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## On the generation and evolution of internal solitary waves in the northwestern South China Sea

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The northern South China Sea (SCS) forms the most active oceanic internal solitary waves (ISWs) among the global oceans. Most previous studies focused on the ISWs from the Luzon Strait to the northeastern continental shelf. An internal wave distribution map compiled by multiple ENVISAT ASAR and ALOS PALSAR images shows that the ISWs are also very active in the northwestern SCS ; however, the generation and evolution of the ISWs remain less understood in this area. By analyzing the SAR images, we divide the ISWs in the northwestern SCS into four regions: (1) the region to the northeast of Hainan Island, (2) the region to the southeast of Hainan Island, (3) the region from the south of Hainan Island to the north of Vietnam coast and (4) the region along the north of Vietnam coast (Fig.1). Here we focus on the ISWs observed in regions 2 and 3. First, the generation and evolution of internal waves in region 2 are investigated using synergistic satellite observations, in situ measurements and numerical simulations. We found that a diurnal internal tide emanates from the Xisha Islands, propagates through the deep basin in the form of a wave beam and undergoes consecutive reflections in the westward propagation. Then the diurnal internal tide excites short scale nonlinear bores at the shelf break. The nonlinear bore continues to evolve into an ISW train on the mid-shelf which finally emerges to the southeast of the Hainan Island and is observed on SAR images. Second, assuming the ISWs in region 3 are of tidal origin, we diagnosed their generation through calculating the body forcing term. In some cases, the strong tidal forcing along the shelf break suggests that the ISWs are probably generated by local tide-topography interaction along the shelf break. However, in other cases the weak tidal forcing along the shelf break cannot support the local generation mechanism and these ISWs may originate from the remote sources (i.e. Xisha islands) via the same generation mechanism as that reported to the southeast of Hainan Island. On the other hand, the statistics on the occurrence frequency of ISWs show that the ISWs are not regularly linked to the spring/neap tides, which strengthens the finding that the ISWs in region 3 arise from the contribution of both local tide-topography interaction mechanism and the remote internal tide mechanism. Finally, a two dimensional numerical experiment is carried out to examine the generation of ISWs by the local tide-topography interaction.

