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Ocean Science Discussions

Interactive comment on "A statistical model for sea surface diurnal warming driven by numerical weather prediction fluxes and winds" *by* M. J. Filipiak et al.

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Reply to comments of Anonymous Referee #2 Ocean Sci. Discuss., 7, C416-C417, 2010

> General Comments:

>This authors developed a simple formulation to calculate sea surface temperature diurnal cycle based on 6-h wind and 24-h acummulated net heat flux from the ECMWF output. Results agree well with those from geostationary satellite (SEVIRI) measurements and the AMSR-E microwave measurements from polar-orbiting satellites. In general, the manuscript was written clearly. The review of previous work was also

good.

> Specific comments:

> Only relatively minor revisions are needed.

> (1) The maximum hourly wind W is used in Eq. (1) and is critical for the proposed statistical method. It was stated that "The wind are 6-h analyses" on line 22, p. 2508. Are those instantaneous winds at the model time step every 6 hours or are they 6-hour averages? How was the interpolation to hourly values done? by linear interpolation? It seems to be more appropriate to refer to W as the maximum wind from 6-hourly data.

These winds are instantaneous winds at the model time step every 6 hours. They are the combination of observations in a time window around the 6 hours with the forecast from the previous analysis, combined with 4D-Var data assimilation. The interpolation to hourly values was simple linear interpolation. We agree that our definition was not clear and will change it to 'maximum wind from 6-hourly data'.

> (2) The interpolation of daily accumulated net heat flux (discussed on p. 1509) would also introduce biases that depend on weather condition, because the authors' method essentially assumes the independence of cloud effects on radiation fluxes of the solar zenith angle. For clear-sky conditions (with strong diurnal cycle of SST), the interpolation may be acceptable. For partially cloudy condition, however, the interpolation method would introduce biases. This point should be acknowledged in the paper.

It seems more likely that time variations in heat flux (for example, because of cloud) would increase the scatter of the fit between wind and warming. It is likely that these flux variations contribute to the exponential tail of the error in D (Figure 3) and the bias caused by this error has been (approximatley) removed as described in 1511 l. 27 - 1512 l. 5. The wind data is 6-hourly so will be less affected by sub-diurnal variability. We will explain in the paper that using low time resolution data will introduce errors.

> (3) The easiest way to address the above two concerns would be to use hourly

data directly. If it is impossible to do so, at least sensitivity tests should be done and discussed. For instance, results in Figs. 6(a) and 9(a) could be discussed from this perspective.

This would be the ideal case (but see below some comments on the use of the wind maximum) and solar and long-wave data is available hourly from SEVIRI, and wind and sensible and latent heat flux data is now available at 3-hourly resolution from ECMWF ERA-Interim NWP model results available to us. However, using the SEVIRI flux data would mean that predictions would be possible only in the SEVIRI area and we wanted to test and use the statistical model globally.

The model basis may need to be changed if high time resolution winds are used. In the current model the wind maximum in the period from dawn to the observation time is the measure of the wind. The coarse time resolution means that short periods of strong wind will tend to be smoothed out, which would not the the case with high resolution wind data, and some sort of time history of wind would have to be used instead.

Sensitivity tests would be possible to do, unfortunately funding for this project ended some time ago so, practically, we will not be able to do these tests.

> (4) Because eq. (1) gives the whole diurnal cycle, it is desirable to show a few more results of the actual diurnal cycles of SST (beyond Fig. 7). For instance, the authors could select a few days with strong SST diurnal cycle and plot the actual SEVIRI results and computed results over a few selected areas.

The model cannot reproduce this level of detail for comparison with observations. The best that can be done is to compare space-averaged (Figure 7) or time-averaged (Figure 8) statistics. The main reason is the mis-match between the NWP model wind minima and observed diurnal warming maxima, and this is why we used the frequency matching method to derive the statistical model, rather than regression.

Interactive comment on Ocean Sci. Discuss., 7, 1497, 2010.