



Cities on Volcanoes 9
November 20-25, 2016
Puerto Varas, Chile

'Understanding volcanoes and society: the key for risk mitigation'



A laboratory experiment able to analyse the influence of volcanic ash on GPS signals

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Keywords: GPS data, experimental set-up, volcanic ash influence, noise signal

Recent studies have shown the ability of Global Positioning System (GPS) to retrieve the volcanic plume. However, data analysis during Etna explosive events has shown that the Signal to Noise Ratio (SNR), indicating the presence of volcanic plumes, may depend on the distance of the GPS station from the summit craters. In order to investigate why and improve our knowledge on detection limit, an experimental set-up was realized. The set-up is able to measure the interaction among the GPS L1, L2 carriers and volcanic ash and is composed by: i) two identical high-frequency GNSS receivers; ii) weather station; iii) container; iv) ground humidity sensor. A conical container having length, width and height of 1m x 1m x 1m is used to hold the volcanic ash having two different particle sizes (here named fine and coarse classes). The container was built using a radio-transparent material transparent to the GPS L1 and L2 carriers. The container is a truncated cone with a vertex angle of 100 degrees that includes an useful volume of about 60 dm³. One receiver was placed below the container while the other one was located nearby but in free air. The difference between the L1 and L2 signals of the two receivers will highlight the contribution of the volcanic ash. We performed different type of measurements collecting data: i) in absence of ash (bottom); ii) changing the height of the ash (fine class) inside the container in steps of quarter-wave; iii) changing the height of the ash (coarse class) inside the container in steps of quarter-wave. Preliminary results are here described and shown.