022. Machine Learning and Artificial Intelligence to Advance Earth System Science: Opportunities and Challenges: Proceedings of a Workshop. Washington, DC: The National Academies Press. <https://doi.org/10.17226/26566>](#)

⁹[Wilkinson et al. 2016. FAIR Guiding Principles.... Nature Scientific Data](#)

¹⁰ESIP Data Readiness Cluster (2022): Checklist to Examine AI-readiness for Open Environmental Datasets. ESIP. Online resource. <https://doi.org/10.6084/m9.figshare.19983722.v1>

plan. As noted in the “AI Analysis Ready” Checklist, and where relevant, applicants should consider developing and documenting uncertainty estimates for their data, which will advance its use by other science communities. Additionally, applicants are encouraged to consider creating interactive notebooks or tutorials using and accessing the resulting dataset or product. Applicants proposing to use AI techniques may be interested in joining the [NOAA AI Community of Practice](#) to share notebooks and other lessons learned.

Data Dissemination/Archival

All products and deliverables produced via solicitation will reside in the open access / open source domain, freely available to the public. Funding recipients should plan to submit data to [NOAA National Centers for Environmental Information \(NCEI\)](#), which will provide public access and archiving.

A recent Town Hall hosted by NOAA’s NCEI at the 2024 Ocean Sciences Meeting revealed that the No. 1 problem raised with UxS data is findability, a key component of F.A.I.R.⁹ guiding principles. Importantly, [NOAA’s Uncrewed Systems Strategic Plan \(2021 - 2025\)](#)³ requires the *creation of an inventory/database of UxS data NOAA currently has access to and those that are available through other agencies, academic institutions, and industry*, in line with NOAA Administrative Order 212-15B¹¹, but there is currently a lack of coordination between science teams, labs, and programs to achieve this goal. Per the award conditions, the program manager will facilitate conversations between PIs and NCEI data coordinators to develop a central repository for UxS datasets and tools resulting from this competition. The collective point of contact for UxS data services at NCEI is ncei.uxs.data@noaa.gov. More information on NCEI archive services can be found here: <https://www.ncei.noaa.gov/archive>. Projects adhering to state of art data management principles are highly relevant.

Contact Information and Submission Information

For questions related to the competition, please contact the Competition Manager Samantha Wills (samantha.m.wills@noaa.gov).

Letters of Intent (LOIs)

- Principal Investigators submitting a proposal in response to this joint competition announcement are required to follow the Letters of Intent (LOI) and Proposal preparation and submission guidelines described in the Climate Program Office FY 2025 Notice of Federal Funding Opportunity (NOFO) announcement.
- Investigators are strongly encouraged to submit an LOI prior to developing and submitting a full proposal. LOIs must be [submitted directly through this Google Form](#) to be considered for review. Investigators will be notified by the COM Program Competition Manager as to whether a full proposal is encouraged based on the LOI within four weeks of the LOI due date. LOIs are not required.

¹¹[NAO 212-15B: Management of NOAA Data and Information](#)

General Information

- A webinar will be offered to potential applicants soon after publication of this announcement. For information on webinar timing and registration procedures, please check the CPO FY25 NOFO Announcement.
- Administrative questions regarding the Notice of Federal Funding Opportunity (e.g., proposal formatting or submission guidelines) should be directed to Diane Brown (diane.brown@noaa.gov), please cc: samantha.m.wills@noaa.gov
- **Federal Investigators *only*** should submit proposals directly to the Competition Manager (samantha.m.wills@noaa.gov). Federal Investigators, please contact the program manager to discuss submission guidelines.
- For questions regarding administrative and/or grant submission issues, please contact the CPO Grants Specialist, Anne Li (anne.li@noaa.gov)
- Each PI and Co-I on the same project, but from separate institutions, should submit separate proposal applications through <https://www.grants.gov/>. **SUBAWARDS ARE STRONGLY DISCOURAGED** except in rare cases. Please contact the program manager if you anticipate the need for a subaward.