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Earthquake preparation and warning: science, methods and technologies,

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Abstract

The paper aims at giving suggestions for a deterministic approach to earthquake warning based on combined ground and space observations of earthquake precursors and related theoretical modeling. On the occasion of a destructive earthquake often a strong debate arises between administrators, engineers, specialists in applied geophysics and seismology, technicians of local and civil services, and authorities that need to take adequate measures for assistance and protection of the population and reconstruction of houses and infrastructures. But on the same occasion also a question about a possible prediction of the event and prevention damage arises in the people and scientists, which of course, can not receive any exhaustive answer. Under the emotional stress of people involved in the disaster, often there are also misleading overlapping proposals and procedures, misdirections and not constructive solutions. A possible contribution to earthquake warning and prediction may be given by observations and physical modeling of earthquake precursors aim at seeing in perspective the phenomenon earthquake within the framework of a unified theory able to explain the causes of its genesis, and the dynamics, rheology, and microphysics of its preparation, occurrence, post-seismic relaxation, and inter-seismic phases. Unfortunately, up to now what is lacking is the demonstration of a causal relationship (with explained physical processes and looking for a correlation) between data gathered simultaneously and continuously by space observations and ground-based measurements. In doing this, modern and/or new methods and technologies have to be adopted to try to solve the problem. Coordinated space and ground-based observations imply available test sites on the Earth surface to correlate ground data, collected by appropriate networks of instruments, with space ones detected on board of Low-Earth-Orbit (LEO) satellites. Moreover, a new strong theoretical scientific effort is necessary to try to understand the physics of earthquake(s). Within this framework a few projects and experiments have been carried out on the subject by our team and accompanied by specific theoretical interpretations. They are reported in the paper. As an introduction and justification to these studies the paper also clarifies some basic concepts, critical and methodological aspects concerning deterministic and statistic approaches, and their use in earthquake prediction and warning.