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Reproducibility and uncertainty for national Canadian hydrometric stations

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Reliable and accurate river streamflow or discharge measurement and reporting are essential for engineering, economic, and social decision-making. Discharge values are often perceived as true and deterministic by users, modelers, and decision-makers. In this study, the processes of discharge estimation by the Water Survey of Canada, WSC, are presented. The process of inferring the discharge (water volume over time) based on stage (water level) through stage-discharge relationships or "rating curves" including related terminologies is described. Multiple practices of rating curve construction and discharge estimation across WSC hydrometric stations are explored. Major processes of "override" and "temporary shift" which significantly affect the discharge estimation are elaborated. The reproducibility of the published discharge data using data from the production process for approximately 1750 active hydrometric stations operated by WSC is examined. Other impacts of temporary shift and override have been evaluated on the properties such as discharge residuals or performance metrics. Recommendations are made for wider access to metadata and measurements that are essential to quantify the reproducibility and uncertainty of reported discharge values. Open science, particularly Earth system modeling, demands clear communication of reproducibility, and uncertainty of published discharge.