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Assessment of the influence of the global climate model (GCM) generation on Empirical Satistical Downscaling outputs: A case study from Canadian GCMs

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This work analyze the influence of Global Climate Model (GCM) as a driver element on Empirical Statistical Downscaling (ESD). The later establishes empirical relationships between local climate variables [predictands] and the characteristics of large-scale synoptic atmospheric circulation patterns from global climate models (GCM) [predictors]. Three generations of the Canadian GCM respectively CGCM1, CGCM2 and CGCM3 are considered as drivers for ESD simulations. Simulated variables are minimum and maximum temperatures and precipitation at daily scale. The database includes the above variables observation for a midlatitude and a subarctic sites and the corresponding associated large scale atmospheric circulation predictors from the Canadian GCMs.
The ESD modelling was carried out from two LSD tools: the Automated Statistical Downscaling (ASD) and the Statistical DownScaling Model (SDSM). The first is based on an objective selection of predictors from a stepwise or partial correlation whereas the second is processed from a subjective user-based selection of predictors. The simulations cover as well as the historical period (1961-2000) than the future (projections in 2020, 2050, 2080).
The results highlight the profit of GCM evolution on ESD outputs in terms of magnitude and expected improvements regarding physical processes. The need and utility of ESD regarding the gap between raw advanced GCM data (CGCM3) and ESD outputs for the considered sites and variables is also discussed.