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Airborne Mission Concept for Coastal Ocean Color and Ecosystems Research

Liane S. Guild, Stanford B. Hooker, John H. Morrow, Raphael M. Kudela, Sherry L. Palacios, Juan L. Torres-Perez, Kendra Hayashi, and Stephen E. Dunagan

NASA airborne missions in 2011 and 2013 over Monterey Bay, CA, demonstrated novel above- and in-water calibration and validation measurements supporting a combined airborne sensor approach (imaging spectrometer, microradiometers, and a sun photometer). The resultant airborne data characterize contemporaneous coastal atmospheric and aquatic properties plus sea-truth observations from state-of-the-art instrument systems spanning a next-generation spectral domain (320–875 nm). This airborne instrument suite for calibration, validation, and research flew at the lowest safe altitude (ca. 100 ft or 30 m) as well as higher altitudes (e.g., 6,000 ft or 1,800 m) above the sea surface covering a larger area in a single synoptic sortie than ship-based measurements at a few stations during the same sampling period. Data collection of coincident atmospheric and aquatic properties near the sea surface and at altitude allows the input of relevant variables into atmospheric correction schemes to improve the output of corrected imaging spectrometer data. Specific channels support legacy and next-generation satellite capabilities, and flights are planned to within 30 min of satellite overpass. This concept supports calibration and validation activities of ocean color phenomena (e.g., river plumes, algal blooms) and studies of water quality and coastal ecosystems. The 2011 COAST mission flew at 100 and 6,000 ft on a Twin Otter platform with flight plans accommodating the competing requirements of the sensor suite, which included the Coastal-Airborne In-situ Radiometers (C-AIR) for the first time. C-AIR (Biospherical Instruments Inc.) also flew in the 2013 OCEANIA mission at 100 and 1,000 ft on the Twin Otter below the California airborne simulation of the proposed NASA HypIRI satellite system comprised of an imaging spectrometer and thermal infrared multispectral imager on the ER-2 at 65,000 ft (20,000 m). For both missions, the Compact-Optical Profiling System (Biospherical Instruments, Inc.), an in-water system with microradiometers matching C-AIR, was deployed to compare sea-truth measurements and low-altitude Twin Otter flights within Monterey Bay red tide events. This novel airborne and in-water sensor capability advances the science of coastal measurements and enables rapid response for coastal events.