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Tidal hydrodynamics of the Hudson Bay and its impact in the global ocean tide

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In 2012, the global ocean tides atlas FES has been updated with the financial support of the French Space Agency (CNES). The examination of the tidal energy budget from the hydrodynamic solution has demonstrated the critical impact of the tidal dissipation in Hudson Bay (over-estimated in FES2012) for the accuracy of global solution especially in the Atlantic. To further explore this issue, a regional study of the tidal hydrodynamics of the Hudson Bay has been carried out with a numerical model (the finite elements model T-UGOm) and observations (altimetry-derrived and in situ data). This study aims to answer questions about the role of tidal dissipation in the Hudson system in relation with the global ocean tides.

Among the numerical parameters, the two most critical in terms of tidal dissipation are the bathymetry and the friction coefficient. A sensitivity study has been carried out using the standard bathymetry data set (GEBCO, ETOPO, Smith and Sandwell) and prescribing regionally varying friction coefficients. In addition, a new Hudson bay bathymetry has been reconstructed from ship tracks sounding and other direct depth measurements.

Despite these improvements, mostly due to the reconstructed bathymetry, the total energy dissipated by the bottom friction in the Hudson Bay is still significantly too large. The reason for that could be the large remaining uncertainties in the bathymetry especially in Fox Basin. Another reason could be the limitation of 2D modelling in accurately reproducing the energy dissipation in a resonant system such as the Hudson Bay, especially the effect of vertical momentum diffusion in the water column. Consequently, a 3D configuration has been set up to extend our sensitivity study. The results of this work will be presented, concentrating particularly on the energy budget.