Using Near-Real-Time Satellite Ocean Color Fields (Chl-a, Kd_{490}, Kd_{PAR}) in Operational Ocean and Seasonal Forecast Systems

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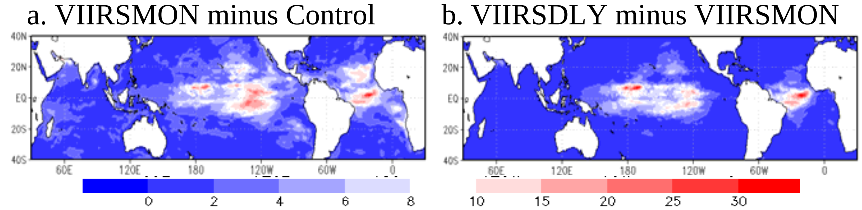
Numerous modeling studies, *e.g*. Ballabrera-Poy *et al*. (2007), attest to the importance of including a solar radiation penetration-absorption scheme to better represent near-surface conditions and processes, large-scale oceanic heat transport, and coupling with the atmosphere. This team's efforts are focused on using near-real-time Visible Infrared Imaging Radiometer Suite (VIIRS) ocean color fields in NOAA's operational ocean (Mehra *et al*., 2011; Behringer, 2007) and coupled seasonal forecast systems (Saha, *et al*., 2013). To date, the work has established three key points: 1) the ocean responds vigorously to ocean color variability at all time scales, particularly in the daily-to-monthly band; 2) the composited daily VIIRS ocean color fields show significant variability; and 3) the ocean heat content response to ocean color variability can be validated with ARGO temperature and salinity profiles (Nadiga, *et al*., 2015). Employing the Modular Ocean Model version 4 (MOM4; Behringer, 2007), a preliminary study examined the differences in model response to different ocean color inputs. Three satellite chlorophyll-a (Chl-a) fields were used in this study: a) the current operational climatological monthly-mean (1997-2001) dataset from the Sea-viewing Wide Field-of-view Sensor (SeaWiFS), b) VIIRS mapped monthly-mean data (2012-2013), and c) composited VIIRS mapped daily fields (2012-2013). All fields were spatially and temporally interpolated to the model grid. The simulations were forced by daily fluxes from

a. VIIRSMON minus Control b. VIIRSDLY minus VIIRSMON



RMS Sea-surface Height Difference (percent)

Figure 1. Root-Mean-Square (RMS) sea-surface height difference, as a percentage of RMS of Control SSH: a) VIIRSMON minus Control, and b) VIIRSDLY minus VIIRSMON.

NOAA's Climate Forecast System Reanalysis (CFSR; Saha et al., 2010). The model was weakly constrained at the surface by relaxation to daily satellite sea-surface temperature fields and a climatological mean sea-surface salinity field. Three simulations were conducted: the **CONTROL** case employed NOAA's MOM4 operational configuration, which uses the 1997-2001 climatological monthly-mean SeaWiFS chlorophyll-a fields; the **VIIRSMON** case used VIIRS monthly-mean chlorophyll-a fields; and the **VIIRSDLY** case used VIIRS daily chlorophyll-a fields. Each simulation began from the same ocean initial conditions and was run for two full years (2012-2013). Figure 1 (Nadiga *et al*., 2014) depicts that the ocean model's sea surface height (SSH) is quite responsive to differences between the prescribed Chl-a fields. While the biggest differences are seen between SeaWiFS to VIIRS (Figure 2a), due in part to representativeness issues (dominance of the 1997-1998 El Niño) with the operational SeaWiFS climatology, comparable differences are also produced from incorporating higher-frequency (daily to mesoscale) Chl-a variability (Figures 2b and 2d).

Equatorial (5^0S-5^0N) Subsurface Temperature Differences

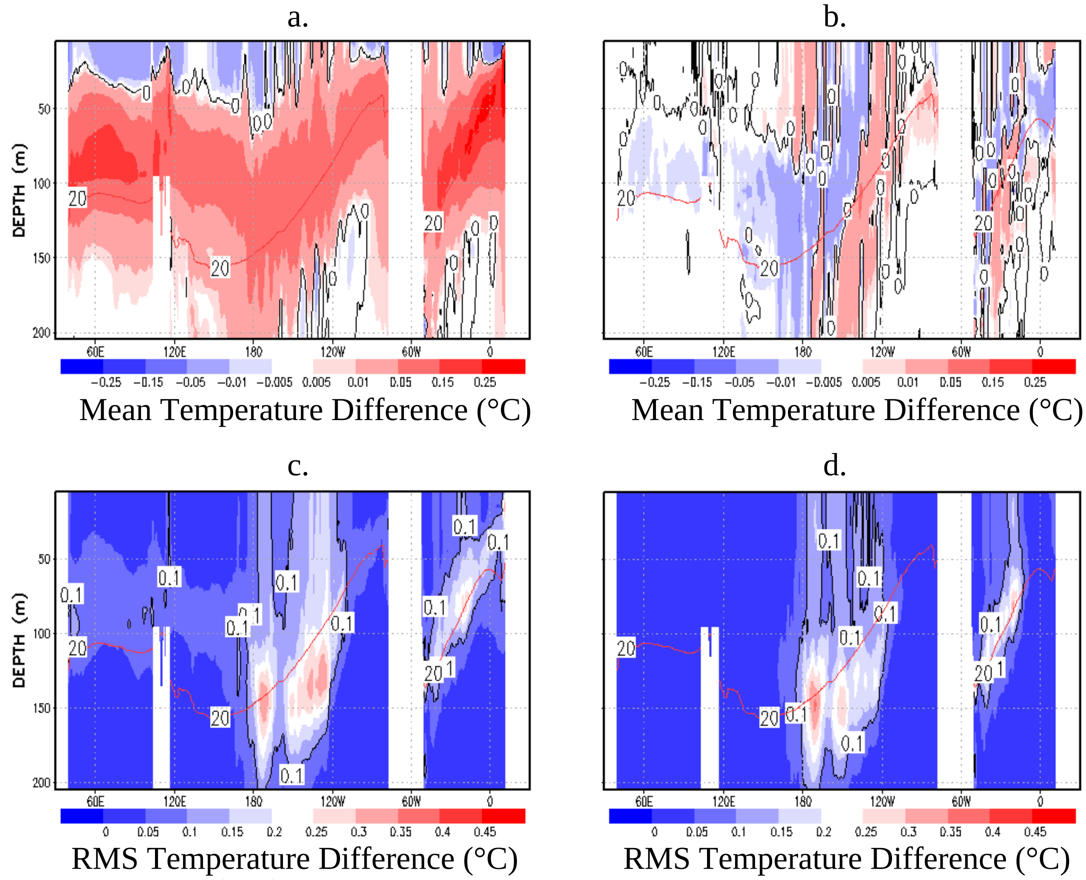


Figure 2. Equatorial (5^0S-5^0N) subsurface temperature differences: Mean difference **a)** VIIRSMON minus CONTROL, **b)** VIIRSDLY minus VIIRSMON; Root-Mean-Square difference **c)** VIIRSMON minus CONTROL, and **d)** VIIRSDLY minus VIIRSMON.

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