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Overview of quantifying the air-surface exchange of elemental mercury vapours using enclosure and micrometeorological methods

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Reliable quantification of air-biosphere exchange flux of elemental mercury vapor (Hg0) is crucial for understanding the global biogeochemical cycling of mercury. Although several techniques with widely diverse principles have been applied, a standardized method for quantifying Hg0 flux does not exist. In this overview, the methods for measuring Hg0 flux, principally the enclosure and micrometeorological approaches, are discussed. Field data obtained from an integrated set of collocated instrumentations deployed to quantify Hg0 flux over bare soil and lightly vegetated canopy are presented to illustrate the data comparability and measurement uncertainties associated with different techniques including relaxed eddy accumulation (REA), modified Bowen-ratio (MBR), aerodynamic gradient (AGM) and two dynamic flux chamber (DFC) methods. Each Hg0 flux measurement technique has its own analytical fingerprint due to the complexity of surface exchange processes as well as the application principles and assumptions of the method. Statistical analysis indicates that the median fluxes measured by micrometeorological techniques (REA, MBR and AGM) are not significantly different. The Hg0 flux observed by a modified DFC method that incorporates surface shear correction is comparable to MBR-measured flux over bare soil, suggesting that data scaling using the friction velocity inside a DFC bridges the gap between the Hg0 fluxes measured by enclosure and micrometeorological methods. The uncertainty of Hg0 flux measurement varies greatly with the applied methods and environmental conditions. Recommendations are made in terms of selecting a suitable technique for a given set of environmental constrains to reduce Hg0 flux quantification uncertainty.

Biography

Jerry Che-Jen Lin is a Full Professor of Environmental Engineering at Lamar University. He received his MS degree at Duke University in 1995 and PhD at the University of Cincinnati in 1998. He was a Postdoctoral Associate at Oak Ridge National Laboratory during 1998-1999 before joining Lamar. He has authored and co-authored more than 70 peer-reviewed journal articles with more than 1600 citations, mainly in the areas of chemistry, fate and transport of atmospheric mercury and membrane technology. He also serves as a member in the Science Advisory Board of USEPA.

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