Robotic sunphotometry to enable over-ocean characterization

Stephen Broccardo[a] [*], Conrad Esch[a], Roy Johnson[b], Robert Dahlgren[c], Stephen Dunagan[b], Sherry Palacios[d], Connor Flynn[e], Jun Wang[f]

[a] *Bay Area Environmental Research Institute/NASA Ames Research Center, Moffett Field, CA, 94035, USA*
[b] *NASA Ames Research Center, Moffett Field, CA, 94035, USA*
[c] *University of Minnesota, Minneapolis, MN, 55455, USA*
[d] *California State University Monterey Bay, Seaside, CA, 93955, USA*
[e] *University of Oklahoma, Norman, OK, 73019, USA*
[f] *University of Iowa, Iowa City, IA, 52242, USA*

[*] *Presenting author (stephen.p.broccardo@nasa.gov)*

We present developments for the Sea-going Sky-Scanning Sun-tracking Advanced Research Radiometer (SeaSTAR), a ship-based instrument for aerosol characterization over the ocean. Sun-tracking measurements of spectral solar irradiance are made in the conventional manner using filter-photodiode radiometers, and co-aligned polarizing filters are switched into the optical paths of the radiometers to measure polarized sky-radiance measurements. A robust high-performance robot with camera-feedback sun-tracking, and inertial measurement unit feed-forward motion-compensation is used for the sun- and sky-viewing modes respectively. An inverse-kinematics solver is used to point the instrument at the chosen position relative to the sun and ensure that the polarizer axis remains in the desired orientation, allowing the Stokes vector components of the sky radiance to be resolved by rotating the measurement barrel about a third robot axis. SeaSTAR aims to provide a resource for cost-effective validation of aerosol property measurements over the oceans in support of satellite missions such as PACE, SBG and GLIMR.

References

[1] Broccardo et al, 2019, NASA's next-generation airborne sunphotometer (5STAR): science drivers and requirements, in *Hyperspectral Imaging and Sounding of the Environment*, San Jose, CA
[2] Xu, X et al, 2015, Retrieval of aerosol microphysical properties from AERONET photopolarimetric measurements: 2. A new research algortithm and case demonstration, Journal of Geophysical Research, https://doi.org/10.1002/2015JD023113
[3] PACE Science Data Product Validation Plan, 2020, https://pace.oceansciences.org/docs/PACE_Validation_Plan_14July2020.pdf

Preferred mode of presentation ☐ Oral ☒ Poster ☐ Either

Topic *(check all that apply)*
☐ Advances in the theory of polarimetric remote sensing
☐ Scattering of light by terrestrial aerosols, clouds, oceans, and land surfaces
☐ Polarimetric applications in astrophysics and planetary science
☒ Improvement of polarimetric instrumentation quality and information content
☐ Development of advanced retrieval algorithms and data processing
☐ Upcoming and current satellite missions and field campaigns
☒ Long-term calibration and validation
☐ Discussions on the life and legacy of Michael I. Mishchenko
☐ Other: *if checked, enter description here*