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The new tiltmetric network of Tenerife: technical and scientific issues

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Since 2004, the Instituto Tecnológico y de Energías Renovables (ITER) in collaboration, since 2011, with the Instituto Volcanológico de Canarias (INVOLCAN), are monitoring Canary Islands archipelago with a network of more than 30 differential GPS stations. Specifically, in Tenerife island alone there are 12 permanent GPS receivers. Data are processed automatically using Bernese software, constituting an important tool for the geodetic monitoring of Tenerife.

Since 2016, the volcanic system of Tenerife is experiencing a hydrothermal unrest, with a marked increase of the diffuse CO₂ flux from the crater of Mt. Teide, the major volcanic edifice of the island. This increased flux is likely to be related to the injection of fluids of magmatic origin within the hydrothermal system of Tenerife. The subsequent pressurization of this system is reflected also by the increase in the background microseismicity observed since July 2017. Until now, the GPS network has not recorded significant ground deformation above the instrumental error.

With the aim of improving the geodetic monitoring of Tenerife, detecting possible small ground deformation below the sensitivity of the GPS network, INVOLCAN has recently started deploying, since June 2019, high-gain tiltmeters (Jewell Instruments A603-C) in the surrounding of Mt. Teide. Currently the tiltmetric network consists of 3 tiltmeters, located close to existing seismic or GPS stations. Data are automatically downloaded via UMTS connection and processed daily.

The nominal sensitivity of such instruments is less than 2.5 nrad, hence their installation and calibration require very careful operations. The sensors are equipped with leveling worm-gear feet to guarantee a perfect levelling. However, the high sensitivity of the instrumentation makes adjustments made manually totally useless. The tilt change caused by the weight of the human operator during the levelling is enough to drive the instrument out of scale. For this reason, INVOLCAN developed a robotic system to perform the required adjustments from remote. The system is based on Arduino Mega 2560, driving two servomotors to adjust the leveling worm-gears. Another servomotor allows switching the gain level. The system can be accessed and operated through an internal web page, which allows driving the servomotors and checking the leveling of the tiltmeter platform by using an Arduino Ethernet.

