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## Evaluation of the daily cycle in the simulation of the ClimEx large-ensemble

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To estimate the impact of climate change on our society we need to use climate projections based on numerical models. These models make it possible to assess the effects on climate of the increase in greenhouse gases (GHG) as well as natural variability. We know that the global average temperature will increase and that the occurrence, intensity and spatio-temporal distribution of extreme precipitations will change. These extreme weather events cause droughts, floods and other natural disasters that have significant consequences on our life and environment. Precipitation is a key variable in adapting to climate change.

This study focuses on the ClimEx large ensemble, a set of 50 independent simulations created to study the effect of climate change and natural variability on the water network in Quebec. This dataset consists of simulations produced using the Canadian Regional Climate Model version 5 (CRCM5) at 12 km of resolution driven by simulations from the second generation Canadian Earth System Model (CanESM2) global model at 310 km of resolution.

The aim of the project is to evaluate the performance of the ClimEx ensemble in simulating the daily cycle and representing extreme values. To get there, 30 years of hourly time series for precipitation and 3 hourly for temperature are analyzed. The simulations are compared with the values from the simulation of CRCM5 driven by ERA-Interim reanalysis, the ERA5 reanalysis and Environment and Climate Change Canada (ECCC) stations. An evaluation of the sensitivity of different statistics to the number of members is also performed.

The daily cycle of precipitation from ClimEx shows mainly non-significant correlations with the other datasets and its amplitude is less than the observation datas from ECCC stations. For temperature, the correlation is strong and the amplitude of the cycle is similar to observations. ClimEx provides a fairly good representation of the 95, 97, 99<sup>th</sup> quantiles for precipitation. For temperature it represents a good distribution of quantiles but with a warm bias in southern Quebec. For precipitation hourly maximum, ClimEx shows values 10 times higher than ERA5. For temperature, minimum and maximum values may exceed the ERA5 limit by up to 20°C. For

precipitation, the minimum number of members for the estimation of the 95 and 99<sup>th</sup> quantiles and the mean cycle is between 15 and 50 for an estimation error of less than 5%. For the 95, 99<sup>th</sup> quantiles of temperature, the minimum number of members is between 1 and 17 and for the mean cycle 1 to 2 members are necessary to obtain an estimation error of less than 0.5°C.