



## An overview of past and current Ocean data assimilation efforts at NRL

data assimilation (DA) plays a crucial role in the prediction of the ocean environment, from global to regional scales. Numerical ocean models have matured over the years and are now simulating the ocean at very high resolution. Ocean forecasts still contain errors, especially at smaller scales, due to various sources of errors: boundary conditions (for regional models) and external forcing, parameterizations of physics and unresolved processes, ... etc. Over the past few decades, the U.S. Naval Research Laboratory (NRL) has implemented progressively advanced data assimilation methods (from univariate optimal interpolation to 3D and 4D variational techniques) with increasingly sophisticated models of the ocean (the Nany Layered Ocean Model (NLOM), the Navy Coastal Ocean Model (NCOM), the Hybrid Coordinate Ocean Model (HYCOM)), ice and waves (SWAN, WW3). The evolution of ocean DA at NRL also includes the types of observations, as well as how sea surface height (SSH) observations have been projected to the interior: from statistical inference and Cooper-Haines to synthetic profiles and direct assimilation. This presentation is an overview of such past and present data assimilation efforts. Also, the spatially-dense observations that have now become available (from a variety of systems) pose a challenge to existing assimilation algorithms because 1) the observation errors can no longer be considered uncorrelated (which complicates the traditional inversion involved in the Kalman gain matrix), and 2) the thinning of these dense observations (for use in traditional assimilation approaches) leads to loss of information that could contribute to the accuracy of analyses and forecasts. We will present a method for addressing the issue.

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