IAF EARTH OBSERVATION SYMPOSIUM (B1)
Future Earth Observation Systems (2)

Author: Mr. Brent McBride
University of Maryland, Baltimore County (UMBC), United States, mcbride1@umbc.edu

Dr. J. Vanderlei Martins
University of Maryland, Baltimore County (UMBC), United States, martins@umbc.edu
Mr. Anin Puthukkudy
University of Maryland, Baltimore County (UMBC), United States, anin1@umbc.edu
Dr. Xiaoguang Xu
University of Maryland, Baltimore County (UMBC), United States, xxu@umbc.edu
Dr. Roberto Fernandez-Borda
University of Maryland, Baltimore County (UMBC), United States, rfborda@umbc.edu
Dr. Henrique Barbosa
University of Sao Paulo, Brazil, hmjbarbosa@gmail.com
Dr. Otto Hasekamp
Netherlands Institute for Space Research (SRON), The Netherlands, O.P.Hasekamp@sron.nl
Dr. Lorraine Remer
University of Maryland, Baltimore County (UMBC), United States, laremer@hotmail.com

THE HYPER-ANGULAR RAINBOW POLARIMETER-2 (HARP-2): A WIDE FOV POLARIMETRIC IMAGER FOR HIGH-RESOLUTION SPATIAL AND ANGULAR CHARACTERIZATION OF CLOUD AND AEROSOL MICROPHYSICS

Abstract

Cloud-aerosol interaction represents one of the toughest challenges to Earth remote sensing and climate study. Clouds rarely form in clean conditions and often take on lofted aerosol to spur rapid condensation. In doing so, the aerosol enhances cloud brightness and lifetime and prolongs rainout. Understanding this interplay is essential: it is still one of the most uncertain contributors to global radiative balance. At the Earth and Space Institute at the University of Maryland, Baltimore County, in Baltimore, MD, USA, we are designing and developing the Hyper-Angular Rainbow Polarimeter-2 (HARP-2), a wide field-of-view (FOV) multi-angle imaging polarimeter instrument to advance cloud and aerosol microphysical surveys. Proposed as a result of the NASA Aerosol-Cloud-Ecosystem (ACE) study and the 2007 NAS Decadal Survey, HARP-2 will fly on-board the NASA Plankton-Aerosol-Cloud-ocean Ecosystem (PACE) spacecraft in the early 2020s. HARP-2 will perform atmospheric and ocean characterization in synergy with the primary payload, the Ocean Color Instrument (OCI), and the SPEXone hyper-spectral polarimeter during the PACE mission. HARP-2's 113 degree FOV and four visible wavelengths, spread across 120 distinct viewing angles, enable multi-dimensional measurement over a broad scattering angle range, both along- and cross-track. Additionally, the PACE polar orbit supports HARP-2 global coverage in two days, benefitted by 700m native resolution at nadir. HARP-2 will perform several calibration modes (solar, lunar, vicarious) on-orbit that exploit an internal transfer calibration mechanic for total radiance and polarization, UV solarization studies, and traceability. Predicted accuracy in degree of linear polarization (0.005) and total radiance (0.03) improves upon earlier HARP concepts: HARP CubeSat, a 10x10x15 (1.5U) payload slated for ISS orbit in 2019, and AirHARP, an aircraft-ready version of HARP CubeSat that participated in two NASA aircraft campaigns in 2017. When launched, HARP-2 will be the only

Earth science polarimeter instrument in space that can spatially characterize a 3D cloud or aerosol scene with (1) high co-located angular and spatial resolution, (2) several wavelengths, and (3) a wide swath in polarized light. Cloud droplet size distribution retrievals from AirHARP measurements and preliminary aerosol studies using the GRASP algorithm will be used to discuss the potential of HARP-2 measurement and synergy with OCI, SPEXone, and other current Earth observing instruments (MODIS, VIIRS, ABI, etc.).