Geophysical Research Abstracts
Vol. 20, EGU2018-15576, 2018
EGU General Assembly 2018

4onse project: preliminary results of a non-conventional monitoring system.

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The availability of environmental monitoring systems is essential to observe hydro-meteorological parameters that are often used for natural disasters mitigation, water management and weather forecasting. However, in low income countries there's often a lack of efficient, dense and modern monitoring systems mainly due to high costs of hardware and software components, low access to replacements parts and limited local capacity.

Thanks to recent technological advances (Internet of Things, big data, ubiquitous of Internet, etc.), "non-conventional" monitoring systems based on open software, open hardware and low-cost sensors can represent a great opportunity both as a complement to official monitoring networks and as main sources of weather information in regions where traditional networks are in decline or totally missing. Although there are great expectations, today we still have poor information on quality and reliability of "non-conventional" systems in scientific literature. There's many documents and examples accessible on different Internet blogs, websites and forums but unfortunately they are often limited to simple "how to" descriptions missing of any scientific evaluation.

To fulfill this gap, the 4onse project studies non-conventional monitoring systems fully based on open technologies (Open Software, Open Hardware, Open Standards and Open Data). In fact, if scientifically verified and validated, such a kind of fully accessible, royalty-free and low cost system, could potentially enable developing countries in managing natural resources and hazards thanks to better reaction time, improved understanding, wiser decision making and more effective policies implementations. The project, after the design and testing of the system, envision the installation of about 30 stations in a Sri Lankan basin and the set-up of management and warning systems for floods and droughts. The system is going to be analyzed for almost two years to fully understand the real cost of ownership, data quality and applicability in real situations and derive scientific conclusions on the real applicability of these technologies in real cases. The aimed impact of the project is the empowering of developing countries in environmental monitoring system development, management and evaluation.

With this contribution we present the details of the designed system which is based on three major layers (hardware, service and communication) all fully based on Open technologies. The hardware layer, which is the weather station, is based on Arduino and globally accessible low-cost sensors; the service layer, which is the data warehouse to manage data and metadata, relies on the istSOS software (www.istsos.org); the communication layer, which enables the fast and secure data transmission between the hardware and the service layer, is based on SIM800 GPRS module. To understand the quality of the system we have tested it for a period of six months by comparing the observations of the 4onse station with a nearby official weather station. The results of the comparison shows promising results with quality of data that highlights temperature mean error of 0.3 degrees, humidity mean error of 4% and pressure mean error of 0.3 hPa.