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Assessment of Earthquake Early Warning Approaches: Inputs, Products and Challenges

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Earthquake early warning (EEW) systems establish an important part of seismic loss mitigation programs. They are used to reduce the social and economic impacts of major earthquakes by providing an advance notification before the arrival of damaging seismic waves to a target site. With recent technological and scientific advances, today's early warning systems can go much beyond this basic function, providing estimates of shaking intensity and potential damage for implementation of post-disaster emergency response plans.

An effective EEW system requires not only a robust seismic network infrastructure and fast communication system but also a rapid event/ground-motion characterization algorithm well-calibrated to capture the seismological attributes of the region of interest. EEW systems should be able to automatically distinguish seismic radiations from noise and estimate shaking intensity of approaching S-waves at a target site based on early P arrivals for maximized notification time. Accuracy of automatic event detections and predicted intensities are as important as the advance warning time for achieving trustworthy EEW systems. These constraints add further challenges over those in conventional seismic monitoring practices.

Most existing EEW systems operate based on two different approaches: on-site and regional. Here, we discuss each approach in terms of their inputs and products, with a focus on the challenges in realizing an effective warning system.