A Case Study of NOAA's Weather Program Office's 2023 Innovations for Community Modeling Competition

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1. Background

A case study was conducted for the FY2023 Innovations for Community Modeling competition funded by NOAA's Weather Program Office (WPO). The objective of this study is to analyze if the notion of innovation was accurately depicted within the Notice of Funding Opportunity (NOFO) descriptions. Insights were gathered from the Innovation Competition's information sheets, website, and associated webinar. A close examination was conducted on the language and context employed within the NOFO, and how WPO communicated the concept of innovation. Also, a smaller interview process occurred which involved four awardees from this competition. The interviewees selected were from either academia, the private sector, or government. They were asked questions regarding how they believe their project is innovative, their thoughts on the format of the funding opportunity descriptions, and the impact of their innovative research towards the advancement of Earth Prediction Systems. The responses from these interviews signify how WPO's actions within the innovation competition resonate with the perspectives held by WPO program managers, leadership, and the wider research community in terms of innovation.

The purpose of this case study is to examine the current practices used during a recent innovation-focused funding opportunity at NOAA's Weather Program Office (WPO). The goal is not only to review the existing approaches but also to use this study to develop recommendations for increasing the success of future innovation-focused funding initiatives. By speaking with the awardees of this competition, valuable insights were gained into the application process for a competition emphasizing innovative research only. Learning from their perspectives helps improve future innovation competitions by understanding the strengths and weaknesses encountered. Such insights help to refine future innovation competitions, select effective strategies, and optimize outcomes. This case study lays the groundwork for advancing our understanding of how to define, measure, and foster innovations in Earth prediction systems, which is work that was continued after this case study.

2. Introduction

This case study was a part of the research to define, measure, and foster innovations in Earth system predictions and guided the results of the study to be as accurate as possible. Those results formed insights from this case study, existing literature on innovation, and extensive

interviews with 20 stakeholders across the weather enterprise. That study had specific results in three key areas: defining innovation within Earth prediction systems, recommending innovation metrics for future Notices of Funding Opportunities (NOFOs) and within NOAA, and prioritizing initiatives to foster innovation among the Weather Program Office's employees and government stakeholders.

In defining innovation within WPO, the study found consensus around the definition of innovative research projects as those that introduce entirely new concepts, methods, or strategies that add value to Earth prediction systems. Each innovation needs to not only align with the Weather Program Office's goals but also with the goals of the end users of the innovation. As stated in the FY2023 Innovations for Community Modeling Competition, innovations funded should be higher risk and higher reward, marking a difference from regular funding competitions. The study highlights the need to prioritize innovations that go beyond incremental improvements on developments that already exist and create something transformative.

Regarding innovation metrics, the study proposed a set of organizational metrics aimed at encouraging experimentation and risk-taking among researchers. These metrics include progress report metrics for Principal Investigators (P.I.s), financial measurements to budget for higher-risk research, and metrics to measure diversity among awardees and reviewers. Additionally, the study outlines specific criteria for NOFO review, emphasizing factors such as mission value, time to transition, cost-benefit analysis, risk assessment, and user benefit.

To foster innovation within WPO's funding competitions, the study recommends expanding outreach efforts to attract diverse applicants and reviewers. It also advocates for a shift in mindsets to embrace risk and recognize the value of radical innovations. Furthermore, the study emphasizes the importance of building stronger inter-sector relationships within the weather enterprise, facilitating collaboration between academia, government, and private industry to accelerate the transition of innovative ideas into operational use. Ultimately, the success of these initiatives hinges on creating a collaborative environment that embraces failure as an integral part of the innovation process, thereby driving significant advancements in Earth system predictions.

3. Methods of Outreach

WPO had outreach for the funding competitions on three main sources of information. Their first form was through a formal information sheet that went into full detail of each

competition. They also posted a brief description of the NOFO for that year on the WPO website, and they uploaded an hour-long webinar video with a question-and-answer session at the end. After analyzing each form of outreach, it was noted that the three platforms had similar ways of conveying the Innovations for Community Modeling competition's description. They efficiently portrayed that the Innovations Competition was seeking high-risk, high-reward research. However, what qualifies as high-risk research in the government? It was clear that this competition was hoping to fund more cutting-edge science. The priority areas for this competition were stated in a way that was open-ended and allowed applicants to think of solutions on their own. Also, in the webinar, it was stated that this competition does not need to be something that is going to produce immediate results or even go into operations, but through this research, there can be a foundation for other ideas to spark and improve the UFS. As stated in the information sheet, "to qualify as innovative, proposals submitted to this competition must focus on substantially new approaches and not on incremental changes". However, a little more clarity on what exactly a substantially new approach or an incremental change is could help applicants understand if their research applies to this competition. Having a clearer definition of innovation in WPO and what 'high risk' is could better convey what WPO is looking for.

Also, through this case study, it was recognized that the review criteria is the same across all funding opportunities and is broken down into these categories:

- Relevance to Program Goals (33% of overall score)
- Scientific and Technical Merit (33%)
- Qualifications of Applicants (14%)
- Project Cost (10%)
- Education, Outreach, Diversity and Inclusion activities, and Integration (10%)

Especially for a competition like this, additional metrics are needed to measure how innovative the proposals are. This is where innovation metrics, such as those stated earlier in this paper, would be beneficial for reviewers to gain an understanding of what proposals are best suited for this competition.

Also, expanding the outreach of this competition to various groups of people could help bring in more innovations. Encouraging more researchers from places that WPO hasn't funded before helps broaden the perspectives and ideas for improvements towards the UFS and earth prediction systems alike. This need for more outreach can also be reflected in who the reviewers

are for these competitions. Finding ways to have people from different backgrounds care about WPO's NOFOs and want to volunteer to be a reviewer would broaden the opinions on what proposals should be selected.

4. Interviews with the Awardees

Although a goal for this paper would have been to interview all recipients of the Innovations Competition, there was only time throughout this investigation to interview four. Those selected were from different backgrounds and were working on different goals for improving the Unified Forecast System. After learning more about what each project entailed, most of the awardees interviewed were not creating a completely new system, but building off of the model that was already in place, testing new theories on it, or implementing new tools to it. With that, the research might not have been completely radical, but these projects were a step up from what the government typically looks for. One project eliminates assumptions that were in place about the model. Another project tests calibration methods for fire weather and gives users a clearer understanding of the forecast. The next project focuses on creating a tool that can integrate different parts of information into one variable, which can be valuable for both the forecasters and the model developers. The fourth person interviewed is working on the concept of hierarchy in western U.S. hydrology model developments and integrating pieces to test configurations quickly.

When questioned about their perceptions of innovation, these awardees agreed that it can involve entirely new approaches, but it doesn't necessarily always entail complete remodeling. P.I. 1 views innovation as optimizing available resources to make the most efficient solutions to existing problems, which may involve only making better use of existing processes. P.I. 2 similarly believes that innovation doesn't require an absolute new system, but must be a creative and new application to existing systems. P.I. 3's perspective on innovation within NOAA emphasizes practicality and a clear path to operations. Innovative research in NOAA is a new but well-thought-out research problem that has expectations to meet.

While all of these perspectives confirm the definition of innovation in WPO, the awardees uniquely emphasized that the innovation does not need to be radical to be awarded funding in these competitions. Future innovation competitions within WPO may strive to fund radical research, but it will take a lot of adjusting for any government office to fund research at that level.

This competition aimed for low-cost projects, so completely new system approaches might not be feasible. Although more medium-risk in the project itself, these projects selected aim to benefit several groups of people, which is a valuable metric and something to consider for innovative research according to P.I. 2. Other metrics for future innovation competitions were not mentioned during these discussions.

These P.I.s appreciated the efforts by NOAA's WPO to begin initiatives to change the risk-averse culture. P.I. 3 mentioned that sponsoring dissertation research through fellowships was a great way to further develop innovations. P.I. 4 believed that concentrating researchers on fewer projects at a time while providing the same pay for less time can accelerate the time it takes to develop one innovation. For Earth prediction systems such as the UFS, P.I. 2 recognized the advantages of user-friendly guides for comprehending new system advancements, which, in turn, could stimulate more innovations in model development and alleviate concerns about staying updated. P.I. 1 validates the importance of an inter-sector partnership in fostering innovation, aligning with the earlier discussed priority initiative for WPO and NOAA.

Those selected interviewees believe that the funding opportunity was worded sufficiently and it was a step up from what the government typically puts out for funding. The priority areas were vague enough that the researchers understood what type of research they were looking for while still not putting constraints on applicants. However, some believe that the competition was too vague on what would count as being innovative. P.I. 1 had never gone through the application process for a NOAA funding opportunity, so the biggest struggle for them was having more clarity on what the process would look like and how to fill out the associated forms. Overall, the people I interviewed felt confident in what the competition was looking for regarding research topics. For the future, interesting perspectives to interview would be from those who were not selected and how they understood the information sheets provided.

5. Applications to Future Notice of Funding Opportunities

Based on the discoveries through the interviewing process, WPO program managers and directors provided more of a specific role of innovation in WPO than what was provided in the Innovations for Community Modeling NOFO materials. The meaning of innovation at WPO as well as some of the innovation metrics they are using to score proposals from this competition could be better portrayed for applicants in future innovation competitions. During the webinar, the

fact that the research did not need to go into operations was better portrayed than on the information sheet, and that information could help applicants feel more comfortable with submitting riskier ideas. This case study showed that although the research selected was a step towards radical, it was still precautionary. WPO releases many funding opportunities that do not focus on innovation that incremental changes can be awarded. The awardees of this competition do have innovative approaches to changing Earth prediction systems, but the projects submitted for these specific innovation competitions should pass medium-risk and try to be even more high-risk, high-reward.