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PRESTO - PROBABILISTIC AND EVOLUTIONARY EARLY WARNING SYSTEM: CONCEPTS, PERFORMANCES, AND CASE STUDIES

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The past two decades have witnessed a huge progress in the development, implementation and testing of Earthquakes Early Warning Systems (EEWS) worldwide, as the result of a joint effort of the seismological and earthquake engineering communities to set up robust and efficient methodologies for the real-time seismic risk mitigation.

In this talk we shall overview the concept and methodologies that have led RISSCLab group of the University of Naples Federico II to the development of the system PRESTo (PRobabilistic and Evolutionary early warning SysTem), which is a highly configurable and easily portable platform for Earthquake Early Warning. PRESTo (PRobabilistic and Evolutionary early warning SysTem) is a highly configurable and easily portable platform for Earthquake Early Warning (EEW) that integrates algorithms for real-time probabilistic earthquake location, magnitude estimation and damage assessment. The system processes the live accelerometric streams from the stations of a seismic network and provides location and magnitude estimations, as well as shaking prediction at the regional scale. The earthquake location and magnitude are obtained by an evolutionary, probabilistic approach combining triggered and not-yet-triggered stations. Peak ground motion is estimated at target sites by GMPEs using location and magnitude. The regional approach is integrated with a threshold-based early warning method for the definition of alert levels at stations and the estimation of the Potential Damaged Zone (PDZ), in which the highest intensity levels are expected. At each station the characteristic P-waves period (τc) and the peak displacement (Pd) are measured on the initial P-waves signal. They are compared with threshold values in order to produce an alert level at each station, which can be finally correlated to the expected local damage. Integrating the measured on-site parameters at stations (Pd, τc) and the estimated regional parameters (hypocenter), PRESTo can identify the damage area in few seconds and send an alarm message containing the evolutionary estimates before the destructive waves can reach target sites. Since late 2009, PRESTo has been under continuous real-time experimentation in Southern Italy, on the data streams of the Irpinia Seismic Network (ISNet). Since June, 2012 similar deployment is implemented at KIGAM accelerometer network, in South Korea. Likewise, PRESTo has been off-line tested on the Mw >= 4 deep earthquakes recorded since 2005 by the Romanian Seismic Network, on off-shore earthquakes of the Iberian Peninsula and on a database of M >3 Japanese earthquakes.

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