

Wang et. al presented a MAX-DOAS observation for tropospheric vertical profiles of NO<sub>2</sub>, SO<sub>2</sub>, HONO, HCHO, CHOCHO and aerosols in the central-western North China Plain in May and June 2016. The MAX-DOAS results are validated comprehensively by the collocated measurements of ground based lidar, sun-photometer and in situ instrument, as well as overpass aircraft. Besides, characteristics of pollutants distribution and variations were analyzed combined with effects of regional and local transport.

As shown in the introduction, there were many studies of the trace gases and air pollutions of NCP in previous, also including the MAX-DOAS measurements. The main concerns is that what is the novelty or unique of this paper compared to the previous. I suggest the authors could highlight these in the manuscript.

Specific comments:

1. MAX-DOAS spectra analysis: It can be concluded from P5, Line27-28 that the authors used a spectrum measured in the zenith direction closest in time to the off-zenith measurements as a Fraunhofer reference spectrum. So if the telescope scanned in the sequence of 1°, 2°, 3°, 4°, 6°, 8°, 10°, 15°, 20°, 30°, 90°, the DSCDs of lower elevation angle (e.g. 1, 2, 3, 4) should use the zenith spectrum in previous scanning, but the DSCDs of higher elevation angle (e.g. 10, 15, 20, 30) use the zenith spectrum of current scanning. It means that the DSCDs of elevation angles in the same scanning were obtained with different reference spectrum. Any explanation or consideration about this treatment, which may bring some unknown effects in the profile retrieval procedure?

Fig.3: why the authors show the CHOCHO spectral analysis in another day compared with other species? And the CHOCHO absorption structure can not be well observed.

2. When you evaluated the DOAS data for HONO, did you consider the impurity of HONO in the NO<sub>2</sub> reference spectra used? There is always some HONO in NO<sub>2</sub> and that is subtracted in the DOAS algorithm. This leads to an underestimation of HONO by ca. 0.5% of the NO<sub>2</sub>, which can be significant during daytime and impacts the conclusions in your discussion about HONO/NO<sub>2</sub>.

3. Aerosol and trace gases retrieval:

How was the vertical grids setting?

How to distinguish the sky condition of high aerosols and clouds?

In section 4.1, since the aerosol retrieval results were poor under the sky conditions of clear sky with high aerosols and cloudy sky (Fig. 6a and b), how to convince the trace gases retrieval are reliable?

All the reliable retrieval are the fundamental of the further analysis about effects of regional and local transport of pollutants.

Technical corrections:

P4, Line 28, "10:00 BT" change to "10:00 LT"

P5, Line 3-7, the results in Fig. 2 d were obtained from NASA website, however, the data in Fig. 2a, b and c? And the spatial resolution of the satellite products? Did the authors do any treatment or filter with the data? Please specify more clearly.

Fig. 2a, c, d, poor resolution. Please correct.

Fig. 7, I suggest the author present a panel plot of the differences of AE between MAX-DOAS and Lidar for more clearly and apparent comparison results.

Acknowledgements:

MAX-DOAS, LP-DOAS and etc. in Wuxi station? But the measurements was in NCP area.

WINDOAS software? But you used QDOAS