PARALLEL SESSION C : IMPACTS AND APPLICATIONS
C3: REGIONAL SCALE HYDROCLIMATE: FROM OBSERVATIONS TO MODELLING TO APPLICATIONS

Precipitation downscaling using the Intermediate Complexity Atmospheric Research model (ICAR) in Western Canada

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Performance of precipitation simulations in climate and weather forecast models over complex terrain are challenging as the physical atmospheric processes are difficult to model. High spatial variability of meteorological variables (e.g. precipitation, temperature, and wind) in complex terrain has important hydrologic consequences, thus requiring careful treatment particularly for climate change simulations. However, the assumption of stationary relationships between atmospheric variables and local observations in both current and future climates, as applied in statistical approaches, and high computational cost of dynamical models such as the Weather Research and Forecasting model (WRF) as run for current and future climates with both sufficient resolution to represent alpine terrain, with ensembles based on many global climate models necessitate the consideration of an alternative solution that considers the main physical processes while minimizing computational resources. In this study, downscaling of the meteorological variables is carried out using the Intermediate Complexity Atmospheric Research model (ICAR) (Gutmann et al., 2016). Outputs from the regional climate models applied in the North American regional climate change assessment program (NARCCAP) have been used as the initial and boundary conditions and the model is run over the Canadian Rockies and southern Yukon Territory. Results for precipitation are compared with local observations from the Canadian Rockies Hydrological Observatory and Wolf Creek Research Basin. Results show that with reasonable reductions in model complexity, we can still obtain reasonably good simulation for precipitation in complex terrain in cold regions. Reliable downscaling of orographic precipitation with non-linear characteristics and higher spatiotemporal variability improves the hydrometeorological prediction uncertainties. This is important to understand the interactions between precipitation phase change, snow energetics, and glacier dynamics in alpine areas under current and future climates in Canadian Rockies and northern Canada. The results help to better assess the vulnerability and resiliency of the water resources that are dependent on alpine snow and glaciers and so support the objectives of GEWEX's International Network for Alpine Research Catchment Hydrology (INARCH).

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