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Monte Carlo simulation of polarized radiative transfer over the ocean surface

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An increasing number of remote sensing instruments measure the polarization state of electromagnetic radiation. The polarization state contains all the information about the sensing object that is available to optical measurement methods. Taking into account the polarization during the radiative transfer simulation leads to a redistribution of energy between the components of the Stokes vector, thereby introducing a correction to the scalar approximation, the value of which may be significant. This information potentially can be used to improve algorithms for removal of surface glint, underwater visibility, to improve radiative transfer retrieval methods if the polarization-sensitive sensors are employed.

A Monte Carlo polarized radiative transfer model termed MCPOLART for the ocean-atmosphere system that is able to predict the total and the polarized signals has been developed. Since the ocean surface is not smooth, the radiation model must take into account waves that occur under the influence of wind. The Cox-Munk ocean wave slope distribution model is used in calculation of the reflection matrix of a wind-ruffled ocean surface. Sensitivity studies are conducted for various ocean-surface and atmospheric conditions, geometric schemes of lighting and observation.

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