



Why South China Sea upwelling water does not enter the Gulf of Thailand?

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South China Sea upwelling system presents some unique features compared with the other upwelling systems in the region: 1) It is a seasonal coastal upwelling drive by southwesterly monsoon wind, 2) The upwelling water process affected by the circulation in the Gulf of Thailand. The trend of South China Sea upwelling was observed using Regional Ocean Modelling System (ROMS) simulation (2009-2016) at 4-5 km resolution over the South China Sea region. The model was simulated in the 3-Dimensional numerical model and initialised by HYCOM data. The cross-section plot at the upwelling area revealed the presence of upwelling water from offshore at the subsurface layer (10-15m) and also the presence of warmer water at surface layer (5m) from the Gulf of Thailand at the nearshore area. However, the upwelling water was able to reach the surface layer when it streamed to the north region towards offshore. This dynamic interaction generates a thermal front zone at the northern area which acts as a barrier between the Gulf of Thailand and the South China Sea. Regardless the intensification of monsoon wind and strength of upwelling phenomena, the colder upwelling water does not enter into the Gulf of Thailand area due to this thermal front zone. Moreover, the upwelling water deflected towards the Vietnam region and merged with the Vietnam coastal current thus it created a clear cold water band at the opening of the Gulf of Thailand. The model-derived data and numbers of observations from the study area proved this thermal front zone has dynamics connections between the colder upwelling water from the east coast Peninsular Malaysia and the warmer water from the Gulf of Thailand. However, the seasonal South China Sea upwelling could not be a cause of barrier when the upwelling is not presents, therefore, the study examines the bathymetry setting in the South China Sea region. The detail bathymetry plot revealed a slightly deeper basin at the centre of the Gulf of Thailand and the shallower area along the ridge at the opening of the gulf thus it separates the Gulf of Thailand and the South China Sea. This also explained that the convergence of water masses and the bathymetry setting is among the contributing factor that limits the water exchanged process between the two basins.