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Landslide risk mitigation by means of early warning systems

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Among the many options available to mitigate landslide risk, early warning systems may be used where, in specific circumstances, the risk to life increases above tolerable levels. A coherent framework to classify and analyse landslide early warning systems (LEWS) is herein presented. Once the objectives of an early warning strategy are defined depending on the scale of analysis and the type of landslides to address, the process of designing and managing a LEWS should synergically employ technical and social skills. A classification scheme for the main components of LEWSs is proposed for weather-induced landslides. The scheme is based on a clear distinction among: i) the landslide model, i.e. a functional relationship between weather characteristics and landslide events considering the geotechnical, geomorphological and hydro-geological characterization of the area as well as an adequate monitoring strategy; ii) the warning model, i.e. the landslide model plus procedures to define the warning events and to issue the warnings; iii) the warning system, i.e. the warning model plus warning dissemination procedures, communication and education tools, strategies for community involvement and emergency plans. Each component of a LEWS is related to a number of actors involved with their deployment, operational activities and management. For instance, communication and education, community involvement and emergency plans are all significantly influenced by people's risk perception and by operational aspects system managers need to address in cooperation with scientists.