

Interactive comment on “Spatial and temporal variability in surface ozone at a high elevation remote site in Nepal” by G. W. K. Moore et al.

Anonymous Referee #2

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This paper presents the temporal variability of observed surface ozone at the ABC-Pyramid site in the Mount Everest region during 2006. The authors analyze correlation coefficients of surface ozone at the study site and total column ozone from OMI as well as meteorological fields from ECMWF, and suggest that there is a significant stratospheric contribution to elevated ozone at Mount Everest in the pre-monsoon period. Observations of trace gases and aerosols in the Mount Everest region are extremely valuable, considering the role of this region in controlling regional and global climate as well as its vulnerability to climate change. However, it is not surprising to know that stratospheric intrusion is an important contributor to surface ozone at high-altitude sites in this region. I agree with the other reviewer that the authors did not provide new quantitative information on how much surface ozone at the site is from the stratosphere. I do not have a chance to read the paper by Cristofanelli et al. (2009) using similar data

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presented in the current paper, thus I have no comments on the originality of this work. I am offering my comments below to improve future version of this paper.

1. This paper will benefit from analysis of concurrent observations of ozone and CO to identify the relative contribution of stratospheric air and long-range transport of anthropogenic sources for specific episodes. A relevant paper for the analysis is Ding and Wang (2005), who used ozone and CO observations to evaluate the importance of stratospheric intrusion on summertime ozone observed at a high-altitude site in the Tibetan Plateau.

Ding, A. and Wang, T.: Influence of stratosphere-to-troposphere exchange on the seasonal cycle of surface ozone at Mount Waliguan in western China. *Geophys. Res. Lett.*, 33(3), 1–4, doi:10.1029/2005GL024760, 2006.

2. Apparently, the Asian monsoon circulation plays a very important role in controlling the seasonality of surface ozone in this region. In the introduction page 16236, line 10–15, the authors stated that the impact of the subtropical jet and monsoonal circulations on surface ozone has not been extensively studied. I don't know much about the subtropical jet, but I am sure that there are quite a few recent studies (listed below and references therein) examining the impact of monsoon circulations on the ozone seasonality in East Asia. These studies are very relevant to the discussion here and should be cited. Elevated ozone in the pre-monsoon season could be due to enhanced photochemical production in relatively cloud-free weather and subsequent long-range transport unless you can provide clear evidence of stratospheric intrusion events.

He, Y. J., et al.: Significant impact of the east Asia monsoon on ozone seasonal behavior in the boundary layer of eastern china and the west pacific region, *Atmos. Chem. Phys.*, 8(4), 14927–14955, <http://www.atmos-chem-phys.net/8/7543/2008/>, 2008.

Lin, M., et al: Multi-scale model analysis of boundary layer ozone over East Asia. *Atmospheric Chemistry and Physics*, 9, 3277–3301, 2009

Wang, Y., et al: Variations of O₃ and CO in summertime at a rural site near Beijing, *Atmos. Chem. Phys.*, 8(21), 6355–6363, 2008.

3. Page 16235, line 16-22: do you mean that high TCO is generally correlated with a region of low pressure? To my knowledge, upward flows generally occur in a region of low surface pressure. Then how comes the downward intrusion of stratospheric air?

4. Please further elaborate the statistical metrics used in this study. How do you define autocorrelation and lagged correlation? What is their statistical meaning? This will help future readers to better understand this paper.

5. In Figure 6-12, the authors present the spatial maps of correlation coefficients between noon ozone at the ABC-Pyramid site and TCO as well as meteorological fields from ECMWF. To my understanding, surface ozone observations are only available at the single site. How do the authors calculate the spatial correlation coefficients between ozone observations at this site and TCO etc. for the whole region?

6. Section 3 and Section 4 can be combined to give a more concise presentation

Interactive comment on *Atmos. Chem. Phys. Discuss.*, 9, 16233, 2009.