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Seasonal mixed layer heat budget in coastal waters off Angola

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The Angolan shelf system represents a highly productive ecosystem that exhibits pronounced seasonal variability. Productivity peaks in austral winter when seasonally prevailing upwelling favorable winds are weakest. Thus, other processes than local wind-driven upwelling contribute to the near-coastal cooling and nutrient supply during this season. Possible processes that lead to changes of the mixed-layer heat content does not only include local mechanism but also the passage of remotely forced coastally trapped waves. Understanding the driving mechanisms of changes in the mixed-layer heat content that may be locally or remotely forced is also vital for understanding of upward nutrient supply and biological productivity off Angola. Here, we investigate the seasonal mixed layer heat budget by analyzing atmospheric and oceanic causes for heat content variability. By using different satellite and in-situ data, we derive monthly estimates of surface heat fluxes, horizontal advection, diapycnal heat fluxes and local heat storage. The results show that the contribution of horizontal heat advection is small. When considering surface heat fluxes and horizontal heat advection only, the local mixed layer heat budget cannot be closed and the resulting residuum increases closer to the coast. Diapycnal heat fluxes at the base of the mixed layer and uncertainties of surface heat fluxes are suggested to explain the residuum. Our data suggests that the magnitude of diapycnal heat fluxes is controlled by stratification with stronger stratification reducing diapycnal heat fluxes. We conclude that local and remote impacts on stratification need to be examined in order to understand the mixed layer heat budget variability off Angola.