Development of GNSS LOwCOst receivers based monitoring array for landslides continuous monitoring

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Starting from the experience achieved using high-end commercial Global Navigation Satellite System (GNSS) dual band (L1-L2) arrays for monitoring landslides during emergencies in the Emilia Romagna region in Northern Italy, we've developed LOwCOst (LOCO) solution in order to increase, with limited budgets, the number of monitoring points that can be readily deployed on active landslides upon necessity during emergency phases. As a matter of fact, the recognized stability of high-end commercial solutions is negatively counterbalanced by prices of several thousands of euros for the minimal setup of 2 receivers array (one acting as master and another as rover). Therefore, the possibility to make effective use, for real-time continuous monitoring, of low-cost technologies, represents a possible ready for action opportunity in the field of geosciences.

Within this contribution, a GNSS LOCO array will be presented. The core of the system is composed by REACH RS$^{©}$ single frequency (L1) receivers originally developed by Emlid Ltd as Real Time Kinematic (RTK) control point for Unmanned Aerial Vehicles (UAV), and lately evolved into a surveying, mapping and data collection tool. Reach RS$^{©}$ is mainly based on a computing Linux module single board coupled with a L1 U-blox M8T GNSS receiver. Base and Rover units communicate using LOng range RAdio (LORA) in order to compute RTK solutions using a fork of the open source software RTKlib. RTK solutions of the Rover (Est-North-Elevation) are then hourly sent, using a commercial low-cost GPRS router, to a remote NAS server at the University facility. Thereafter, a routine that has been specifically developed in R language by the authors, produces the displacement time series and renders results plots in an interactive html page.

At the moment the experimental LOCO GNSS array is deployed in an active landslide characterised by displacement rates ranging from centimetres to several meters per month and its performance is comparable with that of an high-end GNSS array deployed, simultaneously, at the same site.