A RADAR MODULATION TRANSFER FUNCTION FOR OCEANIC INTERNAL WAVES

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Internal solitary waves (ISW) propagating on the ocean pycnocline induce surface currents which can reach 1 m/s or more. These currents modify the small scale surface roughness, and for this reason the ISW can be observed in Synthetic Aperture Radar (SAR) images. The degree of the roughness modulation, as expressed by the amplitude of the normalised radar cross section (NRCS) across the ISW signature, is related to the strength of the ISW, i.e. its amplitude, length scale and induced surface current. However, this relationship is also strongly dependent on the SAR imaging geometry and radar wavelength, as well as surface wind speed and direction. In this study a simulation experiments is first carried out with a sophisticated radar imaging model to derive simplified expressions relating the radar backscatter modulation to relevant geophysical parameters. The derived expressions agree well with observations. Secondly a dimensional analyses is conducted to establish simplified expressions relating the NRCS modulation to geophysical parameters including the width and phase speed of the internal soliton, the strength of the induced surface current, and the ambient wind speed and direction. This simplified analytical expression (transfer function) is found to agree well with simulations with the full radar imaging model.