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State of volcanic ash dispersion prediction

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The Eyjafjallajokull 2010 and Grimsvotn 2011 eruptions created great problems for commercial aviation in Western Europe and in the North Atlantic region. Comparison of satellite images of the visible and predicted ash clouds showed the VAAC prediction to be much larger than the actual ash clouds. No official explanation of this discrepancy exists apart from the definition of the ash cloud boundary. Papers on simulation of the Eyjafjallajökull ash cloud in peer reviewed journals, typically attempted to simulate the VAAC predictions rather than focusing on the satellite pictures. Sporadic measurements made in-situ showed much lower ash concentrations over Europe than the predicted values. Two of the weak points in ash cloud prediction have been studied in airborne measurements of volcanic ash by the Universities in Kyoto Japan, Iceland and Düsseldorf Germany of eruptions in Sakurajima, Japan. It turns out that gravitational deformation of the plume and a streak fallout process make estimated ash content of clouds larger than the actual, both features are not included in the simulation model. Tropospheric plumes tend to ride in stable inversions this causes gravitational flattening (pancaking) of the volcanic plume, while diffusion in the mixing layer is insignificant. New rules from ICAO, effective from November 2014, reiterate that jetliners should avoid visible ash, this makes information on visible ash important. A procedure developed by JMA′s Tokyo VAAC uses satellite images of visible ash to correct the prediction. This and the fact that meteorological data necessary to model gravitational dispersion and streak fallout do not exist in the international database available to the VAAC′s. This shows that close monitoring by airborne measurements and satellite and other photographic surveillance is necessary.