Geophysical Research Abstracts, Vol. 9, 09615, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-09615


# Quantitative radar remote sensing of volcanic clouds due to sub-glacial Plinian eruptions

F.S. Marzano (1,2), S. Barbieri (1), E. Picciotti (2), **G. Vulpiani** (2,3), S. Karlsdóttir (4), C. Textor (5) and W.I. Rose (6)

(1) DIE, University of Rome La Sapienza, Italy, (2) CETEMPS, University of L'Aquila, Italy, (3) MeteoFrance, France. (4) Icelandic Meteorological Office, Iceland, (5) CNRS, France, (6) Michigan Tech University, USA, (marzano@die.uniroma1.it)

The explosive eruptions of active volcanoes with a consequent formation of ash clouds represent a severe threat in several regions of the urbanized world. Ground-based radar systems represent one of the best methods for determining the height and volume of volcanic eruption clouds. Several unknowns may condition the accuracy of radar products, most of them related to radar sensitivity and microphysical variability of ash clouds due to particle size distribution, shape and dielectric composition. In this work, a systematic study on ash cloud active remote sensing problem was carried out taking into account various operating frequencies such as S, C, X and Ka bands. After a summary on evidences of weather radar sensitivity to ash clouds, a microphysical characterization of volcanic ash is defined in terms of quite general modeled particle size-distribution (PSD) functions. The latter have been cast into a scaled Weibull and a scaled Gamma form. The evaluation of Rayleigh scattering approximation accuracy and a model sensitivity analysis was performed and assessed. In order to quantitatively evaluate the ash retrieval by weather radars, a prototype algorithm for volcanic ash radar retrieval (VARR) is formulated and discussed. Starting from measured single-polarization reflectivity, the estimation method has been based onto two cascade steps: i) a classification of eruption regime and volcanic ash category; ii) estimation of ash concentration and fall rate. Expected accuracy of the VARR algorithm estimates is evaluated on synthetic data sets. A minimum detectable reflectivity analysis is accomplished for various ash classes and for some available radar systems at S, C and X band. Finally, the VARR algorithm is applied to C-band radar data available during the eruption of the Grímsvötn volcano in Iceland during Nov. 2004.