Submitted Abstract

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Abstract

The characteristics of snow cover are highly sensitive to variations in temperature and precipitation. In Svalbard these are undergoing significant change in response to a rapidly warming climate and the associated positive feedback processes. The occurrence of wintertime rain-on-snow (ROS) events are expected to increase in frequency and intensity across the Arctic as a result of climate change. ROS events dramatically alter snow cover characteristics, by saturating the snowpack and enhancing surface runoff as well as causing widespread formation of ground ice, which can negatively impact many ecosystems as well as infrastructure. Knowledge of the spatial and temporal variations in ROS occurrence across Svalbard, both past and present is needed to understand which areas are most vulnerable to ROS hazards and how this may change in the future. This work has utilised Synthetic Aperture Radar (SAR) observations to produce an 18-year dataset of wet snow cover observations for Svalbard, from which a method for detecting and mapping both spring melt onset and ROS frequency has been developed. The mean spatial variations in melt onset and ROS occurrence reflect the geographical gradients in temperature and precipitation across the archipelago and are largely in agreement with those reproduced by downscaling of output from regional climate models. The timing of ROS onset as detected using the SAR observations coincide well with in-situ measurements of rainfall, however in some cases the duration of a ROS event cannot be reliably estimated using SAR observations of wet snow, in particular after phase transitions from rain to snow. Linear trends derived from the limited time series of observations suggests that ROS frequency is increasing over most of the archipelago, with largest increases in the south and along the western coast. However, low elevation areas in the central parts of the archipelago exhibit a decreasing trend in ROS over the time period of observations.