



Contribution ID: 1554

Type: **Invited Speaker / Conférencier invité**

ACE-FTS satellite measurements of HCN in the upper troposphere to N₂O in the lower thermosphere

Tuesday, 30 May 2017 16:00 (30 minutes)

Two recent discoveries from the Canadian ACE-FTS (Atmospheric Chemistry Experiment –Fourier Transfer Spectrometer) satellite instrument will be discussed. The first is the production of N₂O in the lower thermosphere, and the second is a global enhancement of HCN in the upper troposphere –lower stratosphere throughout 2016. ACE-FTS has the only available satellite measurements of vertically resolved HCN in the upper troposphere - lower stratosphere and N₂O in the lower thermosphere.

The N₂O measurements show that there is a consistent lower thermospheric source of N₂O via energetic particle precipitation (EPP). This leads to average polar winter concentrations on the order of ~20-40 ppbv near 90 km. In the polar winter, N₂O-rich air descends into the lower mesosphere, and especially during sudden stratospheric warmings ACE-FTS observes N₂O being transported as far down as ~45 km.

In late 2015, a large amount of HCN was emitted from Southeast Asia into the upper troposphere and lower stratosphere. The emitted HCN was then transported by the general circulation from the tropics to polar latitudes. By early 2016, the daily mean concentrations of HCN in the lower stratosphere at all latitudes, as measured by the ACE-FTS instrument, were consistently the largest on record for the region, on the order of 50-90% greater than the climatological mean, and ~30% greater than the 2007 El Niño-driven values.

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Session Classification: T4-6 DASP General Contributions I (DASP) | DPAAE: contributions générales I (DPAAE)

Track Classification: Atmospheric and Space Physics / Physique atmosphérique et de l'espace (DASP-DPAAE)