

## Effects of Climate Change and Land Use, Land Cover Change on Atmospheric Mercury

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**Abstract :** Mercury has been well-known for its negative effects on wildlife, public health as well as the ecosystem. Once emitted into atmosphere, mercury can be transformed into different forms or enter the ecosystem through dry deposition or wet deposition. Some fraction of the mercury will be reemitted back into the atmosphere and be subject to the same cycle. In addition, the relatively long lifetime of elemental mercury in the atmosphere enables it to be transported long distances from source regions to receptor regions. Global change such as climate change and land use/land cover change impose significant challenges for mercury pollution control besides the efforts to regulate mercury anthropogenic emissions. In this study, we use a global chemical transport model (GEOS-Chem) to examine the potential impacts from changes in climate and land use/land cover on the global budget of mercury as well as its atmospheric transport, chemical transformation, and deposition. We carry out a suite of sensitivity model simulations to separate the impacts on atmospheric mercury associated with changes in climate and land use/land cover. Both climate change and land use/land cover change are found to have significant impacts on global mercury budget but through different pathways. Land use/land cover change primarily increase mercury dry deposition in northern mid-latitudes over continental regions and central Africa. Climate change enhances the mobilization of mercury from soil and ocean reservoir to the atmosphere. Also, dry deposition is enhanced over most continental areas while a change in future precipitation dominates the change in mercury wet deposition. We find that 2000-2050 climate change could increase the global atmospheric burden of mercury by 5% and mercury deposition by up to 40% in some regions. Changes in land use and land cover also increase mercury deposition over some continental regions, by up to 40%. The change in the lifetime of atmospheric mercury has important implications for long-range transport of mercury. Our case study shows that changes in climate and land use and cover could significantly affect the source-receptor relationships for mercury.

**Keywords :** mercury, toxic pollutant, atmospheric transport, deposition, climate change

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