

Total depletion of Hg⁰ in the upper troposphere–lower stratosphere

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Abstract

Our current understanding of atmospheric mercury lacks fundamental details. Gas phase elemental mercury (Hg⁰) was measured aboard the NASA DC-8 research aircraft during the Intercontinental Chemical Transport Experiment-Phase B (INTEX-B) conducted in spring 2006 over the North Pacific. Our data confirm efficient chemical cycling of Hg⁰ in the tropopause region and show that it is strongly anti-correlated with O₃ there, yielding a tropospheric-stratospheric mixing curve of $\square -0.20$ ppqv Hg⁰/ppbv O₃. In addition, we found frequent total depletion of Hg⁰ in upper tropospheric (8–12 km) air masses impacted by stratospheric influence. When O₃ mixing ratios were >300 ppbv, Hg⁰ was rarely detected. It appears that in the tropopause and stratosphere Hg⁰ is oxidized on the order of days followed by heterogeneous transformation to particulate mercury. These processes constitute an effective chemical sink for Hg⁰ at the top of the troposphere, which may recycle mercury back to the gas phase as stratospheric aerosols are eventually dispersed into the troposphere.

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