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Breakout Session IV Notes

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These notes are intended as a supplement to the presentations. The following discussion points were captured by workshop rapporteurs during breakout groups:

- The greatest need for wave information, e.g., from buoys would arguably be to support maritime commerce and operations, such as military exercises, search and rescue, navigation, pollution cleanup, fisheries. Consistency in response to a large variety of requirements is an important attribute to support the greatest number of stakeholders. The WAVCIS (operated by Louisiana State University) buoys of today and tomorrow should be multi-purpose, to satisfy several stakeholders.
- Buoy networks provide information for inputs to nowcasts and forecasts, model testing, validation, data assimilation, information for navigators and small craft operators, commercial fishing, coastal industry, military operations, pollution spill tracking, recreation and sports, such as sailing races; search and rescue, surfers and life guards.
- Complicated coastal regions such as the delta and barrier island coasts common to Louisiana need information systems to understand a variety of phenomena such as hypoxia in the Gulf of Mexico. Buoys able to measure winds, waves, currents and water quality parameters provide a valuable resource for coastal engineers and marine scientists, especially to better plan for ocean energy projects.
- Observations can be for a number of months, e.g., to assess a wave model. Longer records provide more reliable results and if carefully sited support a variety of operations. Wave buoy installations would enhance capabilities such as WAVCIS, i.e., the Wave-Current Surge Information Service.
- Wave information is currently disseminated by NOAA on NOAA radio, and commercial radio and television stations, and the web. There should be a system of direct linkage to all coastal decision makers who are responsible for the protection of citizens and property during heavy wave and weather events. A system could be similar to the tsunami warning systems implemented in Hawaii and the West Coast. Surfers are heavy users of this information, and there should be a standardized nowcast and forecast system that addresses their specific needs. WAVCIS could serve as a model for this activity. provides near real time meteorological-oceanographic information via the WWW to federal, state, and local agencies, and other interested users along the Louisiana Coast. WAVCIS could serve as the wave system for a search and rescue exercise.
- Quality control procedures must be in place to ensure public safety and good science. Data providers should provide or have on-hand written quality control procedures.
- Data quality control supports operational use of data for products and decision support tools.
- Buoy networks should make a standard available that allows data quality control to be performed by the provider, the user, or both. The process should begin with an intercomparison, such as those done by the NDBC. Boat generated waves, more easily controlled than natural waves, can be used to develop standards and for instrument calibration. Good maintenance is a necessity, because instruments can become clogged by biofouling, which would alter the frequency response of the sensor.
- Users may develop additional quality control procedures for their particular applications.
- NOAA has hosted workshops on the Quality Assurance of Real-Time Oceanographic Data. Information has been assembled into a technical research pool commonly called, "QARTOD." As an example, QARTOD advocates the use of single-digit data descriptors for QA, e.g., labeling "3" as "passed QA" as opposed to classifying data as "good." Issues relate to making distinctions between real-time flags and post-processing flags, which should be clearly defined in metadata. QARTOD has also explored various output data formats (e.g., ASCII, binary, netCDF, FM-13 Ship Code, and FM-65 WAVEOB format).

Sharing a common format, along Federal Geographic Data Committee guidelines, has been discussed where translators could deliver other formats.

- Integrated wave buoy and modeling systems would be important to better understand impacts such as inundation and capsizing from tsunami and rogue waves.
- The MaxWave project has published advances on the detection of extreme ocean waves by microwave remote sensing techniques, i.e., by Spaceborne Synthetic Aperture Radar (SAR) and Marine Radar.
- The European atlas using MaxWave statistics could be the basis for a system displaying, e.g., the probability of occurrence of very large and extreme waves. They could be shown as variations in a color scale for ease of interpretation.
- Extreme waves have become increasingly sampled in recent years by ship borne wave recorders and wave buoys, especially buoys deployed further offshore.
- Further improvements in observing or forecasting tsunami or rogue waves are best left as objectives for another workshop. Improved models would need to better understand the interactions among currents, winds, and waves.
- Wave buoy observations are important for the analysis of altimeter datasets. Wave buoy data are critical in adjusting significant wave height estimates from satellite altimeters. Satellite-specific correction factors are derived from inter-comparison of altimeter estimates with collocated buoy significant wave height measurements.
- Other measurements from buoys and platforms support the vicarious calibration of satellites.
- Today Liquid Robotics is launching four wave gliders on an approximate 25,000 mile trans Pacific cruise. The gliders will be measuring salinity, temperature, dissolved oxygen, directional waves, fluorescence, and some atmospheric parameters. Data will be made available free of charge and in real-time to people accessing the project online at http://www.liquidr.com/pacx. At some point only registered users will be able to access the data.
- Fully integrated information from databases, buoys, models, and satellites are important to test new source term physics as they are incorporated into numerical spectral wave prediction models.
- Users must have documentation describing the lineage of the data or information, i.e., source, processing, data reduction, etc.
- The NDBC provides adequate quantities of quality controlled data for most of the regions of the coastal U.S. The coverage should be extended to the entire U.S. coast, as well as to fill in gaps, especially in shallow water, but also in some deep water areas, such as off the coast of Florida.
- Inter-operability among GCOOS/IOOS/NOAA/NDBC provides real time observations and validation data for forecasting models.
- BOEMRE funded Sonoma Technologies Inc. to provide meteorological measurements from an oil platform in the Gulf of Mexico. The Sonoma Technology project provides better data for use in improving predictions of boundary layer parameters, improving regional scale, meteorological model predictions of boundary layer parameters and providing a framework for advanced offshore measurements.
- The NASA AERONET project provides critical calibration data to correct satellite imagery to better improve all the infra-red products. Sun photometers have been installed on offshore platforms.
- NOAA is extending the PORTS to include offshore waves at some locations.

Session Summary ─ An integrated combination of sensors and models is needed at all scales, e.g., global, regional, and local. Of the greatest importance is the addition of quality control indicators, especially error bars so that users can evaluate the adequacy of the information to meet their requirements. The latter are a major unfulfilled requirement in the modeling/observational systems available today.

The above rapporteur notes do not necessarily reflect the view of all participants and speakers of the respective breakout groups.