

Terrestrial Mercury Biogeochemistry: A Need To Re-Assess the Role of Dry Deposition of Elemental Mercury

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Terrestrial ecosystems serve both as sources and sinks for atmospheric gaseous elemental mercury (GEM). The current understanding of the significance of GEM exchanges compared to other deposition processes is uncertain and in parts inconsistent with new insights such as those derived from stable isotope characterization.

Here, we discuss the role of GEM atmosphere-surface exchange for terrestrial mercury cycling. First, we present results from a global database to re-analyse terrestrial GEM flux measurements from over 130 peer-reviewed publications, and provide new estimates of global terrestrial GEM exchange and uncertainties. Second, we present stable isotope analyses across 10 sites that show GEM deposition to be the dominant deposition process across multiple forest types and regions. Third, we show how plant community types to a large degree determine soil mercury loads by increasing GEM deposition. Finally, we present results from a mass balance characterization in the arctic tundra where GEM deposition dominates over all other deposition processes, and where an absence of photochemical GEM re-emission positions this system as a persistent and globally-important atmospheric mercury sink. These results highlight the dominant role of GEM dry deposition and the need to better characterize the fate of GEM deposition in terrestrial ecosystems.