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ASSESSING VOLCANIC ASH DISPERSAL AT MT. ETNA BY USING THE CALPUFF MODELING SYSTEM

S. Barsotti (1,2), A. Neri (1), J. Scire (3)

(1) Istituto Nazionale di Geofisica e Vulcanologia, I-56126 Pisa, Italy, (2) Dip.to di Scienze della Terra, Università degli Studi di Pisa, I-56126 Pisa, Italy, (3) Earth Tech Inc., Concord, MA 01742 USA. (barsotti@pi.ingv.it)

During the last eruption of Mt. Etna, started in October 2002, the relatively minor explosive activity shown by the volcano represented a major volcanic risk for the surrounding area due to the significant release of volcanic ash. Such a great amount of ash injected into the troposphere caused many problems to the citizens of the nearby towns (including the city of Catania) and to the Civil Aviation traffic (the Fontanarossa Airport of Catania has the third highest passenger volume in Italy and is located just 35 km away from the volcanic source). Similar dispersal phenomena of fine particles and gases in the atmosphere have been studied since many years to quantify the environmental impact of pollutant emissions released from factory stacks. To this aim several dispersal codes to compute trajectories of ash particles or gas concentrations in air have been developed.

In this work we illustrate the application of one of these codes, namely the CALPUFF Modeling System (Scire et al. 2000), to the simulation of the dispersal and settling of fine particulate matter produced by a low-intensity explosive eruption. The CALPUFF integrated system is composed principally by a diagnostic processor (CALMET) of the main meteorological variables, and a dispersal model (CALPUFF) based on a Lagrangian representation of the volcanic cloud as a discrete number of diffusing packets of particles named puffs. CALMET is able to refine the large-scale meteorological data produced by European (ECMWF) and Italian (Ufficio Meteo Aeronautica Militare) prognostic codes by accounting for the volcano topography and observational data. CALMET can be run for forecast application in its ŞNo-ObservationsŤ mode by making diagnostic fine scale terrain adjustments using ECMWF data alone.

CALPUFF then uses the refined mesoscale flow field and other meteorological turbulent data computed by CALMET to predict the dispersal of puffs made of particles up to 10 microns in diameter. New algorithms for large particle deposition have been introduced into CALPUFF to better treat deposition of the ash plume. The rising and benting of the buoyant plume is described by a numerical non-Boussinesq plume rise model designed for high temperature releases. The ability of the CALPUFF system to describe some of the plume features - such as column height and shape - as well as the large-scale dispersal of fine ash will be presented.
The final task of the work is to produce a predictive tool able to provide useful indications to forecast the proximal and regional dispersal of the ash cloud during volcanic crises.