



Climatology of heavy crown snow loads in the present and projected future climate of Finland

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Crown snow load is snow and rime attaching tightly on tree crowns and other structures in freezing temperatures. The accumulation of snow on tree branches is dependent on meteorological factors. It is most efficient when temperature at the time of precipitation is close to freezing point, preferably approximately between 0 and 0.5 °C. Slightly wet snow is heaviest and if temperature falls below 0 °C after the snowfall, then snow attach tightly to the branches when frozen. Rime accretion occurs when water droplets in fog freeze to the windward side of trees and other objects. Riming can occur in freezing temperatures, however, the colder is the air, the less it can contain water vapour and consequently riming is less intense. Hence, riming usually occurs with air temperatures milder than -8 °C. Topography plays a key role in the riming intensity. In general, forests at high altitudes are most prone to riming.

Heavy crown snow loads can cause forest damages including stem breakages, uprooting and bending or leaning of the stems. In Europe, almost one million cubic metres of wood are on average damaged by snow annually. Furthermore, these forest damages may cause breaks for power transmission as damaged trees may be bended or leaned over power lines. For instance, over 20 000 damaged trees fell over power transmission lines due to a single blizzard (the Pyry storm) in Finland in 2001 leaving 177 000 households without electricity.

At Finnish Meteorological Institute (FMI), a forecasting model has been used operationally to predict heavy crown snow loads since 2006. The model parameters have been tuned based on the empirical experience of model performance in different weather situations. We have applied the model both to historical weather observations and climate model data in order to estimate the climatology of heavy crown snow loads in the present and projected future climate of Finland. The heaviest crown snow loads are found to occur typically in eastern Finland and at high elevations in Lapland. In the future, the risk for heavy snow loads may increase in the eastern and northern parts of the country, although winters are projected to become milder. In southern and western Finland, the crown snow loads are expected to decrease due to climate change.