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On the influence of parasitic capillary ripples on sea surface image

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A model of imaging of the sea surface in scattered sky light is developed, taking into account strong nonlinearity of short wind waves, namely parasitic capillary (bound) waves generated on the gravity wave profile. It is assumed that the spectrum of short gravity-capillary waves is determined both by bound waves located on forward slopes of carrying gravity waves and by free (linear) waves. The contributions of these two wave systems to the surface image are shown to be strongly different due to correlation of the bound and the carrying waves. A simple model of wind wave damping due to films for free waves and a mechanism of “cascade” depression of bound waves due to damping of carrying waves are used to calculate variations of the sea surface radiance and spectral contrasts in slicks. Contrasts in the wavenumber spectrum of wind waves and variations of the sea surface radiance obtained in field experiments with slicks are discussed and are shown to be in good agreement with theoretical predictions. The model is applied for analysis of possibilities of slick detection by simple optical instruments under different observational conditions. It is obtained that the variations of the sea surface radiance in slicks increase with wind velocity growth and depend monotonically on the elasticity of films. The latter effect can be used for remote sensing of marine slicks. The work was supported by RFBR (Projects 05-05-64137, 04-05-64763).