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Technological Innovations in Continental Scale Routing utilizing the USGS National Hydrologic Model

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Abstract: The intricacies of the streamflow routing technique in hydrological modeling have the capability to alter the timing of the resulting streamflow more than any other single part of the modeling process. Many large-scale models use a relatively simple non-dynamical channel flow as a routing scheme, where storage of water in a reach is linearly related to inflow and outflow rates, in order to model streamflow delay and (flood) attenuation. Considerable and valuable gains in model performance have been identified in large floodplains by switching from non-dynamical to dynamical routing. In dynamical routing, streamflow is delayed and attenuated while changing the characteristics of the streamflow depth and velocity. This is done by approximating a wave speed for the streamflow with kinematic calculations on a particle. Kinematic wave tracking is more physically realistic but is also more computationally expensive than the non-dynamical routing. Assessment of dynamical routing on the continental-scale needs to take into account the increase of computational expense along with the limitations of data resolution for deriving parameter and calibration datasets. In a new continental-scale model utilizing the USGS National Hydrologic Model, we test the effect of dynamical routing on model performance. In addition, we explore the enhancement of continental-scale streamflow routing with gaining and losing streams, again investigating the trade-off between model physical realism, data availability, and computational expense.

***Keywords**:* National Hydrologic Model; streamflow routing; kinematic wave tracking