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Impacts on Atmospheric Mercury from Changes in Climate, Land Use, Land Cover, and Wildfires

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Abstract : There have been increasing concerns on atmospheric mercury as a toxic and bioaccumulative pollutant in the global environment. Global change, including changes in climate change, land use, land cover and wildfires activities can all have significant impacts on atmospheric mercury. In this study, we use a global chemical transport model (GEOS-Chem) to examine the potential impacts from global change on atmospheric mercury. All of these factors in the context of global change are found to have significant impacts on the long-term evolution of atmospheric mercury and can substantially alter the global source-receptor relationships for mercury. We also estimate the global Hg emissions from wildfires for present-day and the potential impacts from the 2000-2050 changes in climate, land use and land cover and Hg anthropogenic emissions by combining statistical analysis with global data on vegetation type and coverage as well as fire activities. Present global Hg wildfire emissions are estimated to be 612 Mg year-1. Africa is the dominant source region (43.8% of global emissions), followed by Eurasia (31%) and South America (16.6%). We find significant perturbations to wildfire emissions of Hg in the context of global change, driven by the projected changes in climate, land use and land cover and Hg anthropogenic emissions. 2000-2050 climate change could increase Hg emissions by 14% globally. Projected changes in land use by 2050 could decrease the global Hg emissions from wildfires by 13% mainly driven by a decline in African emissions due to significant agricultural land expansion. Future land cover changes could lead to significant increases in Hg emissions over some regions (+32% North America, +14% Africa, +13% Eurasia). Potential enrichment of terrestrial ecosystems in 2050 in response to changes in Hg anthropogenic emissions could increase Hg wildfire emissions both globally (+28%) and regionally. Our results indicate that the future evolution of climate, land use and land cover and Hg anthropogenic emissions are all important factors affecting Hg wildfire emissions in the coming decades.

Keywords : climate change, land use, land cover, wildfires
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