

ESTIMATION OF WAVE AND WIND FIELD PARAMETERS FROM TERRASAR-X IMAGERY IN THE BALTIC SEA

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ABSTRACT

In this paper detection of wave field parameters from SAR imagery in the Baltic Sea is presented. Over the Baltic Sea region common SW and W winds induce steep waves with shorter wavelengths compared to ocean waves. Thus, with the use of previous SAR sensors (e.g. ENVISAT/ASAR), it was not possible to detect singular waves. Since the year of 2007, when TerraSAR-X reached its orbit, high spatial resolution data is available for measuring sea state parameters.

The main objective of this work was to demonstrate the capability of detecting wave field parameter from TerraSAR-X imagery in the Baltic Sea. The wave field parameters obtained from SAR imagery were compared with *in situ* measurements and SWAN wave model.

The comparison showed a significant correlation between SWAN and SAR derived wave propagation direction ($r = 0.872$; $P < 0.001$; $\text{RMSD} = 25^\circ$) and wavelengths ($r = 0.907$; $P < 0.001$; $\text{RMSD} = 9.4$ m). The peak period was also calculated from SAR based 2D wavenumber spectrum and compared with SWAN results ($r = 0.697$; $P < 0.001$; $\text{RMSD} = 1.19$ s). The comparison of SAR based wave field information with buoy measurements showed also good agreement in case of wave propagation direction ($r = 0.950$; $P < 0.001$; $\text{RMSD} = 30^\circ$), wavelengths ($r = 0.831$; $P < 0.001$; $\text{RMSD} = 13.2$ m) and peak period ($r = 0.633$; $P < 0.001$; $\text{RMSD} = 1.38$ s).

With the case studies, it is shown that SAR data enables to detect land shadow effects and small scale wave field variations in the coastal zone. It was shown that SAR data is also valuable for improving the wave model results. In consequence of common slanting fetch cases over the Baltic Sea region, wave directions are investigated in relation to wind directions.

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