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Stratospheric Aerosol and Gas Experiment observations of stratospheric nitrogen dioxide

An important component of the reactive nitrogen (NO_X) budget of the stratosphere is nitrogen dioxide (NO_2), which participates in key reactions influencing the life cycle of stratospheric ozone. For example, it can limit the availability of reactive chlorine by forming chlorine nitrate ($ClONO_2$), but is also directly involved in catalytic cycles destroying ozone. A major source of stratospheric NO_2 is photolysis and oxidation of nitrous oxide (N_2O), which has been shown to have a decreasing lifetime [1], but increased tropospheric emission. Using the solar occultation technique, the Stratospheric Aerosol and Gas Experiment (SAGE) family of instruments have measured profiles of NO_2 concentration 1984-2005 (II), 2002-2005 (III/M3M) and 2017-present (III/ISS). Here these data sets are examined for a range of time scales: diurnal, seasonal, biennial, etc.; as well as following episodic increases in stratospheric aerosol amount from volcanic eruptions or extreme wildfire smoke. Comparisons are made with contemporaneous measurements by the Atmospheric Chemistry Experiment –Fourier Transform Spectrometer (ACE-FTS) and the Optical Spectrograph and Infrared Imaging System (OSIRIS). With the possible extension of the III/ISS record through this decade it is important to understand the linkage of the newest data product version (v6) to other NO_2 datasets.

[1] Prather, M. J., Froidevaux, L., and Livesey, N. J.: Observed changes in stratospheric circulation: decreasing lifetime of N_2O, 2005–2021, Atmos. Chem. Phys., 23, 843–849, https://doi.org/10.5194/acp-23-843-2023, 2023.

Topic

Atmospheric composition (Earth and planets), chemistry and transport

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