Characterization of the St. Lawrence Estuary's suspended matter size and composition

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The St. Lawrence Estuary is a large seasonally ice-covered estuarine system in eastern Canada. The suspended particulate matter (SPM) dynamic in this estuary is strongly influenced by winds, tides, river runoff, and coastal jets. The particle size distribution (PSD) is an important property of the SPM as it may affect sinking rates, particle re-suspension and distribution of pollutants. A deeper understanding of the PSD helps to determine the vertical and horizontal fluxes of the matter in the water column.

Although information exists concerning the composition and the SPM dynamic in the St. Lawrence Estuary in summer, there is a lack of recent spatial and vertical characterization while no winter data is available. Thus, the purpose of this study is to better characterize the SPM particle size and sedimentological properties in the St. Lawrence Estuary during summer and winter conditions.

The PSD was measured using a laser diffractometer LISST-100X directly in the water column during the summer of 2010 and in the laboratory using water samples taken at discrete depths for winter 2019. X-ray diffraction and fluorescence analysis were used for the characterization of the particles' mineralogical and chemical composition from which the detrital sources were evaluated.

Results show that SPM concentration is spatially more variable during summer than in winter. In contrast, the PSD's is inverted in winter with relatively smaller size particles upstream and larger particles downstream. The depth distribution of the PSD shows slight differences between the seasons. In summer, larger particles are mostly present at the pycnocline whereas in winter, larger particles reach deeper depths and are mostly of inorganic origin. Throughout the estuary for both seasons, particulate inorganic matter contributed the most to total SPM. The winter mineralogical and chemical composition of the SPM was similar throughout the estuary confirming previous studies indicating an origin from the Canadian Shield. Taken as a whole, this study provided valuable new information on suspended matter dynamics in a large Subarctic estuarine environment.