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Simulating rain-on-snow events for Norway

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Rain-on-snow (ROS) events are multivariate hydrometeorological phenomena requiring a combination of rain and snowpack, with complex processes occurring on and within the snowpack. Impacts include floods and landslides, and rain may freeze within the snowpack or on bare ground, potentially affecting vegetation, wildlife, and permafrost. ROS events occur mainly in high-latitude and mountainous areas, where sparse observational networks hinder accurate quantification – as does a scale mismatch between coarse (50-100 km) resolution re-analysis products and localised events. A recent study (Pall et al., submitted; available at: https://eartharxiv.org/k72ej/) used a high (1km) resolution observational data set for mainland Norway to construct a ROS climatology for recent decades. Its main result was that, compared to 1961-1990, ROS events in the 1981-2010 period decrease most in the southwest in winter, southeast in spring, and north in summer (consistent with less snow cover in a warming climate), and increase most in the southwest, central mountains, and north in winter-spring (consistent with increased precipitation and/or more snow falling as rain in a warming climate). Here we will investigate this result further, by using a high-resolution climate model to simulate a Norwegian ROS climatology for a future period (2070-2100; under the IPCC RCP8.5), as well as first evaluating model simulations against the aforementioned observed climatology (1981-2010). A particular focus will be on investigating changes in ROS events that result in large damaging floods such as in Oppland county in May 2013. This work forms a contribution to the LATICE (Land-ATmosphere Interactions in Cold Environments) project at the University of Oslo.