

Modeling and Analysis
Steering Team (MAST) of the
Integrated and Sustained
Ocean Observing System
(IOOS)

Chris Mooers
RSMAS/UM and
IOOS - MAST Chair

GCOOS-RA MEETING
26 FEB 08

OUTLINE

- Introduction to the Modeling and Analysis Steering Team (MAST) (charge, members, general needs, and “passions”)
- The “operational” Regional Coastal Ocean Observing Systems (RCOOSs)
- RCOOS modeling and related requirements

MAST Charge (21 NOV 06)

- **(1) Enhance the collaboration between operational and research modeling groups at both national and regional levels**
- **(2) Establish and maintain an inventory of operational and research modeling capabilities**
- **(3) Assess adequacy of model performance and skill for emerging research and operational modeling systems**
- **(4) Develop a community consensus for a research agenda to achieve operational capabilities**
- **(5) Accelerate and facilitate effective processes for transitioning models and their upgrades from R&D to operations**

MAST Charge (CONTINUED)

- **(6) Assess and recommend improvements to observing and data management subsystems through use of testbeds for model skill assessment, plus OSEs and OSSEs for existing and proposed observing systems, resp.**
- **(7) Explore the use and efficacy of Community Modeling Networks (CMNs)**
- **(8) Develop a five-year, prioritized action plan and budget for MAST**
- **(9) Work with NOPP, etc. to attract needed funding**

MAST Members

- Frank Aikman, Vice Chair, NOAA-NOS-CSDL, Estuarine and Coastal Ocean Circulation
- Alan Blumberg, SIT, Estuarine and Coastal Ocean Circulation
- C.J. Beegle-Krause, Vice Chair, Applied Science Associates, Water Quality
- **Frank Bub**, Navy-NAVO, Coastal and Global Ocean Circulation/Waves
- **Dale Crockett**, TX Water Dev. Bd.-**RA**, Coastal Ocean Circulation
- **Bruce Ebersole**, USACOE, Waves
- Eileen Hofmann, ODU-PARADIGM, Ecosystem Dynamics
- Anne Hollowed, NOAA-NMFS-AFSC-**RA**, Fisheries
- **Gregg Jacobs**, NRL, Ocean Data Assimilation

MAST Members (continued)

- Harry Jenter, USGS, Watershed Hydrology
- Walter R, Johnson, MMS, OCS Environmental Impacts
- Richard Luettich, UNC-**RA**, Coastal Inundation/Waves
- **Chris Mooers**, Chair, RSMAS-**RA**, Coastal Ocean Circulation
- **Steve Payne**, Navy-CNMOC, Marine Meteorology
- Michele Rienecker, NASA-GSFC, Global Ocean-Climate
- Jorge Sarmiento, PU, Global Biogeochemistry
- Charles Spooner, EPA, Hydrological Monitoring Networks
- Hendrik Tolman, NOAA-NWS-NCEP, Global Waves and Circulation
- John Wilkin, Rutgers-**RA**, Coastal Ocean Circulation and Ecosystem Dynamics
- Ex-Officio, Tom Malone, Ocean.US

AN IOOS GOAL STATEMENT

- Provide ocean state estimation on a continuing, robust, reliable, resilient basis to support
 - Marine Emergency Management
 - Maritime Operations
 - Stewardship of Marine Living and Non-Living Resources in the Presence of Natural and Anthropogenic Global Change,in order to Sustain and Enhance Economic Development, Marine Ecosystems, and National Security

NOTE: requires simulation, detection, prediction, attribution, and mitigation capabilities

IOOS COMPONENTS

- National Backbone of Operational Observations
- National Backbone of Operational Model Products
- Global Ocean
 - NCEP/NWS
 - NAVO
 - CPO/OAR
- Coastal Ocean (EEZ)
 - CSDL/CO-OPS/NOS
 - 11 Regional Associations (RAs) and their “operational” Regional Coastal Ocean Observing Systems (RCOOSs)

IOOS integrates:

- Observing (satellite & in situ) subsystems
- Modeling (numerical) subsystems
- Information management (Web-based) subsystems
- Multiple scales
- Multiple disciplines
- Multiple agencies
- Multiple sectors
- All links in a “user-driven” information system
- Operations and R&D (???)

RCOOS “operational model” types needed

for the Coastal Ocean (i.e., semi-enclosed seas, continental margins, estuaries, and Great Lakes)

RCOOS model needs (continued)

- 3D coastal ocean (baroclinic) circulation
- 2D/3D Lagrangian trajectory and dispersion
- 2D/3D storm surge/inundation
- Tides
- Surface gravity waves
- NPZD etc. ecosystem, fisheries, etc.
- Sediment transport
- Ice dynamics
- Biogeochemical, bio-optical, bio-acoustic, etc.
- Mesoscale atmospheric predictions
- “Coupled models”
- Data assimilation systems (DAS)

RCOOS circulation model forcing needs

- Hi-res, accurate bottom topography
- Mesoscale atmospheric forcing
- Tidal forcing
- Runoff forcing (weakest now)
- Open boundary forcing
- Surface waves
- Typically, 1 hr temporal res., 1 km horizontal res., and 10 m (non-uniform) vertical res.
- Experiments are needed to determine adequacy of the forcing in terms of coastal ocean response

RCOOS circulation model verification/data assimilation data needs

- Sea surface temperature, winds, pressure, etc. time series (NDBC buoys and C-MAN stations) and maps (satellite IR and NWP)
- Horizontal velocity vertical profiles (NDBC buoys & RCOOSs (???)
- Horizontal velocity (& directional wave spectra (?)) surface maps from coastal HF-radar (RCOOSs)
- Surface (USCG and ???) and subsurface drifters (???)
- Sea surface salinity time series and maps (?)
- Coastal sea level time series (CO-OPS tide gauges)
- Temperature and salinity vertical profiles (gliders (RCOOSs (???)
- Sea surface height field (satellite radar altimetry (?))

RCOOS special skill assessment needs

- The quality of the velocity, temperature, and salinity open boundary conditions provided in downscaling from basin or global ocean models to the coastal ocean needs focused and sustained skill assessment
- The coastal ocean is significantly externally forced but also has internal dynamics and, hence, “ocean weather” (viz., mesoscale eddies, fronts, and meandering jets) for which there is a forecast skill challenge

RCOOS Physical Information Transfer to Ecosystem Models or Modelers

- Many ecosystem applications require Lagrangian transport and dispersion estimates
- Other applications require basic characterization of physical habitats (temperature, salinity, currents, and turbulence time series of maps)
- However, the perceived need is for 100 m or much finer resolution = non-hydrostatic models

MAST's "Passions"

- **Improve transition process from R&D to operations**
 - **Community-based skill assessment for quality assurance and buy-in**
 - **Testbeds (sustained)**
 - **Prediction experiments, conducted jointly between R&D and OPS**

MAST “PASSIONS” (continued)

- Establish program of rigorous OSEs & OSSEs for observing system design
- Establish program of re-analyses for diagnostic studies
- Establish model output archival hierarchy
- Establish updatable model inventory (for users of varied levels of sophistication)
- Establish model skill assessment metrics (based on not just statistics but also on phenomenology)

RCOOS/IOOS needs

- Consistent and long-term funding
- Concept-of-Operations (CONOPS): to define functions, roles and responsibilities, resource and management issues, etc.; to identify “marine weather forecasters” (i.e., “super users”); Etc.
- Series of combined field and numerical, regional scale prediction experiments, conducted jointly between R&D and OPS personnel to quantify capability and errors in the context of application requirements
- Education of needed human resources for OPS and R&D
- Facilitation of rapid advances in modeling and scientific understanding by the R&D community for the benefit of the OPS community

Complementary Attributes of Proposed GCOOS Modeling Project

- Use of multiple models: ensemble modeling
- Collaboration between OPS & R&D:
Navy (CNMOC/NAVO), NOAA(NCEP/CSDL),
Oil Company Consortium, & Academia
- Emphasis on skill assessment, testbed activity
- Community-approach to model transition from
R&D to operations
- Assessment of observing subsystem adequacy