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# Photogrammetric retrieval of volcanic ash cloud top height from SEVIRI and MODIS

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Even if erupting in remote areas, volcanoes can have a significant impact on the modern society due to volcanic ash dispersion in the atmosphere. The ash does not affect merely air traffic – its transport in the atmosphere and its deposition on land and in the oceans may also significantly influence the climate through modifications of atmospheric $CO_2$. The emphasis of this contribution is the retrieval of volcanic ash plume height (ACTH). ACTH is important information especially for air traffic but also to predict ash transport and to estimate the mass flux of the ejected material. ACTH is usually estimated from ground measurements, pilot reports, or satellite remote sensing. But ground based instruments are often not available at remote volcanoes and also the pilots reports are a matter of chance. Volcanic ash cloud top height (ACTH) can be monitored on the global level using satellite remote sensing.

The most often used method compares brightness temperature of the cloud with the atmospheric temperature profile. Because of uncertainties of this method (unknown emissivity of the ash cloud, tropopause, etc.) we propose photogrammetric methods based on the parallax between data retrieved from geostationary (SEVIRI) and polar orbiting satellites (MODIS). The parallax is estimated using automatic image matching in three level image pyramids. The procedure works well if the data from both satellites are retrieved nearly simultaneously. MODIS does not retrieve the data at exactly the same time as SEVIRI. To compensate for advection we use two sequential SEVIRI images (one before and one after the MODIS retrieval) and interpolate the cloud position from SEVIRI data to the time of MODIS retrieval. ACTH is then estimated by intersection of corresponding lines-of-view from MODIS and interpolated SEVIRI data.

The proposed method was tested using MODIS band 1 and SEVIRI HRV band for the case of the Eyjafjallajökull eruption in April 2010. The parallax between MODIS and SEVIRI data can reach over 30 km which implies ACTH of more than 12 km. The accuracy of ACTH was estimated to 0.6 km. The limitation of this procedure is that it has difficulties with automatic image matching if the ash cloud is not opaque.