Gulf of Mexico Hypoxic Zone Modeling Technical Review Meeting

Terms of Reference
for
Modeling Technical Review Panel

Developed by the Steering Committee for the *Forum for Gulf of Mexico Hypoxia Research Coordination and Advancement*:

Steve Ashby (NGI), co-chair of Modeling Technical Review Meeting
Alan Lewitus (NOAA NCCOS), co-chair of Modeling Technical Review Meeting
Beth Turner (NOAA NCCOS), co-chair of Modeling Technical Review Meeting
Becky Baltes (NOAA IOOS)
John Harding (NGI)
Stephan Howden (USM)
Dave Kidwell (NOAA NCCOS)
Julien Lartigue (NOAA OAR, NGI)
Dave Scheurer (NOAA NCCOS)
Troy Pierce (EPA Gulf Program)

Goal:

To assess the state of scenario forecast models targeting hypoxic zone dynamics in the Northern Gulf of Mexico, and develop recommendations on modeling approaches to most effectively meet the Hypoxia Task Force management directive to mitigate hypoxia;

Objectives:

1. Evaluate existing models based on:
    a. Ability to address management questions;
    b. Infrastructure, observational, and remaining research needs;
    c. Readiness for transition to operation.
2. Produce:
    a. Pre-meeting *Guidelines for Gulf Modelers* to instruct Gulf modelers of informational needs from presentations and working sessions;
    b. Post-meeting White Paper on *Recommended Modeling Approaches for Scenario Forecasts of Gulf Hypoxia*

Key Management Questions:

1. What is the quantitative relationship between the size of the hypoxic zone (areal extent and volume) and nutrient loadings from the Mississippi/Atchafalaya Watershed? Is there a critical period or season during which nutrient loading has a relatively greater impact on the size and persistence of the hypoxic zone than other seasons or periods within the year?

2. What nutrient reduction levels are required to meet the goal to reduce the size of the hypoxic zone to a 5-year running average of 5,000 km^2?

3. What is the minimal amount of sustained nutrient reduction required to observe a measurable reduction in the size of the hypoxic zone? How long will reduced nutrient inputs need to be sustained before this reduction in size is realized?

4. If interim nutrient reduction targets are developed, what will be their resultant reduction in hypoxic zone size and over what time frame?

5. In addition to nutrients and river flow, what is the influence of ocean and weather conditions on the measured size of the hypoxic zone?

6. What is the effect of coastal restoration activities, such as large-scale river diversions, on the spatial and temporal extent of the hypoxic zone?

7. What is the long-term effect of climate change on the spatial and temporal extent of the hypoxic zone?

8. What are the linkages between the predicted size of the hypoxic zone and the resultant impacts to living resources?

Charge to Panel: The panel should focus its evaluation on the following issues and questions.

1. ***Forecasts*** – Current goals of the Gulf Hypoxia Task Force emphasize the need to reduce Mississippi/Atchafalaya nutrients fluxes into the Gulf of Mexico by 45% in order to meet the goal of reducing the size of the hypoxic zone to 5,000 km^2. The ability to refine these reduction targets and evaluate them in the context of additional ecosystem drivers is required to advance restoration efforts within the Gulf of Mexico and Mississippi River watershed.

    a. Which modeling platforms provide the best quantitative measures to refine the Task Force nutrient reduction goals, including measures of uncertainty? Evaluation should include:

        i. model ability to quantitatively assess flux of multiple forms of nitrogen, including nitrate, as well as phosphorus and silicate, and the relative role of their loading on the formation and maintenance of the hypoxic zone;

        ii. capabilities for discriminating the relative roles of physical characteristics such as river discharge, winds, episodic tropical storms, and currents;

        iii. ability of model(s) to inform the development of interim nutrient reduction targets and goals.

    b. Do existing models provide capabilities for assessing the influences of restoration management actions (e.g. Mississippi River diversions) or climate change on the timing and spatial characteristics of the hypoxic zone?

c. Which models are best suited for use in seasonal forecasting and what is the best approach for integrating them into an ensemble forecast?

2. ***Model Requirements*** **–** Consideration of model requirements is a significant factor in balancing the ability of a model to address management needs with operational requirements, which may serve to limit which models are ultimately transitioned.

    a. **What are the observational requirements for the initiation and validation of scenario forecasting models? Which observations are required to objectively assess model skill?**

    b. **What are the infrastructure requirements for each modeling platform? Infrastructure needs include, but are not limited to:**

        i. **Computing needs and time;**

        ii. **Personnel time for initiation and validation;**

        iii. **Output analysis and dissemination.**

    c. **Does the model output have quantifiable uncertainties, and if so, what are those uncertainties?**

3. ***Research Priorities*** – Although it is envisioned that the next Gulf hypoxia modeling request for proposals will focus on the transition of model(s) to operations, a small portion of available funds may be devoted to model improvements.

    a. Is additional research required prior to the transition of seasonal and/or scenario forecast models to operations?

    b. Is there a particular modeling approach that shows more promise than others, but may need incremental work in model improvement?

    c. Are there priority research needs required to improve model performance after they are transferred to operations?

Framework for developing White Paper:

1. Prior to meeting, expand on *Terms of Reference* to develop *Guidelines for Gulf Modelers*

2. After meeting; have a soft deadline of August 2013, but Panel may prefer a hard deadline; this is flexible so it's the Panel's call; also flexible on whether Panel wants to have additional teleconferences, we even have support for a face-to-face, or can do virtual meetings, so again up to Panel's discretion;

3. Paper itself doesn't need to be long; Steering Committee can help with boilerplate – Intro addressing management relevance, overall goals, etc., figures, tables, getting references;

4. Can see a section specifically evaluating existing models based on standard set of criteria, but key is the recommendations section, which should not address specific models, but rather address modeling approaches for best informing nutrient reduction goals; also recommendations on seasonal forecast ensemble approach (simple vs. complex, etc.)