Draft
US IOOS Modeling Steering Team
Terms of Reference
10/31/13

1) Overview

Modeling is one of three major subsystems of the U.S. IOOS enterprise, providing essential capabilities to: integrate and assimilate observations: hindcast, nowcast and forecast events; and provide model output for use in information products and user support tools The IOOS Modeling system combines Federal agency operational modeling capacities with the capacity supported by the IOOS regions, as well as models operated by academic institutions and others. The design intention of this subsystem nests models at global, basin, and regional scales[1] for leveraging of cross-scale capabilities, integration, and interoperability to address key societal issues.

This IOOS Modeling Steering Team is convened to develop recommendations for guiding the development of the IOOS Modeling enterprise over the next 10 years and to address the recommendations put forward by the National Ocean Council's Implementation Plan and the US IOOS Summit Report.

2) Background

a. In 2008, the Modeling Analysis Steering Team (MAST) organized a workshop that brought together 50 representatives of the IOOS community to develop recommendations for the modeling and prediction subsystem. Those recommendations provide a benchmark for this new effort.

b. In 2010, the U.S. IOOS Program Office initiated the Coastal and Ocean Modeling Testbed (COMT) to enhance the accuracy, reliability, and scope of the federal suite of operational ocean modeling products. The COMT helps ensure that its diverse user community is better equipped to solve challenging coastal problems and is better able to transitions results into operations.

c. In 2013, two national reports specifically address IOOS modeling:
   i. The National Ocean Council's Implementation Plan put forth the action that, by 2014, a national modeling strategy to determine how regional scale models supported by IOOS regions can be integrated into Federal efforts should be developed.
   ii. The U.S. IOOS Summit Report contained two recommendations that address modeling: a) to use the modeling system in the design and assessment of observing system (#15) and b) the development "a ten-year plan for merging regional, national, and global ocean modeling efforts into coupled, nested, and ensemble

[1] The term regional refers to geography as in models for Gulf of Mexico West Florida Shelf, etc., not that it is operated by a RA

models across the time and space scales required for the full range of U.S. IOOS users (#25)" [2]

3) A Draft Vision for US IOOS Modeling– Long-term and Near-term:

a. Long-term Vision The U.S. IOOS modeling system addresses societal needs by integrating observing, data and communications systems, and operating seamlessly through global, basin and regional scales. The requirements for a robust modeling system are many and include, for example,

- the ability to predict extreme events such as coastal inundation and storm surge at the scale needed to support decision-making,
- prediction of ecological and environmental phenomena such as hypoxia, harmful algal blooms, and acidification,
- monitoring and predicting the transport and fate of pollutants and other substances in the coastal environment.

The IOOS modeling system is a "system of systems" interconnecting and nesting models across global, national, regional and local scales. IOOS fosters the transformation of regional, national, and global ocean modeling efforts into coupled, nested, and ensemble models across the time and space scales required for the full range of U.S. IOOS users.

A vibrant partnership between federal agencies and regional associations is required to identify and fulfill national and regional needs for analyses and forecasts. Such a partnership allows for the open exchange of ideas, technologies, and innovations.

b. Near Term Vision

As an enterprise, US IOOS will initially focus on coastal modeling. By 2025, U.S. IOOS will have established a framework for a coastal modeling network, with basic protocols, formats, and outputs specified, consistent with standards already

[2] IOOS Summit Report Recommendations related to modeling:

#15. We recommend the IOOS community continue to more fully utilize modeling in the assessment and design of the observing system
15.1. Consider the Global Climate Observing System (GCOS) observing principles in the design of the observing system, recalling that the time series of observations is also very useful for assessing model accuracy.
15.2. Use modeling to optimize the observing system design to support the data requirements and input needs for coupled, nested, and ensemble models across the time- and space-scales required for the full range of U.S. IOOS users
#25. We recommend the greater U.S. IOOS modeling community work together and with academia, under direction and oversight of the IOOC, on the following:
25.1. Develop a ten-year plan for merging regional, national, and global ocean modeling efforts into coupled, nested, and ensemble models across the time and space scales required for the full range of U.S. IOOS users
25.2. Develop improved, and more localized nowcast/forecast products for the location and movement of Harmful Algal Blooms (HABs), and for the location and movement of protected/ endangered species
25.3. Develop appropriate measures of success, including efficiency of the U.S. IOOS collection/ processing/delivery systems and the usefulness of products, so that improvements in system performance can be measured
25.4. Increase the focus on integrating biological/ecological observations into nested models that address broader ocean issues
25.5. Expand the U.S. IOOS modeling test bed nationally, with broad participation by multiple RAs; use the National Science Foundation's Ocean Observatories Initiative (OOI) for sampling density studies
25.6. Use modeling more in the design/assessment of the U.S. IOOS Observation Subsystem
25.7. Consider developing a process for U.S. IOOS approval/certification of models

developed for IOOS observing and communications systems and National Ocean Service coastal modeling. IOOS Regional Association modeling will address specific local and regional modeling needs, while also, where appropriate, supporting federal agency and national backbone needs for coverage at higher resolution. A structure for assimilating IOOS data streams will have been defined, detailing expectations for such issues as data characterization, reliability, and latency. There will be regular and on-going communication between the regions and the Federal agencies about needs, upcoming plans, feedback on improvements and other topics.

4) Charge to the IOOS Modeling Steering Team

Provide specific recommendations to the Interagency Ocean Observing Committee (IOOC),the U.S. IOOS Program Office, and the IOOS Association for establishing and advancing the IOOS modeling enterprise in the next 10 years, as well as improving communication across the modeling enterprise.

These recommendations will: 1) build on existing federal-regional modeling capacities, 2) scale-appropriately integrate/assimilate robust (reliability, quality, latency) IOOS data streams for enhanced representativeness and improved prediction, and 3) address physical and ecosystem parameters.

The format of the document depends on the answer to the question. If identification and prioritization of needs is external to the modeling subsystems, it's just a matter of mentioning this and identifying where it's coming from. If the modeling subsystems are to play a more integral role in this process, then 'describe the process for identification and prioritization of user needs' should probably be a separate bullet under ' IOOS regional modeling enterprise' and 'IOOS Federal modeling enterprise' in the outline, and maybe add a sentence to this effect in the first paragraph of the overview.

Specifically, the Strategy should:
(NOTE: This is a draft outline of what the Final Report could be and we will use to organize working groups around)

1) Overview and Vision
    a. Articulate the purposes for developing the IOOS modeling capacity at the global, basin and regional scales (the why) and the unique attributes that the US IOOS brings to the national and regional modeling enterprise.
    b. The vision, etc.
    c. Describe the roles of the Federal and regional modeling entities and capacities in a coupled, nested, system of systems.
2) Describe the end use for the models - work with the RAs and others to understand user needs for coastal information and to develop models to support end user needs.
3) IOOS RA modeling enterprise
    a. Describe the existing state of IOOS RA modeling and what needs to be done to fulfill the vision
    b. Regional and local model scale, user requirements,

4) IOOS Federal modeling enterprise
    a. Describe existing modeling federal capacity with relation to IOOS.
5) Linking the Two: A Concept of Operations
    a. Establish the process by which various regional and non-federal models, whether on a national or regional scale, can be transitioned to operations with a federal agency
    b. Establish the communication and funding pathways for sharing development (reducing redundancy) and distribution of information products based on model output
    c. Guide how innovation can be leveraged by the IOOS RA and backbone modeling components
    d. Establish guidelines for:
        i. assimilating observations into national and regional IOOS models that address parameters such as type, accuracy, frequency, latency, reliability, etc.
        ii. determining how requirements (spatial and temporal resolution, length of forecast / hindcast, uncertainty measures, etc.) for coastal models will be determined
        iii. acquiring governmental support for advancing development of IOOS models along a transition path to operational status
        iv. interfacing IOOS models run by different organizations to provide forcing and boundary conditions
        v. producing ensemble forecasts and nested models
        vi. Interoperability, Archiving

6) Priority models
    a. Hypoxia, HABs, inundation, acidification (examples, not final list)
        i. What's the role of IOOS? How can IOOS enhance existing efforts?
        ii. How should it integrate with the Federal IOOS modeling enterprise.

7) Pulling it all together
    a. Initiate a pilot collaboration between the Federal and regional IOOS components to demonstrate operational coastal ocean data-assimilating numerical prediction within a framework supportive of ecosystem modeling.
    b. Identify how the Coastal and Ocean Modeling Testbed can support the IOOS modeling strategy.

5) Members of the US IOOS Modeling Steering Team

Project Manager: Becky Baltes, US IOOS Program Office
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6) Proposed Process and Timeline

November 15 -	Draft package to IOOC and Regions for review and comment
December 15 -	Revised and finalize package
January 15 -	In-person meeting of IOOS Steering Team Define terms, role of IOOS in modeling, role of RAs, interoperability, clarify outcomes, review timeline and responsibilities, key issues to be addressed
Feb 1	Revised outline, working groups established, terms defined
Mar 1	Draft chapter outlines from working groups due, reviewed as group-
April	Update from working groups - Draft outlines due
May	Review of progress with IOOC, RAs and others
June	Revise based on input
Aug 1	Draft chapters due, integrate into whole report
Sept 15	Draft report released for review by IOOC, RAs and others
Oct 31	Final report