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Multiphase iodine chemistry and ozone loss

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Iodine is extremely efficient at ozone destruction. Under stratospheric conditions, the per atom odd-oxygen destruction efficiency of iodine has been previously estimated to be ~600 times that of chlorine and ~10 times that of bromine. In aqueous solution, the reaction rate of iodide with ozone is over a million times that of the other halides. However, the low concentrations and sparsity of quantitative measurements have previously limited estimation of iodine's impact in the atmosphere. First, we examine iodine in the lower stratosphere, where previously there have been only low upper limits on gas-phase iodine and qualitative detection of particulate iodine near the tropopause. We report the first quantitative measurement of iodine monoxide radicals and particulate iodine from aircraft in the stratosphere. We highlight sharp changes in chemical- and phase-partitioning by iodine around the tropopause. We further examine the contributions of iodine to ozone loss including previously unconsidered heterogeneous reactions. Second, we examine dust-plume-accompanied "mini ozone holes" in the free troposphere west of South America. Similar observations have previously been attributed to reactive uptake on dust surfaces. We find iodine monoxide enhancements by up to a factor of six over background associated with the layers. We examine the role of iodine in contributing to the observed ozone loss. We revisit the literature of previous observations of dust iodine and gas-phase iodine enhancements west of the Sahara and examine whether lofted desert dust is a significant source of the iodine to the atmosphere. Finally, we discuss these findings in light of a threefold increase in atmospheric iodine recently documented from historic records.

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Refreshments 3:15 p.m
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