Appendix 1.

Puget Sound Dissolved Oxygen Modeling

Model Technical Advisory Committee

Model Selection Workshop Summary

November 4, 2008

Attendees

Mindy Roberts	Department of Ecology
Andrew Kolosseus	Department of Ecology
Brandon Sackmann	Department of Ecology
Heather Trim	People For Puget Sound
Paul McElheny	NOAA
Bruce Nairn	King County
Parker McCready	UW
Ben Cope	EPA
Tarang Khangaonkar	PNNL
Ed Josberger	USGS
Bob Johnston	U.S. Navy

Summary

1. Lessons learned from other modeling efforts

- Modifying a single tool to address multiple related questions/projects is a big benefit.
- Unstructured grids are particularly useful for complex shapes.
- Sometimes existing models do not include a locally important process, such as submerged aquatic vegetation, but the capability is imperative to modeling the local condition well.
- Processes important for local areas, such as sediment transport in Elliott Bay, are probably not as important in overall Puget Sound applications.
- NOAA's calibration standards, as well as those of other organizations, would be appropriate.
- Current meters, in addition to water surface elevations from measured sites or predicted by other software, provide very useful calibration data.
- Not every input has to be considered separately; in the case of the lower Duwamish, inputs from multiple sources were lumped together because they were not expected to be a big source.
- Run times are highly variable and depend on the spatial and temporal scales of the model application as well as the computing resources available.
- Cluster computing is being used more and more as the technology advances.

- The publication style is different between academia (journal articles) and government projects (technical reports). While detailed technical reports are insufficient as journal articles, journal articles are insufficient as project reports.
- Because the outcome of this project may include regulatory actions, we are required to document a high level of detail in technical reports. Both Ecology and PNNL have stringent peer review requirements, both internal and external, that will be followed in the project. The quality of the work should be such that it could be published in a peer-reviewed journal.

2. Responses to several questions posed to individual participants:

What is the single most important issue/process/factor that we must consider and get right to describe DO in Puget Sound?
(a) Nearshore estuarine influence on eutrophication and Puget Sound circulation, (b) characterizing loads and boundary conditions
Respiration rate
Sources and fate of nitrogen/phosphorus/etc. (we may be able to get the physical modeling already)
Circulation
Phytoplankton and nitrogen relationship
Stratification
Loadings (WWTPs, nonpoint sources, oceanic)
Is there a modeling framework/software we should absolutely use or strongly consider to describe DO in Puget Sound?
Decoupled comprehensive framework such as CE-QUAL ICM or WASP/EUTRO
The water quality validation is the most important step. It should be able to disprove a model.
No. Open source and peer-reviewed would be good starting points.
FVCOM and CH3D
Unstructured grid
Should be what the lead modeler is most familiar with. Starting with a totally new software application or modifying an existing one will always take more time than expected.

3. What are the dominant processes affecting DO?

Brainstormed elements with full group, and compiled the list below. At the end of the meeting, each person was given 2 red dots to identify those processes that we must consider and get right to describe DO in Puget Sound. Each person was given 3 yellow dots to identify those processes that the results are likely sensitive to AND that have less information available than we would hope, possibly contributing to the greatest uncertainty. In addition, if other processes had to be identified for completeness, as many green dots as necessary could be added beyond the red and yellow dots.

Process/factor/issue	Most important (red)	Most uncertain (yellow)	Other (green)
Freshwater inputs of nutrients	1	1	
Natural conditions		3	
Ocean inputs		2	1
Point sources	0	0	
Stratification/mixing	0	2	
Phytoplankton (including patchiness, functional groups)	1	1	
Sediment diagenesis/sediment oxygen demand	1	0	1
Mudflats	0	0	
Ulva (locally important? Human vs. natural?)	0	0	
Groundwater	0	1	
Circulation/residence time	5	0	
Phytoplankton rate processes	3	4	0
Nearshore processes	0	0	
Microbial rates (general)	2	3	
Sediment processes (microbial)	2	2	
Water column processes (microbial)	1	3	
Weather (wind, light, etc.)	0	1	
Air/water exchanges (for volatilization?)	0	0	
Alders	0	0	
Air deposition	0	0	
Respiration/water column processes (see above)	0	0	
Extrapolating to future conditions (climate, discharge, ocean pH)	0	0	
Submerged aquatic vegetation	0	1	
Zooplankton	0	0	
Mobile marine discharges (container ships, recreational boats, cruise ships)	0	0	
Ballast water	0	0	
Storms	0	0	

4. Rank in order (1 for most important through 7) the importance of each time scale to describe DO in Puget Sound.

Larger group was divided into two groups of 4-5 people to consult and respond as a small group.

Time scale	*Group 1*	*Group A*
Hours (tidal exchange, storms)	5	1
Days (blooms, storms)	4	1
Weeks (blooms, storms)	3	1
Months (neap/spring cycle)	1	2
Seasons (inputs, forcing)	2	2
Interannual (forcing, climate)	6	3
Decadal (climate)	7	3

There were subtle differences in the approaches the two groups recommended. Group 1 felt that the critical conditions/time period should be more of a chronic condition (rather than acute), while Group A felt that a big episodic event may be the important driver, such as through higher trophic level controls on lower trophic levels.

5. Other miscellaneous issues that were mentioned:

- Can we use the spice tracer information?
- Validation information is very important.
- Decoupled models would be useful because a coarser scale will be appropriate for water quality.

6. Planned items not included because we ran out of time (assigned as homework via email):

- What data sets or projects have information that might be useful to describe any of the dominant processes as either input or output? (Handed out matrix compiled for the box model) Available models—any to rule out or rise to the top?
- Are there any processes, rates, or sensitivity analyses that we can test with the Puget Sound box model?
- What specific metrics or general images would you consider to determine if the model is calibrated and verified/validated/confirmed/checked?
- Given that the water quality standards are written as changes from natural conditions, what should we consider in describing natural conditions for any of the processes governing DO?
- What else could/should we use these tools for? What other projects would benefit from this information? What other projects produce relevant information to use here? What other scenarios might we consider for our assessment of water quality standards?