

The impact of anomalous winters on society and the potential use of seasonal forecasts in Finland

I. Juga and H. Tuomenvirta

Finnish Meteorological Institute, Helsinki, Finland (ilkka.juga@fmi.fi)

Many parts of Europe suffered from cold and snowy weather during the winter 2009/10 and again in December 2010. The cold winter 2009/10 was related to a strongly negative phase of the North Atlantic Oscillation index (NAO), which is known to be correlated with winter temperature anomalies in Europe. The wintry weather had strong and widespread impacts especially on the functionality of the transportation system. Also in Finland, especially the rail traffic encountered problems due to low temperatures and drifting snow. Also the winter 2010/11 was substantially colder than the long time average, being favorable for sea-ice formation on the Baltic Sea, thus complicating winter navigation. Dozens of ships got stuck on the icy Gulf of Bothnia during the second half of February 2011, waiting for days for the ice-breakers to assist them one by one into the harbours. This was a complete contrast to the situation prevailing during the record mild winter 2007/08, when most of the Baltic Sea (and its gulfs) stayed ice free.

This study focuses on the great variability of winter mean temperatures in Finland and the related consequences. The Helsinki city observation series covers more than 180 winters from 1829/30 on. The average temperature of all those winters (DJF) is -4.92°C and the standard deviation (STD) is 2.69°C . The general atmospheric flow pattern has a strong effect on the temperature conditions during the winter. The correlation between the winter mean temperature anomalies in Helsinki and the NAO was found to be 0.52. If only the anomalous winters are concerned, that is, those deviating more than one standard deviation (± 1 STD) from the long time average, the correlation rises to 0.70.

During the last 30 year period in Helsinki, winters 1981/82-2010/11, the mean DJF temperature was -3.58°C and the STD 2.83°C . Using the ± 1 STD limit for anomalous winter mean temperature yields a threshold -6.41°C on the cold side and -0.75°C on the warm side. Winters having a mean temperature outside these limits may be regarded as anomalous, and statistically (for an ideal normal distribution) such winters should occur in 32% of all cases (16% on the cold side and 16% on the warm side). The mean temperature in Helsinki was $+1.4^{\circ}\text{C}$ during the winter 2007/08, and during the winters 2009/10 and 2010/11 it was -7.4 and -7.3°C , respectively; all of them falling outside the ± 1 STD range.

There is large potential value in seasonal forecasts whenever such anomalous winters can be predicted in advance, so that the society could be better prepared for the expected consequences. However, for example the ECMWF seasonal forecasts did not show any clear signal for the large negative temperature anomalies observed in Finland during the winters 2009/10 and 2010/11. By contrast, the mild winter 2007/08 was relatively well signaled in advance. Although it may well be expected that the skill of the seasonal forecasts will improve during the coming decades, at high latitudes the improvement of predictability is challenging.

This study is associated with the EU/FP7 project EWENT. The objective of the project is to study the impacts of hazardous weather on European transportation system by taking into account the changing climate.