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OCEANIC AND ATMOSPHERIC INTERNAL GRAVITY WAVES IMAGED BY SAR

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ABSTRACT:

Synthetic aperture radar (SAR) is side-looking imaging radar that emits radar pluses and then receives the backscattered energy from the Earth surface. In the past 2 decades, SAR instruments onboard ERS-1/2, ENVISAT, RADARSAT-1/2, ALOS and other satellites have been widely used in Earth observations. Over the ocean surface, a SAR image provides a 2-D view of the sea surface roughness fields due to different wind-current-wave-film-bathymetry-target interaction under day/night and near all-weather conditions. Any oceanic or atmospheric phenomena that modulate the sea surface roughness will leave imprints on SAR images. Internal waves (IWs) happen in the interior of the fluid where the density changes abruptly. The sharp density change usually happens at the seasonal thermocline of the ocean and the inversion layer of the marine atmospheric boundary layer, respectively. The near-surface water and air are either converged or diverged by IWs. Therefore, the sea surface imprint of internal gravity waves originated from both ocean and atmosphere are usually observed as coherent quasi-linear patterns on a SAR image. In this study, we present SAR observations of three atmospheric IWs and three oceanic IWs in the China Seas. The characteristics of these waves are derived from the SAR images. Visible images from weather satellites are also used to interpret these IWs. The IW generation, propagation and dissipation are studied using analytic/numerical models with stratification profiles from the CTD (oceanic cases) or radiosonde (atmospheric cases) measurements. The scale and radiometric differences in the oceanic and atmospheric IW patterns shown in the SAR images are also analyzed.

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