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Cross-polarization GMF for high wind speed and surface stress retrieval

Yuliya Troitskaya (1), Victor Abramov (1), Georgy Baydakov (1), Olga Ermakova (1), Emma Zuikova (1), Daniil Sergeev (1), Alexey Ermoshkin (1), Alexander Kandaurov (1), Nikita Rusakov (2), Eugeny Poplavsky (2), and Maxim Vdovin (2)

(1) Institute of Applied Physics, Nizhny Novgorod, Russian Federation (yuliya@hydro.appl.sci-nnov.ru), (2) Nizhny Novgorod State University, Nizhny Novgorod, Russian Federation

This paper describes the construction of geophysical model function (GMF) for retrieval wind speed and surface stress at high winds from cross-polarized radar backscatter from the water surface. The starting point is the laboratory experiment designed for the study of X-band backscattering from water surface. In particular, it was shown that cross-polarized NRCS keeps sensitivity to wind friction velocity at high winds alternatively to co-polarized radar return. Basing on the analysis of the Doppler spectra it was shown, that the cross-polarized backscattered signal is formed mainly due to scattering from wave breakers and the received power is proportional to the area swept by wave breakers. Using the phenomenological “statistical-physics” approach a parameterization of active white-cap coverage fraction dependence on wind friction velocity, u*, was suggested. With the use of this parameterization, the dependence of the cross-polarized NRCS on u* was derived. Using the surface drag parameterization applicable at strong winds, this dependence was verified on the base of available datasets containing collocated satellite measurements of cross-polarized C-band NRCS and ground measurements of wind speed. GMFs for u* and U10 retrieval were suggested. Analysis showed, that taking into account the angular dependence of cross-pol radar backscattered power increases accuracy of wind speed and wind friction velocity retrieval.
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