

New scientific and technological developments on mobile photometry for shipborne platforms

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A new ship borne automated Sun-Moon photometer has been developed within the activities of AGORA lab (LOA/CNRS and the company CIMEL) and it is basically the combination of a sea-adapted version of an automated CIMEL 318-T (standard in AERONET ground-based measurements) in combination with an integrated gyroscope system to account for the ship movements (heading, pitch and roll). The work reviews the main ship campaigns where the instrument has participated and the main achievements that were obtained in each of them. Special mention deserves the permanent installation of the photometer in Marion Dufresne vessel on July 2021. The uniqueness of this instrument is that can be considered as the first one within the MAN-AERONET network that performs direct Sun-Moon irradiance measurements automatically. These measurements are used to derived spectral AOD (at 8 channels 340-1640nm) and the integrated water vapor (using the 940nm band absorption). The validation of these products was done through regular comparison with the measurements provided by the ground-based instrument from Saint Denis AERONET site in La Reunion (when Marion Dufresne was close to Saint Denis). Other validations were performed with the manual photometer Microtops II, showing an excellent agreement between them. These AOD measurements have been used to run GRASP-AOD code that has provided retrievals of bi-lognormal size distributions and other important aerosol products such as fine mode aerosol optical depth at 500 nm.

Current efforts are mainly devoted to the evaluation of the quality of the radiance measurements. These measurements will provide a complete description of the aerosol scattering phase function, that combined with the already existing high quality extinction measurement will allow to determine the aerosol optical properties (such as refractive index, single scattering albedo) and detailed bin volume size distributions. These aerosol detailed properties will be accessible by the science community and will be the first coming from boat measurements. Note here that satellite derived products over the sea are normally validated through comparison using AERONET coastal sites. This practice shows sometimes some limitations (mixed surface reflectance, influence of marine breeze, etc.) that would be avoided by the use of the same aerosol products derived from shipborne 100% sea conditions.

Keywords: ship-photometer, retrieval algorithm, aerosol.