

## **Experiences in regional landslide forecasting from Piemonte region (North-western Italy) and South-Eastern Norway between the 15th and the 23rd of May 2013**

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Although Italy and Norway belongs to different climates, they can be influenced by the same large low pressure systems. On May 2013, ARPA in Piemonte region and NVE in Norway issued warning for flood and landslides due to the arriving of a deep and large low pressure (known as Vb-tief). This type of weather is well known to produce the largest floods in Europe. Recent studies in Norway confirm that similar systems are also responsible of triggering landslide events.

In this contribution we present how the existing forecasting systems in Piemonte region and in Norway react and we summarize our experiences.

Regional early warning systems (EWS) are operational both in Piemonte region (Italy) and nationally in Norway to forecast shallow landslides, debris flows and debris avalanches. Both EWSs provides daily landslide hazard assessments based on quantitative thresholds and daily rainfall forecasts coupled with qualitative expert analysis. The ARPA Piemonte warning system has been operational since 1994 while the NVE one since 2013: daily bulletins are published respectively by <http://www.arpa.piemonte.gov.it/rischinaturali> and [www.varsom.no](http://www.varsom.no).

From 15th May to 19nd June 2013, ARPA Piemonte rain gauges recorded more that 200mm in Piemonte and 60-90cm fresh snow over the Alps above 2000m asl. Several rivers were flooded and diffuse landslides were occurred over all the region. In Norway the same weather type lasts a bit longer from 15th May to 2nd June 2013. South-Eastern Norway received a lot of rain distributed in 2 major events, the 15th - 16th of May and between the 22nd and 23rd of May. In addition, high temperatures produced intense snow melting over a large area. Snow depth was less than normal but the snow melted within two weeks while the frost in the area was deeper than normal. From 21st to 23rd May heavy rainfall, over 70 mm in a few hours, fell over the Glomma river basin, especially over Gudbrandsdalen, causing extensive flood along Glomma river and hundreds of landslides.

The large floods and landslides caused extensive damages to roads and railways as well as buildings and other infrastructure in both countries. In Norway, the Oppland and Hedmark counties suffered most of the damages, as well as railway lines and road line estimated at over 175000 Euro.