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Statistical adjustment of simulated inter-annual variability in an investigation of short-term temperature trend distributions over Canada

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Plausible climate trajectories towards warmer temperatures are made up of a succession of positive and negative short-term trends. Cooling trends over short durations ($\sim$ 5 to 25 years) are thus to be expected, and related probabilities have to rely on simulations from physically-based climate models. However, because simulations often present offsets in many statistical properties relative to observations, it is important to address the issue of statistical adjustment prior to characterizing expected short-term trend distributions. In this paper, we discuss the impact of statistically adjusting inter-annual variability on short-term cooling probability for locations across Canada and during the current period (2006-2035). Two methods are considered, one that uses a transfer function based on the dissimilarity between simulated and observed detrended annual temperature values (residuals) during a calibration period, and another that uses an autoregressive model of the observational residuals for generating variability. Long-term trends remain invariant in both methods. Results show that although short-term trends in individual simulations are in some cases highly impacted, cooling probabilities based on a multi-model ensemble are only slightly altered by each of the two methods, due to compensational effects. In summary, this paper presents an application where final results are robust to how simulated inter-annual variability is handled.