THREE DIMENSIONAL MODELING OF NELSON RIVER ESTUARY

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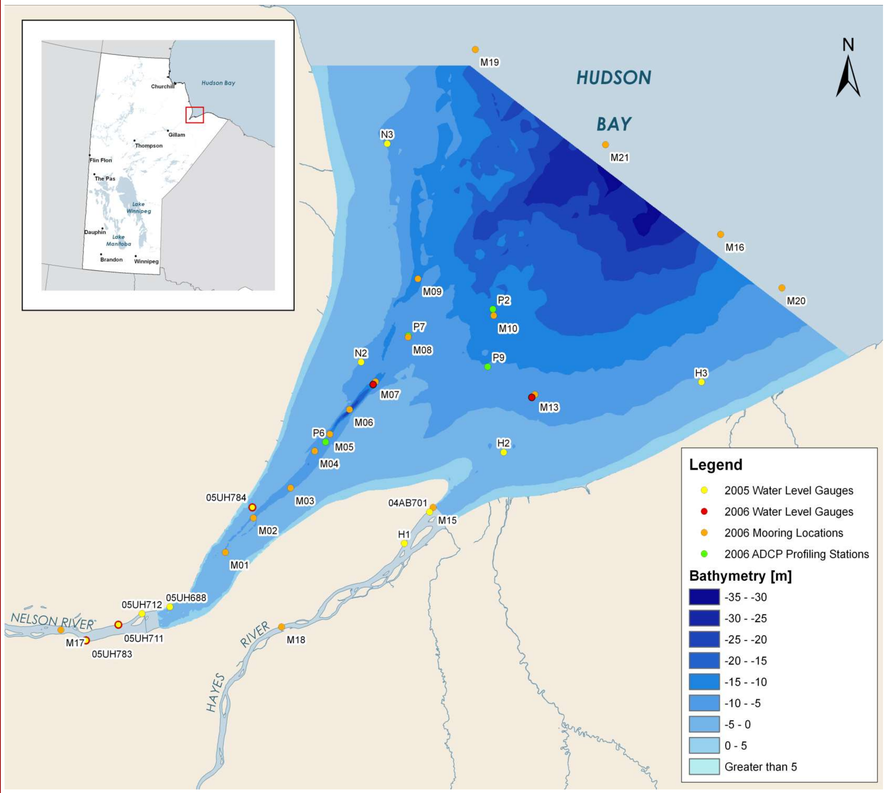
Nelson River Estuary & Field Measurement



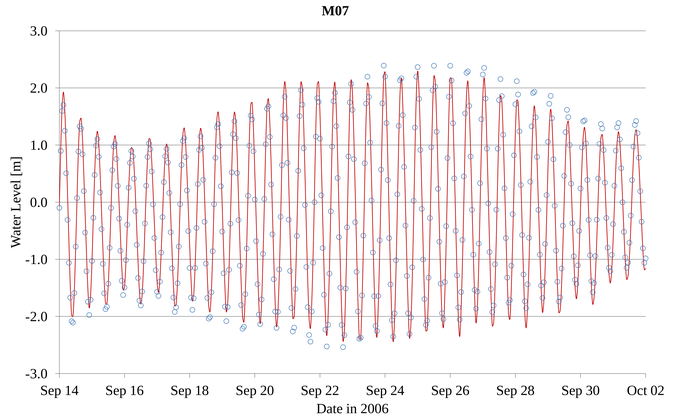
The Nelson River is regulated for hydroelectric generation downstream of Lake Winnipeg, and is a major component of Manitoba Hydro's hydraulic system. This figure shows a bathymetric map of Nelson River estuary including the position of the water level gauges, mooring locations (temperature and salinity loggers) and ADCP profiling stations.

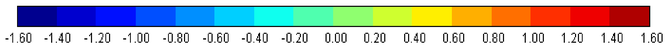
Computational Hydrodynamic Model & Set up

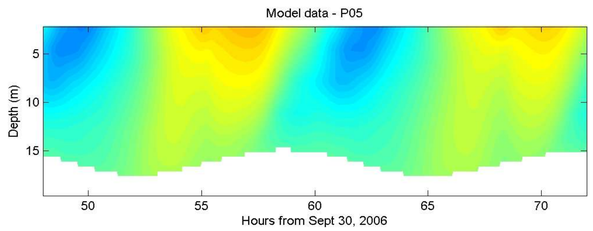
The MIKE 3, a computational fluid dynamic (CFD) model, is based on the numerical solution of the three-dimensional incompressible Reynolds averaged of Boussinesq and hydrostatic pressure on a finite volume framework. In the horizontal plane an unstructured grid is used while in the vertical domain a structured discretization is used.

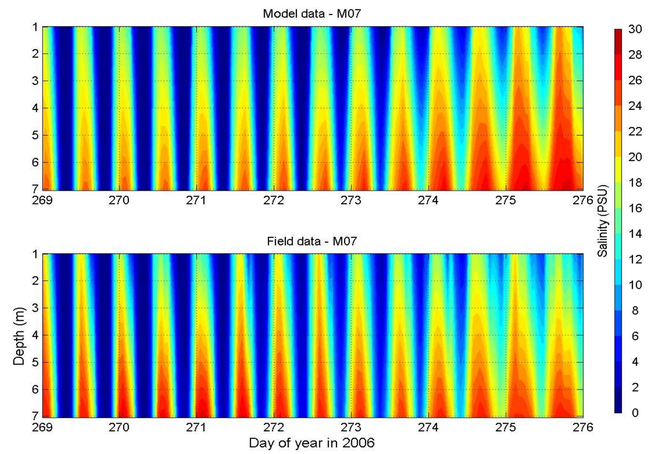
The model was forced by tides, freshwater discharge and constant Coriolis force at the reference latitude of 57°. Time-varying fresh water discharge, measured temperature and zero salinity were prescribed at upstream boundaries in Nelson and Hayes Rivers. At the downstream boundary, spatio-temporal water level, temperature and salinity obtained from monitoring stations (M19, M21, M16, and M20) were prescribed. Simulations were performed with 10 Sigma layers for 25 days, from 8 September until 3 October in 2006 with Smagorinsky horizontal mixing and k-ε vertical mixing.

Model Calibration & Validation





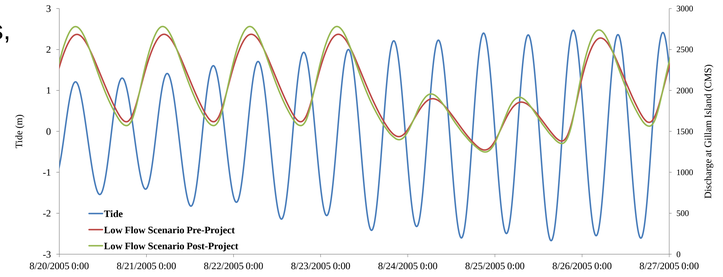


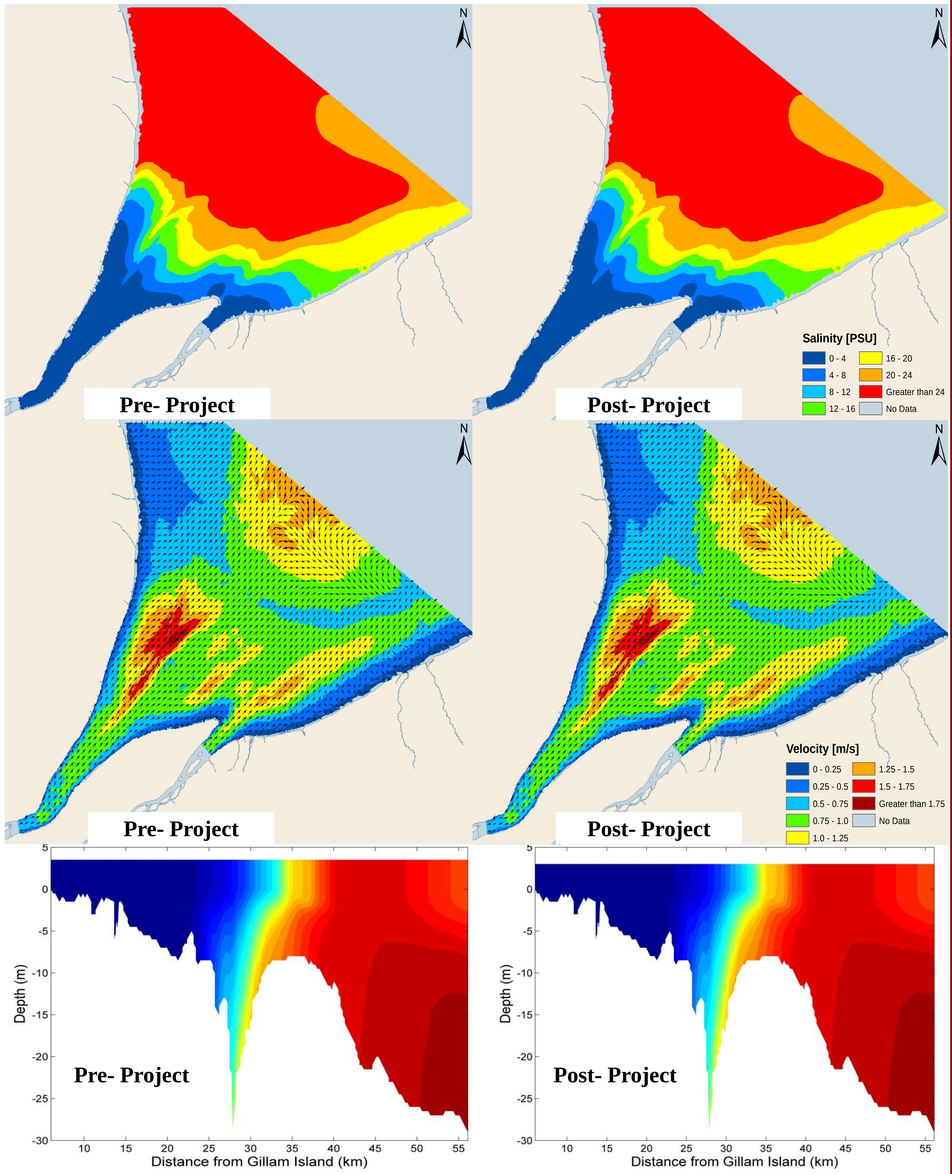


Comparison of instantaneous modeled and measured water level (blue dots are field data), current velocities and salinities.

Pre- Vs. Post- Conawapa (Preliminary Low Flow Scenario)

Flow and tide BCs, simulated surface salinities, surface currents and thalweg salinity profiles during spring ebb tide.





Acknowledgements

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