

Trend in frequency of extreme precipitation events over Ontario from ensembles of multiple GCMs and RCMs

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Summary: Trends in frequency of extreme precipitation events over Ontario are assessed based on ensembles of NARCCAP RCMs and CMIP3 GCMs. The results show that there are significant increasing trends in heavy precipitation days. The increasing trends are significant in summer and winter, south and east but weak in other seasons and areas.

Introduction: Ontario is vulnerable to climate change. Mean temperature and total precipitation are significantly increasing, what's the situation of extreme precipitation events?

Data and Methods

Bias correction: $y^{(1)} = (y - R_c) \times r_0 \frac{E_o}{E_m} + 1.0$

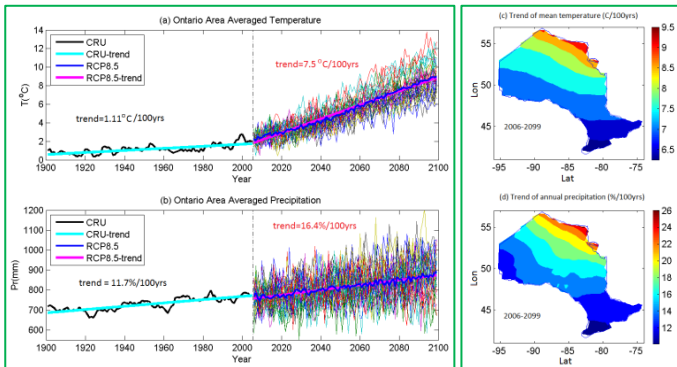
Downscaling: $Y = a_0 + a_1 y' + bt + \epsilon$

Indices: R10mm, R20mm, R95p and R99p

Trend estimation: $\ln[\lambda_t(i)] = \alpha + \beta i + \epsilon$, $P\{k\} = \frac{e^{-\lambda_t} (\lambda_t)^k}{k!}$

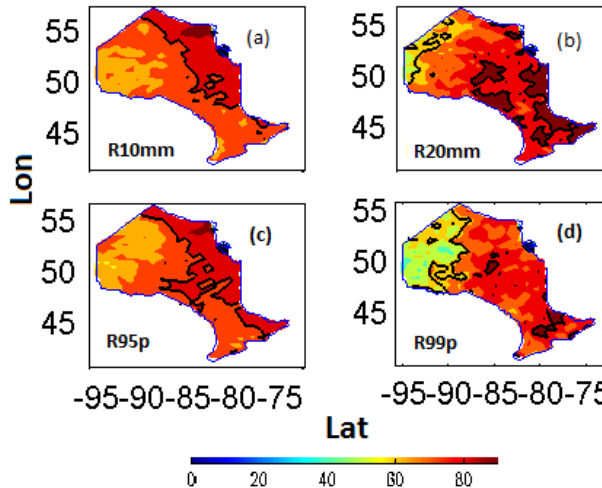
Results

(1) Trends in annual mean temperature and precipitation



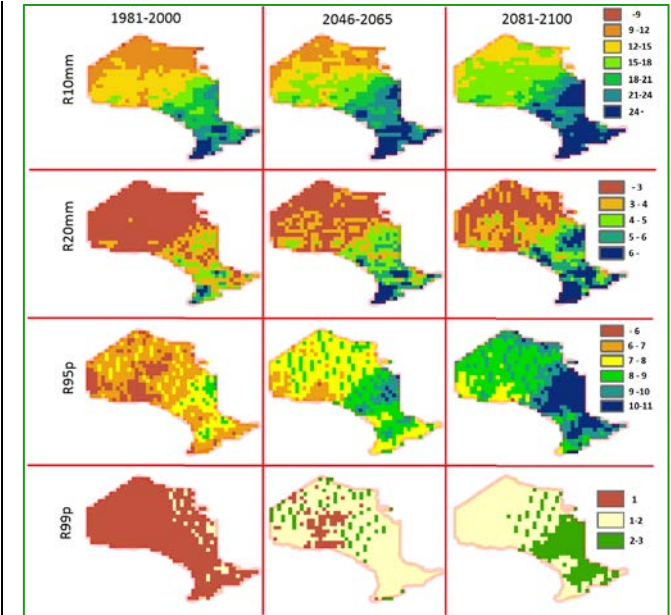
Temperature and precipitation increased in the last century and will continue increase faster in this century with larger trends in the north than south.

(2) Likelihood of significant increasing trend in counts of extreme precipitation events



Counts of extreme precipitation events (heavy and very heavy precipitation, wet and very wet days) are likely (with a 66% chance) to significantly increase in eastern areas; very heavy precipitation days is very likely (with a 90% chance) to increase in central and eastern areas.

(3) Mean counts of extreme events for 3 periods



Mean numbers of extreme events for 3 periods

Extreme precipitation events mainly happen in central and southern areas and the high frequency areas are likely to expand to north.

Conclusion

While mean temperature and precipitation are continuing increase, it is likely that the counts of extreme precipitation events significantly increase and the areas with high frequency of extremes expand from southeast to northwest.

*R10mm (heavy precipitation days): days with daily pr>10mm; *R20mm (very heavy precipitation days): days with daily pr>20mm;
*R95p (very wet days): days with daily pr > 95th percentile; *R99p (extreme wet days): days with daily pr > 99th percentile