Written Testimony

John W. Nielsen-Gammon, Ph.D.

Regents Professor, Department of Atmospheric Sciences, Texas A&M University

Texas State Climatologist

Director, Southern Regional Climate Center

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Protecting Lives and Property: Harnessing Innovative Technologies to Enhance Weather Forecasting

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1. Introduction

Chairman Franklin, Ranking Member Amo, and members of the Subcommittee on Environment:

Thank you for the opportunity to testify before you today regarding the **Weather Research and Forecasting Innovation Reauthorization Act of 2025** (hereafter, the **Weather Act**). I appreciate all you do to help Americans avoid dangerous weather and to help us make well-informed decisions regarding the risks that weather and climate throw at us.

My name is John Nielsen-Gammon. I am a Regents Professor of Atmospheric Sciences at Texas A&M University in College Station, Texas. My comments and testimony today reflect my own viewpoints and perspectives and not that of my employer.

While my original area of specialization was in weather and weather forecasting, I have served as the Texas State Climatologist since 2000 and as the Director of the Southern Regional Climate Center since 2021. The Southern Regional Climate Center is funded by the **National Oceanic and Atmospheric Administration (NOAA)** through a competitive process, and much of my weather and climate related research is funded by **NOAA** as well.

My group's research involves extreme weather risks, particularly droughts and floods, and their impacts on such sectors as agriculture and energy. Our tools include historical observations, physics-based models, and machine learning. As State Climatologist and Regional Climate Center Director, I help translate the data and forecasts of **NOAA** into

products and information of particular relevance to the many weather-sensitive government activities, industry sectors, and citizens and residents of the State of Texas and the southern United States. More broadly, I served from 2022 to 2024 as the President of the American Association of State Climatologists, and I am an Editor of the Journal of Applied Meteorology and Climatology.

Today I'd like to discuss a few examples from my personal experience of how **NOAA's** weather-related activities, particularly the ones contemplated in the **Weather Act,** are critical to the well-being of Texas and the rest of the United States.

2. Drought

Every week, our office collects information from our **National Weather Service (NWS)** offices and local stakeholders on drought within the state of Texas and makes recommendations to the author of the **US Drought Monitor**. The **US Drought Monitor** is produced jointly by **NOAA**, the US Department of Agriculture, and the National Drought Mitigation Center. Having an accurate **US Drought Monitor** is critical not just for situational awareness for farmers, water suppliers, and wildland firefighters -- it is the basis for hundreds of millions of dollars annually in drought relief from the USDA to ranchers, so our office works to ensure that those relief funds go specifically to the people who deserve them.

One day I received a call from a rancher reporting severe drought conditions at his ranch and wondering why the **US Drought Monitor** wasn't indicating the presence of drought there. I looked into it, and found that the only nearby rain gauge was way at the other end of his county, and that according to the **NWS** weather radar network it had received several thunderstorms that the rest of the county had missed. His drought just wasn't visible in the standard tools. So with funding from the USDA and **NOAA**, we developed a way to take the precipitation estimates that the **NWS** makes from radar data for the sake of flood forecasting and convert it into measurements of drought severity and its variations within individual counties. **NOAA** now supports real-time delivery of that drought tool for the entire United States through the Southern Regional Climate Center. This is an example of data that **NOAA** collects and analyzes for one purpose turning out to be essential for other applications.

In addition to research funding, the **Weather Act** authorizes funding for the **National Integrated Drought Information System (NIDIS)**. We work directly with **NIDIS** through its Southern Plains Drought Early Warning System to improve the ability of folks in Texas, Oklahoma, and Kansas to understand, anticipate, and deal with drought. Just last week, we participated in **NIDIS's** latest Southern Plains Drought Update Webinar, where we painted a picture of current conditions and interpreted **NOAA's** forecasts and seasonal

outlooks as they relate to drought development or reduction this summer and fall. With **NIDIS**, we're finalizing a report on the Southern Plains drought which began in 2021, looking at how lessons learned from earlier droughts have been applied to reduce the impact of the current one.

The **US Drought Monitor** is based on percentiles: how unusual is the current drought compared to droughts of the past? An emerging problem is that droughts are becoming hotter. So how are you supposed to compare a drought from the 1950s, say, to a present-day drought that might have more precipitation but hotter temperatures? We have a project specifically to look at that and come up with answers, and it has been recommended for funding under a joint program with **NIDIS** and **NOAA's Oceanic and Atmospheric Research (OAR)**. We're hoping to dive into that next year, pending funding of **NIDIS** and **OAR** such as would be authorized by the **Weather Act**. We're finishing up another **OAR** project this year, looking at extending our record of droughts back in time to better understand what the atmosphere is capable of and what sorts of possibilities people should be planning for.

3. Extreme Rainfall

Unfortunately, in Texas, droughts often end with floods. And floods are not just Texas's problem, as we've seen in Kentucky this year and Georgia, North Carolina, and Tennessee last year. In Texas, the impetus for creating the TexMesonet was a flood in central Texas in 2015 when rain fell upriver where no real-time rain gauges were available. Since then, the State of Texas has installed over a hundred mesonet stations, recording weather, rainfall, and soil moisture conditions every few minutes.

The State of Texas has focused on filling gaps in the existing real-time observing network, whose weather stations are primarily located at airports. Radar is a great tool for monitoring rainfall, and the **Weather Act** would help move **NOAA** forward in replacing the existing radar network with state-of-the-art technology, but radar can only estimate rainfall rates and it can't follow the rainfall all the way to the ground. So, many states install and operate mesonets to monitor on-the-ground weather conditions for public safety, agriculture, and many other applications. This data is then available for the **National Weather Service** to detect emerging severe weather threats, provide ground truth for the radar estimates, and improve warnings of hazardous weather.

State climate offices in many other states operate mesonets, and we're grateful for the **National Mesonet Program**, included in the **Weather Act**, for helping to offset some of the costs of operating the mesonets and ensuring that the data remains of high quality. We're going to see the value of such data continue to grow as artificial intelligence, trained on

local high-density observations, will in turn be able to provide rapid-update forecasts at high spatial resolution.

The **Weather Act** also includes provisions for **NOAA** to purchase data from the private sector. The private sector is driving a lot of innovation in observations, and it's great that **NOAA** can take advantage of that, especially if the data and documentation, known as metadata, is publicly available and accessible. At Texas A&M, we're far from any **National Weather Service** radars, and replacement parts for our research radar no longer existed. So we worked with a private company, ClimaVision, who installed a brand-new Doppler radar on the roof of our building. That radar now provides coverage of local rainfall and thunderstorms for emergency managers, broadcast meteorologists, and the **National Weather Service**, and its data helps train our own students as they become the next generation of weather forecasters.

4. Severe Weather

We're subject to all sorts of severe weather in Texas, and the **National Weather Service** is critical to how we deal with that. They work closely with our Division of Emergency Management, embedding personnel in our state-level Emergency Operations Center and coordinating with broadcasters, emergency managers, and other state and county officials. Communication of weather warnings and emergencies is challenging, especially in states with large immigrant populations, some of whom may not be fluent in English or understand the particular types of weather hazards that we experience. Even former Californians don't understand our weather hazards unless they've lived here for a while. The emphasis in the **Weather Act** on effective communication of weather hazards, with techniques based on sound science, is critical for ensuring that people understand the weather situation when their lives are at risk.

The **Weather Act** also outlines several research programs on severe and high-impact weather, focusing on hurricanes, tornadoes, and atmospheric rivers. I'm personally grateful that the VORTEX tornado research program is expanding from the Southeast to become **VORTEX-USA**.

I also like the continuous evaluation of observation needs that the **Weather Act** calls for. In Texas, accurate short-range forecasting of severe weather requires knowing the environment in which severe weather is developing. In a typical severe weather outbreak, most of the air over Texas has recently arrived there from Mexico. Along the entire southern border of the US, from San Diego to Brownsville, there are only five upper air weather balloon sites operated by the **National Weather Service**. That's not enough to really understand how severe weather is going to develop. A better mix of observations, carefully chosen to provide critical information during high-risk days, would improve public safety in

Texas and enable better weather forecasts downwind across the central and eastern United States.

5. Conclusion

In my prepared testimony, I've highlighted a few examples where **NOAA** observations, research, collaborations, and weather forecasts and warnings provide critical benefits to society. There are many more that I could mention were time to permit it. Weather affects everyone, and high-quality data, models, scientific knowledge, forecasts, and warnings enabled by the **Weather Act** will help us take advantage of the good weather and deal with the bad. Thank you again for the opportunity to share these examples with you.