MESH configuration for hydrological reanalysis and climate change projection in the Fraser River Basin

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The Fraser River Basin (FRB) in British Columbia is one of the important watersheds of Western North America, encompasses a diverse range of biogeoclimatic zones from dry to wet, and supports a population of approximately three million people. Climate change due to warmer winters and phase change of precipitation has already influenced the hydrology of the FRB and will continue to have an impact on the environment, the economy, and water resources planning and management. To address water security concerns in Canada, the Global Water Futures (GWF) program has initiated and developed the production of reanalysis and climate change scenarios covering major river basins, including FRB using the Modélisation Environnementale communautaire - Surface Hydrology (MESH) modelling framework. MESH is well-suited for this application due to its ability to represent large-domain, cold-region hydrology.

The MESH model has been set up at 0.125°×0.125° (longitude/latitude) grid scale. By creating land cover sub-classes based on tree species, the heterogeneity within the FRB's needleleaf forests was captured. To configure the MESH model, the initial parameters of Mackenzie River Basin (MRB) were used, and the model was calibrated based on nine streamflow observations. A benchmark simulation demonstrated a reasonable performance of the MESH model compared to the observed streamflow across the basin's diverse landscape. Summary metrics indicated acceptable streamflow bias values for all nine major streamflow stations selected for analysis. This MESH configuration will be used to generate a hydrological climate change projection for the remainder of the 21st century, providing information for decision-makers to develop adaptation strategies in response to the changing hydrological regime.