13th International Atmospheric Limb Workshop



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Understanding trends and variability in stratospheric inorganic chlorine in the stratosphere with the ACE-FTS and the TOMCAT 3-D CTM

Stratospheric inorganic chlorine comprises product gases, e.g., HCl, produced by the decomposition of ozonedepleting substances (ODSs) such as chlorofluorocarbons (CFCs). Following action initiated under the 1987 Montreal Protocol, the tropospheric abundances of many long-lived ODSs have been declining as expected, leading to a corresponding decrease in total stratospheric inorganic chlorine since around the year 2000. Continued monitoring of chlorinated species is crucial to ensure that these abundances are decreasing as expected and to monitor potential factors of variability, including emissions of very short-lived substances (VSLSs), which are not regulated by the Montreal Protocol, non-compliant emissions of regulated gases, e.g., CFC-11 and CCl4 (Li et al., 2024; Montzka et al., 2018), hemispheric variability in stratospheric dynamics (Mahieu et al., 2014), and transient variability like severe wildfire smoke plumes (Bernath et al., 2022). The limb sounder able to regularly measure various chlorine species is the Atmospheric Chemistry Experiment –Fourier Transform Spectrometer (ACE-FTS), operational since 2004 and capable of observing multiple other species (Bernath, 2017).

To investigate the trends and variability of inorganic chlorine abundances over the past 20 years, the 3-D offline chemical transport model TOMCAT (Dhomse et al., 2019) has been used to compare to observations and for analysing the variability in the cited factors above. The use of TOMCAT alongside ACE-FTS measurements ultimately allows us to infer trends of chlorinated species in the stratosphere, allowing a comprehensive analysis and providing valuable insights into inorganic chlorine chemistry and the path to ozone layer recovery.

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Topic

Atmospheric composition (Earth and planets), chemistry and transport

Author: TOSO, Lavinia (School of Physics and Astronomy, University of Leicester, Leicester, UK; National Centre for Earth Observation, University of Leicester, Leicester, UK)

Co-authors: Dr HARRISON, Jeremy J. (School of Physics and Astronomy, University of Leicester, Leicester, UK; National Centre for Earth Observation, University of Leicester, Leicester, UK); Prof. CHIPPERFIELD, Martyn P. (School of Earth and Environment, University of Leeds, Leeds, UK; National Centre for Earth Observation, University of Leeds, Leeds, UK; National Centre for Earth Observation, University of Leeds, Leeds, UK; National Centre for Earth Observation, University of Leeds, Leeds, UK; National Centre for Earth Observation, University of Leeds, Leeds, UK; National Centre for Earth Observation, University of Leeds, Leeds, UK; National Centre for Earth Observation, University of Leeds, Leeds, UK; National Centre for Earth Observation, University of Leeds, Leeds, UK; National Centre for Earth Observation, University of Leeds, Leeds, UK; National Centre for Earth Observation, University of Leeds, Leeds, UK; National Centre for Earth Observation, University of Leeds, Leeds, UK; National Centre for Earth Observation, University of Leeds, Leeds, UK; National Centre for Earth Observation, University of Leeds, Leeds, UK; National Centre for Earth Observation, University of Leeds, UK; National Centre for Earth Observation, University of Leeds, UK; National Centre for Earth Observation, University of Leeds, UK; National Centre for Earth Observation, University of Leeds, UK; National Centre for Earth Observation, University of Leeds, UK; National Centre for Earth Observation, University of Leeds, UK; National Centre for Earth Observation, UNIVERSITY, UNIV

Presenters: TOSO, Lavinia (School of Physics and Astronomy, University of Leicester, Leicester, UK; National Centre for Earth Observation, University of Leicester, Leicester, UK); Dr HARRISON, Jeremy J. (School of Physics and Astronomy, University of Leicester, Leicester, UK; National Centre for Earth Observation, University of Leicester, Leicester, UK; National Centre for Earth Observation, University of Leicester, Leicester, UK; National Centre for Earth Observation, University of Leicester, UK; National Centre for Earth Observation, University of Leicester, UK; National Centre for Earth Observation, University of Leicester, UK; National Centre for Earth Observation, University of Leicester, Leicester, UK; National Centre for Earth Observation, University of Leicester, Leicester, UK; National Centre for Earth Observation, University of Leicester, Leicester, UK; National Centre for Earth Observation, University of Leicester, Leicester, UK; National Centre for Earth Observation, University of Leicester, Leicester, UK; National Centre for Earth Observation, University of Leicester, Leicester, UK; National Centre for Earth Observation, University of Leicester, Leicester, UK; National Centre for Earth Observation, University of Leicester, Leicester, UK; National Centre for Earth Observation, University of Leicester, Leicester, UK; National Centre for Earth Observation, University of Leicester, Leicester, UK; National Centre for Earth Observation, University of Leicester, Leicester, UK; National Centre for Earth Observation, University of Leicester, Leicester, UK; National Centre for Earth Observation, University of Leicester, Leicester, UK; National Centre for Earth Observation, University of Leicester, Leicester, UK; National Centre for Earth Observation, UNIVER; National Centre f