BRDF correction for PACE's OCI using multi-angle polarimetry

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NASA's Plankton, Aerosol, Clouds, ocean Ecosystem (PACE) mission, launched on 8th February 2024, carries a hyperspectral radiometer, Ocean Color Instrument (OCI) and two multi-angle polarimeters, Hyper Angular Rainbow Polarimeter (HARP2) and Spectro-Polarimeter for Planetary Exploration one (SPEX-one). The simultaneous deployment of these sensors offers an unprecended opportunity to derive more accurate bidirectional reflectance distribution function (BRDF) for correcting the sun-sensor viewing dependence of the remote sensing reflectance derived from OCI. A bidirectional remote sensing model that explicitly accounts for particle backscattering shape is used to inverse the angular distribution of the volume scattering function, i.e., the χ factor from the multi-angle observation of the polarimeters. The derived χ factor is in turn used as the input to bidirectional remote sensing model to predict the BRDF factor corresponding to the sun-viewing geometry of the OCI data. Evaluated using three datasets simulated using three different radiative transfer models, the proposed method can estimate χ factor with an uncertainty of 30% and BRDF factor with an uncersinty of < 10%. Because the proposed method estimates the χ factor directly from the multi-angle observation, it fully accounts for the natural variability of the volume scattering function, which was assumed to be fixed or within a limited variation in the earlier BRDF correction models.

Preferred mode of presentation: Oral