The Diurnal Cycle of SST in CFSR

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The Results

Abstract

A study of the diurnal cycle of sea surface temperature in the Coupled Forecast System Reanalysis (CFSR).

Motivation

A study of the diurnal cycle of sea surface temperature in the Coupled Forecast System Reanalysis (CFSR). The ocean model component of CFSR assimilates subsurface temperature and salinity profiles every six hours to produce ocean initial conditions (OICs) for NCEP’s Coupled Forecast System. In addition, the CFSR海 surface temperature (SST) fields are relaxed to daily-averaged SSTs. The relaxation in daily-averaged SST fields can be expected to impact the amplitude and phase of the CFSR SSTs. In this study, the diurnal SST fields from CFSR are compared to observations from Tropical Atmosphere-Ocean (TAO) buoys and a multiproduct merged SST analysis incorporating satellite data and ship observations (herein called MPM after Wang and Xie, 2007). It is shown here that (1) the amplitude of the diurnal cycle of SST in the CFSR is roughly half that observed, and (2) the phase of the diurnal cycle is reasonably well captured by CFSR.

Data and Data Processing

The diurnal SSTs were computed at each grid point by removing the pointwise daily-averaged SSTs from the original signal. The CFSR has a temporal resolution of 1 hour and a 1-degree spatial resolution. The MPM data were obtained from Suru Saha and have a 3-hour temporal resolution and a quarterly/decadal spatial resolution. TAO data are for point locations in the Tropical Pacific Ocean and have a temporal resolution of 10 min. These data were then collected to 1-hour intervals. The TAO data were downloaded from NOAA/PMEL’s website. The data used for this study is from the years 2005 and 2006.

For most locations in the global oceans, RMS values for 2005 are within 20% of those for 2006, suggesting that these computations are robust.

The spatial patterns in the MPM data are similar to that in CFSR but the amplitudes are typically twice as large. A hemispheric shift is seen in the CFSR data with low amplitudes in the northern (southern) hemisphere during boreal (austral) winters. Also, high amplitudes are seen in upwelling regions such as in the cold tongue region in the equatorial eastern Pacific, shallow continental shelves, and in ocean frontal regions.

The RMS of the diurnal cycle of SST in the CFSR varies spatially and from season to season. The RMS values are highest in shallow seas, upwelling regions, and ocean frontal zones. The RMS values are lowest in deep ocean high-latitude regions where the amplitude of the diurnal cycle of solar insolation is small and the upper ocean water column deep.

The phase of the diurnal cycle (in Zulu time) of SST in the CFSR varies zonally as is expected due to the earth’s rotation about its axis.

The amplitude of the diurnal cycle of solar insolation is small and the upper ocean water column deep.

The RMS values are highest in shallow seas, upwelling regions, and ocean frontal zones. The RMS values are lowest in deep ocean high-latitude regions where the amplitude of the diurnal cycle of solar insolation is small and the upper ocean water column deep.

The spatial patterns of the amplitude of the diurnal cycle in CFSR appear similar to that in the MPM data. However, the CFSR shows greater hemispheric variation with season than the MPM data. The amplitudes are smallest in the northern (southern) hemisphere during boreal (austral) winters.

Summary and Conclusions

The spatial patterns in the MPM data are similar to that in CFSR but the amplitudes are typically twice as large. A hemispheric shift is seen in the CFSR data with low amplitudes in the northern (southern) hemisphere during boreal (austral) winters.

References:


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For CFSR data access at NCDC:

http://nomads.ncdc.noaa.gov/NOAAREanalysis/cfsr