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Session 2 Notes

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Session II Notes

These notes are intended as a supplement to the Session II presentation. The following discussion points were captured by workshop rapporteurs:

- Since the late 1990s, NOAA has participated in the development of the U.S. Integrated Ocean Observing System (IOOS). The NDBC Ocean Observing System of Systems includes wave buoys from other ocean observing systems. The wave buoys are important to assess the skill of wave models that are also included in the Integrated Ocean Observing Systems. In addition to observations, Ocean Observing Systems also include a modeling component.

- To be effective, especially in the generation of products or to support operations, the Federal and non-Federal ocean observing systems should maximize access to data and information products. Easier and better access to wave information improves navigation, marine spill response, search and rescue, the maintenance of seafloor cables, and the management of beaches. The wave buoy data is especially important for complex coasts such as Louisiana's delta coast.

- A variety of different models are currently being run and produce output in a variety of different data formats and conventions. Some of the key models discussed were NOAA WAVEWATCH III (WW3), Simulating WAves Nearshore (SWAN), and Delft3D. Most of the coastal modeling systems produce data on fixed horizontal grids with fixed or stretched vertical coordinates, and deliver results in a machine-independent binary format (NetCDF, HDF or GRIB). Some observing systems are using unstructured grid data, e.g. from the Finite Volume Coastal Ocean Model or FVCOM.

- WW3 is a third generation wave model developed at NOAA/NCEP in the spirit of the WAM wave model. The governing equations simulate temporal and spatial variations of mean water depth and mean current, and wave growth and decay resulting from the implied force of the surface wind, dissipation (e.g. white capping), and the effect of the bottom friction on the water column. Since the physics of breaking waves is not included, the output is only applicable outside of the surf zone and on larger scale wave features. Both a first order and a third order accurate numerical scheme are used to solve the governing equations. Outputs from the model include: gridded fields of significant wave height (highest 1/3 of the wave heights), wave directions and wave periods associated with these wave heights and spectral information that describes the wave energy at the different wavelengths and directions.

- Attendees described several research efforts that support higher resolution computations and the use of structured and unstructured grids, including efforts to integrate Coupled Ocean/Atmosphere Mesoscale Prediction System (COAMPS), SWAN, Navy Coastal Ocean Model (NCOM), and WW3.

- SWAN is a spectral wave model developed at the Delft University of Technology, The Netherlands. It models the energy contained in waves as they travel over the ocean surface towards the shore. In the model, waves change height, shape and direction as a result of wind, white capping, wave breaking, energy transfer between waves, and variations in the ocean floor bathymetry and currents. Initial wave conditions, including wave height, wave direction and wave period, are entered into the model, and the model computes changes to the input parameters as the waves move toward shore. Weather forecasting offices are using SWAN to produce marine forecasts. Local versions of SWAN may use input from WW3 for boundary conditions.

- Delft3D source code for FLOW, MOR, and WAVE are available online. The hydrodynamic module Delft3D-FLOW is a multidimensional hydrodynamic simulation program that calculates non-steady flow and transport phenomena resulting from tidal and meteorological forcing on a curvilinear, boundary-fitted grid. The MOR module computes sediment transport (both suspended and bed total load) and morphological changes for an arbitrary number of cohesive and non-cohesive fractions. Delft3D-WAVE computes wave propagation, wave generation by wind, non-linear wave-wave interactions and dissipation, for a given bottom topography, wind field, water level and current field in waters of deep, intermediate and finite depth. Therefore, Delft3D might be ideal for including the effects of longshore currents and rip currents.

- Navy participants were quick to point out that Delft3D can be used to provide surf prediction for areas with complicated bathymetry where the use of a one-dimensional surf model such as the Navy Standard Surf Model is inappropriate.

- Bathymetry that is necessary to run Delft3D is still difficult to obtain owing to the existence of data-sparse littoral regions.

- Surf characteristics are poorly observed and the forecasting of these characteristics remains art rather than science. One attendee stated, “the surf zone remains the black hole of modeling.”

These rapporteur notes do not necessarily reflect the view of all participants and speakers during this discussion session.