Evaluating recent air temperature variability in the Labrador region of northeastern Canada

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Research Context

The Labrador region of northeastern Canada is a climatically sensitive region due to the importance of ocean-and-atmospheric teleconnections and its proximity to the thermohaline circulation downwelling zone in the Labrador Sea. Recent regional warming has occurred at a faster rate than climate models have projected due to the combined influence of natural and anthropogenic climate forcings (Way and Viau, in press). Impacts of warm anomalies are being felt by communities and future warming scenarios suggest that warming will continue throughout the next century (Brown et al., 2012; Finnis, 2013). This contribution discusses recent research into historical and future climate change in Labrador.

Methods

Area-averaged monthly Labrador surface air temperatures from atmospheric reanalyses (n=4), CMIP5 climate models (n=38) and observational datasets (n=3) were extracted for the gridcells covering the region 60°N-66°N and 22°W-66°W using the KNMI climate explorer (Trouet and van Oldenborgh, 2013). Assessment of natural and anthropogenic components of historical climate change in the region followed from the analysis performed by Way and Viau (in press) and used oceanic-atmospheric teleconnection indices made available by the National Oceanic and Atmospheric Administration's (NOAA) Climate Prediction Centre. Spatially distributed air temperatures (e.g. Figure 3) for the Labrador region were generated from 53 climate stations distributed across the Labrador-Ungava with gaps in temporal coverage filled using a reanalysis-based technique (Way and Bonniventure, submitted). Spatial grids were generated at a 1 km resolution using a digital elevation model and a thin plate spline-based interpolation with x-position, y-position, and elevation as independent variables.

Results and Discussion

According to Figure 1 there is strong agreement between the various air temperature observational datasets for Labrador over the past century which all indicate a ~1.5°C warming over the 20th and early 21st century. Over the past several decades when warming has occurred rapidly, there is close agreement between observations and several atmospheric reanalysis datasets (ERA-Interim, MERRA). The synthesis of natural drivers of climate variability in Labrador presented by Way and Viau (in press) (see Figure 2) suggests that interannual air temperature variations show a clear sensitivity to ocean-atmospheric teleconnections and volcanic forcing. The spatial pattern of changes in air temperatures (Figure 3) shows annual air temperatures over much of southeastern Labrador exceeding 0°C over the past decade with the change in decadal mean temperature from 1900-1909 to 2010-2014 (+1.5°C) being similar to the change projected to occur by the mid 21st century (+1.7°C). Comparison of observed air temperatures to future climate scenarios (Figure 4 & 5) suggests that anomalous warmth of 2010 was comparable in annual and seasonal magnitude to that projected for the mid 21st century.

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References