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Monitoring and Early Warning of the 2012 Preonzo Catastrophic Rockslope Failure

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In this contribution we describe the accelerated creep stage and early warning system of a 210'000 m3 rock slope failure that occurred in May 2012 above the village of Preonzo (Swiss Alps). The very rapid failure occurred from a larger and retrogressive instability in high-grade metamorphic ortho-gneisses and amphibolites with a total volume of about 350'000 m3 located at an alpine meadow called Alpe di Roscioro. This instability showed clearly visible signs of movements since 1989 and accelerated creep with significant hydro-mechanical forcing since about 1999. Because the instability at Preonzo threatened a large industrial facility and important transport routes a cost-effective early warning system was installed in 2010. The alarm thresholds for pre-alarm, general public alarm and evacuation were derived from 10 years of continuous displacement monitoring with crack extensometers and an automated total station. These thresholds were successfully applied to evacuate the industrial facility and close important roads a few days before the catastrophic slope failure of May 15th, 2012. The rock slope failure occurred in two events, exposing a planar rupture plane dipping 42° and generating deposits in the mid-slope portion with a travel angle of 38°. Two hours after the second rockslide, the fresh colluvial deposits became reactivated in a devastating de-bris avalanche reaching the foot of the slope.