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Mesoscale variability, high frequency winds and their impact on the vertical velocity fields of the South China Sea

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The South China Sea (SCS) is a marginal basin with a complex dynamics influenced by the East Asian Monsoon, river discharge and intricate bathymetry. As a result, both the mesoscale eddy field and the near-inertial energy distribution display large temporal and spatial variability, and they strongly influence the biogeochemistry response of this region. Here, with an ensemble of numerical integrations using ROMS, we investigate how the temporal resolution of the forcing wind field modifies the vertical velocity patterns and impacts vertical mixing. We evaluate the response of the ocean circulation in the SCS under three different forcing conditions: monthly mean, daily mean and six-hourly winds from NCEP/QUICKSCATT for the period 2000 and 2007. While the surface circulation does not display significant differences, the vertical velocity field shows high sensitivity to the frequency of the wind forcing in correspondence to mesoscale vortices and filaments. The high frequency wind energy injected at the surface is transferred at depth through the generation and subsequent straining effect of Vortex Rossby Waves (VRWs) immediately below the surface, and through near-inertial internal oscillations trapped inside anticyclonic vortices below $\sim$50m. We analyze the physical mechanism responsible for those changes and the details of the interplay between the near-inertial and mesoscale eddy fields under the various forcing fields, and we quantify the impact of those changes on the vertical mixing. Our results are consistent with theoretical approximations which have been tested over analytical domains.