Water-leaving Radiance in the NIR Spectral Region and its Effects on Atmospheric Correction of Ocean Color Imagery

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Abstract

Atmospheric correction of ocean color imagery is commonly based on the assumption that water-leaving radiances (L_w) at near-infrared (NIR) wavelengths are negligible. To investigate the validity of this assumption, we carry out radiative transfer simulations using a model appropriate for the coupled atmosphere-ocean system. In this model both reflection (including total reflection) and refraction at the atmosphere-ocean interface as well as light scattering both in the atmosphere and the ocean are taken into account. We assume that the atmosphere-ocean system is vertically stratified, and that the effects of wave-slopes have been removed so as to leave behind a flat atmosphere-ocean interface. Simulated results show that for common open-ocean aerosol loadings (aerosol optical depths in the range 0.08-0.11) water-leaving radiances at NIR wavelengths (e.g., 865 *nm*) are usually *not* negligible.

The impact of the non-negligible values of water-leaving radiances at NIR wavelengths on atmospheric correction depends on (i) the ocean particle concentration; (ii) the scattering characteristics of particles in the near-surface ocean water, described by their shape, size, and refractive-index distributions, which in turn determine the scattering phase function; (iii) the aerosol optical depth; and (iv) the sun-satellite geometry. Our simulations demonstrate that a new approach to atmospheric correction of ocean color imagery is needed to obtain reliable and accurate results for open-ocean waters when particle concentrations are high. This is particularly important when the aerosol loading is low because then the contribution from the water-leaving radiance to the total radiance received by the satellite sensor is relatively larger, and will if ignored introduce significant errors in atmospheric correction.