

Meeting of the NOAA Science Advisory Board

July 26-27, 2023

Location: Southern California Coastal Water Research Project
3535 Harbor Blvd., Suite 110
Costa Mesa, California

Presentations for this meeting have been posted on the Science Advisory Board (SAB) website:
<https://sab.noaa.gov/past-meetings/past-meeting-documents/#July2023>

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SAB members in attendance:

Mr. John Kreider, President, Kreider Consulting LLC (Chair); Mr. Jon Allan, Senior Advisor, Senior Academic and Research Program Officer, School for Environment and Sustainability, University of Michigan; Dr. Ilene Carpenter, Earth Sciences Segment Manager, Hewlett Packard Enterprise; Mr. David Grimes, President and CEO, Grimes Consulting; Dr. Robert Grossman, Frederick H. Rawson Distinguished Service Professor in Medicine and Computer Science and Jim and Karen Frank Director, Center for Translational Data Science, University of Chicago; Dr. Ruth Perry, Marine Scientist and Regulatory Policy Specialist, Shell Exploration and Production Company; Dr. Zhaoxia Pu, Professor, Department of Atmospheric Sciences, University of Utah; Dr. Martin Storksdieck, Director, STEM Research Center and Professor, College of Education and School of Public Policy, Oregon State University; Dr. Steve Weisberg, Executive Director, Southern California Coastal Water Research Project; Dr. Anthony Wu, Executive Director, AeroMarine LLC; Dr. Donald Wuebbles, The Harry E. Preble Professor of Atmospheric Sciences, University of Illinois.

NOAA senior management and Line Office representatives in attendance:

Dr. Rick Spinrad, Under Secretary of Commerce for Oceans and Atmosphere and NOAA Administrator; Dr. Sarah Kapnick, NOAA Chief Scientist; Dr. Evan Howell, Director, Office of Technology, National Marine Fisheries Service; Dr. Stephen Volz, Assistant Administrator, National Environmental Satellites, Data, and Information Service; Dr. Steve Thur, Assistant Administrator, Oceanic and Atmospheric Research; Dr. Mark Monaco, Senior Scientist, National Centers for Coastal Ocean Science; Dr. Terence Lynch, Director, Office of Science Support, Oceanic and Atmospheric Research; Dr. Stephan Smith, Director, Office of Science and Technology Integration; Dr. Gary Matlock, Deputy Assistant Administrator for Science, Oceanic and Atmospheric Research.

Staff for the Science Advisory Board in attendance:

Ms. Casey Stewart, Executive Director and Designated Federal Officer; Dr. Cynthia Decker, NOAA Scientific Integrity Officer and former Executive Director, NOAA Science Advisory Board; Ms. Karin Bucht; Mr. Joseph Fillingham; Ms. Katherine Longmire; Mr. Andrew Peck; and Ms. Viviane Silva

Opening Statement of the Chair

John Kreider, Kreider Consulting and Chair, NOAA SAB

John Kreider welcomed the attendees to the meeting and introduced the SAB's new Executive Director, Casey Stewart. Moreover, John Kreider announced that this meeting would be slightly different to make the proceedings more interactive.

SAB Consent Calendar

John Kreider, Kreider Consulting and Chair, NOAA SAB

- April 2023 SAB meeting minutes
- Working Group status reports

David Grimes made a motion to accept the consent calendar. The motion was seconded by Robert Grossman and was passed unanimously.

Discussion on NOAA Update

Rick Spinrad, Under Secretary of Commerce for Oceans and Atmosphere and NOAA Administrator

Dr. Spinrad provided an update on NOAA activities since the previous SAB meeting. NOAA has continued its work on the FY24 and '25 budgets, ensuring alignment with the Bipartisan Infrastructure Law (BIL) and Inflation Reduction Act (IRA) investments. Between the two bills, NOAA is the beneficiary of over \$6 billion in one-time funding. It is Dr. Spinrad's goal to demonstrate the value of this historic investment to justify future budgets. NOAA will soon be releasing Notices of Funding Opportunities (NOFOs) for its Climate Resilience Regional Challenge (\$575 million), Ocean-based Climate Resilience Accelerators (\$100 million), and to develop a Climate-Ready Workforce (\$60 million). NOAA is utilizing a letter of intent approach for these NOFOs because they are anticipating roughly 10-to-1 proposal pressure for the available funds. The NOFOs also include a heavy equity emphasis. Next, Dr. Spinrad shared his list of topics that are keeping him up at night, and noted that not all of the topics were bad – many are exciting opportunities. This list included: operational climate authority; the North Atlantic Right Whale Vessel Strike Rule and entanglement issues; new Sanctuaries designations; expanded service delivery; offshore wind; illegal, unreported, unregulated fishing; major capital expenditures, including fleet, aircraft, and satellites; Arctic issues; and recruitment and retention, among various other items.

Dr. Spinrad encouraged members to visit NOAA's website to see the projects being developed. For example, NOAA has been developing several new services, such as the Hurricane Analysis and Forecast System (HAFS), a higher resolution Water Model, and operationalizing ecological forecasting. In addition to the recapitalization of its fleet, airplanes, and satellites, NOAA is investing in rebuilding or improving many of its facilities, such as renovating a port facility in Ketchikan, Alaska. NOAA has also instituted the Youth Changemakers Fellowship, started the Marine Debris Foundation, and is building the National Integrated Heat Health Information System with colleagues at the Department of Health and Human Services. For the first time, NOAA is also a part of the Industry University Cooperative Research Consortium with insurance and reinsurance industries. Finally, NOAA has continued to strengthen and diversify external partnerships, such as working with Esri, a GIS software development company, on its Climate Mapping for Resilience and Adaptation tool. In summary, NOAA's political team is fully staffed and brings a wealth of far-ranging experience to the agency and Dr. Spinrad is excited about the direction NOAA is going.

Discussion

David Grimes asked if there has been coordination to support continuous observations amongst the circumpolar nations, given the political situation in the Arctic and the Arctic Council having been suspended. Dr. Spinrad said there has been a lot of dialogue with other federal agencies on what the U.S. posture should be with respect to changes in the Arctic Council leadership. His understanding is that they have reached a détente at which they can maintain the scientific working group activity for things like data exchange and continued observations.

Jon Allan asked for NOAA's perspective on the threshold at which climate-induced environmental change starts to manifest as true social unrest. Dr. Spinrad pointed to Alaska as an example of a conservative state taking the lead in the call for action because of the dramatic changes they have experienced. When the climate-induced impacts are at the individual level, affecting livelihoods and the broader economy, the response is more immediate. Dr. Kapnick said NOAA is engaging with various economic agencies to better understand the connection between climate and macroeconomic shocks. El Niños can lead to drought, food insecurity, and destabilization worldwide, so NOAA has been engaging with the State Department to make sure they are prepared for potential ripple effects.

Discussion on NOAA Science Update

Sarah Kapnick, NOAA Chief Scientist

Sarah Kapnick presented an update focusing on key documents released since the previous SAB meeting. Since the full update was provided to SAB members in advance of the meeting, she focused on a few key topics for this presentation. In June, NOAA released its Carbon Dioxide Removal (CDR) Strategy, which evaluated various CDR approaches regarding safety, sustainability, and fairness, as well as the science needed to advance each method. The strategy went through multiple public reviews and received substantial input. NOAA has received feedback from multiple governmental agencies, industry, and other science agencies on how helpful this has been in laying out the available science so that people can see where this space might be headed. In May 2023, NOAA published the FY25 Strategic Research Guidance Memorandum (SRGM), which is available on the Science Council website. This document covers all of the science and R&D within NOAA for FY25. The FY26 SRGM is currently in development and Dr. Kapnick will be discussing some of her ideas for re-envisioning the SRGM later in this meeting.

For the remainder of her presentation, Dr. Kapnick presented vignettes from across the agency ordered around NOAA's three R&D Vision Areas. Under Vision Area 1 (Reducing societal impacts from hazardous weather and other environmental phenomena), NOAA has shifted HAFS from test phase to running alongside operationally during the hurricane season in advance of transitioning it to being the primary hurricane tool. Early seasonal analyses showed a 10-15% improvement in track and also improvements in rapid intensification prediction. Additionally, the National Ocean Service's (NOS) new Monthly High Tide Flooding Outlook and improved Advanced Quantitative Precipitation Information project will help to improve NOAA's precipitation and temperature forecasting capabilities. Next, under Vision Area 2 (Sustainable use and stewardship of ocean and coastal resources), Dr. Kapnick highlighted a study on the value of the Pacific Northwest Harmful Algal Bloom (HAB) Bulletin and NOAA's role with regard to Per- and Polyfluoroalkyl Substances monitoring. Finally, under Vision Area 3 (A robust and effective research, development, and transition enterprise), Dr. Kapnick highlighted new models predicting growth, survival, and reproductive strategies for all known fish in the world and the improvements in the capabilities of uncrewed systems made possible by using cloud services. Finally, in terms of new technologies, NOAA's Global Monitoring Laboratory deployed high-value, balloon-borne greenhouse gas and meteorological instruments onboard a glider to 90,000 feet and returned them to the

launch point collecting atmospheric samples all the way down. This is an achievement that greatly expands NOAA's ability to observe the upper atmosphere in both remote and climate-critical regions.

Discussion

Zhaoxia Pu asked if Dr. Kapnick had any insights on next steps for data assimilation research that was called out in the Priorities for Weather Research (PWR) Report. Dr. Kapnick said NOAA has announced IRA funding opportunities for data assimilation, including funding for expanding data assimilation to be able to bring in novel types of data and also to ensure they are integrating as much satellite data as possible. Stephan Smith added that NOAA is working to set up a data assimilation consortium to advance this work and that pursuing data assimilation remains a high priority for the agency. Dr. Pu said data assimilation is not only important for weather modeling, but also for subseasonal-to-seasonal (S2S) and climate forecasts. Dr. Kapnick added that they are communicating extensively on the Hill and externally about data assimilation needs for S2S and S2D (seasonal-to-decadal) and how important ocean observations are for improving these capabilities.

Dr. Pu asked about the topic of artificial intelligence and machine learning (AI/ML) in weather forecasting. The private sector is already pursuing this and she asked if NOAA intends to pursue this path as well. Dr. Kapnick said NOAA is discussing AI extensively and all the efforts they need to implement as an agency, such as including AI in scientific integrity policies, providing training on different AI techniques, and developing new ways to create pilot programs. They also identified all of the different ways AI is currently being used across the agency. Dr. Kapnick has specifically been working towards new partnerships with the private sector on AI. NOAA will continue to assess where they think key development areas are for AI, bring in new talent and develop talent in-house, and find new ways to partner through Memorandums of Understanding, Cooperative Research and Development Agreements, or competitive research projects. AI was one of the areas that received some awards through the Small Business Innovation Research program and NOAA is working to ensure they support tech transfer in this space.

Jon Allan asked how NOAA is incorporating deeper levels of social science understanding of the consequences and value of its products and how people are responding to those products. Dr. Kapnick said NOAA is bringing on more social scientists to explore the impacts of NOAA's systems and where they are deployed. She has been talking to Department of Commerce leadership about hiring a senior social, behavioral, and economic sciences (SBES) scientist to assess the non-physical impact of NOAA's work. Engraining this practice into its systems moving forward will be increasingly important for NOAA. Dr. Smith said that the National Weather Service (NWS) and the Office of Oceanic and Atmospheric Research (OAR) have begun to respond to the need for SBES scientists, as recommended in the PWR report. They are exploring the application of longitudinal survey methodologies via tactical surveys prior to major weather events in order to understand what information people are collecting and what actions they are taking as a result. Along with this, they are exploring social network analyses to understand how different social networks work in different communities. Scientists are also exploring how to apply agent-based modeling to these problems to predict what kinds of macro outcomes they might see. Moreover, using BIL funds, they are beginning to overhaul NOAA's legacy SBES database, Storm Data. Finally, the Office of Science & Technology will be on-boarding four new social-behavioral scientists in the coming weeks and looking to add another three or four. The Weather Program Office in OAR will be doing the same.

Joellen Russell expressed concerns about NOAA's strategy for marine Carbon Dioxide Removal (mCDR) and the lack of observable systems for measuring its impacts. She asked about NOAA's plans for its observational and prediction science associated with evaluating, measuring, and reporting on mCDR. Rolling out a strategy for mCDR seemed premature when there is so much research still needed. Finally,

she has not seen the necessary investment from NOAA in measurement infrastructure required to observe inventory changes in the ocean. Dr. Kapnick said part of having the science strategy is also developing the communications techniques and the internal and external funding for them. She sits on an interagency group led by the Department of Energy focused on the future of carbon management. Additionally, the NOAA Ocean Acidification Program has been advising on the science and acquiring funding for new technology. There have also been conversations with NOAA's financial economic agency counterparts around their scientific needs and objectives. Finally, Sea Grant has led the charge on developing nature-based solutions for addressing mCDR, including through sea grass and mangrove growth.

2023 Environmental Information Services Working Group (EISWG) Report to Congress

Brad Colman, Co-Chair, EISWG

Scott Glenn, Co-Chair, EISWG

Brad Colman introduced the EISWG's sixth report to Congress. Over the last six years, the reports have evolved into one of the working group's most important activities. They have been improving the process for developing the report based on the SAB's previous recommendations. EISWG is now more comfortable in their tracking of how NOAA responds to the Weather Act and to the EISWG and SAB recommendations. Additionally, previous reporting cycles were very formal and involved extensive reviews that did not match the timeline of many of the recommendations, particularly those that required urgency. In following the SAB's recommendation to explore more informal interactions with NOAA, the engagements became more productive. The report now includes a section dedicated to how NOAA is responding to the SAB's recommendations.

Scott Glenn presented the report itself, beginning with the new statement on the environmental and congressional urgency, per the SAB's previous suggestion. The section on NOAA's progress on EISWG recommendations now aligns even more with Congress's goals for the Weather Act. Dr. Glenn then summarized each section of the report, including NOAA's progress on EISWG recommendations, EISWG recommendations already approved by the SAB and transmitted to NOAA, new EISWG topics in preparation, the relation to the PWR recommendations, and a summary of common threads. Key messages from the report include: the motivation behind selecting the topics included in the Weather Act is still relevant today; much has been accomplished by dedicated NOAA staff and the collaborative approaches within NOAA and with the external community; and common threads running through the challenges align with the immediate first steps identified in the PWR report, including incorporation of SBES and high-performance computing needs. The Weather Act Reauthorization bill is currently being developed in Congress and EISWG feels they will likely be asked to provide additional input.

Discussion

David Grimes complimented the report. In particular, he said the graphic illustrating the average number of days between billion-dollar storms was an especially impactful demonstration of urgency. Adding commentary below the graphic to communicate the urgency for science improvement would be valuable. On the other hand, he thought the report could have a softer tone in certain places. Specifically, he asked if there was a more diplomatic way to communicate the need for investment since the SAB had previously decided not to advise NOAA or Congress on funding of key areas. Dr. Glenn responded that EISWG included language on what NOAA should be doing but not how. They were very careful to simply list the investments needed. Dr. Colman argued that stating that additional investments, given more resources overall, would be within the congressional ask of EISWG. Chair Kreider agreed that identifying and addressing resource allocation was more of a leading indicator. He felt it stepped to the line without crossing it and was important to include.

John Kreider commended EISWG for being very proactive about continuous improvement to the process.

Jon Allan made a motion to accept the EISWG Report to Congress. Robert Grossman seconded the motion and it passed unanimously.

Updates from SAB Working Groups

Climate Working Group (CWG)

Kirstin Dow said that the CWG will have several membership changes in the near future, as Drs. Dow and Russell step down as co-chairs. They are currently identifying potential new members and they have a plan to establish the next co-chairs. The working group's white paper, *Organizing Civilian Operational Ocean Forecasting*, should be ready in time for the SAB's Fall meeting. The CWG transmitted two white papers at the April 2023 SAB Meeting, one titled *Climate Information Needs for 5-10 Year Hazard Mitigation Planning Cycles* and the other titled *Air Quality in a Changing Climate: NOAA's Role*. At this meeting, they will present their *Review of the NOAA Climate Program Office's Draft Strategic Plan*. The CWG will continue to work with other SAB working groups and provide comments on NOAA's climate portfolio as requested.

Data Archive and Access Requirements Working Group (DAARWG)

Ilene Carpenter said DAARWG has been very active over the last few weeks, scheduling a virtual meeting for August and an in-person meeting in September. They are working to recruit new members and have received some positive responses.

Ecosystem and Sciences Management Working Group (ESMWG)

Molly McCammon said the ESMWG are still recruiting new members and have decided to recruit broad-thinking individuals. They are also still trying to choose an impactful and useful topic to pursue and they intend to use their fall meeting to narrow their list. Topics include AI and disruptive technologies, HABs, and ocean acidification and hypoxia. The ESMWG met with NOAA Assistant Secretary Jainey Bavishi earlier in the summer and they also sought feedback from NOAA and the SAB on potentially researching the cumulative impacts of the recent infrastructure funding. Chair Kreider suggested discussing this topic during the session later in the meeting on NOAA's budget.

Environmental Information Systems Working Group (EISWG)

Scott Glenn discussed EISWG's work beyond the efforts already described. It has been an active year, especially with onboarding of their cohort of new members. They are making progress on several reports, including their report, Radar Gaps report and National Environmental Satellite, Data, and Information Service's (NESDIS) Observing System Backbone, both of which will be presented at the fall SAB meeting. EISWG has also been exploring the topic of heat and human health and they are beginning to triage the new initiative on systematic errors and machine learning. EISWG's interactions with the line offices and SAB have continued to grow thanks to the efforts of their liaisons. The group continues to benefit from their discussions with the NOAA Assistant Administrators (AAs) and they will meet with the NOS and NESDIS AAs soon to learn about their priorities. At their fall meeting, EISWG will develop their 2024 work plan and integrate more PWR recommendations into the EISWG processes.

Tsunami Science & Technology Advisory Panel (TSTAP)

Rocky Lopes said TSTAP has been meeting monthly and have nominated one person to be appointed to the panel. At their in-person meeting in May 2023, they received NOAA's response to the 2021 TSTAP Quadrennial Report, which did not make as many commitments to the recommendations as they had

hoped. TSTAP will engage NOAA and NWS further about their ongoing concerns. Later in this SAB meeting, Corina Allen will present TSTAP's statement on the Federal Emergency Management Agency's (FEMA's) National Risk Index (NRI) and, if approved by the SAB, the panel hopes the NOAA Administrator will share this statement with FEMA directly. Additionally, TSTAP has been exploring international tsunami issues and NWS' Tsunami-Ready Program and plans to meet with the NWS Director on the status of his list of priorities. Finally, they will explore potential suggestions to modify their terms of reference at the next SAB meeting.

John Kreider said that he wanted to ensure the meeting of the working group co-chairs and the SAB liaisons is rescheduled, since they were not able to meet prior to this SAB meeting and it is a valuable activity.

SAB Special Session Introduction and Goals

Steve Weisberg, Southern California Coastal Water Research Project and SAB Member

Steve Weisberg introduced the panelists and moderated the discussions. The aim of the session was to hear local perspectives on how different stakeholders are using NOAA science and where there are areas for improvement.

Case Study 1: Ocean Acidification and Hypoxia

Ocean Acidification Monitoring in the California Current Ecosystem

Dick Feely, NOAA Pacific Marine Environmental Laboratory

Dick Feely, NOAA Pacific Marine Environmental Laboratory (PMEL), discussed how he interacts with the states and how the states modify their actions as a result of NOAA's work. He presented the Geophysical Fluid Dynamics Laboratory (GFDL) model illustrating the projected acidification of oceans through the end of the century. The oceans absorb about 20% of emitted CO₂, which impacts upper ocean chemistry along with other stressors like temperature, dissolved oxygen, and HABs. Delineating the anthropogenic processes related to ocean acidification (OA) from other natural processes affecting the environment requires a sustained observational system that includes physics, chemistry, and biology to get a range of spatial and temporal scales. Doing this for the entire world's oceans and understanding the anthropogenic CO₂ is the PMEL's primary role.

Dr. Feely described collaborations with National Marine Fisheries Service (NMFS) and universities to focus on the impact of acidification on key species and ecosystems. Efforts include joint cruises to bring the chemistry, biology, and physics together. Since 2010, they have also been working with states, as well as Sanctuaries and local groups, to teach them how to gather data compatible with other NOAA datasets and share and interpret their findings. Recently, the NOS' Integrated Ocean Observing System (IOOS) collated all the data that was available from NOAA and its partners and made it accessible along with each sample's quality level. IOOS Regional Associations provide access to real-time datasets for a particular site, allowing stakeholders to make informed decisions about their daily operations. NOAA also partnered with states through task force teams to develop strategies for how to make measurements, collect certain kinds of data, and integrate the chemical and biological monitoring. They have also developed strategies for the continuous improvement of models and strengthening of long-term funding situation for the observing systems.

Working with the Current Acidification Networks (CANs), NOAA co-developed a list of their highest priorities relative to their needs for each of the regions around the country. There is also an international aspect through the Global Ocean Acidification Network, which includes 100 countries and over 500

scientists working together and contributing to the data portal. Dr. Feely's key takeaways included: (1) Federal participation in research and planning is necessary to coordinate between regions, states, and tribes; (2) OA impacts are a clear and present danger for marine ecosystems right now and continued federal-state coordination on maintaining the observing system is needed; (3) The California Current Ecosystem is particularly sensitive to OA and will become increasingly vulnerable in the future; and (4) Chemical and biological observations need to be incorporated into current models. Looking forward, NOAA needs to improve its integrated observing, primarily through continued funding, and find an operational and accessible home for the models and data.

Discussion

John Kreider asked what percentage of PMEL's datasets come from NOAA versus external sources. Dr. Feely responded that it was about 50/50. NOAA provides the large-scale datasets while state and local colleagues provide the time series. PMEL is trying to incorporate and assess as much data as possible so that it can be appropriately applied. Dr. Weisberg added that NOAA has brought significant expertise to the states, such as training on ocean chemistry at different levels of precision depending on the purpose. The states bring their own priorities and initiate biological collections.

Robert Grossman asked about issues with proprietary data and what the trade-offs are, particularly when biological and chemical data are integrated. Dr. Feely responded that there have not been many problems with collaboration among partners. NOAA is required to submit its data to the National Centers for Environmental Information (NCEI) within a year and NOAA works with the partners to ensure their data is up to NCEI's quality standards. The primary goal has been verifying that the data are interchangeable. Dr. Grossman asked if NOAA tracks the use of its data, including sharing and its impact. Kathy Turner said NOAA does track, but the granularity varies depending on the topic.

Jon Allan asked about the struggle to handle increasingly sophisticated levels of monitoring data. Dr. Feely responded that scientists need to collaborate with policymakers not only on currently available information but also on information needed to create better policies in the future. PMEL is currently collaborating with the State of Oregon on crafting water quality criteria that better matches the science. Mr. Allan asked if Dr. Feely thought this would lead to substantial changes in behavior and operations, ultimately altering the trajectory of OA. Dr. Feely said this is possible and potential mitigation options are important to discuss with policymakers. Mr. Allan asked about the social disruption attributable to OA. Dr. Feely responded that NOAA's vision is to look at the vulnerability of the ecosystem as well as the human response.

Zhaoxia Pu asked for clarification on the social impact of this monitoring data and the expected data users. Dr. Feely responded that the most interested stakeholders were individuals and communities directly impacted by the information, particularly fishing communities and tribal nations.

David Grimes asked if coastal biological measurements were similar to deep ocean behavior. Dr. Feely responded that in the open ocean, the acidification signal is very clear because variability is significantly lower than along the coasts. It takes far longer to measure the OA signal above the natural variability of coastal waters, therefore, scientists are more reliant on models. Generally, the open ocean models are reliable. It is unclear, however, whether the impacts of mCDR efforts could be measured. The observing system for carbon in the global ocean is designed to understand carbon spread over large areas and interpolation is used in between those areas. On the other hand, mCDR is localized, mostly coastal, and the processes are largely unknown. Scientists will have to redefine the observing network in order to address this.

Martin Storksdieck asked if NOAA has collected enough data on the West Coast and elsewhere, or if more data are needed. Dr. Feely said the OA coverage for the West Coast is better than most areas, but

they are surface measurements and the subsurface is acidifying at a much faster rate. NOAA is just beginning to ponder this dilemma.

NOAA-California Partnership on Numerical Model: How Can We Build on Our Success?

Martha Sutula, Southern California Coastal Water Research Project

Martha Sutula, Southern California Coastal Water Research Project (SCCWRP), discussed the partnership that the State of California has formed with NOAA to develop ocean numerical models, as well as key biological interpretation tools. Through NOAA's investment and partnership with the California Ocean Protection Council (OPC), this decade-long effort has been successful and very supported. State and local partners have matched NOAA's investment five-fold and that leveraging continues to grow. The modeling toolkit is now being used to inform California's climate change strategies, including how local water quality management actions could help to build resilience and buy time in the face of rising OA and hypoxia. They are also using the model to develop the capabilities for evaluating new mCDR technologies. Additionally, the model is being leveraged for multiple new applications, including microplastic fate and transport and optimizing kelp aquaculture. To evolve their relationship with NOAA, this modeling enterprise should be sustainable and collaborative with the latest tool development and diverse applications to ensure the modeling toolkit can assist states with meeting the challenges of climate change.

Dr. Sutula then went into further details on the ocean numerical model approach, a 3-D mechanistic model for the entire West Coast with high resolutions nests for coastal applications. NOAA support for this model was essential for sources of data and compiling the data in readily usable formats through IOOS supercharged the state's ability to validate the model and achieve community acceptance of the model. Additionally, through joint funding of the OPC and NOAA's Coastal Hypoxia Research Program, they developed OA thresholds and oxygen indices that enabled the translation of model-predicted ocean chemistry to biological effects. This is key to informing state managers on potential policy actions. It is also worth exploring how NOAA funding and staff can support mechanistic community-based models that are state-supported or engaged. Finally, the State of California wants to ensure that sharing new science and tools becomes routine. They want to explore joint collaborations with NOAA on applications, such as for mCDR, and the potential to develop a common scientific toolkit for application in state and federal waters. This toolkit would streamline the federal-state coordination on siting, permitting, and monitoring.

Discussion

Steve Thur asked for more information on the application of the modeling toolkit to inform climate change strategies, including how local water quality management actions could build resiliency. He asked how that engagement came about and how it could be replicated in the future. Dr. Sutula responded that there were several elements of the interaction that were important, including the existing relationships in which scientific conversations informing policy are routine and taking deliberate steps throughout the model's development to engage the community early on the validation needed to instill confidence in the model.

John Kreider asked if collaborating with people who earn their livelihoods in the ocean (e.g., fishermen, crabbers) built trust with them and reduced the sometimes-adversarial relationship. Dr. Sutula said they have made progress in engaging with the water quality community but they could further engage with the marine resource community in the use of the model. Dr. Weisberg added that NOAA needs to partner with the state and local levels so that people impacted by the agency's decisions can trust the model used.

Ruth Perry asked how SCCWRP sustain their partnership with NOAA over the long-term and how they expect the dynamic to change when start mitigation actions at a state and local level. She asked where NOAA should step back versus where they should lead and how best to operationalize funding so that NOAA views this model as a private tool that needs to be sustained. Ms. Eckerle said OPC's work is rooted in ensuring the best available science to inform policy and management decisions. This is a critical partnership and she did not see a need for NOAA to step back. The State of California is highly invested in this model and communicating any concerns to the relevant regulatory agencies. Ms. Eckerle's experience has been that people understand that they are all working together towards the same goal. Dr. Perry said using a science tool for regulatory actions changes the paradigm of the NOAA-state relationship. Mark Monaco, Senior Scientist, National Centers for Coastal Ocean Science (NCCOS), said NOS has made a strong commitment to continue funding operable tools. It is a challenge, but NOAA continues to determine the optimal funding sources, internal and external. Steve Volz noted that across the board at NOAA, its global and regional-scale models lead to spin-off applications developed externally. NOAA needs to determine its role in supporting these spin-offs. This could be a topic for the SAB to consider, particularly with climate services.

Evaluating OA and Hypoxia in Oregon under the Clean Water Act

Lesley Merrick, Oregon Department of Environmental Quality

Lesley Merrick, Oregon Department of Environmental Quality, discussed how the State of Oregon is assessing the impacts of OA and hypoxia under the Clean Water Act. Oregon's Department of Environmental Quality (DEQ) is responsible for translating science to policy and is federally required to report to the Environmental Protection Agency on the status of all waters in the state. DEQ is also required to identify impaired waters and develop action plans to address the pollution. Ms. Merrick described their efforts to develop a methodology to assess the beneficial use of aquatic life support in the state's coastal waters. NOAA's contribution to this effort was critical. Since Oregon does not have a marine monitoring program, they relied heavily on NOAA's observational data, particularly from the Newport Hydrographic Line and West Coast acidification cruises. In addition to the data, NOAA also assisted with the research that emerged. Ms. Merrick highlighted the importance of NOAA staff time in this effort. Looking forward, Oregon requests further collaboration with NOAA to generate more data that allows them to make confident assessment conclusions, create a data portal with all current and older data in a consistent format, and devise best practices for applying NOAA's regional estimates locally to understand the conditions and changes in the nearshore.

Discussion

Martin Storksdieck asked what the regulatory agency does when relative source contributions are identified as impairing marine waters. Ms. Merrick said the State of Oregon does not have many point source contributions, which are the easiest targets. They do have estuaries, which can be source, sink, or both, so a model demonstrating the impacts of freshwater inputs on nearshore environment would help the state understand the contributions of a total maximum daily load (TMDL) or non-point source pollution. Dr. Feely added that this is where mCDR could come into play because estuaries are one of the best places to do mCDR. Developing mCDR might present a solution for restoring an impaired environment.

Steve Weisberg asked about Ms. Merrick's familiarity with NOAA's new mCDR Strategy, if her organization had any involvement in its development, and if it is something the state is looking to advance. Ms. Merrick said her water quality program is largely freshwater focused so it was not involved, but they intend to collaborate with Oregon's Coastal Management Program in the future. Andy Lanier added that Oregon was studying the anthropogenic impacts of OA, including pollution from at-sea waste, and developing a standard to mitigate these impacts.

Jon Allan asked for insight on how to build trust among partners when ultimately one partner has the authority to cast a final decision. He added that voluntary programs only go so far. Having a seat at the table when discussing past, present, and future actions is critical to building trust among partners. The notion of building trust on information and data systems is fundamentally different than building trust in the outcomes of regulatory drivers. People may understand the science and its implications but not agree with regulatory actions if they could negatively impact them. Ms. Merrick said that, in her experience, if the science is strong then courts usually side with the regulators. Mr. Allan said that all the trust that is developed in the science breaks down when a legal arbiter is needed to say who is right or wrong. Ms. Merrick agreed that that is unfortunately the case, but being able to say that the science was developed in cooperation with NOAA, academia, and other partners helps the state regulators' argument.

John Kreider noted that the panelists made no mention of the private sector, either industry or philanthropic. Ms. Merrick said that the Technical Work Group that developed the 2024 OA and hypoxia assessment included members from philanthropic groups. The one public comment they received was from the state's largest wastewater treatment operator, with whom Oregon has a good relationship. Having these stakeholders at the table initially would have been helpful if Oregon was in the same situation as California, where there are large discharge points.

Case Study 2: West Coast Ocean Health Dashboard

Andy Lanier, Oregon Coastal Management Program

Andy Lanier, Oregon Coastal Management Program, discussed the work of the West Coast Ocean Alliance (WCOA), the authorized Regional Ocean Partnership for the West Coast. WCOA works to ensure compatible and sustainable ocean uses, provides understanding and transparency around decisions being made, and provides comprehensive ocean and coastal data as needed. They also work to increase the understanding of and respect for tribal rights and traditional knowledge, resources, and practices. Legislators from West Coast states asked WCOA to create ocean health report cards for their states, which WCOA subsequently regionalized, since the standardization of understanding ocean health across the West Coast would be more powerful. Examining West Coast ocean health at the regional scale is appropriate, given all three states are part of the California Current Large Marine Ecosystem. The states need to survey regional ocean planning and policies to understand the context of their own decisions across the broader region.

The West Coast Ocean Health Dashboard will communicate ocean health patterns and trends on the West Coast, to inspire coordinated action toward the stated goals of the WCOA. Target audiences include state, tribal, and federal ocean resource managers, policymakers, and the broader public. The eventual dashboard will aim to: raise awareness about regional ocean health issues; influence policy, resource management and regulatory decisions; and inform plans and actions by governments, including research priorities and resource decisions. The dashboard will achieve these outcomes by providing a shared platform for assessing and interpreting data, harmonizing existing data streams, identifying data gaps, and producing a coherent story about ocean health on the West Coast. As WCOA builds the dashboard over the next 3-5 years, NOAA's involvement will be essential, because they can help with each of the framework elements.

For their pilot, an OA indicator, WCOA engaged IOOS Regional Associations to both understand the resources and data that were available and to understand the types of interactions and evaluations that could be most possible. Preliminary results for selected areas show the extent to which OA has impacted coastal waters. Moreover, NOAA provided satellite data and aerial photography for the development of kelp indicators and assisted with measuring change over time in the kelp beds relative to an average. They have already realized many benefits from the conceptual development and implementation of the

dashboard visioning process and many more benefits are expected. With NOAA's help, WCOA will continue to develop the dashboard and create products the Alliance will use as part of its communication tools.

Discussion

Jon Allan asked if WCOA senses that information released to the public regarding the condition of their resources is resonant with the public perception. He said that, in his work, he has found a difference of opinion between what the public perceives as progress and government agencies' perceptions of the same datasets, particularly over resources that the public views as their own. Mr. Lanier said they have only introduced the dashboard to stakeholders on the WCOA, so there has not yet been a public vetting. One of the main goals is to provide the best answer they can along with an explanation for the level of inherent uncertainty. Mr. Allan pushed back, saying he has found it incredibly difficult to communicate the notion of scientific uncertainty to the public. He asked how states, tribes, and local governments can help the public understand the notion of empirically-derived uncertainty in a system. Becky Smyth said that when they started developing the report cards, they had debates over the intended audience. Legislators had asked them to create the report cards, and an ongoing challenge is how to re-frame them for the public. Jenn Eckerle said they are developing indicators with the states who want to know how their investments are improving ocean health. Mr. Allan remarked if there's a gap in perceptions on what progress looks like between science-informed agencies' and the public, this can hinder further efforts. The SAB is interested in coupling; it is not a question of whether or not the two perceptions are in sync, but it is worrisome how fast they are diverging.

Case Study 3: Creating Coastal Resilience

Creating Coastal Resilience

Jenn Eckerle, California Ocean Protection Council

Jenn Eckerle, California Ocean Protection Council, discussed the work of the OPC, a non-regulatory state policy body focused on protecting the state's coast and ocean for current and future generations. OPC serves as an advisor to the governor on ocean and coastal issues, employing science-based policy and management strategies, and playing a critical role in catalyzing partnerships and collaborations to accelerate action. The strategic plan that guides their work through 2025 includes four priorities of climate change, biodiversity, equity, and a sustainable blue economy. Though OPC partners with NOAA around these priorities in many ways, Ms. Eckerle focused her talk on the topic of coastal resilience, specifically their work developing guidance on sea level rise for the state.

California's coastline includes habitats that are biologically, culturally, and economically important, in addition to being the home of nearly 70% of the state's residents. Sea-level rise presents a significant threat to the area if they do not develop critical infrastructure, public access, public health/safety, cultural resources, and the biodiversity that drives the economy. It is the state's responsibility to ensure they have the best available science underpinning the adaptation planning and implementation of projects to ensure coastal resilience. OPC is the state lead in developing this guidance, which is updated every five years. The Council supports a Sea Level Rise Science Task Force that just finished translating sea-level rise scenarios from NOAA's national report into California-specific scenarios. Ms. Eckerle is currently working on the difficult task of enabling people to use the scenarios in a precautionary approach to planning. Coastal Resilience Challenge funding will be very helpful and the state is mobilizing to put forth transformational projects. OPC would benefit from automated finer-scale habitat mapping to allow for change detection over time. Moreover, they still need to understand the socioeconomic impacts of sea-level rise, particularly the impacts to underserved and tribal communities, to ensure they are

transferring money to the communities that are most in need. This information is helpful at the state level, but it will actually be implemented by local practitioners and jurisdictions.

Discussion

David Grimes asked about the next steps beyond communication with local jurisdictions. Land-use planning is not always at the state level, for example, the Port of Los Angeles/Long Beach. He asked how OPC engages key communities in land-use change or jurisdictions where there is a significant amount of built infrastructure. Ms. Eckerle said their engagement process has been evolving over time and they have learned a lot. Practitioners and local jurisdictions have become increasingly savvy even in the last five years about how they can integrate the information into their planning. They have strong relationships with partners that have a large network of communities. When OPC releases its draft, they will seek feedback on what worked and what did not in previous iterations. Mr. Grimes responded that involving the key actors early in the process will result in more positively viewed outcomes.

Martin Storksdieck asked how OPC is leveraging the collaboration with NOAA to increase attention to the policy agenda. Ms. Eckerle said the partnership enhances the defensibility and strength of the science and being able to say that the state is acting in alignment with the national level is a major benefit. The strength of the national science integrated into the state's policies makes it easier for decisionmakers to say this is the right path forward. Dr. Storksdieck then asked how other coastal states deal with the issues that OPC is addressing. Ms. Eckerle said OPC is unique in that they have this special role in state government serving as an umbrella organization and interacting with every agency that touches the coast and ocean space. Mr. Lanier said the comparable work in Oregon falls within his agency, stewarding efforts like the Territorial Sea Plan and advising the governor on ocean management policy issues. Jenn Hennessey said she is in the governor's cabinet for the State of Washington. The state's coastal program has a similar relationship under the state's Shoreline Master Programs wherein the state sets the guidelines for local jurisdictions, but they develop the local plans.

Mark Monaco asked for further clarification on the habitat mapping. Ms. Eckerle said they need to include all coastal habitats, more than just wetlands. OPC is working to establish a baseline inventory for all coastal habitats in order to map sea-level rise scenarios. Ultimately, the aim is to understand how best to adapt those habitats. A reliable standard data set to measure change detection would be extremely helpful. Dr. Monaco said he would follow up with her after the meeting on efforts underway or already established that could help with this. NOAA is getting better at the automation, but there is more work to do.

Jon Allan commented that every community in America will be in the capital markets borrowing money over the next 20-30 years. Large capital players supporting bonding at the local level are building environmental, social, and governmental metrics around lending. He noted the potential capacity for capital markets to start forcing local communities to assume risk reduction through resilience planning, which the regulatory side and the compelling efforts have not been able to do.

Coastal Resilience in Southern California

Phyllis Grifman, University of Southern California Sea Grant Program

Phyllis Grifman, University of Southern California Sea Grant Program, discussed the Urban Ocean Program, which addresses coastal issues such as water quality, coastal management, sea-level rise and coastal impacts, aquaculture/seafood, maritime affairs, and education for the 18 million people that live in the Los Angeles Metropolitan Area. Sea Grant is a boundary organization with boots on the ground representing NOAA for local communities, bringing the science and policy people together. Sea Grant downscales and translates scientific understanding applicable to public policy to the local level. One

example is the AdaptLA program, based in a regional approach using the best possible models. The program helps with place- and science-based tech transfer and enables local communities to do their own work.

One of University of Southern California (USC) Sea Grant's key roles is community engagement and developing techniques to build community trust in their work. For example, USC Sea Grant brought trainings and expertise on modeling from the Office for Coastal Management to communities. Ms. Grifman discussed the importance of building partnerships and collaborations for local efforts. NCCOS has been invaluable for the AdaptLA program in helping them determine where to focus effort and provide NOAA products and resources to better understand community vulnerability. Additionally, USC Sea Grant invited stakeholders from many sectors to help determine needs and project goals, as well as local expertise on specific indicators. NCCOS also helped with two projects on the environmental effects of sea-level rise and adaptation strategies that would be most beneficial. Finally, USC Sea Grant along with other partners are wrapping up their fourth installment of a longitudinal study that began in 2005 on local needs for coastal climate adaptation. This study provides an overview of how communities are progressing in their planning and adaptation work. Ms. Grifman concluded that mandates would facilitate this work for coastal communities.

Discussion

Ruth Perry asked if the Sea Grants are involved in the proposals for BIL and IRA funding. She noted that there are very few effective conduits at NOAA for translating science and research into operational decision-making. Despite being one of the smallest organizations in the NOAA enterprise, Sea Grant has always played that role. Ms. Grifman agreed and added that USC's program is one of the smallest programs in the Sea Grant network, yet they serve the largest population. One of their many roles is to translate NOAA NOFOs, which can be daunting to communities who do not have grant writers available. Dr. Perry said Sea Grant is an underutilized resource for effective translation and communication to communities.

Steve Thur provided further information on the NCCOS study as an example of risk-taking science, for which some parts of NOAA have the capacity. A potential and useful area for the SAB to examine would be how the agency views risk in its scientific portfolio.

David Grimes asked how Sea Grant influences the priorities of NOAA, given their local engagement and insights. Ms. Grifman responded that SAB meetings are one venue for that. Moreover, the National Sea Grant Office transfers many of the local messages to NOAA leadership. The key is to establish and maintain relationships to ensure two-way conversations.

Jon Allan asked if NOAA should provide Sea Grant with the resources to become the climate corps for the United States' coastal system. Ms. Grifman said the Sea Grant Network has amazing capacity and if NOAA provided resources, Sea Grant programs likely would not shrink from it.

Roundtable Discussion on the Effectiveness of NOAA Interactions with States and Tribes in Facilitating Use of Science

Jenn Eckerle, California Ocean Protection Council
Andy Lanier, Oregon Coastal Management Program
Joe Schumacker, Quinault Tribe Department of Fisheries
Jenn Hennessey, Washington Department of Ecology

Steve Weisburg asked the panelists to respond to the question: How could NOAA better enable the panelists to excel at their jobs? Jenn Hennessey expressed a deep appreciation for the value of NOAA science to states. NOAA could offer more assistance, however, to states that translate science into interpretive products useful to different audiences and users. Keeping up to date with the latest science is a challenge. Uncertainty underpins everything in climate science and the degree of risk tolerance that different communities have weighs heavily in the decisions they make. This is something the collective community needs to think about - they cannot wait until the science is perfect before they act. One of the hardest concepts to navigate is how to provide guidance on the best data for use in different decisions. NOAA's Regional Climate Leads offer valuable help to staff in navigating the available information and integrating it into a wide array of decisions.

Joe Schumacker discussed the importance and challenges of working with tribes. There are 574 federally recognized tribes in America, all of them place-based. The land is the root of their identities, without which their cultures do not exist. They need information from NOAA that pertains to their specific geographic location and it is incumbent on the tribes to advise NOAA of their needs. In return, they need NOAA's assistance in downscaling the available information and translating it. NOAA has tribal liaisons, including regional tribal liaisons, but a data liaison would be very helpful, someone with knowledge of the wealth of information NOAA has available and how best to access it. Tribal liaisons do not have this expertise, as theirs is more about cultural connections. Ensuring that tribal input reaches NOAA is essential. Additionally, NOAA should include relevant search terms and tags in their databases in a similar way that they do for states. NOAA should also consider how they can create AI tools that would be meaningful for tribes. AI provides great capability for addressing the challenges of working with all of the different tribes and sovereign governments. Mr. Schumacker pointed out the White House Office of Science and Technology Policy's (OSTP) recent guidance to agencies on using traditional knowledge and incorporating it into their decision-making. He asked how this is going within NOAA's work. NOAA's efforts in equitable climate service delivery are meaningful and the outreach should go beyond receiving public comments to include engaging with tribes in a meaningful way.

Jenn Eckerle briefly commented on the value of NOAA science and partnership, especially through Sea Grant, across a breadth of issues. OPC also works with Sanctuaries and the Office of Coastal Management and makes extensive use of NOAA sources, such as the California Cooperative Oceanic Fisheries Investigations, to inform their decision-making. Learning how to incorporate traditional ecological knowledge is a high priority in California. Any guidance NOAA could provide on this would be helpful. Moreover, NOAA could assist with offshore wind, a major issue that OPC is facing. California has five active leases where surveys and site assessments are currently underway. The state needs environmental monitoring data to understand the baseline and potential impacts as they move through construction, operation, and long-term monitoring.

Andy Lanier echoed the need for background and framing information. His organization is a land-use planning agency with a focus on coastal management issues and goals specific to the state of Oregon. Communities in the state depend upon the ocean for their livelihoods, culture, and many other uses, however, the rapidly changing ocean climate on the West Coast is a major challenge. Given that OA and hypoxia could impact communities differently depending on the specific geography, the state needs help understanding how their investments respond to changing climate impacts. He encouraged NOAA to increase the amount of funding they provide for critical ocean observations that states rely on and have long-term maintenance plans. Regional Associations need to be able to grow their observational networks in order to inform models on downscaled impacts to local communities. Additionally, the current Administration has prioritized offshore wind and offshore aquaculture, adding to the West Coast's increased demand for ocean space. The West Coast needs assistance to model the environmental impacts of these new priorities. Mr. Lanier would love to see regional assessments done prior to future call areas.

In particular, a California Current regional assessment would help inform Oregon of potential impacts from California's offshore wind projects.

Discussion

Tony Wu asked how state agencies engage with grassroots and community-based organizations and efforts. Ms. Eckerle said OPC works closely with local nongovernmental organizations (NGOs) and have established a network of 14 community collaboratives along the California coast to help with outreach, education, and stewardship. One of OPC's critical roles is liaising within the state agencies and with federal, academic, tribal, and community partners. As a small agency, they are constantly working to build networks. Mr. Lanier said Oregon engages with NGOs and other stakeholders as they plan for amendments to their Ocean Resources Management Plan. They have a legislatively established advisory board built into their Ocean Resource Management Framework that allows stakeholders to give the state advice. Dr. Hennessey said the State of Washington has similar engagement mechanisms. She added that they work closely with Sea Grant on coastal resilience work.

John Kreider asked the panelists for one thing local communities must do when partnering with NOAA and one thing they should avoid doing. Regarding tribes, Mr. Schumacker said that the wrong people are often contacted. NOAA needs to research more thoroughly and meet with the decisionmakers, or at least the people that need the data. Dr. Hennessey agreed and added that NOAA should not present communities with data and products already finished, but should rather co-design them with stakeholders. Ms. Eckerle noted the importance of acknowledging where federal policies and priorities may not necessarily align with state priorities, highlighting the example of Aquaculture Opportunity Areas in California.

Steve Weisberg asked the panelists for input into the development of NOAA's mCDR strategy. Each of the panelists said they were aware of conversations around mCDR, but were not involved in advising NOAA on the strategy. Dr. Thur said that the NOAA-wide strategy did not involve significant community engagement due to the pressure to release it quickly. The next opportunity for engagement on mCDR will be the Implementation Plan. Dr. Feely said PMEL, other NOAA labs, and all of the Line Offices had interacted quite a bit with the State of Washington during the development of the Strategic Plan. The problem was that there was no clear mandate for NOAA's role, so they had to define it. Then they had open meetings, including with the California CAN and tribal nations, and there will be a presentation on the strategy in the coming week.

David Grimes asked the panelists if NOAA should establish an engagement process that details how science priorities should be established to address some of the fundamental needs discussed at this meeting. The SAB could examine potential institutional mechanisms to establish or build upon to allow for gaining core insights on high priority areas. Ms. Eckerle said that would be useful and exploring existing partnerships to leverage could be the best path forward. Dr. Hennessey agreed and said that Sea Grant, Fishery Management Councils, and regional partnerships provide good science-to-management interfaces. Connecting these existing spaces would be helpful, rather than creating something new.

Ruth Perry asked if there were persistent points of failure where engagement with NOAA breaks down. Mr. Lanier responded staff retention and turnover is a persistent point of failure in his experience. Dr. Hennessey said that sustained support for projects is sometimes lacking.

Jon Allan asked for comment on the different approaches and goals for incorporating traditional ecological knowledge (TEK) into NOAA's work versus their usual ways of collecting data. Dr. Storksdieck asked for thoughts on non-extractive ways of incorporating TEK and other wisdom from practitioners. Mr. Schumacker responded it is important to remember that TEK is often proprietary and

cannot be shared. He also described recent interactions with NOAA on the Olympic Coast National Marine Sanctuary in which tribal elders were able to recall kelp conditions from long before there were any measurements. This was helpful to establish baseline conditions. He encouraged NOAA simply to ask the tribes what information they can share.

Steve Weisberg summarized two topics from the discussion that the SAB should opine on: (1) NOAA needs to be seen as a trusted partner and there are multiple strategies for achieving this, including NOAA affiliates as local trusted partners; and (2) Determining at what scale NOAA needs to provide data and at what point does the state or locality take over. Dr. Perry added that co-creation was also a key point raised during the discussions.

Public Comment

Jan Newton highlighted another useful mechanism for engagement, the IOOS Regional Associations, most of which are approaching two decades of experience. In addition to observations, IOOS Regional Associations have funded sustained models and both real-time and non-real-time data. Lastly, they partner with NOAA, local entities, states, tribes, industry, and NGOs to serve their regions with data and information products tailored to their needs.

Megan Medina, Southern California Coastal Ocean Observing System Regional Association, IOOS, echoed Dr. Newton's comments and added that the Southern California Coastal Ocean Observing System's portfolio also leverages funds from OPC and California Sea Grant.

John Hansen, West Coast Ocean Alliance, briefly described his organization, which is a relatively new regional ocean partnership for the West Coast. Offshore wind and aquaculture are two topics they are currently working on. While they are not a science organization, they seek to fill gaps that are not being addressed elsewhere. The group is excited to connect with NOAA and the SAB to leverage their products rather than inventing them themselves. Furthermore, WCOA wants to explore more ways to work with tribes and address tribal issues and hopes that NOAA can support that effort.

Becky Smyth encouraged NOAA and the SAB to consider the Coastal Commission and State Conservancy as key partners. They are resource managers and decision-makers.

Presentation on the 2025 and 2026 Strategic Research Guidance Memorandum (SRGM)

Sarah Kapnick, NOAA Chief Scientist

NOAA sought the SAB's input on how to most effectively use their annual SRGM, which documents priority areas in NOAA R&D. For the FY26 SRGM, Dr. Kapnick was considering taking a new direction. Previous SRGMs provided great detail on areas where NOAA is doing research, could do research, or where they could expand upon their research. Based on feedback on how people are using and accessing the SRGM, as well as gaps that have been identified, Dr. Kapnick proposed a new structure for the FY26 version by organizing it into four R&D areas: (1) Critical continuing areas; (2) New emerging areas; (3) Areas that may benefit from refocusing; and (4) Risk factors. With the proposed outline, there are sub-focuses that have emerged within each area. Dr. Kapnick discussed each of these and how she envisioned making use of the SRGM as a communications tool. She asked for the SAB's feedback on the proposed outline and a process for providing input going forward.

Discussion

Ruth Perry asked whether sustained observations and the critical need for infrastructure fits into the R&D bucket or if there needs to be a component of the SRGM to address better translation of research into operations. This is an especially important point when engaging with congressional stakeholders, the Office of Management and Budget (OMB), or private sector partners. She commended Dr. Kapnick on including a section on risk considerations, which is important for improving stakeholder understanding. Lastly, she suggested including how R&D fits into other components of the NOAA mission, particularly in the regulatory space.

David Grimes commented on the importance of identifying observations as a risk factor, since having initial boundary conditions is fundamental to supporting modeling. Earth system modeling is going to require an even more integrated approach. He commented that the data assimilation section needs to be more upfront and characterized that way. The SRGM should also include specific reference to the strategic areas outlined in the PWR report. Mr. Grimes concluded that it is also important to include metrics of success or desired outcomes of the research and how it is impactful.

Ilene Carpenter said she did not see anything about the level of urgency. She asked if NOAA has a plan for redirecting or reprioritizing critical work that may need to be done if things change more quickly than anticipated. Dr. Kapnick said that NOAA does not have a holistic strategy on that. They have flexibility but not a strategy. IRA funds are going towards a Climate-Ready Fisheries initiative that will look at the future of this and try to figure out what the strategy should be. This issue may fit into the risk factor section.

Zhaoxia Pu said that observations and improved forecasts are not different components, but the forecast system depends upon a robust observing system. The NOAA plan for observations is included in the SRGM, but the study does not place emphasis on optimizing the system. Based on the different scales of NOAA's forecast and predictions, they need to consider which observing systems need to be built or expanded soon.

Martin Storksdieck asked about how the risks were distinguished from challenges and encouraged consideration of whether each of the items listed were risks. He noted that the category of areas for refocusing did not include any items and asked why that is. Lastly, he pointed to earlier discussions around how human, social, and natural systems are coupled and the degree to which those are being factored into service delivery. He did not believe that was represented in the SRGM.

Dr. Kapnick clarified that "risk factors" is terminology used in financial statements about things that can impact future success. The ability to handle those issues can improve your success and multiply it or it can be negative and it can detract from it. They have added SBES and equitable service delivery/barriers to access to the emerging area. The Science Council is actively discussing this topic. They will continue to discuss whether the SRGM is the appropriate place to discuss areas to refocus or if it should be a communications tool centered on what they are doing.

Stephan Smith commented that the average career of a NOAA bench scientist is 30-40 years, so there is a lot of inertia to deal with. These same scientists are even less inclined to move into interdisciplinary spaces. This also manifests in what they ask Congress for, so it is a challenge to turn the NOAA enterprise into emerging areas. Mr. Allan said that this issue should be identified as one of the risks that need to be tackled directly. He added his support for a stronger articulation of the role of SBES.

Jon Allan said that an ongoing risk of continually adding new sensors and ships is increasing the mountain of data that NOAA does not know what to do with. It is a material risk for an agency if they

cannot articulate what they are doing with all the data they collect. He also commented on the public's loss of confidence in science as a way of knowing and understanding. If NOAA does not understand the forces that undercut science as a way of understanding and informing, a budget that is built on science becomes less and less relevant to the public it is serving.

Mr. Allan also commented that the technology going on ships now will be obsolete faster than what has been installed before. For an agency that is slower moving than the rate at which industry technology changes, this is starting to get out of phase even faster. Dr. Kapnick noted that NOAA is evaluating options for retrofitting new technologies in the future to address Mr. Allan's last comment. Dr. Volz said there is a tendency to conflate technology innovation with the information services NOAA delivers. The objective is to be able to onboard new technology without significantly changing the output information flow, just with enhanced quality and quantity.

John Kreider supported the comment on including metrics as an important way to evaluate programs. This is also a selling point to Congress to maintain funding if NOAA can demonstrate the value of their work. He appreciated Dr. Smith's recognition of the culture challenges, but said he believes NOAA cannot keep asking for more money while continuing things that are not adding value. Leadership needs to make decisions about what needs to end so that money can go towards higher priorities. He would like to see something added about taking advantage of partnerships. He commended Dr. Kapnick on the outline and for trying to make the SRGM more user-friendly.

David Grimes suggested including a section on conditions of success that identifies how the agency can be nimble and responsive to the identified priorities. This would be a good place to include the aspects of partnerships or culture challenges.

John Kreider said that the SAB would be interested in engaging further on the SRGM, first on the format and then on the actual research priorities once they are filled in. He offered to work with Dr. Kapnick to figure out the next steps and how to do that within NOAA's timeframe.

SAB Special Session on SAB Input to the NOAA Budget

John Kreider, Kreider Consulting LLC and Chair, NOAA SAB

Dr. Spinrad, who had requested the special session on the SAB input to the NOAA budget was unavailable to participate; John Kreider shared that his impression was that the session objectives were to discuss prioritization and focal areas pertaining to the NOAA budget. He said that Dr. Spinrad gets input from OSTP and OMB, which tends to be too late in the cycle for real input into the budget and not particularly helpful. As an example, if OMB tells Dr. Spinrad to "prioritize climate services" but gives no further guidance, he would like to be able to get input from the SAB on what "climate services" means and what is important. This could then be used by NOAA as justification when they do their budget formulation.

Dr. Carpenter said that a lot of recommendations have been probably been spelled out in SAB reports. Mr. Allan said if the SAB wants to articulate what they would like to see NOAA putting resources towards, they should do that in a way that generates a list that NOAA would then respond to.

Dr. Wu said that part of the discussion should address the timing of how things are developed. If the SAB is going to have meaningful engagement, it would need to be in the summer when NOAA is formulating its priorities, and part of that process should be something that provides a context of what changes the agency is formulating.

Mr. Grimes said that he was more focused on the SAB's process and role in this than in how to respond. He thought putting the emphasis on the SRGM would go farther in making the kind of contribution that NOAA is looking for. NOAA has the mechanism to call a special meeting if they want insights or clarification on a particular topic. Rather than trying to invent a process to redo much of what they have already done, he was inclined to rest on the input the SAB has previously provided.

RADM Hann made several comments based on conversations she has had with Dr. Spinrad through the budget process. She said that the SAB's guidance on how NOAA can position itself to be most effective in budget requests could come in the form of keeping NOAA focused on who its audience is and what their objectives are. This could involve having specific plans vetted by the SAB that NOAA can point to when requesting funding.

Dr. Thur said that getting input now through the late fall is the appropriate time if it is going to be incorporated into the FY26 request. It is too late to have any meaningful influence over the '24-'26 requests. He said that any Administrator is going to include their own priorities in the budget irrespective of whether the SAB agrees with them. It is also the case that additional funding for the agency's core services is never high on an Administrator's list because they are not as exciting as new concepts. One of the roles the SAB could play is to provide information about long-term needs not tied to the priorities of a particular Administration. Since five of the six AAs are career positions, that advice will have longevity regardless of future changes in Administration.

Dr. Volz said that the SAB's input is not as helpful in the operational or strategic ways they develop budgets, since they are working years ahead. Their support is helpful in nudging and driving NOAA to recognize strategic changes that the agency needs to be adapting to. 80 to 90% of NOAA's budget is driven by operational "must-dos." The only way to change the course of the agency is to change some of those must-dos and the way they are done. NOAA needs to consistently evaluate how they should evolve over the coming 3-5 years. Dr. Howell said NOAA could use advice on how the agency can take calculated risks and what efforts could be reprogrammed, where they can start to act as "One NOAA" as opposed to a collection of Line Offices, and in what ways they can get research to operations more effectively.

Zhaoxia Pu said that the observing system needs updating and that should be at the top of NOAA's budget considerations. With their S2S forecasting priority, NOAA should also consider how they are contributing to the Global Observing System and how that could be improved. Dr. Wu said that plus-ups offer opportunities to get new things done even if the next few budgets are already set. Also, if the agency is unable to execute obligating funds in the BIL or IRA, there is a process for reprogramming money that has not been expended.

Mr. Grimes said that characterizing risks to help NOAA understand where vulnerabilities are with respect to maintaining and supporting operational systems would be useful. There may not be enough time to do this for FY26, but the SAB could set up a process that would allow them to provide insights based on where there are critical vulnerabilities. They could also look at areas that have been deprioritized within NOAA and the vulnerabilities that presents going forward. Dr. Perry agreed and added that she did not want the SAB to get involved in telling NOAA what to do and how to do it, but rather focusing on what NOAA should be doing in the future.

Chair Kreider suggested posing questions about vulnerabilities that NOAA is not asking itself to stimulate thinking. Dr. Wu said that a budget overview and highlights can provide a good sense of policy priorities within a budget. The SAB does not need all the details of the line items to get a sense of what the longer-term plans are. The other aspect is the context of execution. To be forward-leaning, the agency should look at potentially unobligated funds and where they could be used before they get moved to other

agencies for other purposes. Dr. Pu noted the \$7 million increase in the IRA funding to improve weather prediction that was likely influenced by the SAB and the PWR report.

Mr. Grimes suggested that the SAB focus on inputs to the FY27 process at their next meeting to get a better sense of the give-and-takes that happens in the current budgets. They could come prepared to discuss what they feel are the emerging risks or vulnerabilities or aspects that might need extra attention in the budgeting process. Rather than offering any input to the FY26 budget, the SAB should focus on working with Dr. Kapnick on re-envisioning the SRGM and how the SAB could influence that.

Dr. Weisberg suggested the SAB should have a conversation about visioning. Once a vision is set for a few target areas, they can talk about where that fits into a budgeting process. Chair Kreider agreed that providing long-term issues was a reasonable approach and considered putting it in the form of a question, such as "What's your objective for the percentage of eDNA surveys in five years and how are you going to get there?"

Dr. Storksdieck suggested doing nothing until Dr. Spinrad has a chance to read what they have discussed and provide further guidance on what he is seeking. Mr. Grimes suggested the SAB should acknowledge that (1) they have noted the points made by NOAA leadership during the discussion, (2) they are concerned that the integrity in NOAA is strong through the whole process, and (3) they are open to future invitations to take on actions or requests for providing input.

John Kreider asked the SAB Office to prepare minutes of the discussion to share with to Dr. Spinrad. Chair Kreider offered to engage in a phone call with the NOAA Administrator to go over the discussion and take any feedback, to ensure he is not looking for something else. If this discussion missed the mark of Dr. Spinrad's intentions, Chair Kreider will reach out to the SAB and they can figure out where to go from there.

SAB Tsunami Science and Technology Advisory Panel (TSTAP) Statement on National Risk Index

Corina Allen, Co-Chair, TSTAP

Corina Allen presented the TSTAP's statement on improved tsunami risk characterization in FEMA's National Risk Index (NRI). Currently, no national tsunami hazard map exists for the U.S. In the absence of such a map, FEMA developed a method to determine tsunami hazard zones and at-risk areas. TSTAP has concerns about these methods and believe that FEMA's approach drastically underestimates local and state tsunami risks. The consequences of this include an inaccurate national definition of at-risk coastlines for tsunami hazards, which conflict with tsunami hazard zones identified by NOAA's National Tsunami Hazard Mitigation Program. This could result in reduced FEMA funding for critical lifesaving mitigation activities for certain at-risk areas.

Ms. Allen provided a brief overview of the NRI and its uses, and suggested that the SAB or NOAA look further into FEMA's methods and how they characterize risk. Large amounts of mitigation funding are dedicated to communities designated high-risk by the NRI. With the money available from BIL and IRA funds, this is an important time for communities looking to invest in tsunami risk mitigation and having risks properly defined in such a tool is critical.

TSTAP's statement includes the following three recommendations: (1) NOAA should communicate to FEMA leadership and federal decision makers that the NRI currently misrepresents tsunami risk and that these errors can have negative impacts to community preparedness, local and county planning, mitigation funding opportunities, access to funding, and policy making; (2) NOAA should support its federal, state,

and territory partners to develop interim tsunami hazard maps for local and distant tsunami sources for NRI use based on subject matter expertise that includes consistent hazard mapping assumptions and includes attributes relevant to the NRI; and (3) NOAA should work with its partners to develop national probabilistic tsunami maps for local and distant tsunami sources that are updated every four years to align with the building code cycle and the U.S. Geological Survey's National Seismic Hazard Map.

Discussion

John Kreider asked if there are concerns with the other elements of FEMA's hazard assessment map beyond tsunamis and if NOAA was in communication with them during its creation. Dr. Lopes said that the NRI has been developing and expanding for the last 15 years from its original focus on hurricanes and inland flooding. Ms. Allen said that TSTAP has been in communication with FEMA and they presented at one of TSTAP's meetings. There was no coordination with NOAA's National Tsunami Hazard Mitigation Program during the development of NRI's tsunami component. She added that there was no significant engagement on the earthquake or volcanic hazards components either. Dr. Carpenter said that flash floods are currently not captured in the database and there is no group analogous to the TSTAP looking at other risk areas.

Martin Storksdieck asked if the TSTAP expected any conflict to arise from this statement or if the various parties were all in general agreement. Ms. Allen said it is all about timing. It would have been great if there had been coordination in the development of the NRI, but the product exists and it is urgent for NOAA to reach out to FEMA to say that it does not accurately capture risks for tsunamis (and perhaps other risks as well). TSTAP has had discussions with FEMA and they seem interested in collaborating, but they are currently not planning to update the NRI for at least another five years. The impacted communities need mitigation funding and it is important to support better data for informed decision making. There is broad agreement on the need for a national map of this data, but there is no entity currently willing to take on the task of developing it or funding it. Dr. Lopes noted that FEMA sought public input on the NRI Community Disaster Resilience Zones, and the public comment period just closed. If the SAB approves this statement and NOAA transmits it to FEMA, it would be very timely.

Zhaoxia Pu commented on NOAA's role in tsunami prediction and the need for increased research for long-term prediction and projection going forward. Ms. Allen said that International Building Code calls for probabilistic tsunami modeling that incorporates sea level rise. States are far behind in this effort and there is a need for information and modeling to be able to include future climate conditions into tsunami modeling.

Ilene Carpenter proposed other meteorological-dependent risks that are not reflected in the NRI, such as riverine flash flooding, severe heat, or if sea level rise is incorporated in coastal flooding as a potential topic for the SAB to explore. Dr. Storksdieck noted the potential political dimensions of such maps.

Steve Thur said his team was strongly in concurrence with the TSTAP's recommendations, particularly the very short relative time period to consider developing the NRI for tsunami risk. They noted a 1700 Cascadia magnitude 9.0 event that resulted in a tsunami but was not included in the NRI because of timing issues.

Martin Storksdieck made a motion to accept the TSTAP's statement and transmit it to NOAA. Ilene Carpenter seconded the motion and it passed unanimously.

John Kreider said he would be interested in hearing whether NOAA has been in communication with FEMA concerning their hazard indices. Dr. Carpenter suggested asking if NOAA has undertaken an evaluation of the validity of the NRI for other hazard types that fall within NOAA's scope. Mr. Grimes

suggested including the question in the transmittal letter accompanying the TSTAP statement and the SAB agreed.

Overview of the National Environmental Satellite, Data, and Information Service (NESDIS) Space Weather Office

Elsayed Talaat, Director, Office of Projects, Partnerships, and Analysis

Elsayed Talaat provided an overview of the Office of Space Weather Observations (SWO). For many decades, NOAA has worked to understand the sun's changing environment as part of its role as the national operational space weather advisory service. The SWO provides decision makers and users with actionable information and tools to help plan for, respond to, and mitigate harmful impacts of space weather through observational data from NESDIS, commercial data buys, and partnerships with ground-based observations. SWO provides storm forecasting by the Space Weather Prediction Center (SWPC) and data management by NCEI.

Dr. Talaat discussed the impacts of space weather on infrastructure and activities vital to national security and economy. As the solar maximum approaches, the likelihood of impacts is increasing and the maximum event is now expected to be twice as active as previously predicted, making space weather information even more critical. A 2017 study indicated that global economic impacts from an intense solar space weather event ranged from \$2.4 to \$3.4 trillion in the number of outages over a year. Another study the same year estimates large-scale space weather-induced blackouts affect about two-thirds of the U.S. population. The resulting potential domestic economic loss to the United States is equal to \$41 billion per day and an additional \$7 billion in daily losses to the global economy.

SWPC interfaces with a variety of stakeholders and end-users that rely on actionable information for forecasting space weather storms. NESDIS' capabilities to predict solar storms as they propagate towards earth and how those predictions are coupled with the environments of the earth's magnetic field and how that translates down on-the-ground electric currents that could affect local power grids has advanced in the last decade. Even with these advancements, significant model developments are needed, along with a broader effort to incorporate data from observations, lower orbits, and beyond. These need to be simulated in models to improve forecasts in line with the increasing needs of SWO stakeholders.

Dr. Talaat discussed SWO's assets and partners. SWO and its partners' research has not only advanced their capabilities to predict space weather and its impacts, but also highlighted the need for enhanced observations. Critical space weather assets are well beyond their planned life, which is why SWO began developing follow-on systems that will succeed those observations. These include the Space Weather Follow-On and Space Weather Next programs. Additionally, enhancements are planned that will require enough funding to provide continuity. This work is being done in the context of space weather as a national priority and growing demands on NOAA for improved modeling and capabilities.

There are also several government directives outlining this, such as the Promoting Research and Observations of Space Weather to Improve the Forecast of Tomorrow (PROSWIFT) Act, which integrates the national space weather activities and codifies the whole-of-community/whole-of-government approach to space weather. The PROSWIFT Act directs NOAA to provide operational space weather monitoring forecasts and long-term data archiving, maintain their ground- and space-based assets, and provide research support to operational responsibilities.

To continue meeting user needs, NOAA needs a stronger research infrastructure to support its operational responsibilities. The PROSWIFT act also instituted a Space Weather Advisory Group that has provided recommendations to the OSTP's Space Weather Operations, Research, and Mitigation Subcommittee.

NOAA has kick-started a One NOAA Space Weather Strategy effort that will foster cross-organizational engagement, alignment, and commitment to NOAA's space weather enterprise. They plan to create a cohesive, compelling narrative on NOAA's vision and future state, as well as coordinate to have a One NOAA communication effort to champion the strategy.

Discussion

Brad Colman asked for an update on the Global Oscillation Network Group (GONG) and the strategy for developing the Next Generation GONG (ngGONG). Clinton Wallace, Director, NOAA Space Weather Prediction Center, said a \$17 million investment is needed just to begin the design of a new GONG network. SWPC is working with its partners to support the Solar Observing Optical Network and Solar Electro-Optical Network and discussing the potential to merge these with GONG into a common network. SWPC has discussed this need with the Department of Homeland Security in hopes that they may be able to contribute to the effort. NWS supports the continued operations and maintenance of the GONG network in partnership with the National Science Foundation (NSF), but they still need to secure the appropriations to make the necessary investments.

Tony Wu asked if the lifetime estimates for satellites presented were based on design life, mean time to failure, or a distribution of historical lifetimes. Dr. Talaat said they were derived from a mixture of these. The Solar and Heliospheric Observatory, Advanced Composition Explorer, and Deep Space Climate Observatory are all beyond their design life and have definitive end dates due to a lack of fuel or degradation from the solar particle effects. There is an agreement to extend the Polar-Orbiting Satellite's lifetime for five more years to ensure continuity, but the particle measurements are not being continued right now and that is what they are trying to plan for with Space Weather Next.

Ruth Perry said that it seemed like there is a robust plan for the observing network and new assets coming online. It was not clear where the urgency was, which is something an appropriator would need to see. It may just be an issue of the messaging and the information not aligning. Dr. Talaat said they have a plan and funding that would only currently allow for a single stream resiliency in Lagrange Point 1. Single streams for an operational asset are risky. SWO also needs to have enough funding to replenish assets in geostationary orbit coming with the end of the Geostationary Operational Environmental Satellite (GOES) series. There are also capability enhancements identified by SWPC and stakeholders that SWO cannot do right now. Complementary resources are needed for modeling, because they cannot take advantage of the current or planned observations without sustained R&D from an operational viewpoint. Dr. Perry said that these things should be made clear in the messaging. It would also be helpful to see where the funding needs to be initiated in the fiscal year cycles to meet objectives.

Steve Weisberg commented that the slide stating \$41 billion is needed for NOAA's space weather work did not outline what that investment was for and what the value of that investment would be for the nation. Dr. Talaat said accurate space weather forecasting is critical for national security (particularly high-frequency radar), positioning, precision agriculture, power grids, and more. Space weather impacts on an area like the Eastern Seaboard could have trillion-dollar costs associated with them.

Martin Storksdieck asked about how they intend to tell the story of space weather. He said, whether Congress or the public, people do not know about this science, and NOAA needs to tell a more informative story of what actually happens. The immediate impacts of space weather need to be made clear to listeners.

Ilene Carpenter asked what some of the other impacts from space weather could be. Dr. Talaat said that positioning systems could be knocked out for hours to days. Transformers could go down for weeks, months, or even years depending on how long it takes to replace. Civil aviation is another area that could

be impacted due to turbulence in high-frequency communications and increased radiation for passengers and crew.

David Grimes noted that NOAA made commitments to the World Meteorological Organization to serve as a leader on this topic because of the global risks. He was surprised that was not mentioned during the presentation. He also suggested approaching the needs from the perspective of what might happen if the needed investments are not made. They should highlight the most important pieces that allow them to operate effectively. There may be huge financial consequences of just funding this at enough level. He stated that financial numbers do not always have the same impact as characterizing the immediate consequences, such as a prolonged blackout.

Report on the Review of the Cooperative Institute for the North Atlantic Region (CINAR)

Steve Weisberg, Southern California Coastal Water Research Project, SAB Member, and Chair of the Review Team

John Kreider recused himself from the discussion, and Casey Stewart chaired in his stead. Steve Weisberg presented the report and began by stating that the reviews team was impressed with the operations at CINAR and proposed a rating of outstanding. NOAA is receiving high quality scientific products from the relationship with CINAR, and it is beyond what it could produce alone. Another advantage that CINAR offers NOAA is continuity, with 10-year extramural grants, compared to typical two or five-year grants. The research CINAR does is particularly relevant to NOAA. There are a high percentage of students coming out of CINAR that would not otherwise have considered working for a federal agency, but are because of the program. The report provides examples of each of these benefits to NOAA.

Opportunities for improvement include: better leveraging of untapped resources at CINAR institutions, especially by better educating their staff on available opportunities. The review team recommended broadening participation in CINAR by developing ways to inform faculty about the cooperative institute (CI), its mandate, and opportunities for funding, in addition to better informing NOAA program managers about CINAR opportunities. The research done at CINAR is mostly reactive and responding to immediate NOAA needs. There is no real utilization of contract vehicles, just investigators meeting with NOAA program managers and doing mostly low-risk, short-term projects. This is largely on the granting institution because of the constraints of Task 1.

The review team recommended transitioning CINAR's culture from reactive to proactive by being more involved in NOAA's research planning, holding workshops in selected emerging topic areas, and working with NOAA to find unencumbered funds to invigorate the planning process. The review team also recommended promoting diversity by taking advantage of DEI (diversity, equity, & inclusion) opportunities and establishing mechanisms for tracking diversity.

Discussion

David Grimes said the report was well done, and that he was supportive of both the CI rating and the report. He commented that there is a trend with the CI's reviewed by the SAB where said most of the funding gets put into highly targeted science efforts and there is not much funding going towards fostering better collaboration. He emphasized the importance of increasing the level of funding for Task 1 to enhance outreach and support the mechanisms needed to understand DEI and suggested identifying this in the transmittal letter.

Dr. Decker noted that the DEI issue has not been due to funding, but because DEI considerations were not written into the cooperative agreement. The remedy for that is not necessarily more funding, but language that needs to go into the agreement. Dr. Kapnick said that the CI Handbook has been updated and includes DEI metrics, but this only goes back to CIs when they are seeking a new funding agreement. Dr. Thur commented that many CI DEI activities are not currently funded by NOAA, and it has been questioned whether it is appropriate for NOAA to rate and potentially decide renewal decisions based on something they are not funding the CI to do.

Ruth Perry said that the science and engineering work coming out of CINAR could help deal with regulatory challenges around North American right whale issues. The SAB may be able to figure out how NOAA can tap into the CIs to transfer some of the science, engineering, and R&D into other applications across NOAA.

David Grimes made a motion to accept the review team's report on CINAR. Ruth Perry seconded the motion and it passed.

SAB Special Session on Artificial Intelligence: Overview of NOAA Activities

NOAA Center for AI (NCAI) Objectives and Current Activities

Rob Redmon, NOAA Center for Artificial Intelligence

Rob Redmon provided an overview of NOAA's Center for Artificial Intelligence (NCAI), whose role is to carry out the agency's strategic objectives through their AI community of practice. NOAA's AI strategy is aligned to the NOAA Strategic Plan, and Dr. Redmon touched on elements of the plan with respect to AI. There is a recognition that climate baselines are decreasingly relevant. To mitigate economic loss, large-scale information products need to be created with increasing frequency and delivered to cloud environments with widespread access. To balance economic growth and environmental stewardship, NOAA's data must be AI-ready, cloud-accessible, and broadly usable. Standardizing what it means to achieve trustworthy and responsible AI will be critical.

NCAI's goals include: efficient governance advancing AI research all the way to operations and application; new partnership development; and workforce training for development and management purposes. This all requires a "One NOAA" approach and taking strategic steps to increase coordination. All of NOAA's major offices are contributing staff to realize their vision together.

NCAI's implementation vision centers on their Center of Excellence Tech Hub Small Program Office. With initial resourcing provided by NESDIS, they have achieved some early initial steps toward creating a library of human talent, training materials, data standards, and new partnerships. Ultimately NCAI is working to optimize work flows for those who want to use these tools, sharing knowledge, and obtaining results with AI. The vision in the AI strategy fits well in the context of the SAB's mandate and working group activities.

Open science is a critical tenet of NCAI. With the resourcing they have received to-date, they are advancing three initiatives and several pilot projects to help mature those initiatives. NCAI's flagship effort at NOAA is developing an AI-ready data standard to provide a scientific data stewardship trajectory that advances the fairness of their data and accelerates the development of new ethical environmental services. They are doing this by contributing to and leading contributions through the Earth Science Information Partners data readiness collaboration cluster.

Mr. Redmon proposed that responsible AI can make or break the equities that NOAA cares most about. Workers who can responsibly integrate AI into institutional work flows will position themselves and their institution for the future, including for environmental equity and justice.

As part of planning for greater coordination, NCAI curated a collection of more than 60 new projects not yet resourced that would exponentially advance NOAA's mission with the infusion of responsible AI techniques. Project themes included advancing climate information partnerships, advancing earth system prediction, and preparing NOAA's capabilities to power future digital twins. It is essential to the success of NCAI that it continues to engage in conversations outside of NOAA to maximize the benefits of integrating truly responsible AI and other emerging technologies to realize NOAA national objectives.

Oak Ridge National Laboratory

Katherine Evans, Oak Ridge National Laboratory

Katherine Evans presented the Department of Energy's view on AI from her vantage at Oak Ridge National Laboratory (ORNL), the largest of all science-focused National Laboratories. Topical areas at ORNL include biology and the environment, which has many connections to NOAA, the National Academies of Science, and other earth science agencies. Dr. Evans' division applies large-scale model simulation and data analytics to oceans and atmospheres; this connects to the Oak Ridge National Laboratory's Biological and Environmental Systems Science Directorate, which does various kinds of modeling and experimental work.

ORNL has started an initiative across its labs to build out the use of AI/ML methods to apply to several science areas. Their focus areas are AI for engineering and science (including digital twins, network systems, controls, and prognostics), AI for scientific discovery and design (including surrogate models for multiscale systems and processes, AI-based optimization and system design, and causal analysis and design of experiments), assurance (including uncertainty quantification, verification and validation, explainability and interpretability), and scalable AI.

Their mission is exploring AI applied at the largest scales of computing. Dr. Evans provided several examples of how ORNL is using AI for earth science, including surrogate models and inversion-free prediction, using ML to reduce computational costs, and using the open source NOAA Ocean Model data to develop basic foundational models for specific applications. She presented areas with opportunities for augmenting ORNL's impact by using AI for earth science, particularly workflows and science efficiency. ML potential for improving predictability is highest when sufficient data is unavailable, which is always a challenge.

AI and the Microsoft Research Portfolio

Ashley Llorens, Microsoft Research Outreach

Ashley Llorens shared that Microsoft Research has been around since 1991, and their work includes many disciplines beyond computer sciences. In recent years, there has been a paradigm shift from functions that can perform one type of mapping training through a process of supervised learning in order to predict future measurements. These are called foundation models, or generative pre-trained models, where one model can produce many such mappings.

A new trend in AI space is multimodality, which has significance for the SAB's focus areas. These models are trained on language, but also on images, code, and other modalities and can apply inference. Another key trend is the scale of models they are seeing, with scale referring to the number of tunable

parameters in a model. There are emergent capabilities where improvement in a simple training metric greatly improves many downstream tasks, sometimes in unexpected ways.

Microsoft has a rigorous responsible AI community that spans research engineering and policy. Through its governance processes they have integrated these capabilities in many different products.

Mr. Llorens emphasized three points that are worth the SAB's consideration: (1) The broad boost in productivity from utilizing foundation models for many different tasks; (2) The potential for unlocking value from massive heterogeneous data through the process of pre-training; and (3) The potential for enabling a new paradigm of scientific discovery. He described examples of applications for each of these benefits within the Microsoft Research portfolio.

Center for Equitable AI & Machine Learning Systems

Kofi Nyarko, Center for Equitable Artificial Intelligence and ML Systems, Morgan State University

Kofi Nyarko began by mentioning that with the accelerating pace of AI/ML development, it is important to remain aware of the potential for algorithmic bias, which could cause harm to particular populations.

Morgan State University's Center for Equitable Artificial Intelligence and Machine Learning's (CEAMLS) mission is two-fold: (1) To facilitate the relevant deployment and verification of socially responsible AI and (2) To make sure that the public comes along and is able to follow the rapid advancements in AI in a way that they can understand its potential impact on their health, prosperity, and well-being.

CEAMLS serves as a facilitator, not just in R&D but also in developing standards and new methods/technologies that do not sacrifice performance for responsibility. They are currently working with the State of Maryland and a few organizations on applying responsible AI and ensuring that they have practices and procedures in place for remediation of harm caused by AI.

The four goals of CEAMLS are: (1) To make sure their research is competitive; (2) Address the emergence of potential algorithmic bias; (3) Ensure more diversity of voices in the development of AI systems; and (4) To be good collaborators with government, industry, and the private sector to can extend what they have learned and help shape standards and best practices. CEAMLS' interdisciplinary research currently focuses on best practices and standards, AI transparency, objectivity optimization, bias detection and remediation, testing and validation, AI misapplication, and model stress testing. They have also developed an ethical AI framework that governs some of the work in trustworthy AI.

Dr. Nyarko discussed some of the projects underway at CEAMLS, particularly those with a connection to climate science, including the extension of data obtained from satellite imagery and extended from obtaining AI to volumetric information through the training of surrogate models.

Opportunities and Challenges for AI in NOAA's Weather and Climate Mission

John Williams, IBM

John Williams presented on work of IBM's The Weather Company, who use large amounts of NOAA data and content. The Weather Company does their best to amplify NWS messaging around hazardous weather and they are stakeholders in advances in NOAA's technology portfolio.

Environmental science time frames range from historical and current conditions, up through seasonal climate forecasts. While the forecasting element of this is probably most exciting day-to-day, authoritative and curated historical data are also essential in developing AI methods. For the weather enterprise, the weather content value chain includes observations, models, forecasts, their impacts, and decisions. AI has a role in all these steps. AI allows users to extract information from the growing collection of data sources, perform translations, calibrations, quality control, and generate a simulation in models. This is all at a scale that would not be possible with automation and use of more data sources.

AI can add value to traditional physics-based numerical weather prediction (NWP) through post-processing that corrects or quantifies systematic model errors. Ensembles of model forecasts can be calibrated to represent uncertainty. AI is bringing a revolution to the field of NWP and this has great relevance to NOAA's portfolio. There has been a lot of skepticism within the weather enterprise around whether new models can be competitive with dynamical weather models. Over the last 18 months, it has become increasingly clear that they are the “real deal” and need to be taken seriously.

Deep learning NWP provides profound opportunities and challenges for those NWP modeling portfolios. Opportunities include potentially improved forecast accuracy, amplified model development, and faster processing on simpler hardware. Calibrated ensembles, coupled with impact and optimization models, are essential to enabling better decisions. NOAA could use its resources and convening power to orchestrate community development in comparing emerging machine-learned NWP methods. Challenges include the fact that these technologies are being advanced very quickly and NOAA's traditional cycle of model development and deployment may not be nimble enough to keep up.

Dr. Williams highlighted several of the possible areas where AI could provide meaningful benefits along the weather content value chain and some challenges due to its current limitations. It is not currently clear where AI will go in the future, but it is clear that, to take advantage of these new technologies, it may be necessary to change traditional ways of doing things and implementing AI/ML tools to stay relevant.

NOAA will likely have institutional challenges in pivoting to take advantage of some of the new opportunities presented by AI. Many of these challenges have been recognized by NWS and NOAA more broadly and are being addressed by the NCAI, including in their upcoming workshop. NOAA may still need even more urgent attention to this topic, given the velocity and scope of recent advancements in AI.

Dr. Williams concluded by highlighting the NSF AI Institute for Research on Trustworthy AI in Weather, Climate, and Coastal Oceanography as a successful example of multi-sector collaboration between government, industry, and academia.

Panel Discussion on the Role of Artificial Intelligence in Advancing NOAA's Mission

Zhaoxia Pu asked what NCAI sees as its main function for AI in NOAA's operational prediction and observation roles. Dr. Redmon said their main role is to increase coordination for sharing knowledge across the organization. NCAI is not going to replace the work that other groups are doing. It is more about trying to encourage and set guidelines and eventually requirements for teams that are doing work at and with NOAA to develop AI-ready data and reproducible lessons learned and integrate them into transition-to-operations plans. Dr. Pu said she would like to see a clear roadmap for NCAI, AI research, and its operational use in NOAA. Dr. Redmon pointed to NOAA's AI strategy, which addresses some of these issues.

Martin Storksdieck asked the panelists to explain why AI makes work so much faster and better than traditional methods. He also asked if the bias in AI is in the model or in the data the model is being trained on, and what NOAA should consider before using it more broadly. Mr. Llorens discussed a few factors where AI speeds up work processes, such as AI-accelerated hardware and the ability to predict outputs. Depending on the problem, the speedup can manifest in different ways. Dr. Nyarko added that parallel processing and simplified representations also contribute to speeding up computations. Dr. Evans said this simplification means they are faster, but not necessarily more advanced. A lot of this work is done at lower precision.

Dr. Williams said bias often exists in the datasets used to train models. Users must adjust for this in how they are training and using the model for it to make reasonable predictions. Dr. Nyarko said there are several sources of bias, including data bias, selection bias, label bias, algorithmic bias, confirmation bias, measurement bias, and others. Mr. Llorens said that bias shows up in the generative pretraining regime differently than the way it shows up in supervised learning. Users can tell the model not to be biased in certain ways through prompts and induce different behaviors relative to the different ways that bias shows up. This is a fundamentally different paradigm for controlling and mitigating bias.

Brad Colman commented on how far AI applications have come towards being competitive with traditional models in such a short time. He asked if there is a good development path forward for forecasting systems that EISWG should be considering. Dr. Williams said many of the models are running on reanalysis data, which relies on a dynamical model and the data assimilation framework. There may be opportunities to use deep learning to generate large ensembles that are useful for data assimilation. He imagines that new techniques will be trained on a huge amount of expertise and domain knowledge and will serve as accelerants and tools for the modeling community. There is the risk of getting caught unprepared if scientists do not start adopting these methods. He suggested finding out where AI work well and where they do not, as well as putting resources into making them better and more usable.

Stephan Smith said that the analysis required of AI outputs to ensure their quality currently negates much of the productivity gains from utilizing the tools in certain contexts. To Dr. Colman's question, scientists will still have to interpret the predictions that the models provide. In a physics-based model, this is straightforward but there may need to be an investigative board to find out why AI models get things wrong; the analysis of how AI generates output is very challenging. One area that NOAA that would benefit the weather service industry is getting better and more affordable generative ensembles that get into the probabilistic realm.

Michael Morgan commented on the direction that NOAA should be going with respect to NWP; NOAA should be investing in exploring how to improve its models, parameterizations, and data assimilation techniques.

John Kreider asked about the skepticism around models being developed by computer scientists without domain knowledge. He asked if there were examples of bringing the two communities together, and if it that helps the situation or impedes it. Dr. Williams said it is probably a good thing to do. The NSF AI Institute he mentioned in his presentation is a combination of social scientists, domain scientists, computer scientists, industry, and government. Mr. Llorens said that Microsoft Research is focusing this paradigm of scientific discovery involving training deep learning emulators of natural phenomena. Their AI for Science lab brings together people from the natural sciences with their pool of talent in deep computing. There are people in scientific domains who are energized to work with computer scientists on some of these things, and that is where they see a lot of good collaboration happening. Dr. Nyarko added that domain knowledge is valuable because AI models can have issues with generalizing, where they are trained on a specific task, but struggle to apply learning to related but different areas. He said that domain

expertise can help better define problems and improve models' interpretability, which helps with generalizing.

Jon Allan asked about the possibility of taking non-analogous datasets from weather prediction, climate science, and social science, and training them to understand where to look for precursor signals of social unrest. Mr. Llorens said a language model that can take a lot of disparate conversations and qualitative descriptions of events would be a tool for exploring this topic. He added that there is a different family of tools whereby they try to seek the answers to causal questions. Some combination of these more correlational language processing tools and causal computational techniques may be appropriate. Dr. Williams said that, as a theoretical structure, he might consider agent-based models which have some capacity to infer value functions for agents based on observed behavior. Dr. Evans commented on the challenges with data models versus physics-based models. Dr. Redmon said that the European Union's Destination Earth project is seeking to create a digital twin that pairs climate and weather information with socioeconomic and social mobility information to run various scenarios.

David Grimes asked if AI would be a good tool to try to probe the relationship response between physical changes in the earth system and the biological response that follows. This could inform adaptation and mitigation elements and may present one method that could help inform the risk profile associated with taking technological actions to decarbonize. He also asked how AI might be used as an extension of NOAA or other agencies' warning products to help the public better understand potential impacts of an event. Dr. Redmon said the digital twin for earth systems concept presents a lot of opportunities for evaluating relationship responses and that is an area that is being explored now. On the second question, he said that NOAA's Social Science Initiative Committee is interested in potential avenues where sophisticated AI can be used to enhance their communications. Dr. Smith said that they are moving out in multiple fronts on social science and its application to mission operations. AI is part of this, but NOAA's efforts in this space are still in their infancy. The potential is high but it must be done in an equitable manner.

Rob Redmon asked what NOAA thinks of synthetic data generation and data augmentation for use in weather modeling. Dr. Williams said they need to be careful that they are generating synthetic data that is physically realistic. He has an intern currently working on fronts prediction by creating synthetic data, which helped extend the available dataset. Dr. Nyarko cautioned that this does not always catch the nuances of the real world. Dr. Evans said that in the area of human health, synthetic data is a great way to do training and other things without having to worry about privacy issues.

Ilene Carpenter asked how close we are to having methods that give very fine resolution of downscaled data for decision support using these kinds of data-driven models. Dr. Williams said he would be surprised if those models were not available in the next year. Instead of statistical downscaling or dynamic downscaling, they are looking at ML methods as an alternative to get high resolution data.

Cynthia Decker asked the panelists what they think ethical and responsible AI is and how NOAA can guard against misuse of AI. Dr. Nyarko said it is AI that tries very hard to make sure not to disenfranchise any particular group of people. He explained that this involves paying attention to the potential for AI to act in a way that is not just wrong, but wrong to a particular group of people. Mr. Llorens recommended reading the voluntary commitments that the White House has asked of some of the largest tech companies in this space and what they have responded with. Dr. Williams said that responsible and ethical AI should be transparent. Dr. Nyarko added that accountability is also very important and mechanisms need to be in place to determine who is responsible if an AI system does cause harm.

John Kreider asked the panelists what they would want from NOAA that would help accelerate their work. The panelists wanted more NOAA data made available in a way that allows the public to be able to train their models and extract insights from it. NOAA could use their educational mission to educate the public on AI. NOAA could use both competitions and its convening authority to bring new AI methods to light and evaluate them.

SAB Climate Working Group (CWG) Review of the Climate Program Office Draft Strategic Plan 2023-2027

Kirstin Dow, Co-Chair, CWG

Joellen Russell, Co-Chair, CWG

Joellen Russell presented the CWG's review of the Climate Program Office's (CPO) Draft Strategic Plan. The plan centers on four major goals: (1) Advance the science foundation for climate change resilience and mitigation; (2) Improve knowledge of climate, its risk and impacts, and its solutions; (3) Enhance literacy and capacity to respond to climate change; and (4) Empower the workforce to advance NOAA priorities. These goals address important directions in order for CPO to its pivotal role in NOAA's mission.

The CWG commended the CPO for engaging with other Line Offices in the development of their strategic plan. That approach, which promoted horizontal and vertical integration of goals, presented a valuable opportunity for increasing coordination and dissemination of the CPO's expertise across the agency.

The CWG offered three overarching suggestions for the strategic plan: (1) Include more specific “moonshot” level goals in service of the nation; (2) Better articulate the significance of CPO to NOAA and national and international climate enterprises; and (3) Engage key audiences by adding examples of broadly relevant initiatives under each goal. The CWG believes in the CPO's goals and in its ability to implement the strategy to achieve them. The full CWG report includes further suggestions, but these were the three key ones the CWG wanted to relay to the SAB.

Discussion

Casey Stewart asked on behalf of Steve Thur if the CWG felt the draft strategic plan was responsive to the recommendations from CPO's program review from a year earlier. This was not explicitly addressed in the report. Dr. Russell said the breadth of the suggestions made by the review panel was covered by the strategic plan. The CWG had hoped that the plan would be more specific about things that could be achieved with the caveat of limited resources, but they felt it met the recommendations of the outside panel.

Dr. Thur had also asked for the CWG to provide additional detail on what it meant by "motivators" in their report where it mentions calling out the “motivators to underscore why CPO is needed now more than ever.” Dr. Russell said they were thinking of how CPO provides a value proposition in its work; specifically, its climate scale prediction helps citizens improve adaptation and mitigation efforts.

Martin Storksdieck asked for examples of what some of CPO's “moonshots” might be and what the world of climate prediction and action would miss in the absence of CPO for the next five years. Dr. Russell said she would like to hear from CPO what their stretch goals might be, but the public is asking for 3-to-5-year and 5-to-10-year time scales to help in adaptation efforts. Since NWS predictions stop at two years, CPO's work has been essential in supporting prediction efforts and holding workshops to discuss best practices for preparing areas and services for future events. Large regional differences make this

even more challenging, requiring high performance computing and more research into ensembles. CPO's work catalyzing research in physical science, biogeochemistry, and the carbon cycle are critical, along with its communication, education, and outreach components.

Jon Allan made a motion to accept the CWG's Review of CPO's Draft Strategic Plan. Ruth Perry seconded the motion and it passed unanimously.

Report on the Review of the Cooperative Institute for Research in the Atmosphere (CIRA)

Betsy Weatherhead, University of Colorado, SAB Emeritus Member and Chair of the Review Team

Betsy Weatherhead presented the review of CIRA, first introducing the review team and then discussing the review process. Their written report includes notes from the team on things they found particularly helpful in the review process, including holding preliminary webinars and having a thorough briefing book in advance of meeting in person. The review team was very diverse and brought a range of perspectives. One of the challenges they had in doing this review was that the CI Administration Office was changing its guidance during the time they were planning and carrying out the review.

CIRA's focus is on the atmosphere and includes many and varied applications that are well-aligned with NOAA's mission. One of the things that CIRA does exceedingly well is efficiently developing useful software tools based on satellite observations, often working across disciplines to do so. CIRA has taken several thoughtful and impressive first strides in DEI. In the report, the review team recommended how CIRA could integrate DEI even more effectively and track its results.

CIRA has many unsung strengths, including its use of AI and application of social sciences. The review team suggested exploring whether CIRA wants to codify its approaches and testing of new tools into a sandbox approach for broader community outreach. They also suggested getting the word out to the broader community as to what CIRA does.

The CIs are an incredible resource for moving NOAA's mission forward, but better metrics are needed for describing their contributions. This has been a common theme across CI reviews. The NOAA-CI relationships are stressed by a few factors that perhaps could be addressed, including challenging funding cycles and personnel supervision issues. Close relationships between CIs and their host universities can make an enormous difference in terms of the success, and CIRA has an outstanding relationship with Colorado State University.

The review team unanimously agreed that CIRA deserves an outstanding rating due to the excellence in science, the clarity of the leadership team's vision, and the values presented and exhibited by the whole CIRA community.

Discussion

Ruth Perry asked for clarification on what the team meant by CIRA's "unsung strengths." She asked if they were unsung to NOAA in terms of the full utility it is getting out of CIRA, in terms of what CIRA could offer, or if they were referring to a broader audience. Dr. Weatherhead said they meant it broadly.

Jon Allan made a motion to accept the review of CIRA. Ruth Perry seconded the motion and it passed unanimously.

Report on the Review of the Cooperative Institute for Ocean Exploration (OECI)

Ruth Perry, Shell Renewables and Energy Solutions, SAB Member, and Chair of the Review Team

John Kreider recused himself from the discussion, and Martin Storksdieck chaired in his stead. Ruth Perry explained that OECI is a large and unique CI. It is not only an R&D entity for NOAA, but also an applied application. It is part of NOAA's Ocean Exploration and Research (OER) activities and is the only CI that has a dedicated NOAA program manager for the CI. That NOAA employee is intricately linked into the operational side of OER, and OER has a heavy hand in what the CI is doing and how. COVID and high turnover within OER and their partner institutions created many challenges during the early years of the CI.

The review team gave an overall rating of satisfactory; it was a difficult conclusion to reach given the amount of content in the CI. The review team compared OECI against the broader ocean exploration and scientific community. The review was on the cusp of an outstanding rating, but there were some critical items that the review team felt needed improvement. They believe that NOAA should fund the CI for a second five-year cycle and felt that the CI offers utility from OER that NOAA is not fully harnessing. At the same time, OER was governing the CI in such a way did not allow the CI to push boundaries in certain areas related to their mission.

While the CI had outstanding performance in several areas, such as reporting metrics, partnerships across OECI, programs, education, and their relationship with OER, they were found to have unsatisfactory performance in the areas of support for students and staff, sensors, technology transfer and intellectual property, engagement with the ocean exploration and scientific communities, and data management. The review panel felt strongly that the technology in use at OECI lagged behind the rest of the exploration community. The team made ten recommendations in their report that they felt were critical to address for the next funding cycle. Dr. Perry concluded by thanking the review panel and OECI leadership for their involvement in the review process and suggesting that OECI should be given the latitude to take risks and push boundaries in exploration because they have the capabilities to do so.

Discussion

Ilene Carpenter noted that data management was listed as unsatisfactory but then the recommendation says to “consider” strengthening data management. She asked why the recommendation was softened if it was unacceptable. Dr. Perry said that they broke this out in the full report, but they softened the language because there were some things that needed small improvements and others that needed large improvements. Mr. Allan thought that if their performance is unsatisfactory and they are at risk of losing funding, the recommendation should say “must.”

Jon Allan remarked that where other CIs are fairly independent entities, OECI is deeply interwoven with NOAA. Since OECI is the only CI receiving a “satisfactory” rating, he wondered if NOAA may decide to reduce its involvement and let OECI try to stand on its own. Dr. Perry agreed that the structure has a lot of complications that the review team struggled with. Dr. Perry said the review team felt the relationship was working for certain things but was the wrong structure for activities like R&D. She was happy to take input on how to address the relationship. Dr. Decker noted that they could include comments in their transmittal letter.

Cynthia Decker commented that this would be the only CI to ever get a satisfactory rating. She later clarified that a previous CI had received a satisfactory rating but reiterated how rare this rating has been in past CI reviews. There is a clear argument that specific elements brought it down from an outstanding. She thought the comments made were appropriate and should be included in a strong transmittal letter.

Tony Wu asked if the technology issues were based on the current configuration of the fleet. Dr. Perry said the fleet for OECI is set and commented that this was a challenge for the review panel. OECI has done a lot of work on particular instruments that work together and can range different depths of the water column, but only that particular configuration works together and there is only one instrument used in each configuration. This was a limiting factor in OECI's ability to push what they were doing in exploration and mapping.

Tony Wu said he wanted the mission technology issues to be addressed in the transmittal letter, specifically the mix of vehicles and sensors, as well as a process for path finders to explore some of these new areas.

Steve Weisberg said he had a hard time telling how much of the critique in the report was a critique of the contracted universities versus the entire CI. Dr. Perry said this was difficult to present due to the interlinking. She gave the example of water column exploration, which OECI cited as a priority but the amount of work and research they were doing in this area was not significant. The challenge was that OER was never deliberate about whether this was an exploration priority.

Dr. Weisberg said there is a lot of opportunity for the SAB to provide feedback on the CI review handbook. He said that how the SAB grades a CI depends on which parts are prioritized and what time frame they are looking at. There are many ways to improve these reviews, or at least make them more consistent.

David Grimes said the two recommendations that say "consider" should be strengthened. He also said the report did not provide enough rationalization for why the CI should continue to be funded as opposed to being recompeted. If the review panel thinks NOAA should continue funding OECI, the argument needs to be stronger. Dr. Perry said the team struggled with how to handle this due to the extent of the review team members' own interactions with the CI and not feeling it was their role to make that designation. She agreed to attempt to convene the review team to go over the SAB's feedback and draft a rationale for continued funding. Mr. Grimes and Dr. Perry discussed that sending the report back for revisions and ensuring that the review panel is comfortable with any proposed modifications would be the best approach.

RADM Hann commented on the importance of the timing of the report. She said that the report pertains to both current operations and to a ship being built now that is specifically modified to do deep-water explorations. NOAA is at an inflection point in terms of technological capabilities and the time the SAB is spending on the report is very important to ensure that NOAA is prepared to execute its mission.

Sandy Byers, NOAA CI Office, said the cooperative agreements expire in June 2024, which would give the review team time to revisit the report.

The group discussed next steps for the report. Dr. Decker summarized the discussion and confirmed the group's desire to not approve the report at the current meeting; they would ask Dr. Perry to go back to the review team with the requested revisions, and the SAB would hold a special meeting to reconsider the revised report.

Plans for Next Meeting

John Kreider, Kreider Consulting LLC and Chair, NOAA SAB

The next SAB meeting is tentatively scheduled for the week of November 13, 2023.

Review of Actions

Casey Stewart, Executive Director, NOAA SAB and Designated Federal Official

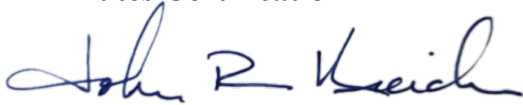
Ms. Stewart reviewed the actions from the meeting, including:

- Approval of the consent calendar.
- The SAB accepted the following products and will transmit them to NOAA:
 - 2023 Environmental Information Services Working Group (EISWG) Report to Congress
 - SAB Tsunami Science and Technology Advisory Panel (TSTAP) Statement on National Risk Assessment
 - Report on the Review of the Cooperative Institute for the North Atlantic Region (CINAR)
 - SAB Climate Working Group (CWG) Review of the Climate Program Office Strategic Plan
 - Report on the Review of the Cooperative Institute for Research in the Atmosphere (CIRA)
- The SAB decided to send the Report on the Review of OEI back for further review.
- The SAB agreed to engage with NOAA's Chief Scientist on the FY26 budget and process.
- John Kreider will follow up with Dr. Spinrad on the SAB's input on NOAA's budget.
- The SAB working group co-chairs will meet with the liaisons.

Adjourn

The meeting adjourned at 5:22 p.m.

Minutes Certification



John R. Kreider, NOAA SAB Chair

16 January 2024

Date

Acronyms/Glossary

<i>AI</i>	Artificial Intelligence
<i>BIL</i>	Bipartisan Infrastructure Law
<i>CAN</i>	Current Acidification Networks
<i>CDR</i>	Carbon Dioxide Removal (also mCDR for Marine CDR)
<i>CEAMLS</i>	Center for Equitable AI and Machine Learning Systems
<i>CI</i>	Cooperative Institute
<i>CINAR</i>	Cooperative Institute for the North Atlantic Region
<i>CIRA</i>	Cooperative Institute for Research in the Atmosphere
<i>CPO</i>	Climate Program Office
<i>CWG</i>	Climate Working Group
<i>DAARWG</i>	Data Archive and Access Requirements Working Group
<i>DEI</i>	Diversity, equity, & inclusion
<i>DEQ</i>	Department of Environmental Quality
<i>EISWG</i>	Environmental Information Systems Working Group
<i>ESMWG</i>	Ecosystem and Sciences Management Working Group
<i>FEMA</i>	Federal Emergency Management Agency
<i>GFDL</i>	Geophysical Fluid Dynamics Laboratory
<i>GOES</i>	Geostationary Operational Environmental Satellite
<i>GONG</i>	Global Oscillations Network Group
<i>HAB</i>	Harmful Algal Bloom
<i>HAFS</i>	Hurricane Analysis and Forecast System
<i>IOOS</i>	U.S. Integrated Ocean Observing System (IOOS®)
<i>IRA</i>	Inflation Reduction Act
<i>ML</i>	Machine Learning
<i>NCAI</i>	NOAA Center for AI
<i>NCCOS</i>	National Centers for Coastal Ocean Science
<i>NCEI</i>	National Centers for Environmental Information
<i>NESDIS</i>	National Environmental Satellite, Data, and Information Service
<i>NMFS</i>	National Marine Fisheries Service
<i>NOFO</i>	Notice of Funding Opportunity
<i>NOS</i>	National Ocean Service
<i>NRI</i>	National Risk Index
<i>NSF</i>	National Science Foundation
<i>NWP</i>	numerical weather prediction
<i>NWS</i>	National Weather Service
<i>OA</i>	Ocean Acidification
<i>OAR</i>	(Office of) Oceanic and Atmospheric Research
<i>OEI</i>	Cooperative Institute for Ocean Exploration
<i>OER</i>	(Office of) Ocean Exploration and Research (OAR)
<i>OMB</i>	Office of Management and Budget

<i>OPC</i>	Ocean Protection Council
<i>ORNL</i>	Oak Ridge National Laboratory
<i>OSTP</i>	Office of Science and Technology Policy
<i>PMEL</i>	Pacific Marine Environmental Laboratory
<i>PROSWIFT</i>	Promoting Research and Observations of Space Weather to Improve the Forecasting of Tomorrow Act
<i>PWR</i>	Priorities for Weather Research
<i>S2D</i>	Seasonal-To-Decadal
<i>S2S</i>	Subseasonal To Seasonal
<i>SAB</i>	Science Advisory Board
<i>SBES</i>	Social Behavioral and Economic Science
<i>SCCWRP</i>	Southern California Coastal Water Research Project
<i>SRGM</i>	Strategic Research Guidance Memorandum
<i>STEM</i>	Science, Technology, Engineering, Mathematics
<i>SWO</i>	Office of Space Weather Observations
<i>SWPC</i>	Space Weather Prediction Center
<i>TEK</i>	Traditional Ecological Knowledge
<i>TMDL</i>	Total Maximum Daily Load
<i>TSTAP</i>	Tsunami Science & Technology Advisory Panel
<i>USC</i>	University of Southern California
<i>WCOA</i>	West Coast Ocean Alliance