

EGU22-5381

<https://doi.org/10.5194/egusphere-egu22-5381>

EGU General Assembly 2022

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Quantifying the impact of bathymetry changes on flood events for the Trois-Lacs Basin

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Floods are a major threat to the security of populations worldwide. Their impact is dependent on the flood extension and water levels, topographic factors, and many other variables. Meteorological factors such as precipitation, snow melt and base flow also influence the magnitude of flood events. Factors like river morphology, slopes, presence of flood plains, vegetation and soil types determine the response of the river or lake to meteorological conditions and hydrological events. Meteorological factors tend to be cyclical while topography is generally considered to remain constant over extended periods of time. However, river bathymetry is subject to changes over time due to sediment transport. For example, sediment re-positioning and accumulation can modify the bathymetry of water bodies. Furthermore, lakes or reservoirs receive and accumulate sediments transported from upstream which could influence flood levels. In this study we use a two-dimensional hydraulic model (Telemac2D) to simulate different flood scenarios coupled with several different bathymetries of Trois-Lacs Lake in the province of Quebec, Canada. Four bathymetries were obtained between November 2020 and August 2021 and 3 historical bathymetries were also provided (yrs, 1974, 2004, and 2019). To compare the bathymetries, total 'available water volume' is calculated, taking a common and constant reference water surface elevation. Streamflows entering the lake system were estimated using Hydrotel, a physics-based semi distributed hydrological model. These streamflows are used to calibrate the two-dimensional hydraulic model with measured water levels. The project may help to establish a direct relation between sediment shifting and deposition and water distribution for extreme flood events, while also allowing the local community to improve measures for civil security and land-use planning at a regional scale.