Icelandic climate and North Atlantic cyclones in ERA-40 reanalyses

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**Abstract**

The frequency of winter cyclones in the North Atlantic is determined for 1957–2002 in the ERA-40 European Center for Medium-Range Weather Forecasts (ECMWF) reanalysis data set. The cyclone frequency shows distinct maxima for the intensity and the variability between southeastern Greenland and Iceland. The numbers of cyclones near Iceland (50 – 60N, 30 – 10W) and their intensity show an increase consistent with the North Atlantic Oscillation (NAO) and decreasing surface pressure in Iceland during 1961–2001 (station Reykjavik). Noteworthy is the decrease in near surface temperature (previously found) and 10m wind speed. Positive correlations are observed for the numbers of Icelandic cyclones with the NAO-index, the Icelandic surface pressure, and wind speed, while near surface temperature is not correlated. For precipitation the correlation with the cyclones is higher than with the NAO-index.

**1 Introduction**

Northern Atlantic depressions and their relationship with large scale teleconnection patterns and the European climate have been analysed in a number of studies. BRÜMMER et al. (2000) determine the Arctic cyclone statistics in ECMWF ERA reanalysis in 1986–91 and find large monthly variabilities. For climatological analyses it is relevant that weak cyclones may still be insufficiently observed, assimilated and predicted in operational weather forecasts (for example in the Fram Strait, BRÜMMER et al., 2001) and, hence, in the ERA-40 reanalyses (CONDRON et al., 2006). According to BRÜMMER et al. (2001) these cyclones are correlated with the ice export (correlation coefficient 0.4 – 0.66 during 1978–1993) which is itself relevant for the temperature in northern Iceland (HANNA et al., 2004).

In a detailed climatological study, HANNA et al. (2004) analyse trends of several climatic variables in Iceland including air pressure, temperature, precipitation and sunshine data during the 20th century to assess a possible climate change. The authors find trends in certain time intervals, however, without a general trend during the century that could be related to global warming. There are station dependent correlations with the North Atlantic Oscillation (NAO) index: r ≈ −0.26 . . . 0.09, for seasonal temperatures, and significant values, r = 0.29 . . . 0.45, for annual precipitation.

The cyclones in the vicinity of Iceland are in part caused dynamically by the Greenland massive (SERREZE et al., 1997). To determine this influence DETHLOFF et al. (2004) and JUNGE et al. (2005) analysed high resolution simulations with removed Greenland orography. The comparison with a control simulation shows that the cyclonic activity between Greenland and Iceland is reduced to one half if the orography is eliminated.

In winter cyclone frequency increases in high-latitudes and decreases in mid-latitudes in NCEP reanalyses (MCABE et al., 2001). The northward shift of the cyclone intensity is also observed in ERA-15 ECMWF reanalyses (SICKMÖLLER et al., 2000). A similar northeast shift is detected in increasing greenhouse gas scenario simulations (e. g. SCHUBERT et al., 1998).