COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
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"Winning in Weather: U.S. Competitiveness in Forecasting and Modeling"

Written Statement of Dr. Neil Jacobs

Chairman Miller, Ranking Member Ross, and Members of the Subcommittee, thank you for the opportunity to testify at this hearing on a topic that is extremely important for the future of our country's scientific leadership.

Over the last few years, there have been several major successes owed to the Weather Research and Forecasting Innovation Act of 2017. Considerable progress has been made towards developing a community-friendly Unified Forecast System (UFS), which streamlines the software architecture, while embracing an open innovation approach that is mutually beneficial to the public, private, and academic sectors. This is a major paradigm shift because previous versions of code would only work on NOAA's internal supercomputers. Supporting the broader scientific community through public-private-academic engagement that grows the user base will not only result in greater access to innovative solutions that improve forecast skill, but it simultaneously trains the future workforce.

The Earth Prediction Innovation Center (EPIC) is the program charged with supporting this effort. The goal of EPIC is to empower the scientific community to develop, test and contribute their own innovations to the UFS through a transparent and objective evaluation process. This transformation is underway, but there is a lot more work that needs to be done. The UFS, which is a community model, still needs to finalize its governance that is by the community, for the community, in which NOAA is a critical stakeholder.

At its core, numerical weather prediction is an initial value problem. Correctly predicting the future behavior of any earth system requires high quality observations of its current state. Acquiring higher resolution observations with greater accuracy is essential. Many of these new observations are being produced by private industry. Commercial data buy programs, such as those used for GPS-RO, commercial aircraft data, or the National Mesonet Program, are a cost-effective way to greatly improve forecast model accuracy. While developing or acquiring data from more advanced observing systems is a critical step to improving forecasts, we cannot lose sight of an equally attainable opportunity, which is extracting more value from the data we already collect.

The process of data assimilation, such as the Joint Effort for Data assimilation Integration (JEDI) developed by the Joint Center for Satellite Data Assimilation, is often overlooked, yet it is one of the most important aspects of numerical weather prediction, where significant returns on investment are easily attainable.

One challenge we are facing is how to manage new data when those file sizes are growing exponentially. As files get larger, the transfer speeds get slower. The mission of the National Weather Service is to protect life and property, where often seconds matter. Increasing the latency of data availability, even if it is more accurate, is counterproductive. Whether it is satellite data, forecast models, or processing and visualization tools like AWIPS, cloud is the answer. We must evolve beyond a process that relies on moving data. Not only does cloud computing eliminate the latency problem, the elasticity of on-demand commercial cloud also eliminates the bottleneck of limited access to compute for research and development.

Efficiencies throughout the value chain of forecasting can also be gained from Artificial Intelligence. I am encouraged by NOAA's rapid adoption of various AI and deep learning techniques and would like to thank the Committee for supporting this emerging capability in the Weather Act Reauthorization.

While these are a few technical gaps that need to be addressed, there are broader overarching aspects that are essential to accelerating progress. Workforce recruitment, retention, and development is a growing challenge. There are very few opportunities for the current workforce to upskill or reskill to adapt to rapidly evolving technological advancements. While software engineering is a common field at most universities, finding engineers with a solid understanding of atmospheric physics and dynamics is not easy. Additionally, the programming skills needed for model development are similar to those required in other job markets where the starting salaries are far more competitive. There are a growing number of earth system science degree programs within U.S. universities, but many are limited in their ability to introduce student to model code. Versions of the UFS, through support of NOAA and the National Science Foundation, are being developed for use in the classroom as a teaching tool. Being able to run a global model without access to a large supercomputer was unimaginable just a few years ago; however, we now have versions of the UFS that can run on the public cloud as well as a laptop. While this is a game-changing capability to train the future workforce, we are just now approaching the start line of this race.

Chairman Miller, Ranking Member Ross, and Members of the Subcommittee, thank you again for inviting me to participate today. I would be pleased to answer any questions you may have.