Gaseous Hg stable isotope variations in the free troposphere of the Pic du Midi Observatory

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Mercury (Hg) stable isotope abundances show large variations across biogeochemical reservoirs. These variations result from the gradual fractionation of heavy/light and even/odd Hg isotopes during the multiple physicochemical processes that move Hg across the Earth's surface. No less than five Hg isotope fingerprints (not all understood!) characterize its source, or code for the transformations that Hg undergoes in its biogeochemical cycle. Tracing the dominant natural and anthropogenic Hg emissions at the global level is a challenge. The further Hg emissions travel from their source, the more likely it is that oxidation/reduction, sorption or (de-)methylation reactions modify the original source Hg isotope signatures.

In this presentation we will review Hg isotope signatures of 1. major natural and anthropogenic emission sources, 2. different forms of atmospheric Hg. We will present new observations on atmospheric Hg speciation and Hg isotopic composition of total gaseous Hg (TGM) in the free troposphere of the Pic du Midi Observatory (2877m, France). Small but significant variations in δ^{202}Hg (-0.04 ‰ to 0.51 ‰), and Δ^{199}Hg (-0.11 ‰ to -0.31 ‰) were observed throughout the sampling period and are similar to published observations in the terrestrial boundary layer. The δ^{202}Hg variations were highly related to the sources of TGM at the Pic du Midi, with higher values observed mainly under the influence of oceanic air and lower values dominated by continental air. A significant negative correlation between δ^{202}Hg values and atmospheric CO concentrations was observed and suggests that the isotopic composition of TGM in oceanic air masses may differ significantly from those of anthropogenic sources on the European continent.