

On Radar Imaging of Surface Current Features: Mesoscale Eddy and Current Front Detection

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The surface signatures of meandering fronts, eddies and internal waves have been regularly observed and documented in SAR images. Wave-current interactions, the suppression of short wind wave by natural film and the varying wind field resulting from the transformation of the atmospheric boundary layer by an oceanic temperature front are all contributing to the radar image manifestation of such mesoscale features. The corresponding imaging mechanisms are quantitatively explored using a new radar imaging model (Kudryavtsev et al., 2004) that solves the energy balance equation where wind forcing, viscous and wave breaking dissipation, wave-wave interactions and generation of short waves by breaking waves are taken into account. High quality and synoptic in-situ observations of the surface conditions should ideally be used in this model. However, such data are rarely available. Instead, the fields of temperature and ocean current are herein derived from two distinct numerical ocean models. SAR image expressions of current fronts and eddies are then simulated based on these fields. The comparison of simulated images with ERS SAR and Envisat ASAR images is favorable. We consequently believe that the new radar imaging model provides promising capabilities for advancing the quantitative interpretation of current features manifested in SAR images. Hence, it is expected to contribute to the gradual improvement of regular reporting and forecasting of upper ocean surface conditions.