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Detection and characterization of ash plumes from Eyjafjallajokull with satellite lidar

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The eruption of the Eyjafjallajokull volcano in April-May 2010 highlighted the ash-monitoring capabilities of a variety of sensors now in orbit and the benefits from coordinating observations from multiple existing satellite sensors. Dispersion of the volcanic ash across Europe and subsequent impacts on air traffic resulted in the adoption of safety guidelines on acceptable ash mass concentrations, placing new requirements on the plume transport models used to provide ash advisories. Limited information on eruption strengths and characteristics of the material emitted make quantitative estimates of ash concentrations difficult, however.

The CALIPSO satellite carries a two-wavelength polarization lidar, operating since June 2006. CALIPSO observed the dispersion of the Eyjafjallajokull ash plume as it spread across Europe, providing unique observations complementary to passive satellite sensors and groundbased lidars. Polarization signals allow the discrimination of volcanic ash from marine and urban aerosols. Like infrared sensors, lidar is able to detect ash during both day and night, but lidar is more sensitive to ash than infrared sensors and is less affected by clouds. With a vertical resolution of 60 meters, CALIPSO provides detailed profiles of the vertical distribution of ash. With information on ash particle size, lidar can estimate profiles of mass concentration can be estimated. These profiles can be used for testing the underlying physics of plume transport models and also to refine eruption source parameters used in the models. This presentation will illustrate the capabilities of the CALIPSO to identify and characterize volcanic ash layers.