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Monthly variability and response of thermocline in the South China Sea to ENSO events

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This study analyzes the monthly variability of thermocline in the South China Sea (SCS) and the response of thermocline depth (TD) to ENSO events. The study is based on 51-year (1960-2010) monthly seawater temperature and surface wind stress data from Simple Ocean Data Assimilation (SODA), together with heat flux, precipitation and evaporation data from the National Centers for Environmental Prediction (NCEP), the National Oceanic and Atmospheric Administration (NOAA) and the Woods Hole Oceanographic Institution, respectively. The results reveal that the upper boundary depth, lower boundary depth, thickness and intensity of thermocline in the SCS show remarkable monthly variability. Being averaged for the deep basin of SCS (deeper than 200 m), the upper boundary depth deepens gradually from May to the following January and then shoals from February to May, while the lower boundary depth varies little throughout the whole year. Further diagnostics indicates that the monthly variability of the upper boundary depth is mainly caused by the buoyancy flux and wind stress curl. It is also indicated that the response of the SCS TD to the El Niño or La Niña events is in opposite phase. On one hand, the spatial-averaged TDs in the SCS appear as negative and positive anomalies during the mature phase of the El Niño and La Niña events, respectively. On the other hand, from June of the El Niño year to the subsequent April, the spatial patterns of TD in the north and south of 12°N appear as negative and positive anomalies, respectively, but present positive and negative anomalies for the La Niña case. However, positive and negative TD anomalies occur almost in the entire SCS in May of the subsequent year of the El Niño and La Niña events, respectively.