United States House of Representatives
Select Committee on the Climate Crisis

Hearing on June 9, 2022
"Turning the Tide for Ocean Climate Action:
Unleashing the Climate Benefits of Our Blue Planet"

Questions for the Record

The Honorable Richard W. Spinrad
Under Secretary of Commerce for Oceans and Atmosphere and
NOAA Administrator
National Oceanic and Atmospheric Administration

The Honorable Kathy Castor

1. **Many of the critical ocean observations and science that the United States invests in are utilized to inform climate modelling. These models are vital tools to help scientists and policymakers understand complex systems and test potential solutions. Can you explain how climate models are developed and tested and evaluate the accuracy of U.S. climate models that are utilized to guide climate policy?**

The span of NOAA's modeling portfolio reflects the span of its unique world-class mission from the surface of the sun to the depths of the ocean. Climate models are based on well-documented physical processes to simulate the transfer of energy and materials through the climate system. Building and running a climate model is a complex process of using satellite and on the ground (in-situ) observations and scientific studies to identify and quantify Earth system processes, representing them with mathematical equations, setting variables to represent initial conditions and subsequent changes in climate forcing, and repeatedly solving the equations using supercomputers.

To develop the models, NOAA scientists use objective tools to determine which measurements are to be used in analyses. They apply rigorous quality control and quality assurance measures, which are subject to peer review in producing analyses and model-observations comparisons. Temperature and salinity measurements are used to calculate Ocean Heat Content (OHC), one of the most important climate variables.

Climate models can be tested using a process known as hindcasting. This process runs the model for a period of time in the past. The model results are then compared with observed climate and weather conditions to see how well they match. This testing allows scientists to check the

accuracy of the models and, if needed, revise their equations. Science teams test and compare their model internal process calculations and overall outputs to observations and results from other models to improve the representation of the processes and interactions leading to climate states including variability and changes.

Climate models are further evaluated against other international models in the peer-reviewed literature and as part of the Intergovernmental Panel on Climate Change (IPCC), Sixth Assessment Report (AR6) evaluation of climate models compared to observations. Independent assessments of NOAA's climate models routinely report that they are among the best performing in the world.

NOAA remains committed to continuously improving models for future use. For example, with enhanced ocean model resolution, climate models can achieve excellent simulations of global weather and climate extremes. Increased observations and evaluation of surface climate and ocean heat content can improve key aspects of the overall model development. Each of these efforts to improve models includes dozens of comparisons with global satellite and in-situ observations. Further, historical model-predicted trends in high-impact events, such as droughts, floods, and wildfires, are compared against long-term trends observed in climate data records to provide confidence in future predictions.

To make the findings of climate models accessible to the public and decision-makers, we published the Sea Level Rise Technical Report earlier this year. The findings included in this multi-agency report were used to develop new information and tools such as the interactive Sea Level Rise Viewer and NOAA Sea Level Rise Portal, which offers tools, services, and educational materials.

One of the best examples of facilitating climate information is the U.S. Climate Resilience Toolkit (CRT), which was designed and developed to help decision-makers at all levels of government, businesses, community leaders, and managers of natural and built environments understand their climate-related risks; and to help them produce and implement a climate resilience plan. The site offers regional and topical information excerpted from the U.S. National Climate Assessment (and other authoritative sources), a compendium of free tools from across the Federal government, a library of real-world case studies, a mapping and graphing tool for exploring county-scale climate projections (the Climate Explorer), and a "Steps to Resilience" framework to help guide people through the process of producing and implementing a resilience plan.

NOAA's climate models can help us understand how the climate could change in the future. NOAA produces actionable climate projections and helps inform societal decisions for today and tomorrow. There is a critical need for improved projections of how climate will change on regional scales through the next several decades. This period of time covers a rich decision space for city planning, urban and rural infrastructure, natural resource and energy management,

emergency management, national security, finance and insurance, and numerous other policy areas for understanding carbon neutrality. These models and the information they provide for decision makers are key to helping meet the Administration's climate goals.