Landslide monitoring using Geocubes, a wireless network of low-cost GPS receivers.

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Many geophysical structures such as landslides, glaciers or even volcanoes are features characterized by small extend area and deformation rate in the order of 1 to 10cm per day. Their study needs ever more accurate positioning data with an increased space and time resolution.

Using an Ublox LEA-6T GPS receiver, the French national mapping agency IGN developed its own wireless multi-sensor geo-monitoring system named Geocube. The basic device is equipped with a GPS and a wireless communication media and can be completed with various sensor modules such as meteorological sensors, ground humidity and pressure or seismograph. Due to the low cost of each receiver, spatial dense surveying networks are deployed. Data are then continuously collected and transmitted to a processing computer in real-time as well as saved in situ on a Micro-SD card. Among them, raw GPS carrier phase data give access to real-time accurate relative positioning on all mesh nodes if small baselines are used. In order to achieve a high accuracy, a dedicated GPS data processing method based on a Kalman filter is proposed. It allows an epoch by epoch positioning providing a high time resolution. Special attention is paid on two points : adaptation to wireless networks of low-cost GPS and real-time ability.

A first test of Geocubes usability under field conditions was carried out during summer 2012. A fifteen receivers network was deployed on the landslide of Super-Sauze (French Alps) for a two months trial. The experimental area, the deployed network and the acquisition protocol are presented. Position time series with a 30 seconds sampling rate are then derived from raw data for 10 mobile receivers on a forty days session. A sub-centimetric accuracy on an epoch by epoch positioning is reached despite difficult field conditions due to a 40° elevation mask in the south direction. Then, the measured deformations are compared with in situ rainfall measurements collected by a dedicated sensor added to a Geocube on a network's node.