

GODAE OceanView Review

November 2013

1. INTRODUCTION

The GODAE Ocean View (GOV) review was conducted on 7-8 November, 2013, in Baltimore, Maryland, at the request of the GOV Patrons. The primary purpose of the review was to seek to improve the effectiveness of GOV in the future. The Review Panel was tasked with reviewing the GOV Science Team, the GOV Task Teams, the GOV Project Office and the GOV Web pages. The performance of the national teams and systems participating in GOV was deemed outside the scope of the review.

The GOV Review Panel was comprised of the following reviewers:

Albert Fischer, Intergovernmental Oceanographic Commission, France
Shiro Imawaki, JAMSTEC, Japan
Ming Ji, NOAA Ocean Prediction Center, USA
Ralph Rayner, Centre for the Analysis of Time Series, London School of Economics, UK
Neville Smith, Bureau of Meteorology, Australia
Richard W. Spinrad, Oregon State University, USA (Chair)

The Review Panel was informed with documents and presentation materials. Prior to the review the Panel was provided with written reports from the GOVST co-chairs and the Task Team co-chairs; the GOVST work plan and the Task Team work plans, and minutes of the Team meetings. At the review, the Panel received verbal reports via Powerpoint presentations from the GOVST co-chairs and Task Team chairs, as well as the GOV Project Office Director.

A preliminary summary of the review was provided by the Panel at the end of the review. This document constitutes the formal report of the findings and recommendations of the Review Panel.

2. FINDINGS AND RECOMMENDATIONS

The structure of this report follows the order in which materials were presented at the review. The Panel has chosen to present its report in a format of findings and recommendations, specifically aimed at improving the effectiveness of GOV in the future.

2.a. Overarching finding and recommendation

Finding: GOV has demonstrated great success in continuing the direction defined by GODAE, and in meeting critical objectives. This is reflected in the improvements realized in model development, including coupled runs, higher resolution output and initial incorporation of biogeochemical processes and variables. The use of multi-model ensembles is noted as an important step forward. Additionally, the Panel recognizes the significant improvements made in assessment methodologies.

Recommendation: The improvements made to date, while demonstrable and significant, would benefit from clearer direction and statement of objectives. The Panel recommends the formal development and confirmation of a strategic plan (with 5 and 10 year horizons) defining, with clear priorities, the following:

- Expected outcomes
- Expected investments
- “Returns” as reflected in robust metrics

Additionally, the principles for prioritization in the strategic plan should include:

- Actions and efforts that must be done collectively, or
- Actions and efforts that can be done more effectively on a collective basis
- Clear implications for major practical applications
- Representative of the intersection of community scientific interest and patrons’ expectations or requirements
- Aligned with patrons’ core interests and priorities

Regarding the plan, itself, the Panel encourages GOVST to keep it as concise as possible, adhere to a regular schedule of refreshing, focus on clear basic objectives, with clear proposed actions.

2.b. Organization

Finding: The Panel believes that the organizational structure does not adequately foster engagement with the sponsors (cf. the patrons). The interface with sponsors can be improved; there is an absence of feedback on the leverage achieved through GOV.

Recommendation: The Panel believes that the most effective way of addressing the organizational disconnect with the sponsors is to develop a robust statement of return on investment that the patrons can share with the sponsors. By documenting the measure of effectiveness the GOV community is better placed to retain and expand the attention and interest of the sponsors.

Finding: The Panel finds that the organizational structure of the Task Teams is not well justified in strategic terms. The evolution of definition of the Task Teams seems to have been founded on response to immediate issues, opportunities and concerns. Their definition and structure should be more proactively based and strategic in nature.

Recommendation: As part of the development of a strategic plan, GOVST should assess the governance approach, impact and efficiency of Task Team structure in light of strategic objectives, and consider redefinition. Specific elements of such a redefinition are addressed in subsequent findings and recommendations in this report.

2.c. Science interface

Findings: GODAE/GOV has evolved to a position and capability where the community can now define scientific priorities. Additionally, systematic errors in some places require process experiments to address.

From evidence provided at the Symposium, GOV partners continue to push at the forefront of ocean scientific understanding, in some cases arguably close to the 'bleeding edge'. Since the end of the World Ocean Circulation Experiment (WOCE), there have been far fewer organized experimental campaigns dedicated to understanding the limits of predictability in the ocean, other than those led from climate research. This understanding is critical on all time scales since it impacts interpretation of observations (scales of variability) and the development of parameterizations in and validation of models and model predictions. Fieldwork has continued at a lower level, as expected, and as a consequence has limited progress in understanding processes and mechanisms.

In the absence of such coordinated investigations, the Panel concluded that it would be timely for GOV to embrace and provide leadership and coordination for such activities, in collaboration with others as appropriate. In particular, GOV should identify those 'experiments' needed to deliver the data and improved understanding of processes important for ocean modelling and prediction, particularly those that would alleviate the levels of systematic error in ocean models of all classes. As one example, it would seem that science and technology has advanced to a point where we may be able to observe and model boundary current regimes with significantly improved fidelity. WOCE made significant advances in this area but, ten years on, new approaches are now feasible. A joint experiment with Argo and CLIVAR might be contemplated that would include:

- High-density XBT lines and mooring 'curtains' deployed to a selected number of western and eastern boundary current zones, to resolve transports and circulation interactions;

- The use of new glider technology capable of surveying such boundary current regimes;
- Analysis of these data and coincident satellite data to close heat and transport budgets and to enhance understanding of fine-scale interactions;
- Dedicated reanalysis, nowcasting and forecasting products to guide the experiment design and to improve the understanding of variability and predictability in such zones.

Recommendations: GOV should consider a strategy around scientific activities that will address barriers to progress in ocean prediction and, in particular:

- Consider a small number of experimental campaigns dedicated to improved process understanding and deeper knowledge of predictability, and contributing to the design of future monitoring systems; and
- Consider mechanisms that will formalize such a leadership role in the ocean science community (including the IOC of UNESCO).

2.d. ET-OOFS/GOV interface

Findings: The links between GOV and the JCOMM Expert Team on Operational Ocean Forecasting Systems (ET-OOFS) are strong and continuing to evolve. There is inevitable overlap, both in the actions being undertaken and in the capability being brought to these actions. While this Panel was not presented with a detailed outline of the ET-OOFS work program, it was clear that both groups were giving priority to addressing the coordination challenges, including through cross-population of working groups/teams and direct coordination between GOV and ET-OOFS. The Panel found that the ‘separation of concerns’ could be improved, in part by further stressing the leadership roles for science and operations for GOV and ET-OOFS, respectively, and by more clearly identifying the mechanisms for seeking advice by JCOMM from GOV via ET-OOFS, and for the reporting of GOV into JCOMM and OOPC. An improved separation would lessen the burden for cross-membership of groups and reduce the transactional cost.

Recommendations: GOV and JCOMM/ET-OOFS should seek a clearer ‘separation of concerns’, with GOV clearly identified with scientific leadership and advice, and ET-OOFS responsible for standards and operations of ocean forecasting systems. While the autonomous nature of GOV is a virtue, the Panel recommends that reporting lines to OOPC and JCOMM should be codified and include the ability for both bodies to seek advice, and make requests for action from GOV.

2.e. Transition to operations

Findings: GOV has made significant progress in setting up frameworks that bring together operational centers for routine intercomparison and monitoring of modeling and observing systems. Absolute scientific measures of performance for observing and forecasting systems are important for both GOV as the scientific development activity, and ET-OOFS and operational implementation groups.

GOV Task Teams through their liaison with ET-OOFS coordinated and developed the scientific validation and intercomparison of operational forecast and observing systems. The Intercomparison and Validation Task Team demonstrated an operational framework for intercomparison and validation of operational global ocean forecast models using class 4 metrics. Presently five operational models (Centers) are providing in real time model output to the U.S. GODAE server, allowing intercomparison against real time observations, thus enabling routine monitoring of the quality of operational modeling systems. Using scientific measures to monitor model performance through the intercomparison has resulted in identification of model deficiencies for some participating centers, illustrating the importance of scientific performance measures.

To establish a real time intercomparison practice for operational models in order to monitor performance has been a high priority task of the ET-OOFS work plans for both JCOMM-3 and JCOMM-4 inter-sessional periods. The efforts of the Intercomparison and Validation Task Team are critical for ET-OOFS to achieve an initial operational capability for real time intercomparison of operational global ocean models.

The Observing System Evaluation Task Team developed an approach for routine monitoring of Global Ocean Observing Systems (GOOS), and tested the approach at two operational forecasting centers. The approach leverages operational forecast systems by running routine parallel forecasts but withholding data from components of observing systems, thus enabling routine monitoring of the effect of observing system components. As a demonstration, UKMO tested the approach by conducting data denial experiment for many key components of the GOOS in a six-month period in 2011. The results could be highly valuable for many national agencies supporting these systems.

JCOMM-3 established a formal recognition and linkage between JCOMM and GOV. JCOMM-4 reiterated this strategic linkage. These major GOV achievements clearly demonstrate the value of the close tie between JCOMM/ET-OOFS and GOV.

Recommendation (to Patrons): Promote the utilization of operationally-relevant metrics and applications, and grow the number of participating centers and facilitate increased use by these centers. GOV and ET-OOFS have demonstrated the scientific value and practical applications of using scientific metrics to conduct routine intercomparisons and to monitor operational models and observing systems. Although challenges remain, such as significant computing resource implications, it is important to expand the current demonstration into broad

participation of operational forecast centers, thus accelerating the transition of these significant scientific advancements into operational applications. The patrons group should facilitate informing national agencies of key findings from routine monitoring of models and observing systems to assist in decision/policy making. The patrons group should also promote operational centers participation in routine real-time model intercomparisons and in coordinating routine observing system monitoring approaches through collaboration with GOV/ET-OOFS members.

2.f. Intercomparison and Validation Task Team

Findings: This Task Team provides the GOV focus for the development of scientific methods for validation of ocean models and ocean model forecasts, including techniques for intercomparing model products and observations. Such work has a number of benefits including:

- Improving confidence in model products and thus enhancing uptake;
- Providing guidance on systematic errors and model improvement (including approaches to assimilation);
- Providing robust and independent measures of system performance; and
- Providing metrics of model skill at the interfaces into down-stream applications (fitness-for-purpose metrics).

GOV has experimented with a number of approaches, including the so-called Class-4 metrics, and is probably the leading player in this area, including for seasonal climate applications. There is a clear link to observing system evaluation activities, and to any immediate down-stream application coordinated through GOV. In this case, GOV provides advice on appropriate standards and metrics and facilitates their adoption by research groups and other partners of GOV; ET-OOFS is responsible for implementation and routine monitoring for operational ocean forecasting systems. The Panel found the work to be of high quality and effective within the scope of GOV's mission.

Recommendations: The Panel recommends that GOV continue to give priority to these activities with the ultimate goal of producing consensus among the partners on effective and implementable standards. A Task Team is appropriate for this role, but GOV should focus on the development (finite term defined tasks within a project framework) and not on routine activities which should fall to ET-OOFS. This approach needs to be reflected in the strategic plan, with specific attention on measures of impact (fitness-for-purpose metrics).

2.g. Observing System Evaluation Task Team

Findings: According to the documentation presented to the Panel, the objective of this Task Team is to “support observational agencies by demonstrating the impact of observations on ocean forecast and reanalysis systems”. The Panel found the work to be of high quality, achieving impact, and returning significant value for the partners and sponsors of GOV. This Task Team has worked closely with GOOS and OOPC, as well as the Global Synthesis and Observations Panel of CLIVAR. The responsiveness and production of observation impact statements were particularly noteworthy.

The good engagement with observing system partners at the working level is a model for other teams. The identification with observational agencies, and the responsiveness to their requests, is to be applauded but it does carry a small risk of being seen as advocates rather than as authoritative, independent assessors of the observing system and its impact. In this context, the Panel pondered the advantages of an “Observations Patrons group” that would more clearly provide a link to the sponsors. Together with the intercomparison activities, there is also a responsibility to understand the model impact in what is ultimately a connected set of inputs to data assimilation systems (climatologies and model forecasts sit alongside observations in the ocean estimation process; greater model skill reduces the reliance on fresh observations for a given estimation target).

Recommendations: The Panel recommends further articulation of the OSEval work plan of action and milestones, within the context of the overall GOV strategy, with more explicit connection to partners and greater emphasis on system-wide evaluation. The strategy should seek to develop this Task Team as an objective and authoritative source of advice and evidence on the relevance and impact of the observing system, taking account of model and assimilation changes and improvements.

2.h. Coastal and Shelf Seas Task Team

Findings: The core emphasis of GOV is the global ocean. However, it is clear that many of the key uses for forecast models are in coastal and shelf seas. Having a Task Team focussed on connecting GOV to research communities working in coastal and shelf seas modelling and to applications of operational coastal model systems is therefore essential.

Coastal and shelf modelling activity is relatively mature. Coastal model systems and their products have been employed for many years to underpin a wide range of research and policy applications as well as for supporting diverse operational needs. There are existing research communities at national (for example, the US IOOS modelling test-bed) and regional levels (for example, within EuroGOOS). There are also communities dedicated to specific model types, such as storm surge and coastal

ecosystem models, and to particular end-uses such as fisheries management and design and operation of offshore structures.

Given the relative maturity and diversity of the coastal modelling community the Panel felt it was inappropriate for GOV to dedicate effort to the development of specific coastal and shelf model systems as this is likely to duplicate the effort of others. Similarly, it was felt that the breadth of forecast product needs and the corresponding diversity of groups working on particular application areas meant that it was unlikely that the Task Team would add significant value by working on specific coastal applications.

The focus of this Task Team should be centered on developing the interfaces where global systems can add value to coastal model development or lead to improved coastal forecast products. Particular emphasis might be placed on improvements in the ability to utilize global model outputs as boundary conditions for nested shelf and coastal models.

Recommendations: Consistent with the GOV strategic plan, the challenges in this Task Team's science strategy document need to be prioritized by the 'value add' of collective action. Focus should be on the interfaces between GOV systems and coastal models and applications. Finally, this Task Team should develop a dialogue with other groups working on coastal model development and applications (e.g., Delft Hydraulics, DHI, HR Wallingford, US Army Corps of Engineers, etc.).

2.i. Marine Ecosystem Analysis and Prediction Task Team

Findings: The Panel is impressed with the incorporation of work by this Task Team into the original portfolio of effort of GOV. There is good connection to the GOV systems. Additionally, the focus on four topic areas is commendable, and those topics are well chosen. The Panel believes that the focus of this Task Team on 24/7 operational systems is too restrictive and not justified in terms of end user applications. The added value of this work to GOV writ large is not well defined.

Recommendations: GOV must identify the added value and quantifiable benefits of this Task Team. The measures of effectiveness should be expressed in terms of mission needs of the patrons. Additionally, this Task Team would benefit from a discussion regarding an "exit strategy". That is, can this Task Team be incorporated into the overarching efforts and organizational structure of GOV, without the need for differentiation of ecosystem analysis and prediction (cf. physical system analysis and prediction). Additionally, the Panel believes this Task Team could add much value by changing the mode of operation to engage the sponsors and encourage collaboration through symposia, workshops, and other similar community efforts.

2.j. Short- to Medium-Range Coupled Prediction Task Team

Findings: The benefits of the relationship with the numerical weather prediction (NWP) community are real, but not yet realized. The major effort of this Task Team was to hold a workshop, jointly with the Working Group on Numerical Experimentation (WGNE), to develop links between the ocean and atmosphere groups in the area of short- to medium-range coupled prediction. From the workshop, four white papers on observations, data assimilation, dynamical modelling and physical parameterizations have evolved. Growing evidence of the impact of coupling on medium-range ocean, atmosphere and sea-ice forecasts has been documented. The Panel agrees with the critical objective of this Task Team that observational requirements for coupled research and prediction systems should be defined. Those observational requirements should be discussed with the Observing System Evaluation Task Team. Common techniques for this kind of design and assessment are Observing System Experiments (OSEs) and Observing System Simulation Experiments (OSSEs).

The Panel finds that small incremental improvements would yield large benefits not only to NWP and society, but also to advocacy for ocean observations. In addition, society has been demanding reliable seasonal forecasts, which are coupled problems of atmosphere-ocean-land and other components of the earth system such as sea ice, requiring precise boundary conditions from ocean, land and sea ice. Therefore, temperature and salinity data from Argo floats as well as satellite altimetry data are critical for initializing the ocean for today's operational seasonal forecasting systems. Given the increasing role of the ocean in predictability from medium-range (3-16 days) through seasonal time scale, the GODAE community is well positioned to contribute, through collaboration with the WGNE group, toward achieving the goal of a seamless operational forecasting capability from weather through seasonal climate variability, and to demonstrate the needs of ocean observations to support such a capability. The Panel supports the future plan of this Task Team to maintain the established links with WGNE, and develop links with other groups such as the longer-range prediction groups (e.g. seasonal prediction), and with the waves and sea-ice communities.

Recommendations: Observational requirements should be discussed with the Observing System Evaluation Task Team and a series of Observing System Experiments (OSEs) and Observing System Simulation Experiments (OSSEs) should be implemented to demonstrate improvements in NWP skill. Links to relevant groups should be established to ensure success in establishing seamless forecasting from short-range to seasonal time scale.

2.k. GOV Project Office (*note: as a matter of nomenclature, the Review Panel was unanimous in its perception that this office is more aptly entitled a "Program" office, as its remit extends well beyond the traditional definition of a singular "Project"*)

Findings: The Review Panel is impressed with the overall operations, the efficiency and the effectiveness of the project office. The office is clearly operating smoothly and serving needs of internal and external users. Services provided are cost-effective and responsive. There appear to be efficiencies in the distribution of responsibilities between GOV and related entities such as Argo, GHRSSST, GOOS, etc.

Recommendations: While the efficiency of operations in the Project Office is inferred, there would be significant value in documenting such through an assessment of the in kind contributions for GOV, as this would clearly identify the impact of the Office as evidenced by quantified leverage and added value. Additionally, the Panel believes that there should be a stronger level of effort in communicating between secretariats on common areas of work and opportunities for enhancing collaboration.

2.l. GOV Web site

Finding: The GOV Web site is most effective for internal GOV community activities. The site was determined to be considerably less effective for an external audience.

Recommendations: If the site is intended to include an external audience, messages for those audiences should be compact and timeless, and should be updated through external links, an inherently more efficient practice. The Panel recognizes why there was an initial effort to develop the twiki, but strongly recommends it be replaced with the use of free cloud-based tools for collaboration.

2.m. Other issues of concern

In addition to the specific commentary on each of the Task Teams the Review Panel also identified some more general issue related to the Task Team structure within GOV and to the development of a new strategic plan.

Task Team structure

In general the Panel felt that the existing Task Team structure is well formulated and appropriate. Some Task Teams may require a tighter focus to their activities (e.g., the Coastal and Shelf Seas Task Team) and some may need to be time limited (e.g., the Marine Ecosystem Analysis and Prediction Task Team).

There was a suggestion, during the review, that GOV should form a User Task Team. The Panel did not feel that this was something that GOV should do at this time. Rather it should encourage intermediate and end-user participation in any workshops or symposia relevant to a particular target group.

The Review Panel expressed some concern that there was insufficient specific emphasis on the development and evaluation of assimilation techniques by the GOV Steering Team and that biogeochemical modelling was underrepresented at the Task Team level.

Interface with other communities and professional bodies

As a coordination body GOV needs to interface with many other communities for optimum effectiveness. The new strategic plan needs to map out the key interfaces and determine where responsibility for fostering these rests across the various Task Teams.

There may also be a case for strengthened relationships with key professional bodies and learned societies which could help GOV to communicate with a broader range of stakeholders. Examples of relevant professional bodies would be the Institute of Marine Engineering, Science and Technology (which has an Operational Oceanography Special Interest Group) and the various national professional bodies representing maritime civil engineering. Learned societies such as the Marine Technology Society and the Society for Underwater Technology could also be usefully engaged in connecting GOV with the wider marine science and technology community.

Down-stream activities

There is a large range of potential down-stream activities linked to ocean forecasting and to the work coordinated through GOV (and JCOMM ET-OOFS). Only small subsets of these are within the control and/or direct influence of GOV. The published objectives do not explicitly articulate an objective around down-stream applications although various presentations in the Symposium did refer to such goals. The Panel concluded there did need to be a better articulation of the role of GOV in down-stream application, first at the initial interface between GOV coordinated global and regional observing and forecast production systems and users of that information (such as coastal prediction), and users further down the application chain such as search and rescue and the oil and gas industry. GOV needs to develop a strategy for down-stream applications, distinguishing activities under the direct influence of GOV, from those relationships with intermediate users of GOV-related capability perhaps partly coordinated through GOV, and activities/applications connected to the ultimate beneficiaries in different sectors which may not be under the influence of GOV at all. The Panel believes this can be best achieved through the articulation of a specific objective and associated actions in the strategic approach of GOV (see Recommendations in section 2.a.). This would include identification of the value-add (return on effort invested).

3. CONCLUDING REMARKS

GODAE Ocean View is a solid program with clear added value. The Review Panel appreciates the opportunity to assess both the progress and plans of the Task Teams, as well as the operations of the Project Office. With attention to the recommendations indicated above, we are convinced that subsequent reviews will confirm the continued benefit of GOV for the scientific community as well as the diverse collection of end users dependent on the benefits of this research.