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Wi-GIM wireless sensor network (WSN) for ground instability monitoring: technology and possible applications to volcanic areas

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Active volcanoes are dynamic structures often affected by episodes of instability and subsequent structural failure that can lead to structural deformation and flank failure. Volcano instability can develop over various time scales from months to hundreds of years and involve volumes varying over several orders of magnitude up to several thousands of cubic kilometers. Although the numerous existing technologies used for volcano monitoring, the development of new technologies capable of responding to the needs of accuracy, low cost and ease of installation is still crucial in volcanology. In the frame of EU Wireless Sensor Network for Ground Instability Monitoring - Wi-GIM project (LIFE12ENV/IT/001033), a new wireless sensor network (WSN) for ground instability monitoring has been developed and tested in two instable areas with different behavior: the active Lavina di Roncovetro Landslide (Italy) and the large subsiding area on Sallent village (Spain). The Wi-GIM WSN network system consists of three levels: 1) Master/Gateway level coordinates the WSN and performs data aggregation and local storage; 2) Master/Server level takes care of acquiring and storing data on a remote server; 3) Nodes level that is based on a mesh of peripheral nodes, each consisting in a board equipped with sensors and wireless module. The location of each sensor on the ground is determined by integrating an ultra wideband technology with a radar technology. The sensor nodes are organized as a hierarchical cluster, composed by one master and several slave nodes. The ground movement is detected by comparing day by day the x, y and z coordinates of each nodes. In this contribution we present the architecture of the Wi-GIM system, the technologies implemented in the sensors and the first performance of the system with the purpose of exploring new applications in volcanic areas.