Model Study of the Impact of Hydropower Developments on the Oceanography of Hudson Bay (*MSc Thesis Seminar)*

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ABSTRACT: Hudson Bay is a large inland sea in northern Canada which is characterized by high tides and strong residual currents. It is relatively shallow and isolated from the ocean, and its physical oceanography is largely dependent on freshwater river runoff, surface wind, freshwater and heat fluxes. The freshwater budget of Hudson Bay has a substantial impact on the environment of the basin, its salinity, stratification of the water column and sea-ice formation. The export of fresh surface waters via the Hudson Strait into the Labrador Sea have been a center of intense studies because of their potential effect on the vertical stratification and deep convection in the Northwest Atlantic Ocean.

Over the past several decades, some of the largest rivers which discharge into Hudson Bay (Nelson, Churchill, Moose, and La Grande Riviere) have been affected by dams, diversions, and reservoirs constructed for generation of hydroelectricity. The thesis presents results from a model study of the impact of this development on the oceanography of Hudson Bay. I use an eddy-permitting, non-tidal model of the North Atlantic and Hudson Bay forced with NCEP atmospheric forcing over the period from 1948 up to 2005. River run-off is determined based on Environment Canada data for 23 rivers which discharge into the HBS collected between 1964 and 2005.

The model results suggest that the hydropower developments in the mid-1970s had two major effects on the characteristics of river runoff into Hudson Bay. Firstly, they reduced the amplitude of seasonal cycle of the freshwater input of some major rivers. Secondly, they caused a change in the spatial distribution of annual mean river runoff. The river diversions had a significant impact on the ocean characteristics of the James Bay. The model simulations suggest that the surface salinity in this region increased since the mid-1970s also affecting processes of vertical mixing and ice-formation.

ALL ARE WELCOME!