Weathering the Storm: Unmanned Aircraft Systems in the Maritime, Atmospheric and Polar Environments

Using remotely piloted aircraft and onboard processing to optimize and expand data collection (Invited)

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Remotely piloted aircraft (RPA) have the potential to revolutionize local to regional data collection for geophysicists as platform and payload size decrease while aircraft capabilities increase. In particular, data from RPAs combine high-resolution imagery available from low flight elevations with comprehensive areal coverage, unattainable from ground investigations and difficult to acquire from manned aircraft due to budgetary and logistical costs. Low flight elevations are particularly important for detecting signals that decay exponentially with distance, such as electromagnetic fields. Onboard data processing coupled with high-bandwidth telemetry open up opportunities for real-time and near real-time data processing, producing more efficient flight plans through the use of payload-directed flight, machine learning and autonomous systems. Such applications not only strive to enhance data collection, but also enable novel sensing modalities and temporal resolution. NASA's Airborne Science Program has been refining the capabilities and applications of RPA in support of satellite calibration and data product validation for several decades. In this paper, we describe current platforms, payloads, and onboard data systems available to the research community. Case studies include Fluid Lensing for littoral zone 3D mapping, structure from motion for terrestrial 3D multispectral imaging, and airborne magnetometry on medium and small RPAs.