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Intensity and degree of polarization of the solar backscattered radiation in realistic models of ocean-atmosphere system

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NASA is developing plans for a new sensor with enhanced capabilities to extend and advance the science of global satellite ocean color. One concept being explored is a hyper-spectral sensor that will measure the solar backscattered radiation from 350 nm to 900 nm in 5-nm steps, with additional broad-band measurements in the short wave infrared (SWIR) part of the spectrum. Proper interpretation and understanding of such measurements requires a model of the ocean-atmosphere system, where reflection and transmission laws are properly applied at the interface and all orders of scattering and polarization are accounted for both in the atmosphere and ocean. In this paper we present simulation results of intensity and degree of polarization at the top-of-the atmosphere, just above the ocean surface, and at 5 meter depth in the ocean, as computed with the Ahmad-Fraser radiative transfer code (v3.0) for ocean-atmosphere systems. In these simulations, the model atmosphere consisted of standard gas (air) and aerosols, and the ocean-atmosphere boundary was characterized by a rough ocean surface where the slope probability distribution follows the Cox-Munk wind-direction-independent distribution. The ocean was considered vertically homogenous and consisted of water, phytoplankton, and colored dissolved organic matter (CDOM). A power law, (∼1/r4) where r is the radius of the particle, was assumed for the size distribution of the phytoplankton in the ocean. Simulation results of remote sensing reflectance (Rrs) just above the ocean surface will be presented and compared with in situ measurements, and the minimum Lambert equivalent reflectivity (LER) at 380 and 340 nm will be compared with the observed LER reported by the Ozone Monitoring Instrument (OMI).