



Concurrent trends in snow cover and air temperature in Norway

Jonathan Rizzi, Irene Brox Nilsen, James Howard Stagge, and Lena Merete Tallaksen
University of Oslo, Department of Geosciences, Norway (jonathan.rizzi@geo.uio.no)

At northern latitudes, the sensitivity to global warming is amplified as a result of the unique annual cycle and intensive growth season, which influences the radiative fluxes (e.g. the transport of energy). The Northern Hemisphere snow cover has a strong positive feedback on the energy balance through its influence on the surface albedo. A reduction in snow cover leads to a lowering of the albedo and thus, enhances the warming. Previous and ongoing research have revealed a major increase in air temperature for the whole of Norway, notable in winter and a general reduction in the snow cover at lower altitudes. In this study, we assess to what degree changes in snow cover (i.e. whether or not there is snow on the ground) can explain the enhanced temperature increase in winter. Daily time series of temperature, snow depth and snow cover area available for the whole of Norway at a spatial resolution of 1 km from seNorge (www.senorge.no) are analysed for the period 1958 to 2013. Data is successively aggregated for periods of 30 years (e.g., 1961-1990, 1971-2000, 1981-2010). The aim is threefold; i) to estimate trends and changes in the climate variables on a monthly basis for selected 30-year periods for the whole of Norway ii) to analyse spatial patterns and concurrent trends in the variable and iii) assess to what degree changes in snow cover can explain the enhanced winter temperature using statistical methods, e.g., the regression test. The Theil-Sen estimator was selected for the trend analysis as it considers the relative differences of all the pairs of data of the considered dataset and is less sensitive to outliers than other estimators.

Preliminary results confirm an increasing trend in temperature (especially in winter months). A substantial change in the snow cover area throughout the year is found. Later snowfall is seen in the northern parts of Norway in October, gradually shifting southwards. In November, snow cover reduction is notable in the southern coastal area, and in December a diminishing snow cover is found primarily at the south-east coast. Further, the snow depth decreases over the whole of Norway with larger reduction seen from January to May in the eastern part of Norway. This is likely a result of a shift in precipitation from snow to rain in both the beginning of winter as well as in early spring. In April/May reduction in snow cover is found in the lowlands and throughout the summer a reduction is seen also further north and in the highlands.