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Italian landslide early warning system

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In Italy, intense or prolonged rainfall is the primary trigger of landslides, and rainfall-induced slope failures occur every year, claiming lives, causing economic disruption, and producing different environmental problems. The national Italian Department of Civil Protection (DPC) is responsible for the protection of individuals, communities and their properties, against natural hazards, including landslides, and for rescuing people if a catastrophic event should occur. The main tasks of the DPC are the issuing of meteorological, hydrological, and landslide warnings and the determination of landslide hazards and risk at different geographical scales. In 2007, the DPC asked IRPI, a research institute of the Italian National Research Council, to design and implement a prototype system for the quasi-real-time forecast of rainfall induced landslides in Italy. The system – under development – is based on two main components: (i) a set of national, regional and local rainfall thresholds for the possible initiation of landslides, and (ii) a synoptic (small scale) assessment of landslide hazards and the associated risk in Italy. The system attempt to predict rainfall induced landslides using existing and new rainfall thresholds. The new rainfall thresholds, chiefly of the intensity-duration (ID) and normalized-ID types, will be defined analyzing a catalogue of rainfall events that have or have not resulted in landslides. The thresholds will be established using objective statistical techniques. The assessment of landslide hazards and risk will be performed using statistical models based on small scale thematic information and catalogues of historical landslides and historical landslides with human consequences in Italy, in the period from 1900 to 2005. The catalogues were compiled through a thorough literature and archive search. The two individual system components will be then combined to form a national landslide warning system. A preliminary version of a software tool for the early warning system, comparing rain gauge network measurements with existing and new national rainfall thresholds, has been implemented. In this version, information on landslide spatial and temporal probability at the national scale have been made available. Future versions of the system: (i) will use new Italian regional and local rainfall thresholds, (ii) will consider rainfall estimates obtained from ground-based weather radars, meteorological satellites, and numerical weather forecasts, and (iii) will implement new criteria for the issue of warning based on the combination of rainfall thresholds and statistical models of landslide hazard and risk.