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Quantitative Detection of Iodine in the Stratosphere

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Ozone in the extrapolar lower stratosphere is currently declining for reasons that are not well understood. Iodine is emitted mostly from marine sources, and changing iodine emissions provide a possible chemical reason for why ozone in the lower stratosphere continues to decline (Koenig et al., 2020). Previous stratospheric measurements had detected iodine qualitatively in particles. More recently, IO observations in the daytime tropical tropopause layer (TTL) have suggested that between 0.25 to 0.70 pptv ly are injected into the stratosphere, which is 1.6 to 3.5 times the WMO2014 upper limit. These indirect observations have led to revised estimates of 0 - 0.8 pptv ly stratospheric injection in the WMO2018 report. This presentation discusses first quantitative measurements of IO radicals and of submicron particulate iodine from aircraft in the stratosphere that support 0.77 pptv ly stratospheric injection. Our observations support the WMO2018 upper limit estimate, and clearly are incompatible with zero iodine injection. The implications of the observed iodine concentrations for ozone loss in the lower stratosphere are discussed, also in light of climate records that find increasing iodine in recent decades, observed ozone trends, and ongoing and future research needs to better quantify iodine's contribution to explain these trends.

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