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Detecting sea-effect snowfalls on Finnish coastlines

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Sea-effect snowfalls may cause millions of euros of losses for society. Snowfall events can last several days and easily produce five to ten centimeters or even more of snow accumulation, which can cause tree damage, power cuts, traffic problems and roof damages. In addition to these, nuclear power plants need their own precaution plans because extreme weather can prevent normal operation, endanger safe shutdown or indirectly effect safety through injuries and damages in the transport sector. While even 5-10 cm of new snow may result in several car accidents, snowfall events need to be at least an order of magnitude more intense in order to be of relevance for nuclear power plant safety in Finland. Recent snowfall event of this magnitude was experienced on 8.1.2016 when it snowed up to 73 cm of new snow on the western coast of Finland (Olsson et al. 2017, Olsson et al. 2018). The goal of the present study is to determine the basic characteristics involved in producing sea-effect snowfall in the Baltic Sea region, so that we could anticipate on what will happen to the frequency and intensity of these events in the future. With changing climate, the ice season in the Baltic Sea will become much shorter than in the history. This could increase the frequency or intensity of the sea-effect snowfall in the Baltic Sea region. In this research we are going to use a number of criteria, or threshold values, that favour the occurrence of sea-effect snowfall, together with high-resolution data from a regional climate model, RCA4, for a recent 11-year period. The criteria to detect sea-effect snowfall days on Finnish coastlines for further analysis concern 10 m wind speed, temperature difference between sea surface and 850 hPa, wind shear between 700 hPa and 975 hPa, wind direction, boundary layer height and precipitation amount. Heavy coastal precipitation events are also identified from the daily gridded climate dataset for Finland (FMIClimGrid), based on observations (Aalto et al. 2016, Luomaranta et al. 2019) for comparison with the RCA4 results. We are expecting to gain information on the intensity and frequency of the past sea-effect snowfall cases on Finnish coastlines.

Aalto, et al. (2016): New gridded daily climatology of Finland: permutation-based uncertainty estimates and temporal trends in climate. J. Geophys. Res. Atmos., 121, 3807–3823.
Luomaranta, et al. (2019): Snow cover trends in Finland over 1961–2014 based on gridded snow depth observations. Int. J. Climatol. 2019; 1– 13.
Olsson, et al. (2017): Intense sea-effect snowfall case on the western coast of Finland, Adv. Sci. Res., 14, 231-239.
Olsson, et al. (2018): Sea-effect snowfall case in the Baltic Sea region analysed by reanalysis, remote sensing data and convection-permitting mesoscale modelling. Geophysica, 53(1), 65-91.