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A daily climatology of tropical oceanic diurnal warm layers

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Under light wind conditions in the Tropics, the Sea Surface Temperature (SST) may experience strong diurnal modulation. This is because small surface wind stress reduces the vertical mixing and the solar radiation absorbed in the first meters of the ocean tends to produce a stable stratification. A Diurnal Warm Layer (DWL) then forms with a daytime augmentation of the SST that can reach several degrees. During night, mixing by oceanic convection destroys this surface stratification, giving a SST close to the bulk mixed-layer temperature. The DWL thus augments the daily average SST and may impact the tropical climate variability at different timescales. The DWL is indeed a mechanism increasing the heat transfer from the ocean to the lower atmosphere. This enhances the boundary layer temperature contrast between regions and may have an impact on the atmospheric circulation.

To address this point, we build a daily climatology of Diurnal SST Amplitude (DSA) linked to the formation of DWL. This climatology is based on a simple DWL parameterization forced by hourly-interpolated surface radiative and turbulent fluxes given by the ECMWF Re-Analysis (ERA) dataset for 1979-2002. The result is validated using surface temperature measurements of the Surface Velocity Program (SVP) drifters of the Marine Environmental Data Service (MEDS). Monthly climatology and other statistics (size and the duration of the DWL) are discussed to illustrate potential applications of this daily climatology. The same approach can be used to parameterized DWL in forced or coupled atmospheric Global Circulation Model (GCM). The interest of the implementation of such a DWL parameterization in atmospheric GCM is discussed.