EGU2020-22606
https://doi.org/10.5194/egusphere-egu2020-22606
EGU General Assembly 2020

Using Ship-Deployed High-Endurance Unmanned Aerial Vehicles for the Study of Ocean Surface and Atmospheric Boundary Layer Processes

Scott M. Brown[1], Christopher J. Zappa[1], Nathan J. M. Laxague[1], Tejendra Dhakal[1], Ryan A. Harris[1], Aaron Farber[2], and Ajit Subramaniam[1]
[1]Lamont-Doherty Earth Observatory, Columbia University, Palisades, NY, USA
[2]L3 Latitude, Tucson, AZ 85701, USA

Unmanned aerial vehicles (UAVs) are proving to be an important modern sensing platform that supplement the sensing capabilities from platforms such as satellites, aircraft, research vessels, moorings, and gliders. UAVs, like satellites and aircraft can provide a synoptic view of a relatively large area. However, the coarse resolution provided by satellites and the operational limitations of manned aircraft has motivated the development of unmanned systems. UAVs offer unparalleled flexibility of tasking; for example, low altitude flight and slow airspeed allow for the characterization of a wide variety of geophysical phenomena at the ocean surface and in the marine atmospheric boundary layer. Here, we present the development of cutting-edge payload instrumentation for UAVs that provides a new capability for ship-deployed operations to capture a unique, high resolution spatial and temporal variability of the changing air-sea interaction processes than was previously possible. The modular design of the base payload means that new instruments can be incorporated into new research proposals that may include new instruments for expanded use of the payloads as a long-term research facility. Additionally, we implement a novel capability for vertical take-off and landing (VTOL) from research vessels. This VTOL capability is safer and requires less logistical support than previous ship-deployed systems. Furthermore, these VTOL UAV systems have 15-hour endurance with 15-lb payloads, fully autonomous take-off, flight, and landing from ships, and high-bandwidth data telemetry (100 Mbits/s over 50+ nm range) for real-time mission control and provide for our “eyes over the horizon.” The payloads developed include thermal infrared, visible broadband and hyperspectral, and near-infrared hyperspectral high-resolution imaging. Additional capabilities include quantification of the longwave and shortwave hemispheric radiation budget (up- and down-welling) as well as direct air-sea turbulent fluxes. Finally, a UAV-deployed dropsonde-microbuoy was developed in order to profile the temperature, pressure and humidity of the atmosphere and the temperature and salinity of the near-surface ocean. These technological advancements provide the next generation of instrumentation capability for UAVs. We present on the results of 3 case studies in the South Pacific near Fiji, including measurements characterizing meso-scale ocean SST fronts, trichodesmium blooms, and floating pumice rafts from a recent undersea volcanic eruption near Tonga. When deployed from research vessels, these UAVs will provide a transformational science

prism unequaled using 1-D data snapshots from ships or moorings alone.