The grueling journey of Regional Climate Model validation

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Validating regional climate models (RCM) has never been an easy task since difficulties come from both observations and RCMs. Even nowadays, typical RCM grid meshes are still too coarse to compare easily with station observations. Gridded observations datasets, coming from in situ or remote sensing data, are very useful but have their limitations. The emergence of simulations produced at convection-resolving resolutions will certainly exacerbate many observations-related issues.

Most of RCM-related error sources fall into three main categories: formulation, inputs and configuration. Formulation-related problems occur when some processes are missing or misrepresented. It includes making use of parameterizations that are not as suited for RCMs since they were originally tailored for coarser resolution Global Climate Models (GCM) or assimilated Numerical Weather Prediction (NWP) models. The second category deals with the sources related to RCM inputs like their driving data –either GCMs or reanalyses– used to provide lateral boundary conditions and prescribe ocean surface conditions. Since many climate processes are very sensitive to surface representation, this category also includes problems linked to geophysical data describing surface properties of each grid cell. Finally, RCM configuration choices like domain size and location, horizontal and vertical resolution, and nesting technique are known to affect climate simulations and modulate internal variability. Major progresses have been made to estimate uncertainties related to RCM configuration choices but, depending on the phenomenon under study, they can have consequences on biases.

As an illustration of these different sources of biases, examples will be taken from various evaluations of the current and previous versions of the Canadian Regional Climate Model (CRCM). We also want to emphasize the key role played by both the participation in international regional modeling initiatives and the close contact between modelers and users, through a boundary organization like Ouranos, in identifying some of CRCM's biases.