

## **Space Geodesy for the monitoring of Volcanoes and Surrounding Hills of Arequipa using the Arequipa Station as a reference**

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Historically, Arequipa, which is located within the Pacific "Ring of Fire", has special seismictectonic conditions and the presence of the Misti Volcano adds seismic-volcanological 17 conditions. The objective of this project is to implement a monitoring network that allows analyzing deformations before, during and after seismic and volcanological events by applying spatial geodesy techniques, allowing possible risks to be alerted. Among the techniques used for spatial Geodesy, there are the GNSS (Global Navigation Satellite System), SLR (Satellite Laser Ranging), VLBI (Very Long Baseline Interferometry) and DORIS (Doppler Orbitography and Radiopositioning Integrated by Satellite) techniques that allow perform measurements with centimeter or millimeter precision both in planimetry and in altimetry. Regarding measurements on land, there is the EDM (Electronic Distance Meter) technique with a precision of 0.5–1.0 mm for distances between 1 to 12 km, which were used to calculate the deformation of the Long Valley Caldera east of Yosemite in 2005. in United States.

Initially, the GNSS technique was used to monitor the Misti volcano during the years 2021 and 2022 to determine the position and speed of a certain point on the volcano and relate it to the GNSS point of the Arequipa Station. For the processing of the data obtained, the software developed by MIT is used: GAMIT/GLOBK, which allows estimating the three-dimensional relative positions of terrestrial GNSS stations, satellite orbits, atmospheric zenith delays and Earth orientation parameters. GAMIT can reduce measurement error using various ionospheric, atmospheric, meteorological and oceanic correction models, with which this software allows daily measurements to be obtained, 24-hour sessions with millimetric errors. GAMIT is currently widely used by international geodetic institutions such as the "International GNSS Service" (IGS) and other institutions at regional and national levels.

For the elaboration of this project, the GNSS data of the MTPI station located in the Misti volcano were used. These data were provided by agreement between a Peruvian government institution and the National University of San Agustin (IAAPP-UNSA). Although in a later stage, GNSS stations installed by the IAAPP-UNSA that include the SLR/EDM technique will be placed.

The mathematical and theoretical foundations used for the development of the project are presented, the methodology and the steps carried out for the processing of the GNSS data of the local MTPI station with the GAMIT 10.71 software are detailed. This Section details the procedure carried out for the conversion of the binary files and the configurations made in GAMIT/GLOBK for processing, and the results obtained in the processing. Finally, the conclusions of the analysis of the baselines obtained and the possibility of volcanic risk are shown.