



Results from glider data assimilation experiments.

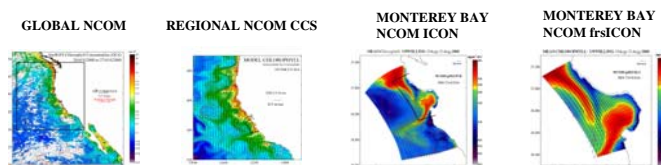


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Abstract

Results of glider data assimilation during the Autonomous Ocean Sampling Network (AOSN) experiments are presented. The modeling system consists of an implementation of the Navy Coastal Ocean Model (NCOM) in the Monterey Bay area. The model receives open boundary conditions from a basin-scale NCOM-based the California Current System, and surface fluxes from the Coupled Ocean-Atmosphere Mesoscale Prediction System (COAMPS) atmospheric model at 3 km resolution. The data assimilation component of the system is a version of The Navy Coupled Ocean Data Assimilation (NCODA) system which is used for assimilation of the glider data into the NCOM model of the Monterey Bay area. Assimilation of the glider data significantly reduced biases and RMS errors in predictions of surface temperature and salinity at mooring locations. Also, assimilation of the glider data provided a better agreement with observations (for example, with aircraft measured SSTs) of the model predicted and observed spatial distributions of surface properties. Moorings observations of subsurface temperature and salinity show sharp changes in the thermocline and halocline depths during transitions from upwelling to relaxation and vice versa. The non-assimilative run shows these transitions in subsurface temperature; however, changes are not as defined as in observations. For salinity, the non-assimilative run significantly differs from the observations. However, the glider data assimilating run is able to show comparable results with observations in deepening (shallowing) of thermocline as well as halocline depths during upwelling (relaxation) events.

Hierarchy of different resolution Navy Coastal Ocean Model (NCOM) in Pacific



Monterey Bay NCOM Models

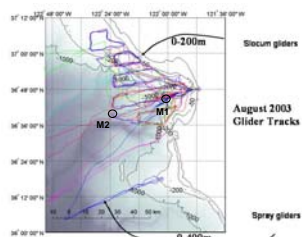
NCOM ICON and NCOM frsICON are forced with surface fluxes from 3km COAMPSTM. NCOM ICON model has curvilinear orthogonal grid with 1-4 km horizontal resolution. The model is one-way coupled to the NCOM California Current Model (NCOM CCS). Tidal forcing is introduced into the model through specification of the open boundary conditions using the tidal constants from the Oregon State University Tidal Solution (Egbert and Erofeeva, 2002) for the U.S. West Coast.

NCOM frsICON model has curvilinear-orthogonal grid with 0.5-1.5 km horizontal resolution. The model is one-way coupled to the NCOM ICON Model.

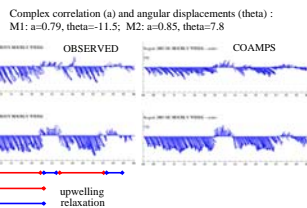
Both models have 30 vertical sigma levels.

AOSN II data sets (T and S from WHOI and SIO gliders data) were assimilated by using NRL Coupled Ocean Data Assimilation System (NCODA) (Multivariate Optimal Interpolation Data Assimilation).

The NCOM model includes a 9-component ecosystem model (Chai et al, 2002).

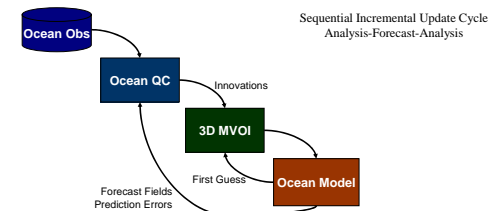


AOSN II (6 Aug. - 6 Sept., 2003)
 Hourly Wind Velocity at M1 and M2



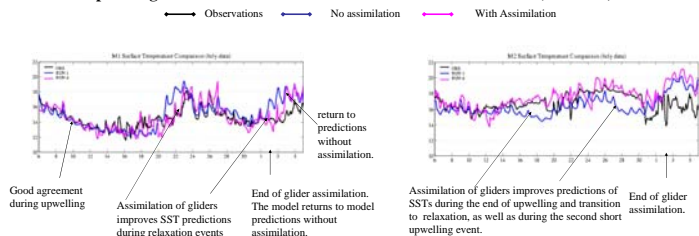
NRL Coupled Ocean Data Assimilation system

- 3D MVOI sequential incremental update cycle
- Data quality control, analysis, performance diagnostics
- Separable Error Covariances : product of a variance and a correlation
- Background Error Variances vary by position, depth
- Background Error Correlations are product of a horizontal and a vertical correlation
- Horizontal correlations are multivariate in mass and velocity, horizontal length scales are non-homogenous and anisotropic
- Vertical correlations can be computed from background vertical density gradients, evolve with time, length scales large (small) when stratification weak (strong)



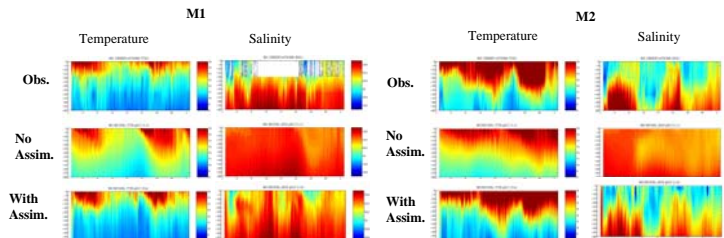
Model forecast fields and prediction errors are used in the QC of newly received ocean observations

Impact of glider data assimilation on model SSTs at M1 and M2 (AOSN II)

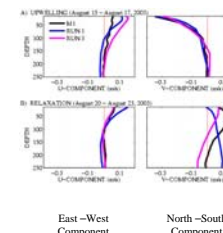


	Relaxation (Aug. 20-22)		Upwelling (Aug. 6-19)	
	at M1		at M2	
	BIAS (°C)	RMS (°C)	BIAS (°C)	RMS (°C)
No assim.	1.7	2.5	-0.7	1.03
With assim.	0.4	0.95	0.4	0.8

Impact of glider data assimilation on the model subsurface structure of temperature and salinity at M1 and M2 (AOSN II)



Impact of glider data assimilation on the model subsurface velocity at M1



Conclusions

- In hindcast, there is marked improvement in model skill with glider data assimilation. The model forecast degrades to the level of the model predictions without assimilation in 1-1.5 days.
- Subsurface T/S and velocity structure were greatly improved with assimilation especially during transition between upwelling and relaxed wind regimes. The glider data assimilating run is able to show comparable results with observations in deepening (shallowing) of thermocline as well as halocline depths during upwelling (relaxation) events.
- Future work will focus on the improvement of the glider data assimilation approach in the framework of the NCODA system. Comparisons data assimilation results with the use of NCODA and Variational Data assimilation schemes which are under development at NRL.

Acknowledgments

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