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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Spatial-temporal variations of surface ozone and ozone control strategy for Northern China" *by* G. Tang et al.

Anonymous Referee #2

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This manuscript presents a comprehensive summary and in-depth analysis of surface measurements of ozone and NOx obtained from a regional scale monitoring network over North China. The authors summarize the temporal and spatial variations of the measurements and the site-to-site comparisons, which provide valuable, new in situ dataset for the scientific community interested in studying the environmental impact of the fast developing North China region. Using WRF's meteorological output, the authors investigate the association between meteorological conditions and ozone variations. They made an interesting finding that the increase in dry deposition velocity from June to July could partly explain the observed reduction of surface ozone. Empirical relationships between observed NOx and O3 and satellite-derived HCHO to NO2 column ratios are used in conjunction to identify VOCs- or NOx-limited regimes of ozone production. The paper is well organized and thoroughly written, although there are

many grammar errors and typos. Overall the paper presents interesting new data and analysis. It is suitable for publication in ACP once several revisions have been made, as described below.

Major Comments:

1. Section 3.4.2, pg 26075, lines 5-14: The WRF-simulated dry deposition velocity shows a 22% increase from June to July over North China. The authors argue this reduction contributes to the observed ozone decrease from Jun to July. To make the argument more convincing and scientific interesting, the authors need to (1) quantify the change in dry deposition flux (rather than dry deposition velocity) between the two months and (2) discuss the factors that drive the increase in dry deposition.

2. Section 4.2, pg 26079-26080: the authors find that the spatial distribution of meteorological parameters corresponds well with the spatial distribution of ozone exceedances, thus arguing the domination of meteorological processes on ozone production over emissions. As no one expects to see homogenous meteorological patterns over North China, are the spatial differences in temperature, RH, radiation, and cloud fraction shown in Figure 14 really statistically significant? The color scale in Fig 14 makes them appear to look different, but statistical analysis is warrant.

3. It seems that the monitoring sites also have VOCs measurements as indicated in the abstract and introduction. Why do the authors choose to use satellite observed HCHO/NO2 column ratios, rather than using concurrently measured VOCs and NOx ratios, to infer the sensitivity regime of ozone chemistry? The measured ratio should at least provide consistency checks on the regime analysis.

4. The paper has a lot of figures. I suggest removal of a couple of figures that are not critical for the analysis or put them in a supplemental material, e.g., Figure 2 (the WRF domain) and Figure 4. The wind vectors in Figure 4 are hard to see. With Figure 3 already showing the seasonal variation of meteorological parameters, Figure 4 is redundant.

Minor comments: 1. pg 26067, equation 3: define DO3(t) in the equation.

2. pg 26075, line 5: Figure 6 should be Figure 9.

3. pg 26078, line 16-19: How do the authors calculate the photochemical production rate of ozone per day? Can the authors calculate the dry deposition loss of ozone per day? The comparison of the dry deposition loss rate (ppbv/day) in June and July can offer a more direction evidence for the importance of dry deposition in causing the observed June to July ozone reduction.

4. Figure 9 caption: 9b should be dry deposition velocity of ozone.

5. In abstract, line 5-6: the text on PM10, PM2.5, and VOCs should be removed from the abstract because these measurements are not shown in the paper.

Grammar errors (list only a few):

1. pg 26060, line 8: surround should be surrounding; 2. pg 26061, line 3: lead should be lead to 3. pg 26073, line 15: resulted should be result

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