Assessment of retrieval capabilities of two polarimeters in the NASA PACE mission using synthetic and real measurements for the joint retrieval of aerosol and ocean color information over coastal waters

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NASA's Plankton, Aerosol, Cloud, ocean Ecosystem (PACE) mission, recently launched in February 2024, carries two multiangle polarimeters (MAPs): the UMBC Hyper-Angular Rainbow Polarimeter (HARP2) and SRON Spectropolarimeter for Planetary Exploration One (SPEXone). Measurements from these MAPs will greatly advance aerosol and ocean ecosystem studies as they contain rich information on microphysical properties of aerosols and hydrosols. The two instruments provide complementary measurement capabilities, with HARP2 observing a wide swath at many viewing angles and four key wavelengths, while SPEXone collects hyperspectral data over a wider spectral range, but for a narrow swath at five key viewing geometries. Synergistic measurements from both polarimeters offer a unique opportunity to decipher the signals from different constituents of aerosol and ocean bodies.

In this meeting, we will present the results from the recently developed joint aerosol and ocean color retrieval algorithm called FastMAPOL/component (Fast Multi-Angular Polarimetric Ocean color/component). FastMAPOL/component incorporates neural network-trained forward models to expedite the retrieval process. It uses multi-parameter bio-optical models suitable to represent coastal waters, and it can be configured to process data from both polarimeters in PACE mission. The retrieval algorithm is applied to synthetic measurements in three different configurations of MAPs in the PACE mission: HARP2-only, SPEXone-only, and combined HARP2+SPEXone observations. In the first part, we include retrieval results from synthetic measurements which show that, for aerosol retrieval, the SPEXone-only configuration works equally well with the HAPR2-only configuration. For ocean color retrieval, however, the SPEXone instrument demonstrates improved retrieval performance due to its larger spectral coverage. For surface parameters, such as wind speed, HARP2 provides better information due to its wide field of view. Combined measurement from HARP2 and SPEXone performed the best to retrieve all aerosol, ocean color and surface parameters. The impact of including or removing measurements from the Sun glint region in the retrieval of aerosol and surface parameters will also be discussed. In the second part, we will present the validation results for the retrieval capability of different configurations using the real measurements from HARP2 and SPEXone as compared to measurements from AERONET ocean color stations.

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