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The influence of atmospheric blocking on extreme winter minimum temperatures in North America

Kirien Whan (1), Francis Zwiers (2), and Jana Sillmann (3)

(1) KNMI, The Netherlands, (2) The Pacific Climate Impacts Consortium, The University of Victoria, Canada, (3) Center for International Climate and Environmental Research, Norway

Regional climate models (RCMs) are the primary source of high-resolution climate projections and it is of crucial importance to evaluate their ability to simulate extreme events under current climate conditions. Many extreme events are influenced by circulation features that occur outside, or on the edges of, RCM domains. Thus it is of interest to know whether such dynamically controlled aspects of extremes are well represented by RCMs. This study assesses the relationship between upstream blocking and cold temperature extremes over North America in observations, reanalysis products (ERA-Interim, NARR) and RCMs (CanRCM4,
CRCM5, HIRHAM5, RCA4).

Generalized extreme value distributions were fitted to winter minimum temperature (TNn) incorporating blocking frequency (BF) as a covariate, which has a significant influence on TNn. The magnitude of blocking influence in the RCMs is consistent with observations but the spatial extent varies. CRCM5 and HIRHAM5 reproduce the pattern of influence best compared to observations. CanRCM4 and RCA4 capture the influence of blocking in British Columbia and the northeastern United States but the extension of influence that is seen in observations and reanalysis, into the southern United States is not evident. The difference in the 20-year
return value (20RV) of TNn between high and low BF indicates that blocking is associated with a decrease of up to 15\({\circ}\)C in the 20RV over the majority of the United States and in western Canada. In northern North America the difference in the 20RV is positive as blocking is associated with warmer temperatures. The 20RVs are generally simulated well by the RCMs.