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The NASA Atmospheric Tomography Mission: A Global-Scale Survey of Composition, Reactivity, and Transport in the Remote Atmosphere

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The last seventy years have witnessed a marked acceleration of the impact of human activity impacting the planet due to the combination of rapid population growth, increased consumption of resources, and technological development. Nearly the entire human population occupies an astonishingly small percentage of the Earth's surface, yet the imprint of human activity is being recorded in global climate and is perturbing the chemistry and composition of the most remote stretches of the atmosphere. These remote regions are exceptionally important for global air quality and climate (accounting on average for 75% of global CH_4 removal, 59% of chemical production of O_3, and 68% of chemical destruction of O_3), yet the paucity of observations over the remote oceans have limited our understanding of these fundamental processes and their sensitivity to increased human perturbation.

The NASA Atmospheric Tomography Mission (ATom) was designed to address these gaps in our understanding of chemical composition, reactivity, and transport through a combination of extensive measurements and photochemical modeling, and to provide much needed observational data from the remote regions of the atmosphere to provide rigorous tests that will lead to improvements in our global chemistry-climate models and to validate remote sensing retrievals. From 2016-2018, ATom utilized the fully instrumented NASA DC-8 research aircraft to collect an unprecedented suite of measurements of trace gases, aerosols, and key radical species from the remote troposphere and lower stratosphere. Four complete pole-to-pole global circuits (one in each season) were conducted by performing near-continuous vertical profiles between 0.2 – 14 km altitude along meridional transects of the Pacific and Atlantic Ocean Basins. The data provided by this project have already led to several significant new findings, with many more on the horizon as research teams continue to uncover the full value of this dataset. In this talk, we will provide an overview of the ATom mission and discuss some of the major outcomes and new findings that have resulted from this project to date.

The ATom Science Team: Steven Wofsy, David Fahey, Paul Newman, Thomas Hanisco, and the entire ATom science team