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Early warning of orographically induced floods and landslides in Western Norway

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In Western Norway, landslides and debris flows are commonly initiated by short-term orographic rainfall or intensity peaks during a prolonged rainfall event. In recent years, the flood warning service in Norway has evolved from being solely a flood forecasting service to also integrating landslides into its early warning systems. As both floods and landslides are closely related to the same hydrometeorological processes, particularly in small catchments, there is a natural synergy between monitoring flood and landslide risk. The Norwegian Flood and Landslide Hazard Forecasting and Warning Service issues regional landslide hazard warnings based on hydrological models, threshold values, observations and weather forecasts. Intense rainfall events and/or orographic precipitation that, under certain topographic conditions, significantly increase the risk of debris avalanches and debris floods are lately receiving more research focus from the Norwegian warning service.

Orographic precipitation is a common feature in W-Norway, when moist and relatively mild air arrives from the Atlantic. Steep mountain slopes covered by glacial till makes the region prone to landslides, as well as flooding. The operational early warning system in Norway requires constant improvement, especially with the enhanced number of intense rainfall events that occur in a warming climate. Here, we examine different cases of intense rainfall events which have lead to landslides and debris flows, as well as increased runoff in fast responding small catchments. The main objective is to increase the understanding of the hydrometeorological conditions related to these events, in order to make priorities for the future development of the warning service.