Oral Abstract

Utilization of Lightweight MS based Instrumentation and Small UAV Platforms for In-Situ Volcanic Plume Analysis

[1]J.A. DIAZ, [2]D. PIERI, [4]G. BLAND, [4]M. FLADELAND, [3]E. GORE, [3]C.R. ARKIN

[1]CICANUM, Universidad de Costa Rica, San Jose, Costa Rica
[2]Jet Propulsion Laboratory, California Institute of Technology
[3]Engineering Services Contract, Kennedy Space Center, FL
[4]NASA, Ames Research Center

We describe the joint research effort to develop low-cost, field-deployable airborne platforms and integrated in-situ MS based sensing instrumentation to perform in situ volcanic plume analysis in conjunction with orbital assets to validate state-of-the-art models of plume transport and composition.

Current remote sensing retrieval and transport modeling efforts to detect, characterize, and track airborne volcanic emissions suffer from very sparse in situ validation data. Ash and gas concentrations derived from analysis of satellite remote sensing data, with rare exception, remain essentially invalidated by in situ data. Given recent European aviation experience after the 2010 Icelandic eruption and past near-fatal aircraft ash encounters, basic assumptions of plume chemical and physical processes, and the boundary conditions for both mass retrieval and trajectory prediction models, are being called into question. In view of the hazardous high-risk flight environment posed by volcanic clouds, the use of small unmanned airborne vehicles (UAVs) to validate SO2 and ash concentration and mass retrievals from orbital multi-spectral infrared sensor data is appropriate.

Using Costa Rican volcanoes as a natural laboratory and different airborne platforms including small unmanned aerial vehicles (sUAV) and tethered balloons; several gas sensors including the ULISSES miniature mass spectrometer system combined with temp, pressure, relative humidity and GPS data are being lab tested and field deployed into the active plume of Turrialba Volcano while collecting near remote sensing data (UV, IR) and satellite remote data.