

An Ocean Data Assimilation Application – Ocean Forecasting for Operation of Shipboard Acoustical Sensors

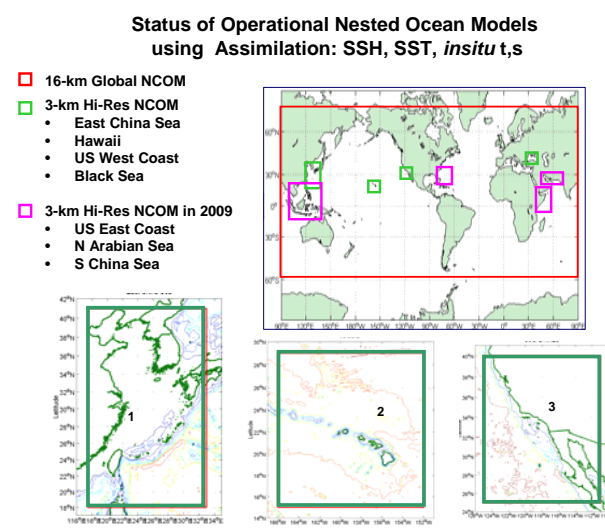
OCEAN FORECASTING FOR ACOUSTICAL APPLICATIONS
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This poster outlines efforts at the Naval Oceanographic Office to attain numerical model simulations of ocean temperature for the purpose of predicting more accurate 3-D sound speed fields for Navy acoustical sensors. The prominent feature of this activity is the need to integrate the sensitivity of selected acoustical sensors with simulations of ocean variability and with the Navy's capacity to improve those simulations through ocean observations. Experience continues to show that Navy shipboard acoustical systems are sensitive to a spectrum of ocean variability and dynamical scales. Against this sensitivity to real and modeled variability of ocean temperature is the pressing requirement to quantify uncertainty in the modeled fields in the vicinity of sensor deployment. The match-up between determinations of sensitivity and forecast uncertainty drives deployment of Navy sampling assets, as gliders, profiling floats, ships and aircraft, on a continual basis. Progress at the Naval Oceanographic Office toward estimating sensitivity and model uncertainty has depended on experimentation and on development of analysis practices embedded within the forecast production. The approach in practice today is to engage numbers of individuals in the daily interpretation of modeled fields and ocean observations. Different ocean settings have yielded different assessments of model performance, largely depending on the dynamical scales and complexity of the phenomena driving temperature variance. Experiences taken from Fleet exercises reinforce the importance of high-resolution circulation modeling both to integrate the effects of differing scales of variability and to render interactions among scales. The need to develop a stronger observational basis, more configurable and able to support and verify particular ocean processes in forecast models, is also apparent.

Goal – Produce sufficiently accurate numerical forecasts of 3-dimensional ocean sound speed fields with an operational ocean modeling system such that users of acoustical detection sensors are able to obtain reliable improvements in operational use of those sensors.

- Strategy –**
- Implement regional, high-resolution, atmosphere and ocean dynamical models able to forecast ocean variability on shorter spatial scales;
 - maintain a global mesoscale modeling operation to provide open-boundary forecast fields.
 - Assimilate information from all available satellite and *in situ* ocean observations into the forecast cycle;
 - maintain automated data quality evaluation.
 - Assemble teams of oceanographers knowledgeable on the ocean processes of multiple selected regions and for the purpose of continually assessing model-forecast uncertainty against the sensitivity of the end user's acoustic sensors, when operated in the respective regions.

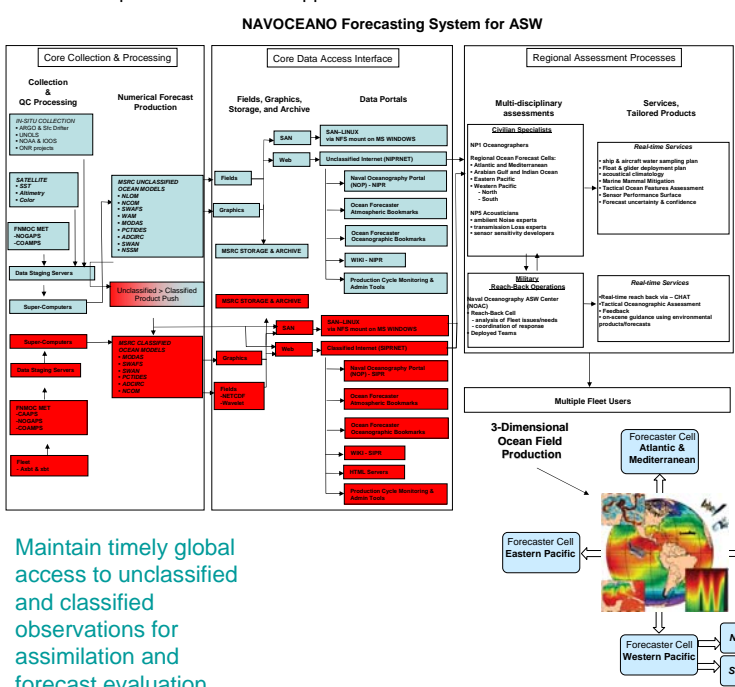


Building end-to-end system for selected application:

Observations + Circulation Models → Sensor Performance Forecast + Guidance for Sensor Use

Oceanographer/Acoustician Tasks:

- a. Determine acoustical sensor sensitivity to the predominant variability.
- b. Assess forecast uncertainty
 - i. Manual evaluation of model vs observed data
 - ii. Development of ensemble approaches



Maintain timely global access to unclassified and classified observations for assimilation and forecast evaluation.

Oceanographers and Acousticians Develop Regional Focus

1. Develop working understanding of environmental features and variability scales that drive variability in acoustic applications for selected geographical areas (bathymetry, atmospheric forcing patterns, ocean variability scales, circulation high-frequency "noise", etc).
2. Develop a working understanding of Fleet sensor performance against changing ocean conditions
3. Continually assess performance of the model against the observational sampling in order to optimize the sampling configurations

Example guidance material produced by oceanographers and acousticians during a Navy Fleet training Exercise in February 2008. Note that two Navy seagliders were deployed to support ocean model performance.

