

Where sky meets sea: integrated aerosol and ocean color product from PACE polarimeters

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The NASA Plankton, Aerosol, Cloud, ocean Ecosystem (PACE) mission, launched in February 2024, provides global observations of the Earth system using three advanced sensors: the Ocean Color Instrument (OCI), Hyper-Angular Rainbow Polarimeter-2 (HARP2), and Spectro-Polarimeter for Planetary Exploration (SPEXone). These sensors provide spectral, angular and polarimetric measurements, and has generated a wide range of high-quality geophysical products spanning aerosols, clouds, land, and ocean environments.

Coupled global aerosol and ocean color products have been produced since March 2024 from SPEXone and HARP2. To support efficient operational processing, the Fast Multi-angle Polarimetric Ocean coLor (FastMAPOL) algorithm was developed to enable large-scale retrieval of aerosol and ocean properties from multi-angle polarimetric observations. Corresponding Level-2 regional products and Level-3 global gridded datasets are publicly available through the NASA Earthdata Cloud. These products include aerosol optical and microphysical properties, as well as ocean remote-sensing reflectance (Rrs) at multiple viewing geometries.

Product evaluation is carried out through a coordinated validation approach that uses observations from both the Aerosol Robotic Network (AERONET) and AERONET-Ocean Color (AERONET-OC) [1]. This approach examines retrieval uncertainties for aerosol and ocean properties simultaneously and evaluates how these uncertainties vary under different atmospheric and oceanic conditions [2]. PACE multi-angle polarimetry therefore provides a new capability for global aerosol and ocean color retrievals, improving our ability to characterize aerosol–ocean interactions and advance understanding of the Earth system.

References

- [1] PACE FastMAPOL validation page: https://pace.oceansciences.org/pace_fastmapol.htm
- [2] Gao, Meng and Aryal, Kamal and Zhai, Peng-Wang and Franz, Bryan and Knobelspiesse, Kirk and Cairns, Brian and Cetinić, Ivona and Fu, Guangliang and Hasekamp, Otto and Ibrahim, Amir and Sayer, Andrew and Werdell, P. Jeremy, 2026, Where Sky Meets Sea: Integrated Aerosol and Ocean Color Retrieval from PACE SPEXone Multi-Angle Polarimetry. Available at SSRN: <http://dx.doi.org/10.2139/ssrn.6297245>

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