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The Effect of Diurnal Sea Surface Temperature Warming on the Mediterranean Sea Heat Budget

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The diurnal cycle in sea-surface temperature (SST) is reconstructed by combining numerical model analyses and satellite measurements in the context of the Optimal Interpolation theory. The method (Marullo et al., 2014) is applied to reconstruct hourly Mediterranean SST fields during 2013 using data from the Spinning Enhanced Visible and Infrared Imager (SEVIRI) and Mediterranean Forecasting System analyses. The Diurnal OI SST (DOISST) fields reproduce well the diurnal cycles including extreme diurnal warming events as measured by drifting buoys. The evaluation of DOISST products against drifter measurements results in a mean bias of $-0.1°C$ and a RMS of $0.4°C$. We evaluate the impact of resolving the SST diurnal cycle on the heat budget of the Mediterranean Sea over an entire annual cycle. The mean annual difference in the heat budget derived using SST's with and without diurnal variations being -4 Wm-2 with a peak monthly difference of -9 Wm-2 in July-August. The impact of these differences in the heat fluxes on the vertical structure of the upper ocean has been investigated using the one-dimensional General Ocean Turbulence Model (GOTM). The model has alternatively been forced using one year of hourly air-sea fluxes derived using SST's with and without diurnal variations. The results of this numerical experiment demonstrated that impact of the surface diurnal SST signal can propagate at depth with non-negligible effects on the heat content of the upper ocean layers.