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Wavelet based bathymetry retrieval method for nearshore X-band radar images

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A wavelet based method for bathymetry retrieval from X-band radar images is proposed. The method combines traditional FFT techniques for retrieving peak frequency maps by evaluation of spectral peaks in the time domain and localized 2D Continuous Wavelet Transform (CWT) for retrieving corresponding peak wavenumbers. In order to verify the proposed method 1D and 2D simulations of the wave shoaling over several bottom topographies based on a mild slope equation were performed. This model allows simulating wave shoaling and refraction. Wave breaking and reflection were neglected in our simulations. As a testing case, the shoaling of an incident monochromatic and JONSWAP spectrum-based wavefields were evaluated. A radar image model including tilt and shadowing modulations together with speckle noise was applied to both 1D and 2D surface elevations. The method's ability to reconstruct the original bathymetry is shown to be robust in intermediate to shallow water depths ($k_p h < 1.2$) for all the synthetic cases with varied probing geometry, bottom topography and sea state conditions. After stochastic simulations checks, the method was also applied to the real data acquired by WaMoS system in Haifa Bay (Israel). Preliminary comparisons with known bathymetric surveys will be presented and discussed.