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Statistical properties of short wind-waves obtained from photo-stereo observations of sea surface.

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Theoretical and experimental description of statistical properties of sea surface play a dominant role in ocean remote sensing techniques, in particular in the microwave regime. Definite connection of non-linear features of sea waves with environmental conditions makes it possible to interpret the signal registered by active and passive sensors. In particular, non-Gaussian wave-height and slope distributions should be included into microwave scattering models to model a more realistic radar signature.

In spite of the importance of a sea surface description, the complex, rapidly changing and multi-scale nature of the dynamics of the upper sea surface still remains difficult for empirical and theoretical modeling. Meanwhile, recent achievements in the experimental investigation of small scale sea surface processes with stereo-photo observation techniques allow us to obtain more information in the field conditions. The goal of the current investigation is to progress in the empirical description of statistical properties of open sea surface in view of microwave remote sensing.

In this work we present results of the statistical analysis of sea surface elevations reconstructed from a dataset of stereo-photo observation. Experimental data were obtained during an experiment on the Black Sea Research Platform of the Marine Hydrophysical Institute, Sevastopol. Analysis was performed for 1.5×1.5 m sea surface patches with spatial resolution up to 1 cm.

The processing of data from this relatively new observation technique raises a certain number of technical issues which are addressed and suffers from limitations which are discussed. In the limit of the attainable accuracy, the higher-order statistics of wave-heights and slopes has been estimated and compared with earlier theoretical and experimental work of the literature. In particular estimates for the one- and two-point functions of third and fourth orders (skewness and kurtosis functions) have been obtained. These quantities are necessary to improve the calculation of the sea radar return in the framework of classical asymptotic scattering models.