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Improvement of Environment and Climate Change Canada's Gem-Hydro Streamflow Forecasting System

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Abstract : A new experimental streamflow forecasting system was recently implemented at the Environment and Climate Change Canada's (ECCC) Canadian Centre for Meteorological and Environmental Prediction (CCMEP). It relies on CaLDAS (Canadian Land Data Assimilation System) for the assimilation of surface variables, and on a surface prediction system that feeds a routing component. The surface energy and water budgets are simulated with the SVS (Soil, Vegetation, and Snow) Land-Surface Scheme (LSS) at 2.5-km grid spacing over Canada. The routing component is based on the Watroute routing scheme at 1-km grid spacing for the Great Lakes and Nelson River watersheds. The system is run in two distinct phases: an analysis part and a forecast part. During the analysis part, CaLDAS outputs are used to force the routing system, which performs streamflow assimilation. In forecast mode, the surface component is forced with the Canadian GEM atmospheric forecasts and is initialized with a CaLDAS analysis. Streamflow performances of this new system are presented over 2019. Performances are compared to the current ECCC's operational streamflow forecasting system, which is different from the new experimental system in many aspects. These new streamflow forecasts are also compared to persistence. Overall, the new streamflow forecasting system presents promising results, highlighting the need for an elaborated assimilation phase before performing the forecasts. However, the system is still experimental and is continuously being improved. Some major recent improvements are presented here and include, for example, the assimilation of snow cover data from remote sensing, a backward propagation of assimilated flow observations, a new numerical scheme for the routing component, and a new reservoir model.

Keywords : assimilation system, distributed physical model, offline hydro-meteorological chain, short-term streamflow forecasts
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