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Barotropic Hydrodynamics at high Frequency around the archipelago of Saint Pierre and Miquelon

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The Saint Pierre and Miquelon (SPM) archipelago is located on the western border of the Newfoundland Grand Banks (GB). This region is an area of great ecological and economic interests. However, hydrodynamical conditions remains poorly known.

Current and Temperature/Salinity measurements have been recently performed around SPM. Strong diurnal currents in the depth averaged speeds with the period of O1 (25.95 h) have been observed. This diurnal period is noticeable because the main tidal components in the archipelago are dominantly semi diurnal. However, a diurnal anomaly has already been described circulating around the Grand Bank, especially on the Eastern part of the Bank. In addition, oscillations in the barotropic current are observed with an unusual period of two days. They can reach 50 cm s-1, which is larger than the effect of the tide. These oscillations are not permanent, but last during a few days after a meteorological wind event.

After presenting these unique observations, this study focuses on the understanding the hydrodynamic processes related to these two oscillating phenomena. Is it possible to relate the diurnal and two day period currents to the dynamics on the whole GB? What is the importance of the local dynamics? To answer these questions, a 2 km regional model has been implemented in the region of the Gulf of Saint Lawrence, Nova Scotia, Newfoundland and SPM. The two dimensional horizontal model was running with tide and/or wind and atmospheric surface pressure forcings. The impact of the wind and of the barotropic tide at a local scale has then been studied. Model results were validated using in-situ and tidal gauges data. These simulations allow exploring and characterizing the processes explaining these diurnal and two day oscillations around SPM and their spatial distribution on the Grand Banks.