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U.S. Senate Committee on Commerce, Science, and Transportation
Nominations Hearing on June 8, 2022
Questions for the Record

Michael Morgan, to be Assistant Secretary for Environmental Observation and Prediction,
Department of Commerce

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Ranking Member Roger Wicker

Question 1: The University of Southern Mississippi is a leader in the use of uncrewed maritime systems. Uncrewed maritime systems are a highly cost-effective way for NOAA to collect many more observations. Studies have shown increased ocean temperature observations dramatically improve hurricane intensity forecasts.

- Will you work with me to ensure observations from unmanned maritime systems are incorporated into weather models?

Response:

The forecast process is enhanced if all available, relevant observations are incorporated into weather models. If confirmed, I will work with you and other partners to advance modern ocean technology and increase NOAA's use of uncrewed maritime systems and the relevant data from these platforms in NOAA's operational suite of models.

Question 2: People who lose their homes in a storm or flooding event may not receive compensation, even with flood insurance, if the cause of damage is undetermined between water and wind hazards. The COASTAL Act required NOAA to work with FEMA to reduce legal conflicts over the determination of whether storm damage was caused by flooding or wind. The President's FY 2023 Budget eliminates COASTAL Act funding.

- Would you commit to working with me to ensure this important work continues?

- The Named Storm Event Model and Coastal Wind and Water Event Database is 92% complete. Are you aware of any barriers to finishing this important work?

Response:

I have experienced first-hand the ravages of extreme weather on my home and personal property. If confirmed, I commit to working with you to ensure that NOAA's work with FEMA is carried out consistent with the requirements of the COASTAL ACT.

If confirmed, I will work to understand and report to you any barriers to completing the database and model that are specified in the COASTAL ACT.

Question 3: NOAA's P-3 aircraft, known as the Hurricane Hunters, provide critical information for accurately forecasting hurricanes. The aircraft are rapidly reaching the end of their service life, yet the President's FY 2023 Budget failed to provide funding for their replacement.

- Do you agree that the P-3s provide critical information?

- Does NOAA have an updated aircraft recapitalization plan? If confirmed, can you commit to ensure that Congress receives the new plan promptly?

- Can you provide information on when that plan will be delivered?

Response:

Yes, NOAA's P-3 aircraft provide critical operational information concerning storm location, motion, intensity, and structure of the hurricane wind field. Additionally, these aircraft provide valuable information for researchers to better understand the inner workings of hurricanes.

If confirmed, I will ensure that Congress receives information on the disposition of any updated aircraft recapitalization plan as expeditiously as possible and will share the plan with Congress once it is completed.

Question 4: A toxic workplace culture can put the scientific enterprise and the stewardship of our nation's natural resources in jeopardy. As was seen most recently at the Office of Science and Technology Policy, leadership within the agency sets the tone for the rest of the workforce. We have heard that there have been issues of disrespect and a toxic work environment within NOAA.

- Do you share my concerns about the work environment at NOAA?

- How would you ensure that there is a culture of respect in the workplace, particularly for women and minorities?

- Do you pledge to respect and protect whistleblowers if they come forward with concerns about workplace culture?

Response:

I share your concerns that a toxic work environment can put elements of NOAA's mission – its scientific enterprise as well as its stewardship of natural resources in jeopardy. Furthermore, I agree that agency leadership set the tone for the workforce. Everyone should feel safe, protected, respected, and included at work.

I will not tolerate any actions that contribute to a toxic work environment and I commit to working with NOAA leadership, line offices, and the Workplace Violence Prevention and Response Program so we can identify the risks, prevent incidents, and respond appropriately.

I pledge to respect and protect whistleblowers if they come forward with concerns about NOAA's workplace culture. All workers should feel confident that their right to express concerns about workplace culture will be unimpeded and that those concerns will be heard and addressed.

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Response: <u>Senator Mike Lee</u>

<u>**Question 1:**</u> As someone who will be responsible for converting data observations to predictions related to weather and climate if confirmed, I'd like to hear your thoughts regarding assumptions of stationarity and non-stationarity in prediction models.

- In your view, what factors are considered when employing a non-stationarity assumption?

- How do non-stationarity and stationarity assumptions each affect predictions of climate and weather?

- Should predictive models assume non-stationarity? If so, on what basis?

Response:

Stationarity of a system would refer to the statistics of that system being invariant with respect to a shift in time. The earth system is not a stationary one as key natural and anthropogenic forcings (e.g., solar radiation and greenhouse gases) to the system are not stationary, and internal system feedbacks allow for changes in the statistics of the system. Despite the variability of these inputs and feedbacks, a non-stationarity assumption may be vaild if both 1) the time scale of variation of the inputs are much longer than the time scales of weather and climate prediction; and 2) the robustness of the feedbacks is weak.

To my knowledge, explicit use of assumptions of stationarity and non-stationarity are not common. What is important for predictions of weather and climate are accurate representation of physical processes and forcings – some of which may not be stationary.

For the purposes of weather prediction or climate projection, it is not clear that an assumption of stationarity or non-stationarity is necessary. Fundamental fluid dynamical equations are well-understood and modeled – note the success of day-to-day numerical weather prediction. A well-modeled non-stationary process would likely be superior to modeling the process as stationary - If the relevant physical processes are well understood and if the modeled representations of these physical processes are accurately coded. Processes that are either not well understood or that cannot be accurately represented in the models (e.g., physical parameterizations) will inevitably contribute to uncertainties in weather and climate model output.

If confirmed, I would be happy to talk with you more about these issues.

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Senator Rick Scott

Question: Florida has experienced several hard-hitting hurricanes that devastated our communities. We know first-hand that preparedness saves lives, and NOAA's work to develop and improve weather predictive services has been critical to our preparedness efforts.
- How do you plan to improve NOAA's weather forecasting services to ensure families have the best information to stay safe?

- How do you plan on communicating that information to both urban and rural areas?

Response:

I understand and appreciate the challenges of living in a region of the country that experiences extreme weather, such as hurricanes. NOAA's predictive, warning, and outreach capabilities are central to its mission to protect lives and property from the devastating effects of hurricanes and all other types of extreme weather.

If confirmed, I would promote advancements to NOAA's observational infrastructure, improve weather models internally and by engaging private sector expertise, and increase NOAA's computational capacity. I would also focus on the workforce needs - including proper staffing levels with commensurate training - to ensure that NOAA has the capacity to produce highly accurate forecasts and disseminate them to the public as timely as possible. Additionally, I would work ensure that model developers and software engineers are brought in as necessary to update the forecast model code on a regular basis so NOAA can take full advantage of computing upgrades.

Finally, working with social scientists, I would identify ways to improve NOAA's outreach across the nation to ensure communities get weather warnings in an understandable and actionable manner and with enough advanced warning to allow them to make sound decisions about their personal safety.

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<u>Questions for the Record from Hon. SINEMA to DR. MORGAN</u>

Drought and Fire Monitoring at NOAA. Fire season began in late April in Arizona, as the
Southwest experiences the most severe drought in twelve hundred years. The Tunnel Fire north
of Flagstaff burned over twenty thousand acres while the Crooks Fire consumed over six
thousand acres south of Prescott. In recent days, three new fires have erupted outside of
Flagstaff. Arizonans rely on National Weather Service predictions and National Oceanic and
Atmospheric Administration data to predict fire trajectory and to determine impacts to
landscapes and human health. It is important that NOAA and the Weather Service have the
resources and expertise needed to predict weather and drought conditions.

<u>Question 1.</u> The bipartisan infrastructure law included $80 million dollars for NOAA high-
performance computing technology and $50 million for wildfire prediction, detection, and
forecasting. How will these resources allow NOAA to improve drought and wildfire prediction
forecasting?
Answer:

*NOAA's mission includes fire weather research and developing and transitioning fire weather
products to help communities better detect and respond to fire weather. More support is needed
in order to improve forecast models and increase NOAA's work with users, including by continuing
to deploy Incident Meteorologists (IMETS) to major wildfires, with the latest computer technology
they can use to provide critical on-site forecasts.*

*NOAA's Hazard Mapping System provides at-risk populations with general information about the
location of threatening wildfires and smoke. The bipartisan infrastructure law (BIL) will enable
higher resolution around wildfire locations so that affected communities can prepare and react
more quickly.*

*If confirmed, I will work with Congress to implement the $100M in the BIL and additional funds in
the 2022 Disaster Supplemental for NOAA's work on wildfires.*

Drought Monitoring, Response, and Inter-Agency Cooperation. As the Southwest continues to
face historic drought, we must use every available tool to assess the length and severity of

drought conditions. The National Integrated Drought Information System has been helpful to me when determining policy responses for drought-stricken areas, but we can always improve.

Question 2. Will you commit to coordinate drought response with other agencies, particularly the
Department of Interior, Bureau of Reclamation, and the Department of Agriculture?
Answer:

If confirmed, I commit to coordinate drought response with all relevant Federal agencies including Department of the Interior, the Bureau of Reclamation, and the Department of Agriculture.

Question 3. If confirmed, how can you make this interagency process more effective so drought mitigation policies can be targeted for maximum impact of federal dollars?
Answer:

Coordinating a timely and effective interagency response so that drought mitigation can be targeted for maximum impact of federal dollars requires 1) an interagency agreement on the goals of the response and 2) a requirement that the expectations of each agencies' contribution to the effort is matched with the unique capabilities and missions of the participating Federal agencies.

Heat Health. 552 people died in Arizona from heat-related causes in 2021, and nearly 2,800 passed away over the past 10 years from heat-related causes. Heat waves are getting worse, with record temperatures set this past weekend in Arizona. Saturday, June 11 saw a high temperature of 114 degrees Fahrenheit coupled with an overnight low of only 90 degrees Fahrenheit.

Question 4. How will you ensure that the National Integrated Heat Health Information System provides the most timely and helpful data and monitoring to the people of AZ?
Answer:

If confirmed, I will ensure that NOAA's contribution to this important activity with the Centers of Disease Control and other partners continues to include improved forecasting capabilities, enhancement of necessary and relevant observational and monitoring capabilities, and work with communities to better understand their unique needs with respect to NIHHIS activities and communications. I look forward to working with your office to understand the unique concerns of residents of your state.

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Questions for the Record from Senator Jon Tester to Dr. Michael C. Morgan

NEXRAD. Dr. Morgan, thank you for your willingness to serve NOAA in this role. Americans are well aware of how weather and climate affect our economy and our day-to-day lives. NOAA's observation and analysis capabilities are critical to accurate forecasts and appropriate risk response.

In 2019, in response to a legislative requirement, NOAA submitted a report to Congress assessing NEXRAD radar coverage as it relates to extreme weather events like tornados and flash floods. The report identified several areas of the continental U.S. where there are significant gaps in weather radar coverage – including large parts of eastern and southwest Montana.

NOAA's report concluded that these gaps did not significantly compromise NOAA's ability to forecast tornadoes and flash floods in these areas. However, the report did not take into account other types of natural emergencies like winter storms or wildfires.

The simple fact is that many Americans live in regions where these radar gaps persist, and so we need to prioritize closing them to ensure we have the best possible understanding of severe weather events nationwide.

Question: Please describe how NOAA under your leadership would prioritize improvements in its observational infrastructure. Will you commit to working to close the identified NEXRAD radar gaps to ensure we have the data coverage we need to forecast and track extreme weather nationwide?

Answer:

If confirmed, I would commit to ensuring that NOAA has the necessary observational assets and forecaster training to ensure that it can issue accurate and timely forecasts and warnings for all parts of our Nation.

Observations are foundational to NOAA's science and operations – including the issuance of forecasts and warnings. NOAA's weather forecast and warnings to protect lives and property are among the most critical work the agency does and is supported by the Weather Research Forecasting and Innovation Act of 2017 that drives NOAA's improvements in this area. I look forward to working with you to continue to implement this Act.

Improving weather and climate forecast and warning capabilities will take an all-of-the-above approach, with advances needed in observations - including next-generation radar, modeling,

high performance computing, dissemination systems, scientific research, and employing the best-trained forecasters that deliver the impact-based decision support to end-users.

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Questions for the Record Submitted by Chair Maria Cantwell to Dr. Michael Morgan

Supercomputing. The European weather forecast model outperforms the American forecast model by providing more accurate three to seven-day forecasts and better prediction of the location of hurricane landfall compared to the American Model. The National Oceanic and Atmospheric Administration ("NOAA") has identified the need to increase their supercomputing power by 32-times over the next three years to support both the research and operational weather needs of NOAA and its community partners.

Question 1: What do you consider the key components of an actionable strategy to ensure that NOAA supercomputing capacity keeps pace with the growing science and modeling needs of our climate and economy?

Answer:
The key components of an actionable strategy to ensure NOAA's HPC is commensurate with advancing science and the modeling needs of both climate and economy include:

1) *Training and hiring software developers and engineers to continually upgrade computer modeling code so that the models can exploit the expected advances in HPC (e.g., exascale computing) that are now emerging. Legacy codes may run a bit faster, but if they are specifically engineered for the upcoming computing platforms, significant acceleration of models is possible.*

2) *Establishment of scientifically-based, realistic long-time horizon, benchmarks for computing that consider where the science capabilities are and recognize that computing is needed not only for operational model runs and associated data assimilation, but also for reanalysis, research, and model development.*

Question 2: I included $80 million for supercomputing in the Infrastructure Investments and Jobs Act ("IIJA"), but more needs to be done. I am concerned that NOAA doesn't have a comprehensive strategy for short and long term investments in supercomputing capacity with detailed information on additional resources needed. What would NOAA's HPC strategy look like, and how would you work with stakeholders, such as tribes, universities, and state governments to ensure it supports the broader weather, climate, and academic communities?

Answer:
A comprehensive strategy for HPC recognizes that computing is needed not only for operational model runs and associated data assimilation, but also for reanalysis, research, and model

development. The strategy should also consider the appropriate mix of physical hardware purchases and cloud-based computing services and the relative costs for each.

I would conduct stakeholder assessments of needed resources, computing experiences, and needed training to ensure NOAA's HPC systems are as effective and up to date as possible.

Extreme Weather Communication. Increases in extreme weather events cause hundreds of deaths, cost billions of dollars annually, and threaten food, water, energy, and economic well-being. One of the major obstacles we face in reducing the loss of life and property from extreme weather is streamlining information delivery so that communities receive more accurate, clear, and timely warnings. The importance of advancing social and behavioral science across NOAA's weather enterprise cannot be overstated. Developing a deeper knowledge about diverse communities is critical to improving the effectiveness of extreme weather communications.
Question 1: The risks associated with extreme weather events fall disproportionally on historically under resourced communities. For example, the Environmental Protection Agency ("EPA") found that black communities are 40 percent more likely to live in areas with increased temperature-related deaths. What will you do to improve connection, communication, and build trust in these communities? In addition, what NOAA products and services need to be updated to support these communities?
Answer:
To improve the connection, communication, and trust in all communities, NOAA's workforce must reflect the diversity of the Nation, and more specifically, the diversity of the communities it serves. If confirmed, I would recommend that NOAA identify trusted community leaders and community organizations to be Weather (and Climate) Ready Nation ambassadors to serve as liaisons to these communities.

I would need to better understand the complete portfolio of NOAA products and services before I could comment on which need to be updated to support communities of color.

Question 2: Tribes are often uniquely impacted by climate. For instance, Tribes are 48 percent more likely to live in areas at risk of flooding from sea level rise and storm surges. How will you work to incorporate Tribal voices in decision-making and resilience activities throughout NOAA?
Answer:

I am committed to adhering to and building on NOAA's 2019 publication "Best Practices for Engaging and Incorporating Traditional Ecological Knowledge in Decision-Making," which outlines a process for ensuring respectful tribal engagement and upholding tribal sovereignty. I would work with NOAA's workforce to ensure Traditional Ecological Knowledge is incorporated into NOAA's decision making, where appropriate.

Diversity. A diverse workforce is more nimble and better at problem solving than a homogenous workforce, while effective outreach to communities on weather preparedness requires a diverse

workforce that is sensitive to the cultural differences affecting how weather information is consumed. Advancing diverse populations in Science, Technology, Engineering, and Mathematics ("STEM") is a national priority, and NOAA is actively working to incorporate policies to support a diverse workforce. Female representation in NOAA has increased from 33 percent to 35 percent between 2010 and 2019. Yet there remains a pressing need for updated short-term and long-term strategies to make meaningful and concrete improvements to Diversity, Equity, and Inclusion at NOAA. If confirmed, you will oversee about half of NOAA, including educational programs. You will have tremendous opportunity, and challenges, when it comes to advancing STEM opportunities in grants, scholarships, and within NOAA's own workforce.

Question 1: What do you envision for the future of NOAA's workforce, and if confirmed, what specific actions will you take to get there?
Answer:
Supporting and hiring a diverse workforce with the necessary skills and knowledge to advance earth systems science (natural, social, computational, and data sciences) and communicate NOAA's data and information broadly is critical. If confirmed, I would build this workforce by 1) increasing outreach to K-12 students to highlight the excitement of doing societally relevant work; and 2) developing, in concert with other Federal agencies (like the NSF) undergraduate (summer) research experience programs at NOAA Cooperative Institutes, NOAA regional climate centers, and other NOAA programs. The outreach and research activities would be targeted to all students with a special emphasis on those from historically under-represented communities (including rural, urban, and tribal).

Question 2: NOAA also has an opportunity to help grow the STEM workforce through supporting educational opportunities for K-12 students, investing in undergraduate scholarships, as well as postgraduate fellowships, such as the Sea Grant fellowship program. How will you leverage these programs to grow the STEM workforce at NOAA, and throughout the federal government?
Answer:

If confirmed, I am committed to learning much more about NOAA's opportunities to grow the STEM workforce. Furthermore, I commit to growing NOAA's STEM workforce by strengthening equity internally by accelerating NOAA's efforts to attract, recruit, retain, and develop talent, including from diverse backgrounds through recruitment in STEM disciplines from Historically Black Colleges and Universities and other Minority Serving Institutions including tribal colleges. If not already in practice, recruitment efforts could be focused on recipients of NOAA undergraduate scholarships and postgraduate fellowships.

Furthermore, I recognize the importance of NOAA in advancing education and the understanding of our science for students and the public served by NOAA. NOAA is well-positioned to lead on environmental literacy and it is critical to its mission, with educational programming reaching 284,000 P-12 students and 46,000 educators in FY20. Programs such as NOAA's Environmental Literacy Grants increase understanding and stewardship of local watersheds through multi-stage activities performed both outdoors and in the classroom and support STEM and environmental

education projects that engage people in using NOAA-related sciences to build community resilience to extreme weather events and climate change. If confirmed, I will commit to working with Congress to ensure these programs are fully supported and implemented at a high-level across the country. I look forward to learning more about how NOAA can improve student and public access to climate and environmental education.