

Diurnal forcing induces variations in seasonal temperature and its rectification mechanism in the eastern shelf seas of China

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This study investigates the seasonal variation in temperature induced by diurnal forcing in the eastern shelf seas of China (ESSC) using a high-resolution Regional Ocean Modeling System model forced by the National Center for Environmental Prediction and the National Center for Atmospheric Research re-analysis data for surface fluxes with both 6-h and daily frequencies, respectively. The comparison between two experiments revealed a $\pm 0.4^{\circ}\text{C}$ modification of the variation in seasonal temperature by diurnal forcing, which also increases the mixed-layer depth (MLD) in August by 26% and reduces the volume of the Yellow Sea Cold Water Mass (YSCWM) by 25%. Sensitivity experiments using different forcing variables indicated that diurnal wind can explain over 80% of the variability in seasonal temperature induced by diurnal forcing. Diurnal wind led to an increase in the net heat flux into the ocean by about 13 W/m² in summer and a decrease by about 15 W/m² in winter. Diurnal wind also generated an additional downward heat transport of 21 W/m² over the ESSC that contributed to variability in the mean MLD and YSCWM in August. Experiments changing the temporal interval of wind forcing suggested that the increase in the forcing temporal interval gradually enhanced the reproduction of the variability in seasonal temperature generated by diurnal wind; a 6-h wind forcing can capture 70% of this type of variability given by 1-h wind forcing, while a 3-h or shorter wind forcing can capture 90%.

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