Long-term variations of atmospheric trace gases observed by ground-based FTIR at the Hefei site

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Hefei FTIR Instrumentation

The Hefei site (31.540°N, 117.100°E, 35.5 m a.s.l.) operates a high-resolution FTIR spectrometer (Bruker IFS125HR) , and a solar tracker (A547N) used to monitor the atmospheric trace gas profile and total columns since 2015. Currently, the spectrometer covers a spectral range of 700–10000 cm^{-1}, enabling comprehensive atmospheric composition measurements.



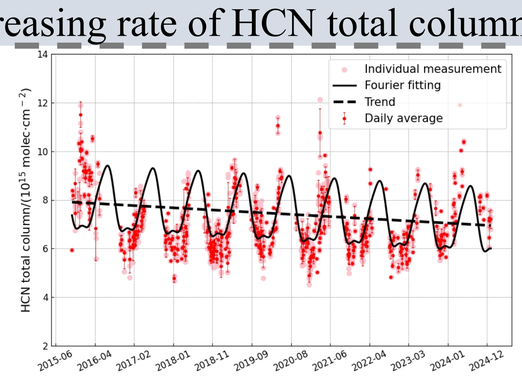


Retrieval strategy

Atmospheric columns of O_3, OCS, N_2O, HCHO, C_2H_6, HCN were retrieved from mid-infrared spectra. The spectral retrieval windows and interfering gases are summarized in Table.

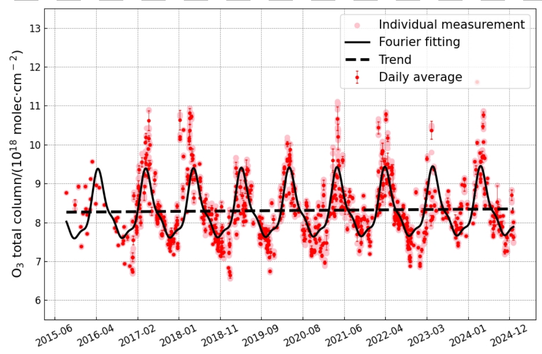
Gases	Spectral range(cm^{-1})	Interfering species
O_3	991.25-993.8 1001.47-1003.04 1005.0-1006.9 1007.348-1009.000	CO_2 C_2H_4 H_2O O_3^{668} O_3^{686}
OCS	2047.85-2048.24 2049.77-2050.18 2051.18-2051.46 2054.33-2054.67	O_3 CO H_2O CO_2
N_2O	2481.30-2482.60 2526.40-2528.20 2537.85-2538.80 2540.10-2540.70	CH_4 H_2O
HCHO	2763.42-2764.17 2765.65-2766.01 2778.15-2779.10 2780.65-2782.00	CH_4 O_3 N_2O HDO
C_2H_6	2976.66-2976.95 2983.20-2983.55 2986.50-2986.95	CO_2 O_3 H_2O CH_4
HCN	3268.10-3268.38 3287.01-3287.48 3299.45-3299.60	H_2O C_2H_2 O_3 CH_4

HCN
- The average total column concentration is 6.86×10^{15} molec·cm^{-2}.
- The annual decreasing rate of HCN total column is -1.387 ± 0.052%.

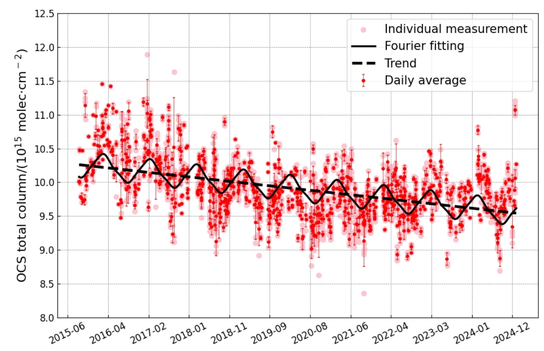


Time series of trace gases

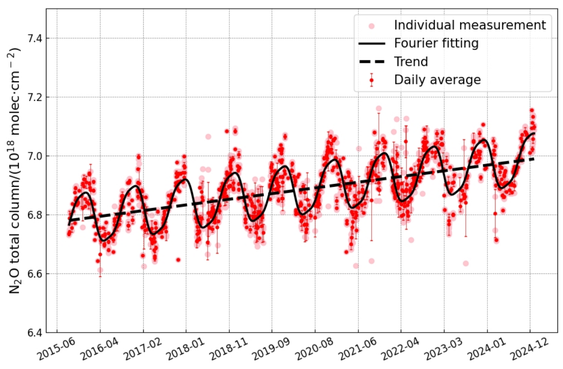
O_3
- The average total column concentration is 8.31×10^{18} molec·cm^{-2}.
- The annual increasing rate of O_3 total column is 0.109 ± 0.001%.



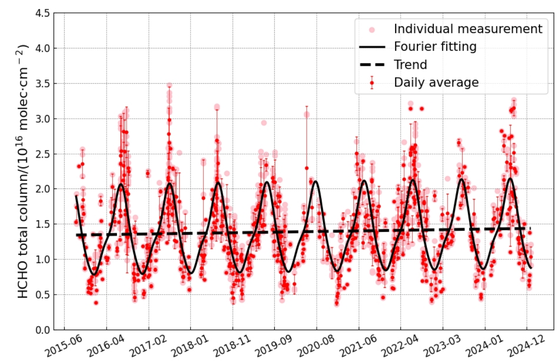
OCS
- The average total column concentration is 9.87×10^{15} molec·cm^{-2}.
- The annual decreasing rate of OCS total column is -0.769 ± 0.016%.



N_2O
- The average total column concentration is 6.89×10^{18} molec·cm^{-2}.
- The annual increasing rate of N_2O total column is 0.326 ± 0.003%.



HCHO
- The average total column concentration is 1.40×10^{16} molec·cm^{-2}.
- The annual increasing rate of HCHO total column is 0.731 ± 0.014%.



C_2H_6
- The average total column concentration is 2.43×10^{16} molec·cm^{-2}.
- The annual decreasing rate of C_2H_6 total column is -1.736 ± 0.081%.

