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Changes in mercury volatilization flux induced by water vapor generation in soils under dynamic temperature

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With the entry into force of the Minamata Convention from 2017, anthropogenic mercury emissions into the atmosphere have been regulated, and therefore global mercury management has become an important issue. It should be noted that the amounts of anthropogenic mercury emissions and natural emissions from terrestrial sources such as soil and vegetation are almost the same based on the Global Mercury Assessment Model by UNEP (2013). Previous studies have clarified that various environmental factors such as temperature, soil porosity and water content, and pH of the water influence mercury volatilization flux from soils. In order to understand and predict transport phenomena of mercury in soils including the emission to the atmosphere, it is necessary to consider in detail not only static factors such as soil porosity but also dynamic factors such as temperature including their spatial variations.

In this study, continuous measurements of mercury volatilization flux were conducted for dynamic temperature, different soil water contents and pH-dependent dissolved mercury species. The results showed that the flux values under dynamic temperature were different from those under static temperature even at the same temperature. Additionally, changes in the flux under dynamic temperature depended on the soil water content. We have found that it is difficult to predict mercury volatilization flux under dynamic condition based on the knowledges obtained under static condition probably due to large influence of water vapor generation under dynamic temperature. It is therefore necessary to understand advection and diffusion in soils in the presence of volatilization and condensation of water and dissolved mercury for better understanding mercury flux emission from the soils.