NOAA Response to:

Towards Open Weather and Climate Services

A white paper prepared by the
Environmental Information Services Working Group (EISWG)
of the NOAA Science Advisory Board
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By
Dr. Jane Lubchenco
NOAA Administrator and Under Secretary of Commerce

Introduction

NOAA welcomes the SAB EISWG paper "Towards Open Weather and Climate Services" and its recommendations to increase public access to all NOAA data and to increase NOAA collaboration with the weather and climate enterprise (the Enterprise) in technology development. NOAA shares the SAB's concern with maximizing NOAA's overall benefit to the public. The symbiotic relationship between NOAA and non-government partners has proven to be highly effective. Examples where NOAA has demonstrated progress towards these concepts include the Level II radar data distribution via Unidata, real-time GOES Variable (GVAR) data broadcasted freely to anyone with a receiving system, the operational Gridpoint Statistical Interpolation (GSI) data assimilation code development process where the NCEP Data Assimilation team was supported by the NCAR Developmental Testbed Center, and the statements of principles regarding free and open access to data in the draft NOAA Environmental Data Management (EDM) Framework (developed in response to another SAB recommendation). NOAA welcomes the opportunity to further enhance this symbiotic relationship with an eye towards increasing value to the Nation in an economic environment where funding for new NOAA initiatives is challenging. As we expand this partnership, it is useful to recognize the foundation already established by NOAA's data/information and partnership policies.

NOAA is committed to full, open, and timely access to its data and information at the least cost possible to the recipient in order for the Nation to fully realize the benefits from the public investment in earth observations.[1] NOAA also recognizes that it cannot fulfill its mission without obtaining data, information and products from external sources, from the academic and research community, from the private sector, and from other countries. NOAA acknowledges that in spite of this policy goal there are limitations that have prevented it from making all its data available to all users and in addressing the SAB recommendations NOAA hopes to reduce those limitations as much as possible.

As for collaboration, the NOAA Policy on Partnerships in the Provision of Environmental Information ("NOAA Partnership Policy"- NOAA Administrative Order (NAO) 216-112 - see http://www.corporateservices.noaa.gov/ames/administrative_orders/chapter_216/216-112.html) states that "the nation benefits from government information disseminated both by Federal agencies and by diverse nonfederal parties, including commercial and not-for-profit entities. NOAA recognizes cooperation, not competition, with private sector and academic and research entities best serves the public interest…. NOAA will take advantage of existing capabilities and services of commercial and academic sectors to support efficient performance of NOAA's mission and avoid duplication and competition in areas not related to the NOAA mission. NOAA will give due consideration to these abilities and consider the effects of its decisions on the activities of these entities … to serve the public interest and advance the nation's environmental information enterprise as a whole."

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[1] NOAA has numerous policies in support of open data sharing, for example the NOAA/National Climatic Data Center Open Access to Physical Climate Data Policy December 2000, NOAA CIO Information Quality policy, the NAO-212-15 the Management of Environmental Data and Information, NOAA/NESDIS's "Policy on Access and Distribution of Satellite Data and Products," and the federal government-wide Data.gov initiative for open government. NOAA policy is consistent with OMB Circular A-130 on the "Management of Federal Information Resources."

As we can see, NOAA policies already are very much in line with the recommendations of the SAB. The important question that the SAB paper has raised and that NOAA welcomes is how these policies can be more effective, especially in light of the fiscal challenges facing our country and the global environmental community. NOAA recognizes that the issues raised by the SAB are not neatly confined within the parameters of weather and climate and they apply more broadly, NOAA-wide. Thus, as we move forward in our collaboration, NOAA views this as an effort to move towards Open Environmental Information Services (Open EIS).

NOAA views the principle of collaboration that inspired the SAB EISWG vision for an Open EIS as being very similar to the principle that inspired the Global Earth Observation System of Systems and it is important to acknowledge that a truly open environmental information service needs to reach beyond NOAA to other US agencies and other countries. The U.S. Digital Government (DG) Strategy issued by the White House in May 2012 states (page 1) expectations that require the Federal Government to be ready to deliver and receive digital information and services anytime, anywhere, and on any device. It must do so safely, securely, and with fewer resources. The entire DG Strategy is essentially a mandate for Open EIS. NOAA is currently drafting a Data Access Procedural Directive which will mandate that new NOAA datasets, and eventually all NOAA datasets, must be made available via appropriate internet-based services.

NOAA would like to respond to each of the specific recommendations in the SAB EISWG paper and then provide an assessment of limitations and challenges that may affect NOAA's capability to fully implement the Open EIS. NOAA also wants to outline its plans for managing collaboration with the SAB and its subcommittees as we move toward the Open EIS, including the identification of points of contact within the relevant Line and Staff Offices. Lastly, NOAA would like to propose some possible areas where we can begin incremental implementation.

Summary of recommendations

Specific Recommendations (OWCS paper)	Response Summary
OWCS 1.0 NOAA leadership should agree that the Open WCS concept as described herein would be beneficial to the nation and that the agency should immediately begin to develop internal programs to implement the paradigm in targeted parts of the organization that will be most effective in delivering the benefits of Open WCS to society. The established endorsement of the concept and commitment to its principles by NWS Director Dr. Jack Hayes is recognized and welcome.	NOAA recognizes the significant value of a vibrant private sector participating in the development and delivery of weather and climate services to the public. Hence, the value of the Open WCS concept to the nation is clear, and NOAA concurs, in principle, that the enterprise should have open access to various types of data that NOAA produces and that NOAA should develop new capabilities and systems in an open and transparent fashion. NOAA views this as a NOAA-wide effort and proposes therefore that we work more broadly toward Open Environmental Information Services (Open EIS). NOAA believes that the entire Enterprise shares the responsibility for the

	execution of these concepts.
OWCS 2.0 NOAA should work closely with the SAB, its relevant working groups (e.g. EISWG, CWG and DAARWG) and perhaps other partners to develop an implementation action plan that will create specific recommendations and follow-on activities to implement the Open WCS approach across the agency. This action plan should be developed quickly and target short-term actions that will lead to prototype and targeted Open WCS implementations whose experiences can be used to develop a more comprehensive NOAA Open WCS strategy.	NOAA concurs with this recommendation. Further engagement with the SAB's committees and working groups is suggested during the first year that projects and actions are undertaken in order to develop an implementation strategy that NOAA anticipates will be included in the first annual report to the NEC before the end of 2013.
OWCS 3.1 Recommend that NOAA implement Open WCS incrementally using targeted programs and prototypes rather than developing broad Open WCS policy and implementation concepts.	NOAA concurs. This response includes a candidate list of potential projects or prototypes. NOAA will work with the community on the further identification and prioritization of the prototypes to test the implementation of the Open EIS concept. NOAA believes that the entire Enterprise shares the responsibility for the execution of these concepts.
OWCS 3.2 Quickly identify short-term actions that can target accelerated implementation of the Open WCS in specific areas that have limited risk or cost and can be achieved without a more comprehensive approach.	NOAA concurs. In this challenging budget environment, opportunities within current resources should be considered.
OWCS 3.3 Consider mechanisms that catalyze better interactions between NOAA's development laboratories and the broader Enterprise such as open access to development datasets and use of open Development Test Centers.	NOAA will consider mechanisms to strengthen interactions between its laboratories and the enterprise. With sufficient community interest, NOAA could broaden existing technology sharing conferences to provide information more targeted to specific use by the Enterprise.
OWCS 3.4 Address various challenges of the Open WCS paradigm including security, costs, fair access and effective internal development in the context of the incremental and targeted implementation approach	NOAA will work with the SAB and its subcommittees to evaluate the challenges to implementing the Open EIS paradigm. NOAA views identification of these challenges as an important focus of short-term actions (see OWCS 3.2 above).

Limitations

NOAA anticipates that it will continue to face challenges and difficult choices not only about what and how to measure in the environment, but in what and how to disseminate. NOAA acknowledges that in spite of its policy goals, the dissemination of all data to all people is not feasible due to the barriers of cost and internal NOAA limitations. Increased partnership with academia and the private sector is one of the most important ways NOAA can overcome these barriers.

NOAA limitations to implementing an Open EIS can be grouped into three main categories: (1) limitations of the internal architecture of NOAA's data systems, (2) limitations of NOAA's capacity to provide data to external parties, and (3) limitations to the use of NOAA data by external parties after they acquire it. Each of these limitations is discussed below.

Currently, NOAA's data dissemination architecture is disjointed and unable to transport all data to a single portal for ease of data sharing[2]. Internal to NOAA, numerous data are resampled to lower temporal and spatial resolutions for ease of distribution to users – even users *inside* NOAA. Other NOAA data, such as satellite data, are very complex to process, and involve extensive calibration and validation, geo-referencing and time stamping. Raw data from NOAA's satellites have very limited value until processed. Satellite data are processed to various levels, including some items that could be considered independently-usable products, and distributed to the NWS and others. Such raw data are discarded in favor of the more processed, value-added version, to limit the bandwidth requirements for the internal dissemination systems.

In addition to internal architectural issues, NOAA's systems also have limited capacity, both in bandwidth and server infrastructure, to deliver high volumes of data to external users. In particular, NOAA doesn't currently have the bandwidth or potential server capacity to deliver the volume of data that might be needed by the private sector and academia. Some data are purely internal, computer-to-computer intermediate results and unavailable for broader distribution absent heroic (and expensive) system-level modifications. In addition, sustainment costs of such an infrastructure could be considerable.

Finally, the recipients of NOAA information also face numerous challenges even after they receive NOAA information, including the following:
- Users must go to a number of different websites and servers to access information since a single data portal doesn't exist;
- Users must understand much about the internal data formats and encodings to exploit data. For example, users must understand internal coding formats such as GRIB2 to be able to decode large datasets;

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[2] As a result of NOAA's fragmented dissemination architecture, there is no diagram available that accurately describes NOAA's data and information architecture. Figure 1 in the Open WCS paper does not accurately reflect the current state of NOAA's dissemination systems, e.g. it implies a single NOAA repository for NOAA's information exists and implies that NOAA's internal distribution systems provide high-bandwidth access to NOAA information throughout NOAA. NOAA has multiple information repositories which are neither physically nor logically consolidated, and high-bandwidth connections *within* NOAA are more the exception than the rule.

- Observational and model data do not always use the same datum, so translating this to a universal geo-referenced framework is left to the user. This leads to potential significant errors if the end user isn't aware of the datum of the original data. This inhibits integrating NOAA information with user data in a GIS framework;
- The metadata (data *about* the environmental information itself) are missing, incomplete, or non-standard; and
- There is a lack of an ontology that translates between user vernacular for data and NWS scientific vernacular. For example, wind can be interpreted as wind speed and direction, U and V components, headwind, tailwind and crosswind.

Policy Framework and Challenges

The NOAA Partnership Policy creates the basic policy framework for an Open EIS. As noted above, the NOAA Partnership Policy recognizes the importance of the various roles of participants in the Nation's environmental information enterprise. In particular, section 3.07 of this policy states that "NOAA's participation in the environmental information enterprise will be founded on the following principles:

1. Mission connection: NOAA's information services will support the NOAA mission. As a government agency, NOAA recognizes its core responsibility to protect life and property.

2. Consultation: Unless public safety or national security concerns dictate otherwise, NOAA will provide interested persons and entities adequate notice and opportunity for input into decisions regarding the development, dissemination, and discontinuance of significant products and services.

3. Open information dissemination: NOAA recognizes that open and unrestricted dissemination of high quality publicly funded information, as appropriate and within resource constraints, is good policy and is the law.

4. Equity: NOAA will be equitable in dealings with various classes of entities and will not show favoritism toward any particular entity within a class. NOAA recognizes it has special responsibilities to some users (e.g., public safety officials) and different legal requirements for its interactions with entities of different types (e.g., other federal agencies). NOAA will not provide an information service to one entity unless it can also be provided to other similar entities. There may be some creative arrangements that the Enterprise can develop that may help the government overcome this challenge. (Example: Ford/GM/Toyota battery development (R&D) model).

5. Recognition of Roles of Others: When faced with requests for information services, NOAA will explain existing NOAA services, including their uses and limitations, and inform the requester that others in the environmental information enterprise may be able to meet the requester's needs."

In effect, the NOAA Partnership Policy and its information management policies already endorse, in principle, the SAB EISWG recommendations and provide the framework for an Open EIS. However, an endorsement in principle does not remove the challenges associated with actual implementation of some of the SAB EISWG recommendations. These policy challenges include:

1. Proprietary Information: NOAA acquires a wide variety of information from external sources, and some of this information is acquired under terms that restrict NOAA's ability to redistribute this third-party information to others. When NOAA accepts data under restrictive terms, these terms must be honored, which may restrict NOAA's ability to make all of its information available to others. NOAA is working on a policy for External Data Usage in response to a separate SAB action.

2. Information Quality: Few NOAA datasets are released that have not been verified through stringent quality control processes. NOAA is subject to the Data Quality Act[3], which is focused on maximizing the quality, objectivity, utility, and integrity of information disseminated by federal agencies. Prior to releasing any intermediate satellite data, NOAA must complete a determination under this Act in support of dissemination. This would likely involve drawing clear distinctions between NOAA's uncalibrated data and NOAA's finished products. Quality control for uncalibrated data would likely focus on timely delivery of an accurate copy of the "unfinished" data.

3. Information Security: There are numerous policies that apply to information security intended to protect the integrity of NOAA's information systems and the information they contain. An Open EIS would need to be consistent with these.

4. Financial Controls: As discussed above, federal agencies, including NOAA, are under enormous pressure to reduce federal spending and the federal budget deficit. In addition to this basic limitation in NOAA's ability to expend funds to implement the SAB EISWG recommendations, NOAA must comply with numerous financial controls regarding the manner in which it acquires funds and the purposes for which these funds are used. To the extent that the expenditure of funds is required, these financial controls may limit NOAA's ability to implement some of the SAB EISWG recommendations. For example, NOAA cannot simply accept funds outside of the appropriations process – it must have specific authority to do so and must operate within the authorities granted.[4]

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[3] Section 515 of the Treasury and General Government Appropriations Act for FY2001 (Public Law 106-554)
[4] Cooperative Research and Development Agreements (CRADA) are examples of a mechanism for external parties to obtain proprietary access and, if needed, to pay for the cost of such access. Such agreements, however, will always be evaluated by NOAA from a broad public interest perspective. CRADAs should be viewed as a temporary mechanism to gain enhanced access to NOAA data and expertise.

The SAB EISWG recommendations ask NOAA to take an incremental and targeted implementation approach. This will afford NOAA an opportunity to develop implementation methods that comply with the various policy challenges above and develop examples that can be followed to expand implementation in ways that address these policy challenges. NOAA does not believe additional legislation is required to provide necessary authorities to begin to implement an Open EIS, but initial projects undertaken in response to SAB recommendations may help clarify areas where legislation could be helpful. These issues are expected to be reviewed periodically by the NOAA Executive Council (NEC).

NOAA expects the many of the challenges to implementation will be resolved incrementally through the Open EIS demonstration projects. Through periodic consultation with the SAB and its subcommittees and other existing partnership processes, NOAA hopes to overcome the limitations and challenges described above and along the way to recognize some guiding principles and establish criteria for selecting projects and actions to be implemented toward the Open EIS.

A Process for Moving Toward an Open EIS

Recognizing the goal of incremental progress toward an Open EIS, NOAA proposes to establish a process to facilitate the identification and implementation of specific projects or actions to demonstrate an Open EIS as well as steps to remove impediments and to facilitate projects and actions. NOAA has numerous existing groups and individuals whose work intersect with the Open EIS concepts: Environmental Data Management Committee (EDMC), Geographic Information System (GIS) Committee, Enterprise Architecture Committee, Data Management Integration Team (DMIT), Program Oversight Board (POB) review of new IT investments and their data management plans, and the NOAA Enterprise Architect and Data management Architect. These groups will be engaged and leveraged to orient NOAA towards Open EIS implementation.

By December 1, 2012, NOAA will designate a member of its senior executive service to champion and coordinate its overall effort as the Open EIS Coordinator . NOAA envisions an annual cycle in which projects are selected for implementation and progress is reported to the NEC by the Open EIS Coordinator. NOAA will look to community input, facilitated by the SAB and other groups, to prioritize the candidate projects and actions in advance of the annual NOAA selection. Initially, in order to expedite the process, NOAA will conduct an internal process to identify a number of candidate projects and actions for community review. Beginning in 2013, NOAA will conduct an open call for proposals that NOAA will evaluate in relation to the NOAA mission, available resources, and feasibility then seek community input on priorities, and finally select for implementation. NOAA will appoint individuals from the Line and Staff Offices to support the Open EIS Coordinator as implementation teams for the selected prototype/pilot projects. The following is an outline of the initial and annual processes and suggested timetable:

Initial Actions   Date

NOAA Open EIS Coordinator Named	December 2012
NOAA seeks community input to prioritize candidate projects	December 2012 – February 2013
NOAA selects projects/actions for implementation	March 2013
NOAA Open EIS implementation team members identified	March 2013

Annual Process (assuming Initial Actions lead to NOAA selection in March 2013)

NOAA Open EIS Report to NEC on status	September 2013 (Six months after project selection)
NOAA Open EIS Report to SAB on status	SAB Fall meeting 2013
NOAA call for proposals	September 2013 (Six months prior to NOAA decision)
NOAA identifies most feasible projects	December 2013 (Three months prior to NOAA decision)
NOAA seeks community input to prioritize candidate projects	February 2014 (One month prior to NOAA decision)
NOAA decides which (new) projects to implement and selects the Open EIS implementation team(s) for the projects.	March 2014 (Six months after annual report)

During the annual cycle, the NOAA Open EIS Coordinator and supporting implementation team(s) will consult with the SAB and its subcommittees, as needed and at the request of the SAB, to discuss the process and progress toward an Open EIS, including the identification of obstacles to implementation and opportunities to remove them. These meetings and the issues raised will be summarized in the annual report to the NEC and SAB. To the extent that progress toward an Open EIS requires a strategy or action plan as well as the identification of guiding principles, NOAA anticipates that these will be articulated in the annual report and NOAA's internal implementation plans will be updated to include the activities to link to the annual SEE process.

Next Steps

NOAA will engage the SAB and subcommittees such as the EISWG, CWG, and DAARWG, in a discussion about the Open EIS implementation strategy. NOAA will continue to use existing mechanisms (e.g. Small Business Innovation Research [SBIR]) to develop partnerships with private-sector companies so they can develop and market enhanced products and services using weather and climate data. The Enterprise will need to determine the measures of success for Open EIS to evaluate the pilots and begin to develop a library of best practices. The Enterprise will need to leverage the baseline set by the "State of the Enterprise" project[5] to understand how

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[5] This project, currently underway under the aegis of the American Meteorological Society's Commission on the Weather and Climate Enterprise, aims to prepare a report periodically (every few years) that summarizes the status of the entire weather and climate enterprise, including private sector, academic, and government participants.

the enterprise has changed as a result of Open EIS. A notional list of candidate prototypes is included below, and further discussion is welcomed on identifying other candidates, and prioritizing amongst them.

Demonstration of the open data concept:

1. **High resolution Temperature and Precipitation climate data pilot:** Make available high-resolution (1 to 50 km TBD) 5/60 minute US precipitation and temperature data that is not immediately made available to the community, but is available after a period of time as a climate record dataset (NESDIS);

2. **Seasonal climate data sharing:** Applications of NOAA information on seasonal climate using the NCEP Climate Forecast System (NWS); and

3. **Convective initiation data sharing:** Deriving information on severe weather and convective initiation from hourly real-time weather analyses and high resolution (<4 km) numerical guidance; available experimentally from NWS/NCEP and OAR/ESRL. (NWS and OAR).

Demonstration of the collaborative development concept:

1. **Collaborative development or upgrades to the Global Forecast System (GFS) model:** Invite the Enterprise to participate in the evolution of the GFS model and develop a management process for the collaboration, including visiting scientist programs (NWS);

2. **Satellite test-bed:** Invite broader private sector participation in NOAA Satellite test-bed activity (NESDIS);

3. **Participation in Satellite Conference:** NOAA's Center for Satellite Applications and Research (STAR) is considering either an expanded Satellite conference or a separate technology-oriented conference. The existing Satellite conferences have been quite successful at bringing in a large segment of NOAA satellite data users for technology updates and feedback. While these conferences do discuss technology, they may fall short of the level of details needed for NOAA collaborators to plan synergistic developments (NESDIS);

4. **Joint development of ensemble-based products:** Inclusion of interested partners in development of ensemble-based products using NCEP's global and regional operational ensemble products (NWS and OAR);

5. **Joint development of rapid refresh situational awareness products:** Development of a rapidly updating analysis of the atmosphere, land and hydrology to support forecaster situational awareness in NWS and commercial applications (NWS and OAR); and,

6. **Joint development of Dual Polar algorithms:** Development of improved algorithms from newly upgraded Dual Polarization Doppler radar (NWS and OAR).