NOAA's Office of Oceanic and Atmospheric Research

Roundtable: Sustaining Observations

On September 10, 2009, Dr. Richard Spinrad, Assistant Administrator for Oceanic and Atmospheric Research (OAR) brought together a diverse group of high-level constituents to discuss how NOAA can sustain and advance its observing systems to meet evolving user needs and applications. Following is a summary of the major points discussed at the roundtable.

Opening Remarks

In his opening remarks, Dr. Spinrad welcomed the group and underscored the important role NOAA research plays in NOAA achieving its mission and goals. He stressed that participants' involvement is essential to NOAA Research's strategic planning and success.

Dr. Spinrad discussed some of the positive statements by the new administration on the value of science, including new leadership at NOAA and the White House Office of Science & Technology Policy (OSTP).. In addition to new leadership, several important policy task forces have recently or will soon issue policy statements on Ocean Policy, Climate Adaptation, and Scientific Integrity.

He discussed where NOAA and NOAA research are headed in the future, highlighting the priorities outlined by Dr. Lubchenco, the NOAA Administrator, in the Annual Guidance Memorandum. Priorities include enhancing NOAA's climate services and supporting the establishment of a National Climate Service; supporting comprehensive marine spatial planning; ensuring sustainability of marine fisheries; strengthening Arctic science and stewardship; and sustaining satellite-based Earth observations.

Dr. Spinrad discussed examples of observations required to address NOAA's priorities and the challenges NOAA faces in sustaining them. He noted that critical climate observing systems, including the Mauna Loa Observatory, the Climate Reference Network, Ocean Acidification Buoy, and Carbon Tracker™, are all supported currently with research dollars. Questions NOAA faces include how to transition observation networks from research to operations and how to position NOAA to support a whole new economic sector

Supporting comprehensive marine spatial planning, which is tied to ecosystem-based management and ocean zoning, will require greater cooperation to avoid the complex web of multiple regulatory regimes. California Cooperative Oceanic Fisheries Investigations (CalCOFI), which brings together multiple agencies, academic institutions, and observing systems, is a good example of how to begin marine spatial planning. In addition, NOAA faces new ocean acidification mandates under Magnuson-Stevens Fisheries Conservation and Management Act. With only five percent of the ocean explored, innovative tools and technologies, such as telepresence technology and Autonomous Underwater Vehicles (AUVs), and continuous improvements on them are needed to finish exploring the ocean. [what job? – never defined].

Sustaining marine fisheries will rely on many of the same systems as comprehensive marine spatial planning. CalCOFI began 60 years ago creating a comprehensive information record of coastal and ocean observations [of what?] for California, but similar systems and records are not available for most of the U.S. coast. The impacts of climate change on ecosystems need to be considered also – if all the ecological factors that define Yellowstone National Park (bison, elk, etc.) moved 50 miles north, would we move the park?

Strengthening Arctic science and stewardship, coupled with an emphasis on climate change, requires expanded observational capabilities in the region. The atmospheric community complains that the paucity of observations in this region hurts weather forecasts. Improved observations in the region will facilitate shipping as the climate changes. Maersk and other shipping lines already have criteria for when they'll alter shipping routes as the Northwest Passage opens. Advancing AUVs and Unmanned Aircraft Systems (UAS) will help collect needed synoptic resource information. Furthermore, the observations will be key to any extended continental shelf claim the U.S. may put forward.

NOAA Research continues to demonstrate the need for satellite-based Earth observations in support of research. While NOAA has had a number of challenges with its Geostationary Operational Environmental Satellites (GOES) and the National Polar-orbiting Operational Environmental Satellite System (NPOESS), the key issue for sustaining satellite-based earth observations is global cooperation.

NOAA relies heavily on sustained observations to improve forecasts of many kinds and facilitate hazard resilience. Further, climate change has strong implications for severe storms, fire weather, and drought. The U.S. Integrated Ocean Observing System (IOOS) together with the Ocean Observatories Initiative might improve coastal storm inundation forecasts. . Last year's Red River flooding is a good example where NOAA can step back and ask how can we do better than we did last year? If you talk to local officials, they want forecasts on two different time scales: What will happen in the next five to seven days (needed for sandbagging and evacuation efforts), and what will happen in the next five to ten years to the intensity and frequency of these events (required for rebuilding and zoning)? Because lives and property are lost to catastrophic weather events, there is sustained support for the observations required for weather forecasts.

Dr. Spinrad discussed topics that "keep him up at night," including securing the resources required to carry out NOAA's mission, ensuring new accountability metrics that are efficient and effective, transitioning research to operations, and engaging the community's interest in environmental issues in the broader context of national priorities, such as the economy, national security, and health care. In talking about the challenges of transitioning research to operations, Dr. Spinrad shared the example of the Wind Profiler Network, noting that once the network was transitioned, the data quality decreased. While the data quality was adequate from an operational perspective, it no longer met the needs of the research community.

Dr. Spinrad ended his opening remarks by noting he is excited by what he sees right now with regard to the role of science and technology in policy, especially as it relates to scientific integrity, the ability of the federal government to attract the next generation of scientists, and the latitude being given to government science agencies to "think outside the box." He highlighted his role on the Google Ocean Advisory Committee and the senior NOAA Research technical scientists sent to work temporarily at Google. He encouraged the participants to help make sure the community is taking advantage of the opportunities available.

Constituent Observations

Participants identified current and future areas where NOAA could focus resources and efforts to help sustain observations in the future. Five persistent themes emerged from the discussion including data and information management and communication; the balance between scientific inquiry and user-driven requirements as drivers for sustained observations; incorporation of research requirements when transitioning to operations; public-private partnerships; and messaging.

Managing and Communicating Data & Information

The challenges of collecting, quality controlling, managing, and communicating data and information were repeatedly raised throughout the roundtable discussion. Participants identified several challenges that need to be addressed.

First, the size of the pipelines that currently move data to agencies and users (e.g. Iridium and/or ARGOS-3) was noted as a limiting factor in collecting and disseminating observational data. Participants suggested that there are other communities (e.g. the financial sector) that deal in large quantities of data and perhaps there are lessons that can be shared.

Second, participants identified the need to ensure availability of observations to meet the needs of various user groups. Participants noted that improved coordination would aid in identifying and minimizing observational gaps at the local, state, regional, national, and international levels.

Participants recommended that NOAA work to ingest data from regional associations, state and local governments, and non-governmental organizations (NGOs). For example, the Integrated Ocean Observing System's 11 regions now are integrated and the IOOS website has a free observation registry open to everyone. IOOS makes available all data it receives. Data integration is critical for in situ observations and across all platforms. NOAA needs to consider how to integrate across UAS and satellites as well.

Participants noted differences in the U.S. and international perspectives on data availability. The U.S. advocates largely for free and open access to data. Many in the international community focus on ability to pay for data. While there is a genuine demand for information, there is in many cases no ability to pay. This fee for data model would be similar to that adopted by the U.S. weather enterprise. Positive Progress in the international meteorological community was acknowledged along with the challenges remaining for the oceanographic community.

Participants recognized a lead role for the government in negotiating data access and standards on an international level and suggested that industry and the non-governmental community could assist with these efforts. Some participants recommended NOAA and its international partners define the minimal information required to ensure protection of lives and property, considered a public good, noting that this approach would still leave a vast array of information available for targeted climate services.

Finally, the diversity of users was a recurring theme throughout the roundtable and raised the need to identify mechanisms for communicating data and information to users with a variety of needs. Key to this effort is understanding who uses the data, how they use the data, and how they access the data. The Google Earth model of making all data available to all users is a great advance for the scientific community, but does not meet all user needs. Participants noted that some users require not data, but clear, consistent information in context. Participants noted that quality data exists only in so much as it meets user expectations.

Balancing the Drivers for Sustained Observations

How to balance the observing needs of the various user communities was discussed extensively. In particular, participants recognized the need to differentiate between scientific users and societal drivers and in balancing the need for research-driven observations with those that meet specific societal needs. They discussed the difficulty of defining user groups, coordinating user needs on a regional basis, and securing user buy-in. They noted that a lack of demand on the users' part should not be construed as a lack of need; users may not yet be aware they need a particular set of observations.

Participants noted that in some cases observations designed to further science are used in creative ways by unexpected users, and that, in some cases, not understanding potential uses results in valid data being discarded. For example, the Coastal Data Information Program in California was developed to support scientific investigations but is used heavily by the recreational surfing community. In another example, Dr. Spinrad noted that NOAA was discarding some data collected by the Deep-ocean Assessment and Reporting of Tsunami (DART) buoys because it was irrelevant for tsunami forecasting; however, surfers could use that data to predict swells even earlier.

Participants noted examples of projects linking user requirements with technological and practical capabilities, which can serve as a model for building and sustaining efficient and effective observing systems.

- The Ocean Observing Panel for Climate and the CLIVAR Global Synthesis and Observations Panel developed the community (users and data providers) consensus on what is needed and achievable in sustained global ocean observations. Subsequently, NOAA's Office of Climate Observations used the Panels' recommendations to create priorities for implementing the U.S. portion of the system.

- In [year], the National Academies Report, *Observing Weather and Climate from the Ground Up: A Nationwide Network of Networks* found that U.S. surface meteorological observation capabilities are driven by local needs recommended increased coordination across all stakeholder groups to account for their complex and differing roles, responsibilities, capabilities, and applications.

Participants also noted that NOAA and other agencies could help balance user needs by helping to remove policy constraints to new technologies. For example, Federal Aviation Administration regulations pose challenges to expanding use of Unmanned Aircraft Systems (UAS) for fire fighting and climate observations.

Some participants pointed out that even within NOAA Research they believe there is not sufficient investment in basic research and there is a greater focus on investing in technology development. Participants further suggested that basic research should be at least 50 percent of NOAA research spending in order forNOAA to meet the future needs of its users. Furthermore, it was argued that NOAA should not forget scientific advancements are often orthogonal to technology development.

Incorporating Research Requirements When Transitioning to Operations

Closely tied to the challenge of balancing the needs of various users is prioritizing research requirements when transitioning observing systems/platforms from research to operations. Some participants noted that the debate over research versus operational requirements comes down to competition for funds and this competitive stance prevents the community from having one voice. Regional associations were discussed as a mechanism for enhancing communications between scientists, government officials, and users. Aggregating demand across these user groups was identified as a potential mechanism for sustaining funding to meet all user needs.

The Joint Center for Satellite Data Assimilation and the reinvigorated Committee on Observations under the Office of the Federal Coordinator for Meteorology were offered as examples of partnerships that work well. Participants agreed enhanced interagency coordination was needed to develop, transition, and maintain observing systems and integrate data across all platforms.

The Joint Subcommittee on Ocean Science & Technology (JSOST) also was cited as a successful example of interagency cooperation, and interagency coordination is a key component for ocean policy. There exists real opportunity to improve efficiency and efficacy through the interagency working groups; however, participants noted that funding is power and agencies do not get more money because they coordinated. Moreover, participants suggested that new programs will be proposed by Congress only if the new administration is on board, and that such programs will need to come up through the Office of Science & Technology Policy and go through the Office of Management and Budget.

Participants recommended mechanisms for helping ensure research requirements continue to be funded through transitions. Suggestions include increased interagency collaboration and planning, as well as bringing industry and academia into the process sooner Participants noted that the community’s ability to aggregate demand across sectors and agencies by linking research requirements to national priorities –

climate, health care, and the economy– will aid in retaining research requirements. For example, a Department of Health and Human Services request for improved algal bloom sensor measurements could be highly effective.

An international task force detached from national priorities was suggested as a potential mechanism for defining a common agenda of required observational capabilities.

Some participants suggested that integration across science communities (e.g., oceanography, climatology, pharmacology, medicine, and public health) would ensure that observing systems can address an array of sensor data requests. Integration from the policy makers to the end user also will help secure a policy framework that supports integration and understands the expected outcomes. In combining both integration paths NOAA can build the systems and the support to maintain and modernize the systems.

Messaging

The participants identified developing and communicating a clear message on the value of research and observations as a critical challenge. Key audiences include the executive and legislative branches, the general public, and users. Messaging was considered even more important in the current budget-constrained environment. Participants recommended NOAA do a better job of taking a more holistic approach, using visualizations to connect and communicate with the general public.

Participants encouraged one another to look at how they see observations in the context of what drives federal funding. Climate, health, and economy were identified as some current drivers of federal funding. NOAA's services touch three trillion dollars, or one-third, of the nation's economy. The National Weather Service secures funding for observations, such as radar, because it helps save lives and property. Other areas of NOAA have not been as successful in adopting the model of tying observational needs to national priorities to sustain funding. For example, funding for the Integrated Ocean Observing System that NOAA has worked on for years has declined from $35 million to $20 million. Perhaps focusing on how these observations will enable marine spatial planning, a key focus of the new NOAA Administrator, will yield stronger results.

Participants suggested that without support for climate observations, research, and services the economy will wither. Some participants suggested that the community has let the climate story be taken over first by the environment with the symbol of climate change being a polar bear, and now by green technology – passing right over the science. The challenge now is refocusing on what information is required to provide the climate services the nation needs.

Participants generally agreed tying to key national issues and aggregating demand can help the community maintain focus on the strategic issues as stake.

Enhancing Public-Private Partnerships

Participants agreed that enhancing partnerships is crucial to sustaining observations and meeting user needs. Key collaborations mentioned included strengthening interagency partnerships, encouraging public-private partnerships, improving collaboration between academia and industry, and international partnerships. The importance of regional associations was discussed, and private sector collaboration was identified as a mechanism for aggregating demand and harnessing the power of their advocacy.

Creative partnerships and technological advancements were suggested as mechanisms for reducing operations and maintenance costs and meeting diverse user needs. Some examples included:

- using technology to reduce ever-increasing operations and maintenance, and labor costs (e.g. greater use of AUVs and small boats, improved sensors, rapid sampling regimes, multi-vehicle collaborative autonomy);
- improving sensor autonomy with a focus on economies of scale and increasing their capabilities for both physical and biogeochemical measurements;
- adopting a disruptive model by moving outside of traditional collaborative communities to work with non-traditional partners in industry; and
- extending the domain of autonomous platforms to truly global sampling, a good example being ARGO; and
- enhancing efficiency ratios by aggregating demand (e.g. NOAA and Navy partnership that resulted in AUVs that can scan for mines and find shipwrecks).

Participants recognized that climate observations create some profound challenges, requiring new types of long-term partnership between the federal government, industry, and the academic research community to achieve objectives that include both global-change research for societal benefit and operational modeling and prediction. The partnership must combine appropriately the respective capabilities of the academic institutions, the federal laboratories, and the private sector.   Again, sustained funding mechanisms are needed to provide a stable basis for continuing global programs.

Some participants noted a role for the private sector in marrying user needs and observing requirements. For example, market research indicates that consumers generally understand that uncertainty in weather forecasts increases for longer forecast timelines, and consumers have a much lower threshold for uncertainty in the zero to six hour time frame. This finding indicates that the nowcast is very important and NOAA should focus on the observations needed to improve predictability in the zero to six hour time frame – demonstrating the value of understanding user needs to enhance observations.

Privatization of data collection, moving the government to the role of consumer rather than producer also was discussed. Some participants suggested that the private sector can innovate more efficiently. However, in order to develop the business case for private sector research and development, the federal government contracting system will need to evolve to allow more year-by-year carryover of money to allow industry to recover up-front costs. Others noted that privatization of observing capabilities creates a sustainability challenge, recognizing, for example, that the U.S. does not privatize the Navy because we need to ensure we have a Navy and private industry involvement is subject to a profit motive.

Sustained and improved funding mechanisms were identified as key to sustained observations. Participants wondered how they can find funding outside of NOAA and break down the stove-piped interagency structure to broaden funding sources.

Improved partnerships between the research community and the private sector are needed to sustain observational capabilities. Participants encouraged NOAA to make greater use of existing mechanisms for cooperation including Cooperative Research and Development Agreements (CRADAs), and the Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) Programs.

Strengthening the value chain across all of the scientific and societal needs through creative partnerships will help sustain observational capabilities to meet all user needs.

Conclusion

Participants identified some key challenges for how NOAA can sustain and advance its observing systems to meet evolving user needs and applications. Challenges included:

- managing and communicating diverse data and information collected globally;
- balancing scientific inquiry and user-driven requirements as drivers for sustained observations;

- incorporating research requirements when transitioning to operations;
- enhancing public-private partnerships; and
- communicating the value of sustained observations by linking to key national issues including health, climate, and the economy.

Participants who completed surveys on the value of this roundtablegenerally gave it high marks for bringing together a mix of interests. The general consensus from survey respondents was that NOAA should hold more discussions like this so that partners and customers can exchange ideas, discuss needs and learn more about NOAA's priorities and plans on a given topic.