Ozone seasonal evolution and photochemical production regime in polluted troposphere in eastern China derived from high resolution FTS observations

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Site and Instrument Description

Site descriptions:

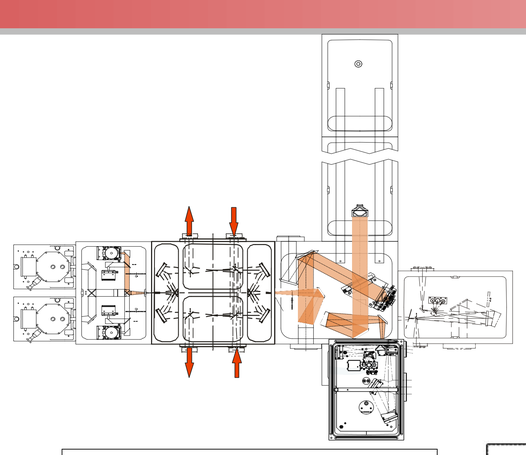
■ Located in an island in the western suburbs of Hefei city (the capital of Anhui province) in central-eastern China.

■ Adjacent to a lake with a longitude of 117° 10′E, latitude of 31° 54′N and altitude of 30m.

Instruments descriptions:

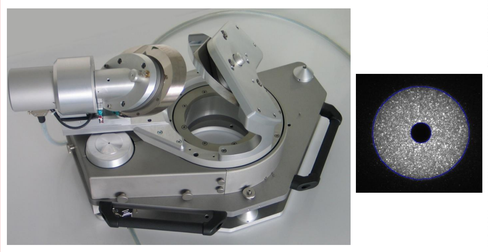
■ Consists of a FTS spectrometer IFS 125HR and a solar tracker. Both of them are purchased from Bruker Company .

■ The MIR spectra are recorded over a wide spectral range (about 600 – 4500 cm^{-1}) with a spectral resolution of 0.005cm^{-1}. The instrument is equipped with a KBr beam splitter & a MCT detector for O_3 and a KBr beam splitter & an InSb detector for other gases, and it has seven optical filters to avoid detector non-linearity.



Optical path inside the IFS125HR

Top view of the location, accessed in 2014/4/14 by Google earth



Solar tracker

Site location, modified from an original TCCON map accessed in 2014/2/27

Methodology

Retrieval strategy:

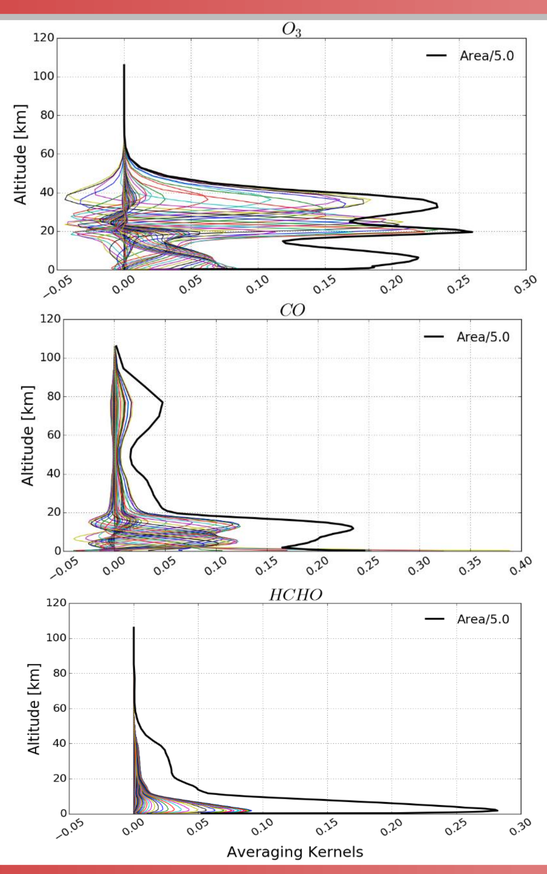
■ The SFIT4 (version 0.9.4.4) software based on optimal estimation algorithm is used in the profile retrieval.

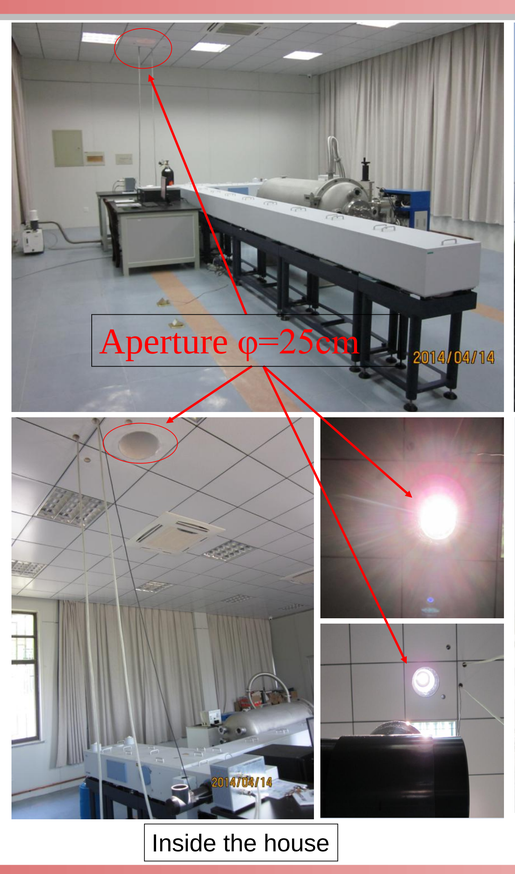
■ Tropospheric O_3, CO and HCHO columns derived from FTS retrievals via integration over ground to 12km. Tropospheric NO_2 columns deduced from overpass OMI observations.

Evolution and production regime:

■ The back trajectory cluster analysis tool HYSPLIT is used to determine the relative contribution ratio to the observed O_3 level.

■ The sensitivity of ozone production (PO3) relative to meteorological parameters, CO, HCHO, and NO_2 changes are used to determine O3 production regime.





Inside the house

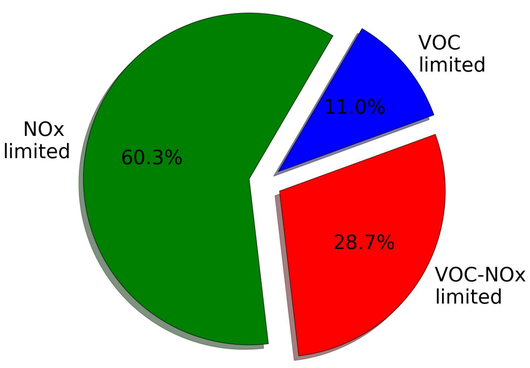
Outside the house

Results

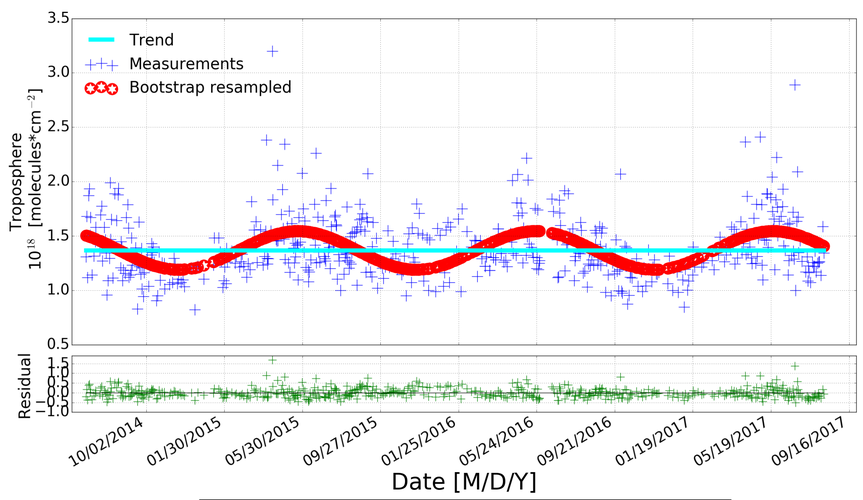
■ The tropospheric O_3 roughly increases over time at the first half year and reaches the maximum in June, and then it decreases over time at the second half year.

■ Air pollutions in megacities in central-southern China, northwest China, and the Yangtze River Delta area in eastern China, dominates the contributions, while the contributions from the other two key pollution areas, i.e., Beijing-Tianjin-Hebei in north China and Pearl River Delta in south China, are very small.

■ The PO3 is mainly NO_x limited in summer and mainly VOC or mix VOC-NO_x limited in winter. NO_x, mix VOC-NO_x, and VOC limited PO3 accounts for 60.1%, 28.7%, and 11%, respectively.



Proportion for chemical sensitivity of ozone production (PO3)



Seasonal evolution of tropospheric O_3 derived from FTS observations.

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