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Atmospheric Chemistry and Physics Discussions

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 #4

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The basic conclusions of the authors are persuasive, that stratospheric intrusions do contribute to surprisingly high surface ozone concentrations during pre-monsoon and early monsoon break periods in the Himalayan foothills. Properties of the unusual hiatus period for 2006 adds weight to the dynamical argument. This is an interesting human health issue and motivates publishing this work. Using column ozone as a proxy for intrusions is reasonable. Due to the poleward / downward circulation around subtropical jets, entry into the troposphere is most likely on the poleward side of the jet, where column ozone maximizes. This is especially true when upper level PV maxima (troughs) extend equatorward, displacing the subtropical westerly jet. This is borne out nicely in the correlation graphs relating surface ozone to high column ozone and high PV and low geopotential heights aloft, whenever equatorward-digging troughs occur during the pre-monsoon period. I have not read Semple et al. 2008 or Cristofanelli et

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Interactive Discussion

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al. 2009, so it is hard to determine the degree of originality beyond those papers. The basis for a very nice paper is present here, but I agree with previous comments that there is too much emphasis on correlation plots and not enough on synoptic/dynamic interpretation. The additional analysis of other trace constituents or of vertical profiles of ozone would add considerably to the strength of interpretation. Specific suggestions and comments follow.

It is quite interesting that the correlation coefficient began to drop in mid-July, several weeks after the hiatus event. Perhaps July 15 is a better partition for dynamical similarity before versus after that date, rather than July 1. Is it possible that the 60-day moving window, if run from left to right, displaces this divisor by two weeks?

The comment that there may be a 5-6 day periodicity during pre-monsoon due to the passage of baroclinic waves in the westerlies to the north could be made more quantitative by a simple power spectral analysis of the time series in Figs. 1-2.

In creating the correlation maps for sub-periods, it would seem better to include the hiatus period with the pre-monsoon period, but include the monsoon period before it with the primary monsoon period, rather than bin all data prior to June 30 together.

Information about 3-D pathways and structures would strengthen the basic thesis. Classical case study maps PV, wind vectors or streamlines and cross-sections would be useful to show the vertical structure of PV and ozone. ECMWF data includes ozone which is of some utility. Sample charts for each weather regime would aid interpretation of the correlation maps. There are Lagrangian trajectory models available online that can be used to illuminate air mass motions. Back-trajectories from the site into the UTLS would clearly support the S/T exchange mechanism, while those from upstream surface sources during monsoon would also be clear. If there were any ozonesonde or lidar profiles of ozone anywhere in the region that would be helpful.

The positive maximum to the southeast of and adjacent to Tibet in Fig. 6b could possibly be consistent with an upstream surface boundary layer photochemical source during monsoon. But again, one would need to show the wind direction.

It would be good to show geopotential height maps along with Figs. 11 and 12 so that the circulation may be better understood.

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

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