NOAA Climate Test Bed (CTB) Information Sheet
Advancing NOAA's Operational Subseasonal to Seasonal Prediction Capability

NOAA's operational prediction efforts are critical to supporting American lives, protecting resources, and promoting economic vitality. As part of NOAA's research Line Office, Office of Oceanic and Atmospheric Research (OAR), the Weather Program Office (WPO) supports world-class weather and air quality research aimed at saving lives, reducing property damage, and enhancing the national economy. WPO closely collaborates with the National Weather Service (NWS) to develop and transition weather and air quality research, including hurricanes, severe thunderstorms, heavy precipitation, fire weather, and air pollution. Together we work to enhance two-way collaboration, coordination, and feedback between operations and research to accelerate the pace of capability improvements. WPO supports research to improve the NWS National Centers for Environmental Prediction (NCEP) Climate Prediction Center (CPC) operational products through an NCEP partnership supporting the Climate Test Bed (CTB). Selected CTB projects are intended to test and demonstrate the potential for scientific advances from the external research community to improve operational climate predictions and public benefits derived from these research activities. The CPC delivers real-time products and information that predict and describe climate variations on timescales from weeks to years, thereby promoting effective management of climate risk and a climate-resilient society. The fundamental mission of the NCEP/NWS Environmental Modeling Center (EMC), in close collaboration with partners and stakeholders, is to maintain, enhance and transition advanced numerical guidance systems to operations for the Nation's weather/water/climate enterprise and the global community for the protection of life/property and the enhancement of the economy.

In the upcoming Fiscal Year (FY) 2024, WPO, in partnership with the CPC and the EMC, is seeking proposals from the external research community to advance the NOAA's subseasonal to seasonal prediction (S2S) capabilities with a preference toward proposed work that enhances precipitation outlooks through the CTB. The CTB supports advanced projects seeking to transition to operations, where testbed interactions and demonstrations in a quasi-operational environment are key aspects. Proposed research projects should focus on:

1. Improvements to data assimilation systems that support climate monitoring and prediction, particularly those related to ocean, sea ice, and land data assimilation using the Joint Effort for Data-Assimilation Integration (JEDI)[1]. Enhancements to current data assimilation (DA) systems toward a more strongly coupled DA system may also be considered, depending on the proposed readiness level. Additionally, proposed projects should aim to improve long-term reanalyses or existing reanalysis datasets to enhance current climate monitoring products, including drought monitoring.

2. Developmental activities to accelerate the S2S portion of the Unified Forecast System (UFS), with specifics outlined in the Strategic Implementation Plan[2] emphasis areas. This includes developing new methods or improvements to existing scale- and aerosol aware parameterizations using the Common Community Physics Package (CCPP), as well as implementing physically-based marine (ocean/sea-ice/waves) component stochastic perturbations for UFS S2S ensemble applications. Mathematical methods for process-level diagnostics and verifications as related to climate-scale modes of variability (such as Madden-Julian Oscillation, North Atlantic Oscillation, Quasi-Biennial Oscillation, El Nino-Southern Oscillation, etc.), improvements to UFS model components[3] are also encouraged.

[1] https://www.jcsda.org/jcsda-project-jedi
[2] https://www.weather.gov/media/sti/nggps/UFS%20SIP%20FY19-21_20181129.pdf
[3] https://ufscommunity.org/#/science/aboutapps

3. Model post-processing utilizing innovative statistical techniques and applications of existing statistical techniques, including Artificial Intelligence (AI)/Machine Learning (ML) methods. Model diagnostic and verification tools, particularly those compatible with or extending METplus, or those that help diagnose process problems, are encouraged. Diagnostics may focus on processes or modes of variability 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. These techniques should be applicable to existing operational NOAA numerical models and ensemble modeling suites, such as those included in North American Multi-Model Ensemble (NMME). Ideal projects will aim to support concepts such as multi-model combinations, extraction of information above currently employed methods, and potentially inform future ensembling strategies by informing optimization strategies.

Within each research area, proposals may focus on one or more of the specific aspects listed above. Projects should demonstrate relevance to strategic programmatic and agency directions[4,5], with a clear path to transition research outcomes to operational prediction systems. Proposed work will ideally lead to capabilities that will improve operational or experimental prediction systems, techniques, or products. However, research that will transition to operations in the next 3–5 years can also be included in the proposed work.

The CTB competition is most appropriate for projects that have reached the "demonstration" level of technical maturity, in other words being at Readiness Levels (RLs) of about 5 through 8 during the project's duration (please see the Appendix of the corresponding FY24 WPO Notice of Funding Opportunity for RL definitions). Consequently, proposals will be evaluated regarding relevance and connection to operational priorities, involvement of a CPC or EMC co-principal investigator, technical merit, research maturity, qualification of applicant, internal test plan/verification strategy, and project cost. Projects selected for funding from this announcement should be prepared to test and demonstrate their new capabilities during the project period. Proposed projects beginning at RL 7, with high potential to demonstrate transition to operations (RL 8) at the start of the two-year funding period will be given priority. Proposals should provide a discussion on anticipated outcomes upon successful operational implementation. Please note, transitioning a mature demonstrated capability from RL 8 to 9 is beyond the scope of our testbeds and funding opportunities, but could occur after the project ends if it is later approved for operational implementation. Projects that are projected to end at or below RL 7 may still apply; however, they must plan on seeking out additional funding sources at the end of the CTB funding period.

Funded projects will require a transition plan signed by the NWS and OAR Assistant Administrators, or their designees, to be developed following selection, due within six months of project start date. For guidance, please see NOAA Administrative Order NAO 216-105B[6] (section 3.06) and the accompanying procedural handbook[7] (Chapter 2, section D). To be eligible for funding, proposals must comply with all requirements for Climate Test Bed proposals as outlined in the Notice of Funding Opportunity (NOFO). This includes demonstrating relevant research with a goal of improving operational prediction or tools that can transition to operations. Proposals must also have an NCEP co-PI or collaborator on the proposal, explicit support from NCEP to access required data and models, and must use NCEP's metrics for evaluation. The proposal should thus identify where and how the research could transition to operations,

[4] https://www.weather.gov/media/wrn/NWS_Weather-Ready-Nation_Strategic_Plan_2019-2022.pdf
[5] https://owaq.noaa.gov/Strategic-Plan
[6] https://www.corporateservices.noaa.gov/ames/administrative_orders/chapter_216/NAO%20216-105B%20UNSEC%20Signed.pdf
[7] https://www.corporateservices.noaa.gov/ames/administrative_orders/chapter_216/Handbook_NAO216-105B_03-21-17.pdf

resources required for long-term maintenance (if applicable), and discuss viability and compatibility of the proposed research with NOAA IT and operational requirements.

Performance progress will be monitored throughout the project by the testbed staff and WPO through regular communications and periodic progress reports submitted by the PIs. Within 90 days after the conclusion of the project, an NCEP-WPO review will assess the feasibility of transitioning the project into operations. Therefore, the transition plan must include an indication that NCEP will support the NCEP co-investigator(s) to implement the new methodologies during the year following the project review, with operational implementation conditional on the review outcomes and at the discretion of NCEP. Completed projects that meet NCEP's metrics for evaluation and operational requirements (e.g., added value, ease of use, computational efficiency, etc.) may be selected later for operational implementation by appropriate NCEP operational offices.

Proposals are strongly encouraged to include support for a team member to work at NCEP as a visiting scientist. Projects with this component must include in their proposal (i) a clear timeline for the visit, (ii) the role of the investigator in the project, (iii) the identification of an NCEP sponsoring staff member, (iv) a request for adequate travel resources, and (v) a description of the resources required by the visitor along with a commitment from NCEP to accommodate them.

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