



A novel technique for evaluating the volcanic cloud top altitude using GPS Radio Occultation data

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Volcanic ash and sulfuric gases are a major hazards to aviation since they damage the aircraft engines also at large distance from the eruption. Many challenges given by volcanic explosive eruptions are still discussed and several issues are far from being solved. The cloud top altitude can be detected with different techniques, but the accuracy is still quite coarse. This parameter is important for the air traffic to know what altitude can be ash free, and it assumes a key role for the contribution of the eruption to the climate change. Moreover, the cloud top altitude is also strictly related to the mass ejected by the eruption and represent a key parameter for the ash and SO₂ retrievals by using several techniques.

The Global Positioning System (GPS) Radio Occultation (RO) technique enables real time measurement of atmospheric density structure in any meteorological condition, in remote areas and during extreme atmospheric events with high vertical resolution and accuracy and this makes the RO an interesting tool for this kind of studies.

In this study we have tracked the Eyjafjöll 2010 eruption by using MODIS satellite measurements and retrieved the volcanic cloud top altitudes by using two different procedures exploiting the thermal infrared CO₂ absorption bands around 13.4 micrometers. The first approach is a modification of the standard CO₂ slicing method while the second is based on look up tables computations.

We have then selected all the RO profiles co-located with the volcanic cloud and implemented an algorithm based on the variation of the bending angle for detecting the cloud top altitude with high accuracy. The results of the comparison between the MODIS and RO volcanic height retrievals are encouraging and suggesting that, due to their independence from weather conditions and due to their high vertical resolution, the RO observations can contribute to improved detection and monitoring of volcanic clouds and to support warning systems.