Experiments with Satellite Ocean Color Fields in an NCEP OperationalOcean Forecast System

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Solar shortwave heating of the the upper layers of the ocean is dependent on the wavelength of the incoming radiation and the optical properties of the water column. Chlorophyll concentration has been found to correlate to the optical properties of the water column. In this study, we use satellite ocean color fields obtained from NASA to study the impact of different ocean color datasets on ocean model simulations. The various data sets used in this study are the 9-km mapped fields of varying temporal resolution from the Sea-viewing Wide Field-of-view Sensor (SeaWiFS), Moderate Resolution Imaging Spectroradiometer on board the Aqua (MODIS-Aqua), and Visible/Infrared Imaging Radiometer Suite (VIIRS) missions. These simulations are carried out on the National Oceanic and Atmospheric Administration (NOAA) National Center for Environmental Prediction (NCEP) Modular Ocean Model version 4 (MOM4), which spans 81S-90N and employs 0.5-degree zonal resolution with variable meridional resolution of 0.5 degrees or less, and provides a fast and robust platform for analyzing ocean dynamics at greater than eddy-resolving spatial scales. For these simulations, the model is forced with NOAA's daily Climate Forecast System Reanalysis (CFSR) fluxes, and relaxation techniques are employed to assimilate daily satellite sea surface temperature fields and climatological monthly sea surface salinity fields from NOAA's 2009 World Ocean Atlas. The ocean color fields modulate the absorption of solar insolation in the upper ocean. Through changes in the density profiles, the differential heating patterns cause baroclinic pressure gradients, which in turn, impact the three-dimensional circulation patterns in the upper ocean. Thus, we examine changes in upper-ocean heat content, mixed-layer depths, and velocity in the top 300 m of the water column. Anomalous buildup of Equatorial Pacific ocean heat content is an important variable for the recharge-discharge oscillator theory for the evolution of El Nino events. Here, we show that the different specifications of ocean color data inputs cause significant changes in the ocean heat content anomalies in the tropical Pacific. Thus, it is important for seasonal predictions that we study the impact that the choice of ocean color data sets has on the ocean forecasts. Finally, in addition to inter-comparisons of the different simulations, we conduct preliminary verification studies between model simulations and independent (i.e, non-assimilated) observations, such as satellite sea-surface height (SSH) fields, vertical profiles of prognostic variables from *in situ* observations, and ocean heat content and mixed-layer depths from CFSR ocean analyses.