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LIGHT IS MORE THAN COLOR - UNVEILING OCEAN PARTICLE PROPERTIES FROM SPACE WITH POLARIZATION

Abstract

Ocean Optics is a scientific field that studies the interaction of light with both water and the water's constituents. How light is scattered and absorbed by particles partly depends on their size, shape, composition, and concentration. Therefore, measurements of a light field can lead to insight about particle properties. Passive remote sensing satellite instruments that collect data in the ultraviolet-to-shortwave infrared spectral region apply this principle by using their radiance measurements to make conclusions about properties and magnitudes of ocean constituents. For example, NASA's PACE observatory, with a scheduled launch date in January 2024, will partly use its observations to gain information about phytoplankton at the ocean's surface, microscopic algae and plants that convert atmospheric CO2 into cellular material and form the base of the marine food chain. Historically in optical oceanography measurements, intensity is the most commonly measured property of light. However, polarization provides an additional property that carries vast information about particle characteristics. Various studies have indicated that polarized radiance data could be used to infer novel information about microphysical characteristics of particles in the ocean (Tonizzo et al, 2009). However, this approach has not been extensively validated with observational data. If it turns out that polarization radiance data could aide in particle characterization, the implication would be substantial. With the upcoming launch of the NASA PACE observatory, which will have two multi-angle polarization instruments, it is important that we expand the data set of in-water upwelling spectral polarized radiance distribution measurements that are critical for both remote sensing algorithm development and satellite data product performance assessments. PixPol is an in water spectral polarized radiance camera system designed and assembled in the Atmospheric and Ocean Optics Lab at The University of Miami to meet this task. PixPol utilizes a unique pixel level polarization structure on its cameras' sensors. This design eliminates the complexity of moving parts or multiple imagers typically required for polarimetric measurements. The purpose of PixPol is to: validate the polarization instruments on PACE, to collect data that can be used to investigate the distribution of the upwelling spectral polarized radiance in the ocean, and to explore the information content in the polarized remote sensing signal. In this presentation, the PixPol polarimetric camera system will be described, along with characterization and sample data, and its applications to measurements that will be made by the HARP-2 polarimeter onboard the PACE observatory.