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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Ship-based MAX-DOAS measurements of tropospheric NO_2, SO_2, and HCHO distribution along the Yangtze River" *by* Qianqian Hong et al.

Anonymous Referee #2

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The manuscript investigates tropospheric NO2, SO2, and HCHO characteristic along the Yangtze River in winter 2015 using ship-based MAX-DOAS measurements. It provides a better insight of tropospheric pollutants distribution and their sources over eastern China. The MAX-DOAS NO2 VCDs were compared to OMI satellite observations. In addition, NO2 to SO2 ratio was used to estimate the relative contributions of industrial sources and vehicle emissions to ambient NO2 levels. Finally, the authors use a multiple linear regression model to estimate the contribution of primary and secondary sources of HCHO. In general, the manuscript is well written and organized. I think the topic and the findings fit well to the journal scope. However, there are still some issues need to be addressed before publication. My comments are listed below.

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Discussion paper

Comments:

1. In section 2.2.2, how many percent of data are removed using the filter wind directions and SZAs?

2. The authors use the trace gas profiles and vertical profiles of pressure and temperature from WRF-Chem for AMF calculation. What is the spatial resolution and time resolution of the WRF-Chem profiles? Did the authors use a fixed trace gases profile for all the measurements or use the unique profile dependent on the measurement locations and time?

3. The authors use the aerosol extinction coefficients measured by Mie lidar measurements for the AMF calculations. Did the authors use a fixed aerosol extinction profile (average the aerosol extinction coefficient from all the lidar measurements during the campaign) or use the specified profile dependent on locations, time and the availability of lidar measurements?

4. A fix set of single scattering albedo (SSA) of 0.95, asymmetry parameter of 0.68 and surface albedo of 0.06 is assumed in the radiative transfer calculations. Please explain why use this setting. Any references?

5. In section 2.2.4, there are too many formula and introduction of the determination of the tropospheric VCD. I suggest shortening the section and combining some of the formula.

6. I agree with the comment from Referee #1 about the high NO2 VCD on Nov. 29. Please explain the reason of high NO2 and relative low SO2 concentrations during this day.

7. In section 2.3, USTC's OMI tropospheric NO2 product is used. I suggest showing more detailed information about the USTC OMI product, e.g., the data source of NO2 slant density (SCD). In addition, USTC shall be explained when appeared for the first time.

8. Figure 7d is a bit confusing, please describe clearly what the green lines represent? Is it 6, 12, 18 or 24 hour backsward trajectories? What is the altitude of the backward trajectories?

9. The authors mention that the different spatial patterns detected by MAX-DOAS and OMI on Dec. 2 might be due to the strong influence by the aerosols. This is an interesting episode because it might show that the effect of neglecting aerosol in satellite AMF calculations on satellite NO2 retrieval. Please prove this hypothesis using the Lidar measurement data.

10. In section 3.1, Line 307-308: "In contrast, lower HCHO VCDs were observed mainly on rainy, cloudy and haze days". Could the authors explain more about the possible reasons for this phenomenon?

11. In section 3.4, please explain how to convert HCHO VCD to HCHO concentrations (ppb).

12. In section 3.4, Line 430: "As other factors can also affect the atmospheric HCHO concentration. . .". Please describe the "other factors" in more detail.

Technical corrections:

There are still some typos in the manuscript. In addition, the use of the notations should also be checked carefully. A few examples of these technical errors are listed below:

1. Line 321: 'Dec 1 and 3' > 'Dec 2 and 4′

2. Line 344: 'aerosol' > 'aerosols'

3. Text on Figure 2: change "dSCD" to "DSCD", and please uniform the units of DSCD (molec/cm2).

4. Explain the caption 'RTM' in Figure 3-5. Or remove it.

5. Text on Figure 6 is too small to read. Please use larger font size and put the colorbar

on the right.

6. Improve the quality of Figure 10 (too many stripes)

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