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The Impact of ENSO on Trace Gas Composition in the Upper Troposphere to Lower Stratosphere

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The El Nino-Southern Oscillation (ENSO) is the dominant mode of interannual variability in the tropical troposphere and its effects extend well into the stratosphere. Its impact on atmospheric dynamics and chemistry cause important changes to trace gas constituent distributions. A comprehensive suite of satellite observations, reanalyses, and chemistry climate model simulations are illuminating our understanding of processes like ENSO. Analyses of more than a decade of observations from NASA's Aura and Aqua satellites, combined with simulations from the Goddard Earth Observing System Chemistry-Climate Model (GEOSCCM) and other Chemistry Climate Modeling Initiative (CCMI) models, and the Modern-Era Retrospective Analysis for Research and Applications, version 2 (MERRA-2) reanalysis have provided key insights into the response of atmospheric composition to ENSO. While we will primarily focus on ozone and water vapor responses in the upper troposphere to lower stratosphere, the effects of ENSO ripple through many important trace gas species throughout the atmosphere. The very large 2015-2016 El Nino event provides an opportunity to closely examine these impacts with unprecedented observational breadth. An improved quantification of natural climate variations, like those from ENSO, is needed to detect and quantify anthropogenic climate changes.