

## Historical Canadian Climate Data: Volunteer Data Rescue Project

While Canada has a relatively short history, observations of its weather have been made for over 250 years. These data exist mainly in archives and libraries. Over the past ten years, with the help of organizations such as the Network in Canadian History and Environment (NICHE), the Meteorological Service of Canada (MSC), McGill University, and the McCord Museum archives, some of these early weather observations have been copied and digitally imaged. Many of the records are from Eastern Canada, where most of the early settlers lived. In order for them to be analyzed scientifically, however, they first needed to be keyed in numerical form.

Fifteen volunteers to key data were recruited through the Canadian Meteorological and Oceanographic Society (CMOS) website and a guest posting on the climate blog RealClimate. From 2010 until 2014, daily weather observations from a dozen different 18<sup>th</sup> and 19<sup>th</sup> century sources were keyed. Additional information from the Atlantic coast was keyed by researchers at the University of Giessen in Germany. Keying these records required a keyboard, a spreadsheet program, and patience. Many of the diaries were in a PDF format, so they could be easily transferred and accessed over the internet. Some knowledge of likely weather conditions was helpful in deciphering data entries (for example, it's unlikely to rain at -10°C). In addition to instrumental measurements, other useful information was found concerning rain, snow and other weather types, and freezing of lakes and rivers, and similar weather-related events. From these data, past frequencies of events such as droughts, heat-waves, floods, cold-snaps, heavy snowfall or ice-storms can be estimated.

The data rescue task of the volunteers was to read (and interpret for obvious errors) the old data sheets and transfer the observations to a standardized spreadsheet. Depending on keying speed and the legibility of the original records, one month of data can be keyed in about 20 minutes to 1 hour. As these observations were made before the establishment of common observation practices, the observations recorded could vary by station, by time and by observer. Software was developed to extract common data and place it in a common form, for example, by estimating minimum and maximum temperatures from hourly observations, correcting barometer readings for temperature, gravity and other effects, sorting wind directions into the nearest 8 cardinal points, and tallying weather descriptions into monthly total rain days, snow days, thunder days, etc. Transfer functions were then estimated to try to compare these data to modern meteorological data available from the MSC website.

While instruments and observing practices have changed and getting them into a state for comparison with modern data is an interesting challenge, much useful information can be found in these diaries. In digital form, these

weather diaries now are being used to examine changes in the weather and climate over periods of hundreds of years. For example, previous analysis of historical weather data from Quebec suggested that winters were quite mild, and summers warm and dry in the 1740s. Other results seem to show that there have been important changes in the number of rain and snow days and in the amount of sunshine and cloud cover over the past two hundred years, leading to more precipitation and less sunshine in recent times. These recovered data can help place more recent changes into historical context, and to help us understand the underlying causes of climate change as it relates to atmospheric circulation and radiation.

Daily temperature readings and estimated minimum and maximum temperatures from regions around the St-Lawrence Valley have been archived at NOAA's paleoclimate data centre (e.g. [https://www.ncdc.noaa.gov/cdo/f?p=519:1:0:::P1\\_STUDY\\_ID:15654](https://www.ncdc.noaa.gov/cdo/f?p=519:1:0:::P1_STUDY_ID:15654)) and pressure data have been provided to the International Surface Pressure Database (<http://rda.ucar.edu/datasets/ds132.0/>)

This was an entirely volunteer project.

Examples of spreadsheets, PDFs files of weather diaries, and a list of weather diaries yet to be keyed are available: (<https://sites.google.com/site/historicalclimatedata/canadian-historical-data-typing-project>).

Questions concerning methods of data input, quality control, or analysis are welcome! Contact: [victoria.slonosky@mail.mcgill.ca](mailto:victoria.slonosky@mail.mcgill.ca) or (450) 923-9482.