EXAMINATION OF RELATIVE HUMDIITY DATA IN CANADA

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Relative humidity strongly affects atmospheric visibility, directly influencing cloud height as well as the formation of smog and fog. Relatively little work has been done examining archival data of relative humidity searching for evidence of climate change as compared to the analysis of temperature and precipitation records. This work is the first study of relative humidity in Canada analyzing data taken on an hourly basis over the period 1953-2003.

Data collected at 75 airport stations located throughout Canada were studied. Large metropolitan cities such as Toronto, Vancouver and Montreal that may act as urban heat islands were excluded. Less than 1% of the data was missing for stations located below 60^{o} N latitude while the corresponding amount of missing data for Arctic stations was less than 10%. In general, relative humidity varies significantly on a daily as well as on a seasonal basis. Hence, the average relative humidity was computed for night, morning, afternoon and evening; and separately for each season. A best fit linear trend was used to estimate the change during 1953-2003 and a statistical t test determined whether the trend was significant at the 5% level.

No discernible difference in relative humidity trends were found for night, morning, afternoon and evening. However, large seasonal differences were observed as shown in

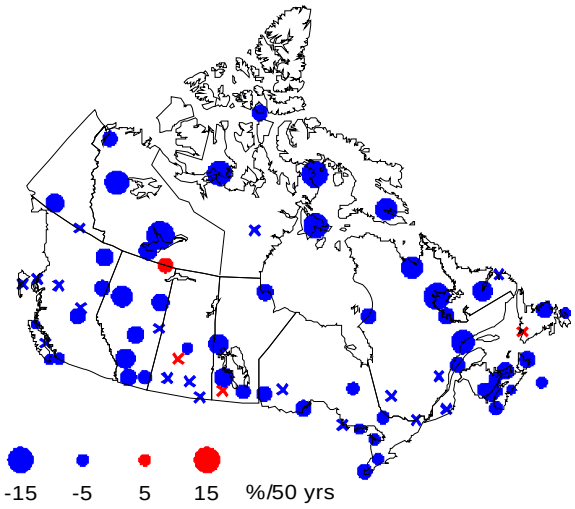
Figure 1. The trends show a substantial decrease in relative humidity during winter and spring throughout all Canada. The largest decreasing trends are found for the Prairies, Arctic and Northeastern Canada. Fewer and weaker trends are observed during summer and fall.

Relative humidity depends on the temperature and absolute water vapour concentration. Hence, hourly measurements of the dew point and temperature as well as daily precipitation totals were also studied. A significant change in the dew point was only found for stations in Northeastern Canada in the winter which experienced a decrease. Mean temperatures increased by about 3°C over 50 years for Western Canada during winter and spring while winter precipitation decreased substantially in Western Canada.

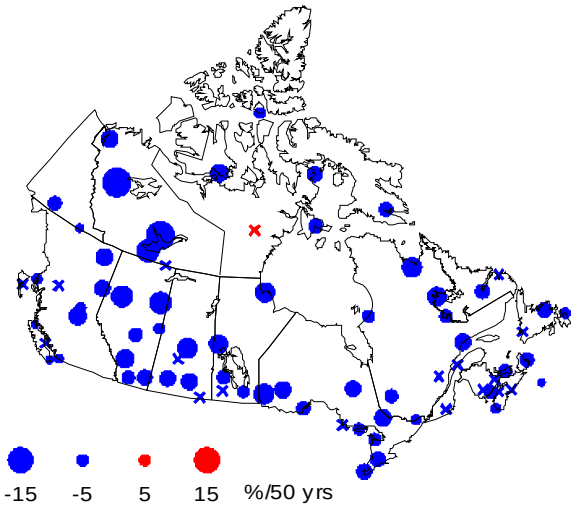
The data was checked for possible discontinuities that could arise due to changes in instrumentation. A decreasing step was observed in winter relative humidity in the early 1970s at several stations. This step appears to coincide with the replacement of the psychrometer by the dewcell. Preliminary analysis shows that this step occurs at very cold temperatures. This does not affect the observed decreasing trends in winter relative humidity at southern and coastal locations.

The decrease in relative humidity is consistent with changes in dew point, temperature and precipitation. It would be interesting to determine whether similar trends exist elsewhere as relative humidity measurements may have the important potential to complement analysis of temperature and precipitation data for detecting climate change.

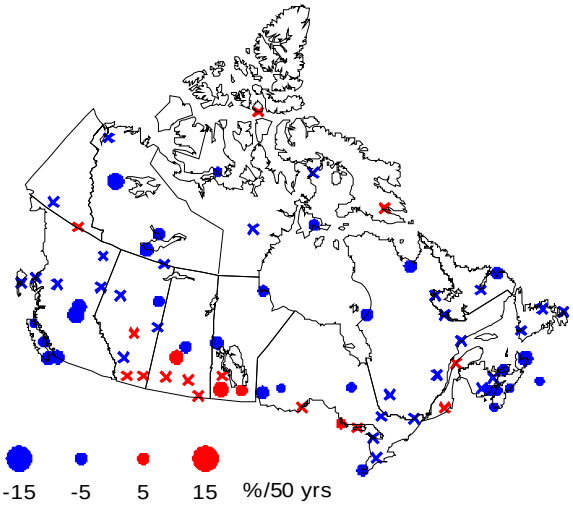
a) Winter 1954-2003



b) Spring 1953-2002



c) Summer 1953-2002



d) Fall 1953-2002

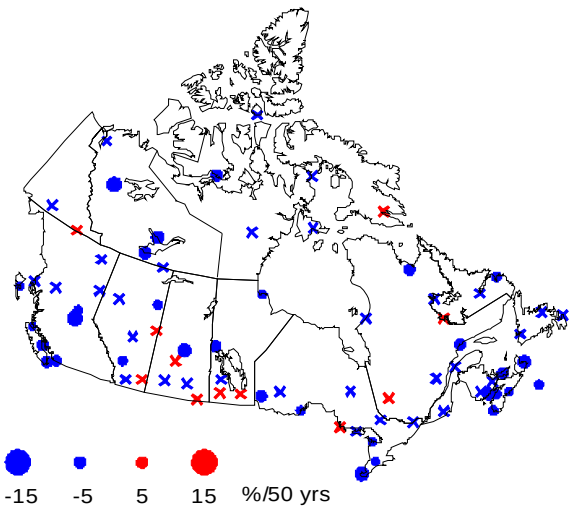


Fig. 1: Trend in Relative Humidity during 1953-2003. Red (blue) dots represent statistically significant increasing (decreasing) relative humidity (at the 5% level). Crosses represent insignificant trends.