Oct 17th, 11:15 AM - 11:30 AM

Ocean Waves Workshop 2019 Session 3 Notes

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Session 3 – Wave Modeling Frameworks

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Running ocean models and managing the results remains a computationally demanding task.

Previously, operational wave models for the Navy were being run at NAVO and FNMOC, but now all the models are run at NAVO, with a backup run at FNMOC.

Littoral forecasts are of particular importance, as a result of which there are 300 Simulating WAves Nearshore (SWAN) domains nested within WAVEWATCH III (WIII). The new ability for WWIII to run with an implicit numerical schemes (similar to SWAN) can help eliminate running the SWAN littoral models. Wind forcing the wave models are currently obtained from the Navy Global Environmental Model (NAVGEM), a numerical weather prediction computer simulation run by the United States Navy's Numerical Meteorology and Oceanography Center.

Modelers don't always understand operational requirements that would guide visualization of output. Efforts to document requirements would support modeling efforts and optimizing the siting of sensors.

Predictions must be accurate and robust or they are not useful.

The scarcity of oceanographic data, especially during extreme events, can lead to uncertainty in wave and surge models and predictions that support operators. In the nearshore, the general lack of resolution for bathymetry and bed type can be limiting.

Information on uncertainty may help planners, ship drivers, and systems operators to make better decisions, especially when they are comparing multiple types of products.

Data assimilation systems should be used to help reduce and quantify uncertainty.

The aim of data assimilation is to improve forecasts.

Most data assimilation methods used in wave forecasting are either sequential or dynamic. Sequential methods are time independent while dynamical ones are time dependent.

Operational assimilation of wave data for wave prediction should focus on dynamic data assimilation methods. The Naval Research Laboratory has developed a 4D variational data assimilation system (4DVAR) for Wave Spectra. Currently, optimal interpolation schemes are being implemented via the Navy Coupled Ocean Data Assimilation. (NCODA) architecture. The entire wave spectrum is uniformly adjusted based on altimeter measurements of Hs.

3D and 4DVAR schemes are currently under development but it will be a while before they are transitioned to operational forecasting.

Cloud computing presents opportunities related to shared data processing workflows that utilize common, adaptable software to handle data ingest and storage

Cloud platforms offer new ways for scientists to observe and predict waves.

Operation of models aboard vessels, especially to support operators in communication limited and denied environments.

Verification metrics should reflect the operator's requirements for information and be collected and analyzed by third parties, not the model developer.

Seminal datasets consisting of extreme wave measurements should be included as a component of any modeling test beds. Seminal data sets are essential to support inter-model comparisons and performance verification.