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# Enhancing PACE Multi-Angle Polarimeter Data Products: Deep Neural Networks for Aerosol and Ocean Color Retrievals

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The upcoming NASA Plankton, Aerosol, Cloud, ocean Ecosystem (PACE) mission, set to launch in January 2023, will observe the global ocean and atmosphere to provide extended data records on ocean ecology, biogeochemistry, atmospheric aerosols, and clouds. The mission is equipped with a hyperspectral scanning radiometer (OCI) and two Multi-Angle Polarimeters (MAPs: SPEXone and HARP2), which can enhance aerosol and ocean color observations simultaneously. However, processing the large volume of MAP data to produce geophysical retrievals of sufficient quality for Earth systems research presents a significant computational challenge.

This talk will discuss our efforts to address these challenges on HARP2 data processing using deep neural network-based forward models [1], analytical Jacobians [2] and uncertainty analysis tools [3,4]. Based on these neural network models, we developed a flexible and efficient algorithm (FastMAPOL) capable of retrieving both aerosol and ocean color in a coupled atmosphere and ocean system. To harvest the unique multi-angle observations provided by the MAPs, we implemented a multi-angle cloud mask that conducts retrievals from non-cloud-obstructing directions, showing promising results in improving data quality and data coverage [2].

We will also discuss our current algorithm testing efforts, including simulating a full day of global HARP2 observations and processing those simulations to Level-2 aerosol and ocean color retrievals with associated uncertainties. These advances are crucial for achieving the goals of the PACE mission and other future Earth observing satellite missions with similar capabilities. Ultimately, the improved data products will help advance our understanding of the Earth's ocean and atmosphere, with important implications for the environment and climate.

**Keywords**: retrieval algorithm, aerosol, ocean color, multi-angle polarimeter, PACE

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