MODIS volcanic ash retrievals *vs* FALL3D transport model: a quantitative comparison.

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Satellite retrievals and transport models represents the key tools to monitor the volcanic clouds evolution. Because of the harming effects of fine ash particles on aircrafts, the real-time tracking and forecasting of volcanic clouds is key for aviation safety. Together with the security reasons also the economical consequences of a disruption of airports must be taken into account. The airport closures due to the recent Icelandic Eyjafjöll eruption caused millions of passengers to be stranded not only in Europe, but across the world. IATA (the International Air Transport Association) estimates that the worldwide airline industry has lost a total of about 2.5 billion of Euro during the disruption.

Both security and economical issues require reliable and robust ash cloud retrievals and trajectory forecasting. The intercomparison between remote sensing and modeling is required to assure precise and reliable volcanic ash products.

In this work we perform a quantitative comparison between Moderate Resolution Imaging Spectroradiometer (MODIS) retrievals of volcanic ash cloud mass and Aerosol Optical Depth (AOD) with the FALL3D ash dispersal model.

MODIS, aboard the NASA-Terra and NASA-Aqua polar satellites, is a multispectral instrument with 36 spectral bands operating in the VIS-TIR spectral range and spatial resolution varying between 250 and 1000 m at nadir. The MODIS channels centered around 11 and 12 μm have been used for the ash retrievals through the Brightness Temperature Difference algorithm and MODTRAN simulations. FALL3D is a 3-D time-dependent Eulerian model for the transport and deposition of volcanic particles that outputs, among other variables, cloud column mass and AOD. Three MODIS images collected the October 28, 29 and 30 on Mt. Etna volcano during the 2002 eruption have been considered as test cases.

The results show a general good agreement between the retrieved and the modeled volcanic clouds in the first 300 km from the vents. Even if the modeled volcanic cloud area is

systematically wider than the retrieved area, the ash total mass is comparable and varies between 35 and 60 kt and between 20 and 42 kt for FALL3D and MODIS respectively. The mean AOD values are in good agreement and approximately equal to 0.8.

When the whole volcanic clouds are considered the ash areas and the total ash masses, computed by FALL3D model are significantly greater than the same parameters retrieved from the MODIS data, while the mean AOD values remain in a very good agreement and equal to about 0.6.

The volcanic cloud direction in its distal part is not coincident for the 29 and 30 October 2002 images due to the difference between the real and the modeled local wind fields. Finally the MODIS maps show regions of high mass and AOD due to volcanic puffs not modeled by FALL3D.