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# Isotopic monitoring of the St. Lawrence and Ottawa rivers, Eastern Canada – Linkage with seasonal and interanual hydroclimatic variability

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Long term records of isotopes in large rivers are needed to model global water cycle in relation with high frequency climate instabilities. From this view point, the St. Lawrence River that ranks $17^{th}$ among world rivers with respect to its discharge rate, presents specific features. It differs from most other major rivers due to the presence of the Laurentian Great Lakes at its head (the largest fresh water body in the world) that constitute a strong isotopic buffering reservoir. In the present study, isotopic compositions of the St. Lawrence and Ottawa rivers have been monitored on a weekly to bi-weekly basis since 1997. Samples are collected at 3 sites : one, near Montreal, represents outlet waters from the Great Lakes, another, near Quebec City, the St. Lawrence River at its estuary, and a third one, at Carillon, near the outlet of the Ottawa River (St. Lawrence's largest tributary). Among other isotopic measurements, the seasonal variability of $^{18}$O and $^{2}$H-contents of water has been more particularly controlled in relation with current hydrological parameters. Waters from the Great Lakes are isotopically heavy (6 year mean $\delta^{18}$O=-7.1$\pm$0.5 ‰, $\delta^{2}$H=-54$\pm$3 ‰) when compared to the Ottawa River ($\delta^{18}$O=-10.8$\pm$0.6 ‰, $\delta^{2}$H=-80$\pm$3 ‰). The estuary of the St. Lawrence shows intermediate values ($\delta^{18}$O=-8.6$\pm$0.9‰, $\delta^{2}$H=-65$\pm$7 ‰). The seasonality of isotopic records is partly driven by isotopically variable inputs from local precipitation. The input signal is subsequently dampened and dephased by 2 to 3 months, due to i) the residence time of water in the basin, ii) its evaporation and iii) the isotopic evolution of the winter snow cover. Interannual isotopic variability of water at the head of the St. Lawrence is relatively small. Nonetheless, a slight but steady enrichment in heavy isotopes has been observed from year to year in late summer-early fall since 1997. Interannual variability of the Ottawa River is more im-

portant and follows closely isotopic variations in local precipitations. The interannual isotopic variability of the St. Lawrence at its estuary depicts a pattern differing from simple mixing between the outflow from the Great Lakes and of the Ottawa River, probably due to contributions of smaller tributaries originating from the Appalachians and the Laurentide mountains.