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The airborne volcanic object imaging detector (AVOID): A new tool for airborne atmospheric remote sensing of clouds

F. Prata, A. Durant, and A. Kylling
Norwegian Institute for Air Research (NILU), Atmosphere & Climate Change, Kjeller, Norway (fred.prata@nilu.no)

A new dual thermal imaging infrared camera system has been developed for aircraft in order to investigate water and volcanic clouds ahead. The system, AVOID, uses interference filters to discriminate clouds of water and ice from volcanic substances (silicates) by utilising the spectral features of these substances at wavelengths between 8–12 μm. Tests of the system were recently conducted in Sicily, in the vicinity of Mt Etna volcano and at Stromboli volcano, during emission of ash and SO_2. The data were acquired from altitudes up to 12,000 ft, sampling from two cameras at frequencies down to 1 Hz. Corrections for the aircraft attitude were made using a very fast sampling attitude sensor, collocated with the imaging system. About 30 hours of data were acquired – over 90% of these measurements were of meteorological clouds of water droplets and ice. Using a radiative transfer model and information on the spectral refractive indices of water, ice and silicate ash, a retrieval scheme has been devised to determine the mass loading and effective particle radius of these substances and some preliminary results are presented. We have also developed a sophisticated simulation tool that allows us to model the 3D structure of clouds based on Monte Carlo radiative transfer. By utilising a narrow bandpass filter centred on 8.6 μm, AVOID can also detect SO_2 gas and some illustrative examples are shown. During March 2012 the AVOID system will be mounted onto an AIRBUS A340 and flown at altitudes up to 38,000 ft. These tests will include measurements of clouds, as well as drifting volcanic ash and SO_2 gas. We intend to present some of these initial results.