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Long-term trends in Hg sources in lakes sediments inferred from Hg isotopes

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Mercury (Hg) atmospheric pollution presents a significant threat to both environmental and human health. Due to long-range transport, atmospheric Hg pollution can reach remote areas and accumulate into forested catchments compartments such as vegetation and soil, as well as in lake sediments. We studied long-term trends of Hg concentrations and Hg isotopes in the sediments of 7 eastern Canadien lakes that vary in terms of catchments characteristics and water residence time (WRT) and in terms of average and long-term trends in pH and dissolved organic carbon (DOC). Overall, the long-term Hg sediment record shows a clear increase in Hg concentration for all the lakes. However, in the last 100 years, the lakes had different responses. Some are showing a small Hg concentration decrease in the last 10-20 years, some are showing a strong and recent increases while others had constant concentrations over the last 40 years. This array of response suggests contrasting Hg inputs and sources. The isotope composition of the sediments strongly varies between the 7 lakes. Based on the δ^{202}Hg and Δ^{199}Hg signatures, we conclude that some lakes have recent sediments converging toward the isotopic composition of the catchment organic soils while some have an isotopic composition close to that of the atmospheric inputs in incident wet precipitation. Lakes with small WRT and high DOC concentrations are more prone to have a Hg isotopic signal close to the soil catchments while lakes with large WRT and low DOC are closer to the atmospheric signal. The widespread increase in DOC observed in northern hemisphere lakes in the last decades is probably enhancing the transfer of Hg from catchment to lakes which may have impacts on Hg trends and isotopic composition in sediments. The combination of isotopic Hg measurements in terrestrial and lake compartments is a promising tool to elucidate potential changes in long-term fluxes and sources.