

Emerging network of automatic ship-based photometers for aerosol characterization over the open Ocean

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Oceans remain strongly under-sampled in aerosol optical properties, limiting our ability to assess marine aerosol–climate feedbacks, long-range transport, and satellite validation over two-thirds of Earth’s surface. The CE318-T Sun–sky–lunar photometer has been adapted for autonomous shipborne operation through PHOTONS (ACTRIS, Univ. Lille, CNRS) in collaboration with CIMEL, fully compatible with AERONET data processing [1].

Here, we present the status and first results of a network of automatic ship-based photometers. To date, five ships have been equipped, covering major maritime regions: R.V. Marion Dufresne (French vessel, Indian Ocean, since July 2021), R.V. Gaia Blu (Italian vessel, Mediterranean Sea, since February 2024), R.V. Sarmiento de Gamboa (Spanish vessel, Atlantic Ocean, since June 2024), R.V. Perseverance (French sailboat, global tour, since May 2025), and MS Richard With (cruise ferry, Norway coast, since October 2025).

Results reveal AOD (440 nm) from <0.05 (pristine South Indian Ocean, Pacific, and Norwegian Sea) to >0.2 (continental influence in the Atlantic and Mediterranean), with EAE and aerosol retrievals (SSA, VSD), reflecting diverse aerosol regimes, including Saharan dust and biomass burning.

Despite challenges from vessel motion and meteorological conditions, the ship-based photometers provide high-quality AOD observations and aerosol microphysical properties. Synergies with lidar (micropulse lidar on Marion Dufresne) highlight the value of combined column and vertical observations [2].

This emerging network is a major step toward global oceanic aerosol monitoring, supporting satellite CAL/VAL and improving our understanding of aerosol distribution over remote oceans. Ongoing efforts focus on optimizing data acquisition and assessing motion effects to enhance data reliability.

References

- [1] Torres, B., et al.: Adaptation of the CIMEL-318T to shipborne use: 3 years of automated AERONET-compatible aerosol measurements on board the research vessel Marion Dufresne, *Atmos. Meas. Tech.*, 2025, <https://doi.org/10.5194/amt-18-4809-2025>.
- [2] Sanchez-Barrero, M. F. et al.: Aerosol variability over oceans using micro-pulse lidar and photometer: insights from TRANSAMA ship-based campaign, *Atmos. Meas. Tech.*, 2026, <https://doi.org/10.5194/amt-19-507-2026>.

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