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SEA SURFACE WIND SPEED RETRIEVAL THROUGH SENTINEL-1 WAVELENGTH CUT-OFF

Abstract

The retrieval of the sea surface wind speed (U) by Synthetic Aperture Radar (SAR) images is still an open question for some aspects. The retrieval of U through the wavelength azimuth cut-off (λ_C) is a problem that has been addressed in literature. Some studies evidence a significant empirical dependency of λ_C on the significant wave height (H_s) and on U but the feasibility of the retrieval of U through λ_C has not yet been demonstrated, even if suggested and attempted. In this study, we evidence that the correlation between λ_C and U is only high for fully developed sea states. Therefore, we focus our attention on the retrieval of U through λ_C only in such situations. The fitting procedure of a Geophysical Model Function (GMF) that relates λ_C to U in fully developed sea states is presented and discussed. The fitting procedure is carried on by taking benefit of a dataset of multi-look images acquired with varying incidence angles in the range between 20 and 45 by the new C-band SAR Sentinel-1 of the European Space Agency (ESA). These images have been co-located with U and Hs from the European Centre for Medium Range Weather Forecast (ECMWF) operational model output. The results of a retrieval exercise are presented and discussed. The retrievals of U are validated against the U measurements of the Chinese scatterometer of the satellite mission HY-2A (HSCAT). The agreement with the scatterometric measurements is within 1 m/s for wind speeds higher than 15 m/s. λ_C strictly depends on the range to SAR platform velocity ratio and its computation does not need a calibrated Normalized Radar Cross Section (NRCS). Therefore, λ_C computed from different SAR systems should be similar in principle, given that the correction for the acquisition geometry is applied and that the differences due to the SAR wavelength are negligible. In this study we compare λ_C computed from COSMO-SkyMed SAR images with from λ_C Sentinel-1 images in similar U and H_s conditions and the differences are discussed.