

RELOCATABLE SHIPBOARD COASTAL MODELING SYSTEM

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LONG-TERM GOALS

The development of limited-area, open-boundary, nowcast/forecast systems that have a stand-alone, shipboard capability and which can be applied around the globe, especially in shallow coastal waters.

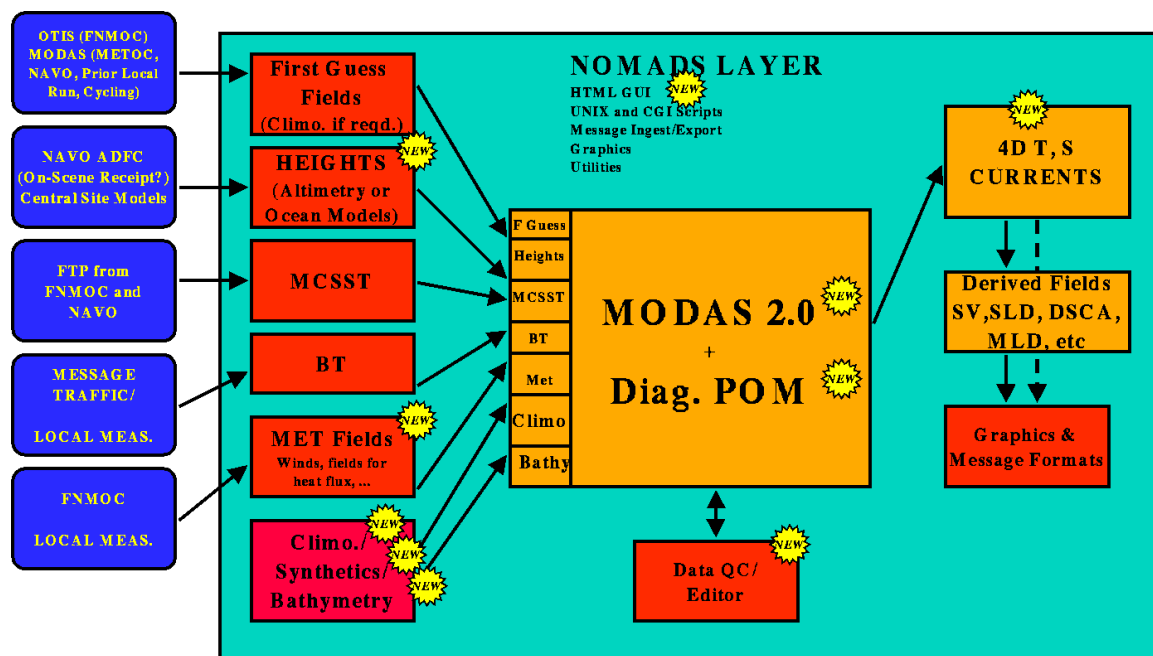
OBJECTIVES

The development of an architecture to modularly combine and evaluate different types of models and data into limited-area, relocatable, open-boundary, nowcast/forecast systems that have a stand-alone, shipboard capability which can be applied around the globe in shallow coastal waters as well as the deep oceans.

APPROACH

Adapt, develop, and evaluate the components necessary for a limited-area, coastal nowcast/forecast system and integrate these components into a demonstration system for evaluation, comparison, and transition. This project relies on and cooperates with other 6.1 and 6.2 projects to do the initial research and development of the models and assimilation methods it will use.

This system is called NOMADS, for NRL Ocean Models and Assimilation Demonstration System, and is outlined below. The key module in this version of NOMADS is the Modular Ocean Data Assimilation System (MODAS), a set of programs and scripts for performing optimum interpolation.



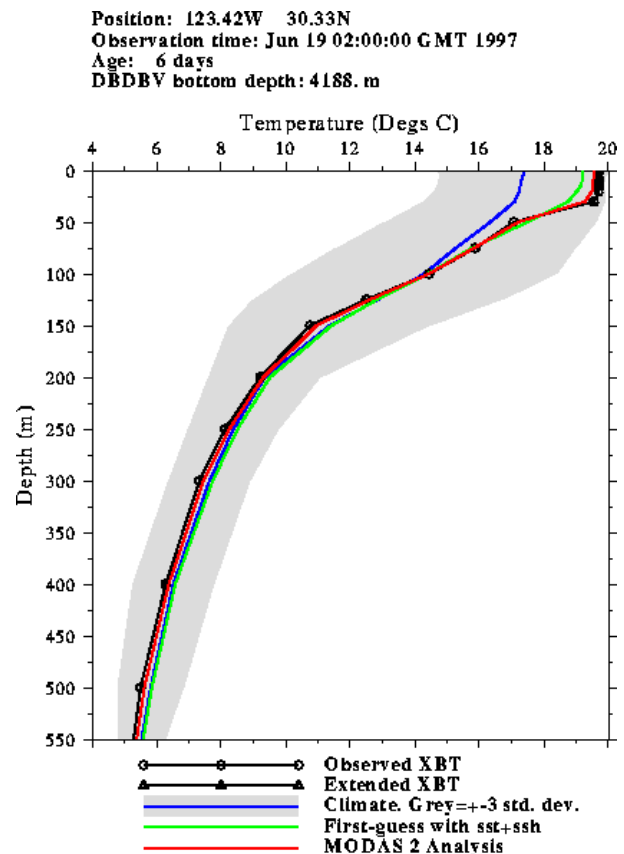
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The figure above outlines MODAS version 2.0 and the NOMADS infrastructure which supports it. Significant advances over prior versions include:

1. The use of global sea surface height fields produced by multiple satellite altimeters and (ultimately) by numerical ocean models.
2. A new web-based graphical user interface which will permit the system to be distributed across PC's and workstations with CPU-intensive tasks being run on remote servers and supercomputers.
3. The incorporation of a relocatable version of the Princeton Ocean Model which is initialized using MODAS fields and is forced using wind stress from various atmospheric models to improve the mixed layer and provide three dimensional currents.
4. Significantly improved climatologies and algorithms to seamlessly transition from deep to shallow water regimes.

WORK COMPLETED

This project completed the development of MODAS 2.0 which was begun in the related 6.2 Shipboard Tactical Nowcast/Forecast Systems project. The result is a set of algorithms and coefficient files derived from MOODS which converts surface measurements of sea surface height (from altimetry or ocean models) and sea surface temperature (from MCSST analyses or models) into vertical profiles of temperature and salinity. A sample analysis from the eastern Pacific ocean off southern California is shown at right. In this figure, the blue line and the grey band represents the MODAS 2.0 climatology for this location and time of year, and the green line represents the profile constructed using only surface height (from a combined TOPEX and ERS2 analysis now being performed globally every day at NRL) and surface temperature (taken from the daily global OTIS 4.0 analysis performed by Fleet Numerical). The black line shows the BT profile that was measured at this point and the red line is the final MODAS 2.0 analysis (which included this profile).

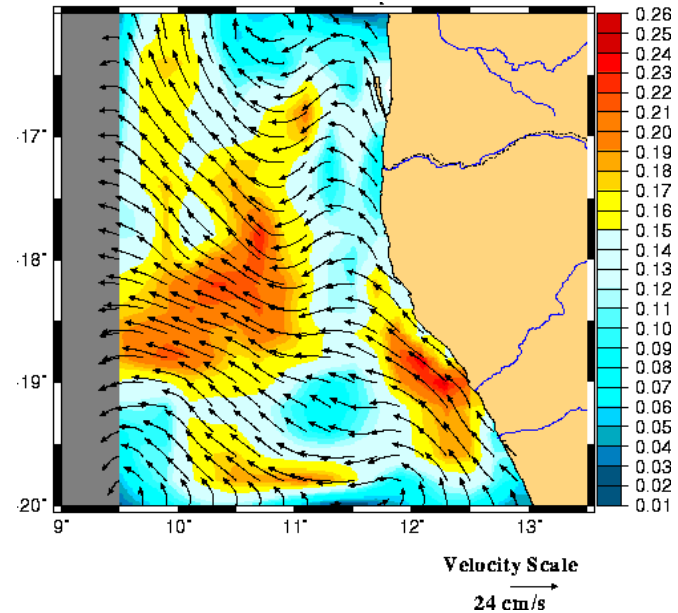


To improve the mixed layer analysis and provide an estimate of the full 3-dimensional current field, a relocatable version of the Princeton Ocean Model was developed which was initialized using the MODAS analysis and winds from various sources, including the FNMOC global NOGAPS and regional NORAPS products, and others. An initial 48 hour spin-up was used during which the POM was relaxed to the MODAS analysis (the strength of this nudging varying with depth). The model is then run in a forecast mode as long as wind stresses are available (typically 48 hours).

Finally, the original NOMADS graphical user interface is being replaced by one which exploits current-generation web technology such as HTML and CGI scripts which will allow the user interface to run on any web-connected computer and the MODAS and POM tasks to run on Unix server machines (workstations or supercomputers).

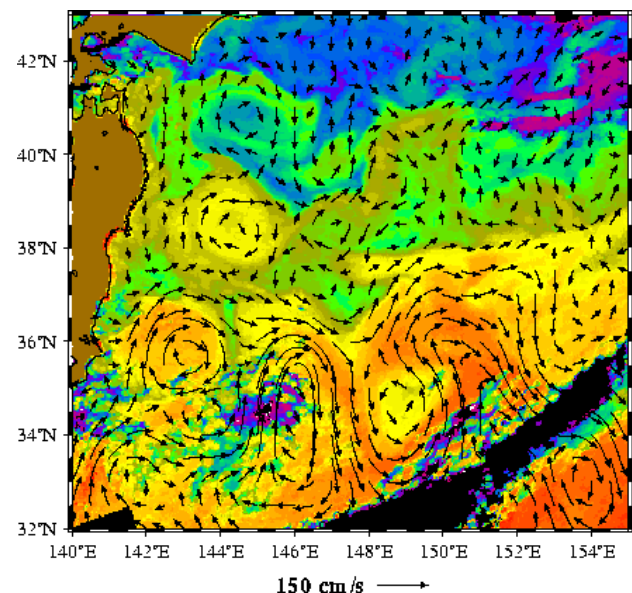
RESULTS

The new MODAS2/POM system, exploiting satellite altimetry, was tested during a recent Pacific Fleet Joint Task Force Exercise (JTFEX 97-2) held off Camp Pendleton, California. Since that time, we have also tested the system during a western Pacific SHAREM/ASWEX exercise and assisted the NAVOCEANO Warfighting Support Center during search and rescue operations for two downed aircraft off Namibia. A sample analysis, with surface currents from the Princeton model overlaid on analyzed sea surface temperature is shown at right.



IMPACT/APPLICATIONS

Prior versions of MODAS have proven to be valuable tools for creating ocean nowcasts, both at the Navy's regional METOC centers, where it is used multiple times daily in areas across the globe, and for research projects at NRL. For example, components of MODAS are used in the processing of altimetry to generate grids of sea-surface height. This new version fully exploits the rapid advances that have been made in near real-time altimeter processing to allow accurate ocean nowcasts and short term forecasts to be made virtually anywhere in the world with almost no set-up time. The figure at right shows the surface geostrophic currents derived from a MODAS2 analysis in the Kuroshio overlaid on a satellite IR image for the same day.



TRANSITIONS

MODAS 2.0 is being transitioned to the TESS/NC project where it will be coupled to the OSTAFc atmospheric model (which is used in COAMPS). It is also being transitioned to the Warfighting Support Center at NAVO as part of the ROAMER project. It will be used in the upcoming Rapid Response '98 NATO exercise, at which point it will be installed at the Naval European Meteorology and Oceanography Center (NEMOC, located in Rota, Spain) and thereafter at all the major Navy METOC centers.

RELATED PROJECTS

Along with the projects mentioned under "Transitions", this project is tightly integrated with the 6.4 Shipboard project and the 6.2 NRL ODA (Ocean Data Assimilation, formerly DART) project.

REFERENCES