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Follow-Up Question
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Describe, in specific terms, the governance structure that is required for effective implementation/manangement of the IOOS. What is the ideal relationship between research/academic institutions and government entities? What lessons can we draw from the "atmosphere/meteorological model?

ESTABLISHING AN EFFECTIVE GOVERNANCE MECHANISM

Comments and Recommendations of Tom Malone, Co-Chair of the U.S. GOOS Steering Committee and the IOC Coastal Ocean Observations Panel.

"Governance" herein refers to the policies and processes by which the design, implementation, operation, and development of the IOOS are controlled and managed.

Recommended Governance Structure

Oversight by a body external to any given federal agency will be required to achieve the vision of an integrated observing system that is sustained. In October 2000, a NOPP Memorandum of Agreement (MOA) was approved for establishing **Ocean.US** as the NOPP interagency ocean observation office. The MOA articulates the responsibilites of Ocean.US as follows:

> The mission of **Ocean.US** is to "integrate existing and planned elements to establish a sustained ocean observing system to meet common research and operational agency needs." **Ocean.US** is to serve as the national focal point for integrating ocean activities and will establish and have responsibility for the ocean observation federation and, as it evolves, other appropriate components of a more encompassing ocean observation and prediction system. More specifically, **Ocean.US** will (1) develop and maintain the long-range vision of the IOOS which will serve as the conceptual foundation for the IOOS and will define the goals of the system; (2) ensure integration of the elements of the IOOS; (3) serve as the focal point to coordinate the implementation and development of the system with the NOPP Interagency Working Group (IWG), the ORAP, the Federal Oceanographic Facilities Council (FOFC), and the international community; (4) report regularly to the Executive Committee (EXCOM) for guidance and to the IWG for coordination and provide an annual report that assesses the status of the IOOS and its products and charts the way forward (including external reviews); (5) recommend enhancements to existing systems, new projects, needs for research and development, and identification of system components suitable for

transition from research to operations; and (6) carry out all tasks as directed by the NORLC.

The fundamental problem with the current arrangement is that Ocean.US has responsibility without authority.

The NOPP structure should continue to be used for developing, implementing, and sustaining the national ocean observing system. Ideally, the title of the governing body (NORLC) should reflect its membership and its charter, that is, it should be re-titled the National Ocean Leadership Council (NOLC). In addition to ORAP, a second advisory group should be established to represent user groups outside the scientific community (state and federal government agencies and regional associations that represent the interests of all user groups in the region such as that established for GoMOOS). This group might be called the "Users' Association."

In this scheme, the NORLC functions as a Board of Directors. It sets policies and Ocean.US functions as the executive agent for the Council, i.e., the NORLC sets policies that are implemented by an independent, interagency office, Ocean.US, under the oversight of an Executive Committee. In this capacity, Ocean.US works closely with the IWG to ensure the coordinated and phased implementation of the IOOS. Ocean.US oversees a Management Office that coordinates the development of Federal Centers and regional associations. Day-to-day operations (including monitoring data streams, the timely generation of products, etc.) are managed and performed by responsible agencies, federal operational centers, and regional associations.

Federal Centers should be established to operate elements of the U.S. contribution to GOOS and the national coastal backbone, e.g. Federal Center for Data Management and Communications, for Time Series Analysis, for Ecosystem-Based Environmental Protection and Resource Management, for Sea Surface State Prediction (these should be cross-cutting centers consistent with the integrated, end-to-end construct of the IOOS – not technology based centers!). Regional Associations[1] should be established to oversee the operation of regional observing systems.

The establishment of priorities for implementing and developing the IOOS, determination of funding levels, and specification of the roles of federal agencies should be a responsibility of Ocean.US, and the process should be initiated two years prior to the fiscal year the funds are to be spent. Each participating agency should have a line in its budget, the IOOS line. Budgeting for the IOOS should involve a process that begins in October and is completed in March as follows:

(1) Ocean.US collaborates with participating NOPP agencies (through the IWG, the ExCom, or another body specifically established for this purpose) and regional associations to establish priorties for FY+2.
(2) Agencies develop proposals for their contribution (with specific objectives, methods and procedures, budgets, etc.) and submits them to Ocean.US.

(3) Ocean.US establishes a review panel consisting of representatives of all major stakeholders that recommends to Ocean.US what should be funded and at what levels.
(4) Ocean.US works with the agencies to agree on their contribution and associated budgets. Ocean.US (with NORLC approval) had final authority. Funding for the IOOS is incorporated into each agency's budget.

Selection Process

A process is needed to select and incorporate candidate observing system elements into the sustained observing system. Ocean.US should have the responsibility and authority to conduct this process. The process should be structured to ensure objective and timely decisions that selectively links, enhances and supplements existing programs consistent with the needs of the Nation and regional user groups.

Under the auspices of Ocean.US (NORLC), candidate technologies and capabilities should pass through a series of stages to be considered for incorporation into an operational system. They are as follows:

(1) Research: The development of observational (platforms, sensors, measurement protocols, data telemetry) and analytical (e.g., models) techniques for research purposes. Performed by research groups.

(2) Pilot Projects: Acceptance of the techniques by research and operational communities gained through repeated testing designed to demonstrate their utility and sustainability in a routine, operational mode. Performed by research groups with input from operational groups.

(3) Pre-Operational Projects: Use of techniques and data by the research and operational communities to ensure that incorporation into the observing system leads to a value added product (is more cost-effective than functioning in isolation) and to ensure that incorporation does not compromise the integrity and continuity of existing data streams and product delivery. Primary performers are operational groups with involvement of researchers.

(4) Operational: Incorporation of techniques and data into the IOOS with sustained support for sustained use. Performed by operational groups with researchers functioning as advisors, consultants, and users.

Projects in stages 1-3 may focus on elements of the system (a particular sensing technology, development of sampling protocols, model development, data communications and management protocols, etc.) or on the development of an integrated system (e.g., a regional OOS). Research may be mission-driven with IOOS funding, or hypothesis-driven with funding from other sources. Pilot and pre-operational projects would be supported by IOOS funding. The selection process should involve the development of national consensus on priorities (stages 1 and 2) and review/endorsement

by expert panels consisting of representatives from major user groups at both national and regional levels (research, operational, and education communities, private enterprise, and NGOs) (stages 1-4). Funding for stage 1 and 2 projects would involve a competitive process through NOPP BAAs. Funding for stage 3 and 4 projects would be directly to the responsible agency or body based on performance as determined by users and approved by Ocean.US.[2]

RELATIONSHIP BETWEEN RESEARCH/ACADEMIC INSTITUTIONS AND GOVERNMENT AGENCIES

I assume that this is in the context of "governance" and development of the IOOS. I will focus on two aspects of this issues: (1) mission-driven vs hypothesis-driven research and (2) transitioning elements from research to operations.

Much of the research conducted within federal agencies such as NOAA has little to do with the agencies mission. In essence, we have established mini-universities within the agencies that conduct hypothesis-driven research. This has resulted in unwanted competition between federal and academic researchers. In my opinion, such research is best conducted outside the confines of mission agencies. Research within these agencies should be clearly related to achieving their missions. In both cases, research may be "basic" or "applied." (Personally, I don't like this distinction. There is only one kind of research, "good" research. I only mention this because mission-driven is not synonymous with applied research.)

Currently, both government agencies (e.g., ENSO forecasting, PORTS) and academia are engaged in efforts to spin up observing systems that are expected to become operational or are operational. Those that are run by researchers in the academic community are funded as research project and the researchers who operate them in an operational sacrifice their research to do so. A related issue is research programs conducted or funded by research agencies (NASA, NSF) that become operational and should be migrated to the appropriate mission agencies (e.g., altimetry to NESDIS, or the routine aspects of the HOTS and BATS time series observations to NOS). A mechanism is needed to selectively transition projects into an operational mode and fund them without the agency responsible for the R&D having to transfer the funds required to operate the technology, time-series, etc.

LESSONS FROM THE ATMOSPHERIC/METEOROLOGICAL MODEL

In terms of governance, we should watch how JCOMM develops. I believe the major barrier for intergovernmental or multi-institutional systems is resistance to change. For example, the GTS is an old system based on old technology. Although it is generally agreed by leading bodies in the WWW that it should be upgraded or replaced and a new system has already been designed, the required commitment of resources has not been forthcoming. This is similar to the problem now faced by U.S. agencies and academia as they consider the U.S. IOOS. It will require changing how business is done, and after a

system is in place, it will be difficult to keep it responsive to users and up to date in terms of maintenance and the incorporation of new technologies and knowledge.

This brings me back to governance. I believe that the key is establishing a body, perhaps Ocean.US, with sufficient power and resources to make decisions and effect changes. I don't think such a body could function within the confines of a federal agency.

In terms of operations, this is an important model because it has institutionalized relations between the research community (meteorologists) and an operational observing system for numerical weather predictions. Meteorological research contributes to improved nowcasts and forecasts and the science of meteorology benefits tremendously from the observes required for prediction. In this way both groups benefit and the scientific enterprise is not compromised by trying to serve data and information operationally.

FOOTNOTES

[1] Regional systems are needed to provide data and information on phenomena that are more effectively detected or predicted on regional scales that go beyond the jurisdiction of individual states. Depending on regional priorities, the regional observing systems will increase the resolution at which common variables are measured, supplement common variables with additional variables, and provide data and information that are tailored to the requirements of stakeholders in the region. Geographic boundaries of regional systems will not be fixed; they may overlap; and they will be a determined by the time and space scales of the phenomena of interest that are high priorities in each region.

A successful federation of regional observing systems requires the establishment of regional associations that follow "rules of engagement" for the common good. IOOS regional associations must be established that have the authority to receive and disperse funds based on priorities and user needs in the region. Such associations must include, but are not limited to, representatives from both the data providers (e.g., scientists and technicians) and data users (e.g., research institutions, institutions of higher learning, non-profit corporations, for profit corporations, and government agencies). Federal agencies may be partners in or cooperators with regional associations but may not be recipients of the funds appropriated for regional associations. Thus, it is expected that participation of federal agencies in regional observing systems and contributions of regional systems to the national backbone will occur via MOAs. To qualify as a Regional Association, the following criteria must be met:

- Proof that a governance structure is in place that can deliver an integrated and sustained system by incorporating, enhancing and supplementing existing infrastructure and expertise in the region.

- Provision of an acceptable business plan that has been endorsed by stakeholders (data providers and users) from the region and describes the procedures by which the observing system will be established, sustained and developed. This must include an analysis of potential economic benefits using established procedures to estimate the expected economic impacts

Specifically, it must be demonstrated that the regional association will

- be capable of routine, sustained, 24-hour-a-day operations, including, as required by user groups, the provision of data and data-products (e.g., a forecast) in real-time or near real-time;

- provide services that include the collection and dissemination of data, data management for timely access to data and information, and the creation of appropriate products that are delivered in a timely fashion to those who use or are affected by the coastal oceans;

- provide free and open access to the data collected; and

adhere to standards and protocols established for the national system such that data and related products can be rapidly exchanged among all regional observing systems and accessible to any user in any part of the nation.

[2] Criteria for Developing and Transitioning Potential Building Blocks through the Four Stages: Process conducted under the auspices of NORLC (Ocean.US).

Research

Research that is likely to contribute to the development of the IOOS may be specifically funded to address IOOS priorities (mission driven research) or may emerge through research designed to achieve goals established by the scientific community (hypothesis-driven research).

- IOOS research priorities are established under the auspices of the NORLC (Ocean.US) through national consensus and consultation with user groups. Research projects may be selected for funding through the NOPP-BAA competition process or through mechanisms established by participating agencies.

Transition from Research to an IOOS Pilot Project

a. Potential Elements of the IOOS

- Specify how the project is likely to contribute to the development of the IOOS (the national backbone and/or regional systems) and what the benefits to potential users groups are likely to be (i.e., projects must be justified in terms of elements of the IOOS that are likely to be improved and/or improved benefits to users)
- High priorities for building the fully integrated system are targeted based on existing capabilities and user needs.
- Objectives, milestones, project management, and performance metrics are clearly defined in terms of the IOOS mission (e.g., feasibility-impact, improving existing elements of the IOOS, product development)
- Goals can be achieved within a specified, finite period (e.g., 3-5 years).
- Although project may be conducted by researchers, collaboration with and/or endorsement by operational groups and potential users must be documented.
- Funding likely.

b. Building a National Federation of Regional Systems

In addition to the above, candidates for regional observing system pilot projects shall meet the following criteria:

- The formation of a regional body that (i) represents data providers (research and operational communities) and users (research and education communities, non-profits, for profit corporations, and government agencies) and (ii) has the authority to receive and disperse funds based on priorities and user needs in the region.
- Documentation that a governance structure is in place and can effectively link all three subsystems by incorporating, enhancing and supplementing existing assets in the region.

- Provision of a business plan that has been endorsed by regional stakeholders (data providers and users) and describes the procedures by which the regional observing system will be established, sustained and developed. This should include an analysis of potential socio-economic benefits using established procedures to estimate expected economic impacts.
- Justification of the project in terms of how it will contribute to and benefit from the national backbone.

Transition from Pilot Project to an IOOS Pre-Operational Project

- Meets all of the criteria for selection as a pilot project.
- Justifies selection as a pre-operational project in terms of how it will improve the value added nature of the IOOS.
- Specifies how the project will contribute to the development of the IOOS (national backbone and/or regional systems) and what the benefits to targeted user groups will be.
- Documents capabilities in terms of sustainability on time scales specified by the users
- Participation by both research and operational groups
- Endorsed by operational groups and users
- Describes procedures by which the system or elements of the system will be incorporated into the IOOS.
- Funding very likely

Migration of Pre-Operational Elements into the Operational System: IOOS

- Meets the criteria for selection as a pre-operational project.
- Demonstrable compliance with IOOS design principles.
- Endorsed by operational and user communities.
- Demonstrably cost-effective increasing the value added character of the IOOS
- Documents affordability and readiness (required assets are available including technical support – does not need a Ph.D. to operate; availability of instrumentation, computing power, etc.; logistics in place).
- Performed by operational groups.
- Funding assured based on performance.