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Title Developing a dynamical-statistical observation operator for SST data assimilation

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Abstract (300-words max)
The diurnal cycle of sea surface temperature (SST) is a fundamental signal of the climate system. Although vertical resolution in ocean general circulation models has been reduced to about a metre at the near surface most models do not properly resolve near-surface thermo-dynamical processes. In low wind and/or high insolation conditions the diurnal cycle in skin SST can be large, thus degrading the accuracy of the ocean surface analysis and prediction. Furthermore, this also presents challenges in assimilating satellite SST observations because infrared sensors (e.g. AVHRR, SEVIRI) measure the skin SST (10 μm depth) and microwave sensors (e.g. AMSR-2) measure a sub-skin temperature (1 mm depth). There is therefore a need for a dynamically-based observation operator for the assimilation of SST observations that can account for near-surface thermo-dynamical processes. In this paper we present results from an ocean column model that explicitly resolves the diurnal cycle of SST. The model is used to estimate the diurnal variability of SST over the Mediterranean Sea for 2013-2015. The modelled diurnal SSTs are validated against SEVIRI measurements. A canonical correlation analysis (CCA) is performed on the model output in various categories of meteorological conditions. The cross correlations, between the high resolution profile data from the ocean column model and the satellite skin SST measurements, are used to derive a statistical-dynamical observation operator. This operator can be used for assimilating SST observations, at appropriate depth and time, and is designed to be easily implemented in any operational data assimilation system.