



Spatially heterogeneous impact of global warming on heavy wet snowfall

Masamichi Ohba and Soichiro Sugimoto

Central Research Institute of Electric Power Industry, Abiko, Japan (masamichi.ohba@gmail.com)

Wet snow is one of the main causes of atmospheric icing, which can lead to severe damage to towers and power lines and, in turn, electrical breakdowns and blackouts. Therefore, we investigated the impacts of global warming-induced climate change on heavy wet snowfall events during the winter season in Japan and their dependency on weather patterns (WPs) using self-organizing maps (SOMs). To investigate the impacts of climate change on daily wet snowfall for different WPs, the SOM technique was applied using surface atmospheric circulation data obtained from the Database for Policy Decision Making for Future Climate Change (d4PDF) to determine the dominant heavy wet snowfall WP. The d4PDF consists of outputs from general circulation models (d4PDF-GCM) and dynamically downscaled for the Japanese region using a regional climate model (d4PDF-RCM) for historical (1951–2010) and +4-K future climate (2051–2110) projections. The horizontal grid spacing of d4PDF-GCM and d4PDF-RCM were 60 km and 20 km, respectively.

The SOMs showed that some obtained WPs had a significant effect on heavy wet snowfall in Japan. The projected future changes in the amount of heavy wet snowfall events showed a nonuniform spatial distribution. The impact of climate forcing on WPs associated with heavy wet snowfall was also evaluated to understand the spatially heterogeneous changes of wet snowfall. The results of the SOM analysis suggest that the future changes in the spatially heterogeneous extreme wet snowfall can be attributed to differences in WP responses to climate change. This can be attributed to the differences in future changes in the freezing point line among WPs, which can alter the spatial distribution and frequency of heavy wet snowfall. These findings can help inform structural design requirements to withstand regional changes in climate.