Development of a wireless seismic array for volcano monitoring

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Volcano monitoring is mainly based on three sciences: seismology, geodesy and geochemistry. Seismic arrays are used to locate the seismic source, based on analysis of signals recorded by each seismometer. The most important advantages of arrays over classical seismic networks are: painless deployment, no major infrastructures needed, able to provide an approximate location of a signal that is not feasible by a seismic network.

In this paper the design of a low-power wireless array is presented. All sensors transmit acquired data to a central node which is capable to calculate the possible location of the seismic source in real-time. The reliability of those locations depends, among other parameters (number of sensors and geometrical distribution), on precision of time synchronization between the nodes. To achieve the necessary precision, the wireless seismic array implements a time synchronization protocol based on the IEEE1588 protocol, which ensures clock synchronization between nodes better than a microsecond, therefore, signal correlation between sensors is achieved correlating the signals from all the sensors. The ultimate challenge would be that the central node receives data from all the seismometers locating the seismic source, only transmitting the result, which dramatically reduces data traffic. Often, active volcano areas are located far from inhabited areas and data transmission options are limited. In situ calculation is crucial in order to reduce data volume transmission generated by the seismic array.