Plinius Conference Abstracts
Vol. 15, Plinius15-55, 2016
15th Plinius Conference on Mediterranean Risks

The water vapour tomography on Mount Etna through the GPS technique

Massimo Aranzulla (1), Claudia Spinetti (2), Flavio Cannavo (1), Francesco Guglielmino (1), Vito Romaniello (2), Pierre Briole (3), and Giuseppe Puglisi (1)

(1) Istituto Nazionale di Geofisica e Vulcanologia - Sezione di Catania "Osservatorio Etneo", Catania (Italy), (2) Istituto Nazionale di Geofisica e Vulcanologia – Centro Nazionale Terremoti, Roma (Italy), (3) Ecole Normale Supérieure – PSL Research University – UMR CNRS 8538 (France)

The GPS electromagnetic waves that propagate in the neutral atmosphere are perturbed by the local characteristics of the crossed medium. Variations of pressure, temperature and water content, together with the presence of hydrometeors and particulates, cause changes in the refractive index along the ray path of the signal. Since 1988, the Istituto Nazionale di Geofisica Vulcanologia, Osservatorio Etneo (INGV-OE) uses the GPS technique to monitor the ground deformations. Nowadays, the INGV-OE network geometry consists of more than one hundred of GPS permanent stations in Sicily, about forty of them are placed over the Mt Etna to provide a dense coverage of the volcano edifice. The GPS carrier phase and pseudorange observables are processed by GAMIT/GLOBK software and the Vienna Mapping Functions (VMF1), to estimate three-dimensional relative positions of ground stations and satellite orbits, atmospheric zenith delays, and earth orientation parameters. In the frame of the EC FP7 MED-SUV project a task has been dedicated to compute the wet refractivity tomography over Mt. Etna volcano. A specific software has been developed starting from the wet tropospheric delays derived by GPS observations. The developed algorithm has been validated by using synthetic tests that confirmed the capability of the software to return the simulated anomalies faithfully. With the aim of applying the tomography algorithm to a real case, we introduce the water vapour content estimated by the MODIS instrument on board of the satellites Terra and Aqua. A comparison of GPS and MODIS derived water vapour content has been performed over the entire 2015 data set resulting in 0.91 of correlation with a bias of 7%. When the cloud covers permits the use of this data, its addition provides a double benefit: it improves the tomographic resolution and it adds a feedback for the GPS wet delay measurements. We present the results of this analysis of some 2015 test cases.