Towards understanding the different forcing mechanisms producing extreme Sea Level events in the Vietnamese east coast

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In this work we have analyzed the long-record of observed SL at the coastal station of Qui Nhon in central Vietnam and compared the observations with multi-year model prediction using the Regional Ocean Modeling System (ROMS). The results show that the seasonally-reversing Western Boundary Current (WBC) plays a very important role in setting up the optimal conditions for extreme SL events, since the strength and direction of the WBC determine the background SL over which higher frequency events evolve. Specifically, geostrophic balance at the peak of the southward phase of the WBC forces high sea level at the coast due to the narrow shelf, making the months of November and December the time when the coast is more vulnerable to other sources of SL variability. This results in a much higher probability of crossing the inundation-line during this time, as evidenced by the observed SL record at Qui Nhon. This highlights the need to better understand the WBC dynamics, which exhibits strong interannual variability and substantial trends associated with climate change. Evolving over this "more vulnerable" background state are high frequency events that, when combined with the higher climatological SL, can produce extreme events. In this study we also identify the most important processes amplifying the winter background SL, which include: the 18.6-year nodal modulation of the dominant diurnal components O1 and K1, coastal trapped waves originating in the Chinese shelf, and the merging of Rossby waves with the WBC.