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Homogenization and trend analysis of Canadian surface wind speeds

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Long-term wind speed observations are widely used in climate analysis and engineering applications. Surface wind speeds recorded at 122 stations in Canada for the period from 1953 - 2004 are analyzed in this study. Station metadata and logarithmic wind profile are used to adjust hourly wind speeds to the standard 10-m level. Monthly means are then derived. Statistical homogeneity tests along with metadata are used to identify artificial mean-shifts (step-type changes) in the wind speed time series. Anemometer height change was found to be the main known source for discontinuities in wind speed time series. Station relocation, instrument changes, and site condition changes are other causes for wind data discontinuities.

Homogenized Canadian hourly sea level pressure data (surface station observations) are used to derive hourly geostrophic winds, which are compared with the homogenized surface wind speed in terms of long-term trends. Homogenized surface wind speed series and the relevant geostrophic wind series show consistent trends, which are notably different from trends estimated from the un-adjusted (raw) surface wind speed series.