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Building an ensemble of climate scenarios for decision-making in hydrology: benefits, pitfalls and uncertainties

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Using climate model output to explore climate change impacts on hydrology requires several considerations, choices and methods in the post treatment of the datasets. In the effort of producing a comprehensive data base of climate change scenarios for over 300 watersheds in the Canadian province of Québec, a selection of state of the art procedures were applied to an ensemble comprising 87 climate simulations. The climate data ensemble is based on global climate simulations from the Coupled Model Intercomparison Project – Phase 3 (CMIP3) and regional climate simulations from the North American Regional Climate Change Assessment Program (NARCCAP) and operational simulations produced at Ouranos.
Information on the response of hydrological systems to changing climate conditions can be derived by linking climate simulations with hydrological models. However, the direct use of raw climate model output variables as drivers for hydrological models is limited by issues such as spatial resolution and the calibration of hydro models with observations. Methods for downscaling and bias correcting the data are required to achieve seamless integration of climate simulations with hydro models. The effects on the results of four different approaches to data post processing were explored and compared.
We present the lessons learned from building the largest data base yet for multiple stakeholders in the hydro power and water management sector in Québec putting an emphasis on the benefits and pitfalls in choosing simulations, extracting the data, performing bias corrections and documenting the results. A discussion of the sources and significance of uncertainties in the data will also be included. The climatological data base was subsequently used by the state owned hydro power company Hydro-Québec and the Centre d'expertise hydrique du Québec (CEHQ), the provincial water authority, to simulate future stream flows and analyse the impacts on hydrological indicators.
While this submission focuses on the production of climatic scenarios for application in hydrology, the submission « The (cQ)2 project: assessing watershed scale hydrological changes for the province of Québec at the 2050 horizon, a collaborative framework » by Catherine Guay describes how Hydro-Québec and CEHQ put the data into use.