Title: In situ Volcanic Plume Monitoring with small Unmanned Aerial Systems for Cal/Val of Satellite Remote Sensing Data

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Abstract:
The development of small unmanned aerial systems (sUAS) with a variety of sensor packages, enables in situ and proximal remote sensing measurements of volcanic plumes. Using Costa Rican volcanoes as a Natural Laboratory, the Universidad de Costa Rica as host institution, in collaboration with four NASA centers, have started an initiative to develop low-cost, field-deployable airborne platforms to perform volcanic gas & ash plume research and in-situ volcanic monitoring in general, in conjunction with orbital assets and state-of-the-art models of plume transport and composition.

Several gas sensors including a miniature mass spectrometer, and an electrochemical SO2 sensor, combined with temperature, pressure, relative humidity, and GPS sensors, have been deployed into the active plume of Turrialba Volcano. Several different airborne platforms such as manned research aircraft, unmanned aerial vehicles, tethered balloons, as well as man-portable in-situ ground truth systems are being used for this research. Remote sensing data is also collected from the ASTER and OMI spaceborne instruments and compared with in situ data. The CARTA-UAV Missions in 2013 and 2014 deployments and follow up measurements demonstrated a path to study and visualize gaseous volcanic emissions using mass spectrometer and gas sensor based instrumentation in harsh environment conditions to correlate in situ ground/airborne data with remote sensing satellite data for calibration and validation purposes. The deployment of such technology improves on our current capabilities to detect, analyze, monitor, model, and predict hazards presented to aircraft by volcanogenic ash clouds from active and impending volcanic eruptions.