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The impact of very-short-lived bromocarbons on stratospheric bromine and ozone: Present and future

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Convective transport of brominated very-short-lived substances (VSLS) from the surface to the stratosphere exerts significant impacts on the stratospheric bromine budget and ozone depletion. Climate change is expected to influence the frequency and intensity of deep convection. Recent modeling studies suggest stronger upward transport in the tropical upper troposphere/lower stratosphere in future climate will increase troposphere-to-stratosphere transport (TST) of very-short-lived bromocarbons in 2100, compared to present day conditions. On the other hand, increased deep convection can lead to increased scavenging of the soluble inorganic product gases, therefore lead to a decrease in product gas injection for VSLS. Sensitivity simulations were conducted for the present day atmosphere using the NASA GEOS-5 CCM with detailed VSLS bromine chemistry with varying deep convection strength. Our model results suggest that the impact of increased scavenging on soluble product gases during strong convection greatly exceeds the relative minor increase in source gas injection, therefore leading to a decrease in total bromine injected into the stratosphere. We will conduct additional simulations for the 2100 condition using GEOS-5 CCM to examine how various changes in deep convection and wet scavenging (i) change the TST of brominated VSLS and their product gases, and (ii) how the subsequent impact on stratospheric ozone chemistry evolve in future climate.