Remote sensing retrieval and transport modeling to detect, characterize, and track airborne volcanic emissions suffer from sparse in situ validation. The Eïjafjallajökull 2010 eruption starkly highlighted this deficiency. Commissioned experts struggled to provide crucial accuracy and precision estimates for predictions of locations, trajectories, and concentrations of the drifting ash. In the aftermath of the Icelandic crisis, ash and gas concentrations from analysis of satellite remote sensing data remain systematically unvalidated by in situ data. Of special concern with respect to aircraft operations are the validity of estimates of the lateral and vertical extent and concentrations of drifting volcanic ash clouds provided by aerosol transport models and remote sensing techniques. The current paucity of in situ data is dictated by the obvious extreme difficulty of deploying and recovering samples and physical/chemical data over remote regions and at altitudes where such clouds occur, especially given the demonstrated danger to manned aircraft that such ash concentrations generally present. I will review the progress of a variety of approaches for conducting in situ validation experiments, including the use of unmanned aircraft to range through ash clouds, and the deployment of instrumented tethered aerostats up into such clouds, in coordination with multispectral satellite, airborne, and ground-based observations, and will present preliminary in situ data. Existing data on in situ solid aerosol concentrations from air conditioning filters on aircraft that have penetrated ash clouds will also be reviewed. [Work performed in part at the Jet Propulsion Laboratory of the California Institute of Technology under NASA contract.]