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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Regional background O_3 and NO_x in the Houston-Galveston- Brazoria (TX) region: A decadal-scale perspective" *by* Loredana G. Suciu et al.

Anonymous Referee #1

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Review of ACP-2016-893

General Comments

This paper describes the use of principal component analysis (PCA) to examine trends in the background concentrations of O3 and NOx in the greater Houston, TX area over a 17 year period (for ozone). Understanding the significant decreases that have occurred in this former extreme non-attainment area since 2000 can help us better understand the effectiveness of ozone control strategies in general. The authors have expanded on the work of previous researchers that applied this technique to maximum daily 8-h average (MDA8) ozone concentrations, by extending the PCA analysis to include NOx and adding 1-h median values of both O3 and NOx to their analysis. The

paper is well written and easy to read. The results, which are consistent with the earlier findings, are both useful and important and should be published with minor revisions to address the points raised below.

Specific Comments.

P3, L16. The authors should point out that one of the key findings of the first TexAQs study was the disproportionate role of highly reactive VOCs (HRVOCs), primarily alkenes, released from petroleum refineries in the rapid production of ozone in the Houston area. These "upset" emissions were greatly reduced before the second study took place, greatly reducing the local ozone contributions.

P3, L25-29. The authors should consider including the study of Darby et al. in their introduction.

Darby, L. S. (2005), Cluster analysis of surface winds in Houston, Texas, and the impact of wind patterns on ozone, Journal of Applied Meteorology, 44(12), 1788-1806, doi:1710.1175/JAM2320.1781.

P6, L8. Did the Varimax rotation make any difference in the interpretation compared to the unrotated PCs?

P6, L18. A logical extension of this work would be to apply the PCA techniques to the diurnal 1-h median values of Ox (=O3+NOx), which is more conservative. Indeed, an analysis of the nighttime Ox concentrations when there is no photochemical activity might provide the best estimate of background ozone.

P7, L26. As noted later in the paper, PC1 equally represents the marine and continental backgrounds depending on the sign.

P8, L6. Figure 2 suggests that the primary NOx PC loadings are associated with the W.A. Parish and other power plants; is this the case?

P8, L29. Another explanation for the difference is that much of the NOx responsible for

the background O3 production has been converted to NOy (e.g. HNO3 and PAN). This would include most lightning generated NOx. Also, depending on the season, a significant amount of the background ozone may also have originated from the stratosphere.

P9, L30. See comment above about VOCs and Daum et al. (for example)

Daum, P. H., L. I. Kleinman, S. R. Springston, L. J. Nunnermacker, Y.-N. Lee, J. Weinstein-Lloyd, J. Zheng, and C. M. Berkowitz (2004), Origin and properties of plumes of high ozone observed during the Texas 2000 Air Quality Study (TexAQS 2000), J. Geophys. Res, 109, doi:10.1029/2003JD004311.

P11, L12. PC5 is not significant for O3.

P13, L25+. The variations in Fig. 4 suggest that the 1-h median approach is (not surprisingly) more strongly influenced by the persistent onshore flow during July than the 8-h MDA8 approach.

P16, L10. The slope is listed as -0.68$\pm$0.27 in Table 7.

P16, L13. The slopes all agree within the margins of error and are not significantly different.

P16, L15. The background ozone trend estimates derived from the current analysis may be twice as precise as those in Berlin et al. (2013), but they are not necessarily more accurate. Indeed, the large interannual variations in the method B data plotted in Figures 6 and 7 suggest that a linear model is not really appropriate. Some discussion of this is in order.

Technical Corrections

P1, L8 (Abstract). Suggest omitting the "the" to give: "...photochemistry is most active..."

P1, L24 (Abstract). Suggest replacing the "the" to give: "...since 2007 and an increase in..."

P3, L16. "Parrish" is misspelled in the reference.

P9, L24. What does VOCs mean? Is this a typo?

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