Atmos. Chem. Phys. Discuss., 8, S4601–S4604, 2008
www.atmos-chem-phys-discuss.net/8/S4601/2008/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Contributions of pollutants from North China Plain to surface ozone at theShangdianzi GAW station" *by* W. Lin et al.

Anonymous Referee #2

Received and published: 9 July 2008

A very large economic growth took place in China during the last decade and nitrogen dioxide emissions strongly increased in this region as documented by satellite observations. This development suggests a simultaneous increase in regional ozone concentration in the planetary boundary layer but only a limited number of studies (referenced in the submitted paper) about tropospheric ozone in China have been published in the reviewed literature. The study presents measurements of ozone and primary pollutants from a surface site (Shangdianzi) approximately 100 km north to Beijing often being in the outflow region of the Beijing area ("North China plain") and the paper provides a convincing interpretation of the measurements including advection regimes. Because the measurements are expected to continue in future providing valuable information of the future development of photooxidant air pollution in the region the re-

viewer recommends publication in ACP if the following comments are properly taken into account. Abstract: 1)Line 9, p. 9140: The reviewer suggests to remove "natural (clean)", compare comment 13; 2)Line 17/18, p. 9140: The last sentence of the Abstract might be changed, possibly by: The emissions of nitrogen oxide in the North China plain cause a decrease in ozone concentrations in winter. Introduction: 3)Line 25, p. 9140: Regarding the strong increase in ozone over Europe you might refer to J. Staehelin, J. Thudium, R. Bühler, A. Volz-Thomas and W. Graber: Surface ozone trends at Arosa (Switzerland), Atmos. Environ., 28, 75-87 (1994); 4)Line 9, p. 9141: "and etc." should be removed; 5)Line 15, p. 9141 and line 26, p. 9151: Staehelin instead of Staehlin; 6)Line 6, p. 9142: Remove "natural", see comment 13. Site and Observations: 7)Line 22, p. 9142: It should be mentioned, that the measuring principle used for measurements of NO2 at the site suffers from interference of other NOy compounds such as PAN and HNO3. The authors might reference the paper of M. Steinbacher, C. Zellweger, B. Schwarzenbach, S. Bugmann, B. Buchmann, C. Ordonez, A.S.H. Prevot, and C. Hueglin, Nitrogen oxide measurements at rural sites in Switzerland: Bias of conventional measurement technique, J. Geophys. Res., Vol. 112, D11307, doi:10.1029/2006JD00791, 2007. This implies that the measured NO2 concentrations have to be viewed as an upper limit, particularly in aged air masses such as in summer; 8) Measurements run under the program of Global Atmospheric Watch (GAW) of World Meteorological Organization (WMO) are expected to be published at the respective World data center, which should be done prior to publication of the measurements in a reviewed paper. Have the authors already submitted the measurements of ozone of the Shagdianzi station to the World Data Center of Greenhouse Gases ? Results and Discussion: 9) Figure 3: It appears that the curves of the diurnal variation of ozone are not correct at midnight for the January and February. Are the respective "jumps" at midnight an artifact of the used software program ? This should be corrected in the revised version; 10) Line 23, p. 9144: "ozone and related gases": SO2 is not directly related to ozone (not a precursor), therefore the term "related" should be replaced by "primary pollutants"; 11) Fig. 4: The diurnal variation of SO2 concentra-

ACPD

8, S4601–S4604, 2008

tions shows a distinctly different pattern than the other primary pollutants particularly compared to NOx; NOx peaks during the time when inversions usually occur, in line with the expectation of dominant emissions into the regional planetary boundary layer. SO2 concentrations peak at 16.00 (average over the year) or 11 (in summer) when the PBL is expected to be mixed with the are larger in the layer above the inversion. This might suggest that larger SO2 concentrations are transported to the measuring site in a layer above the inversion. Please comment on the possible origin of SO2 and possible transport mechanisms; 12) Table 2: The reviewer does not completely understand what "maximum average" and "minimum average" exactly means and how the numbers are determined. Please clarify; 13) Line 4-24, p. 9147: The reviewer thinks, that it is rather difficult to justify that ozone concentrations advected by the N-NNE sector to the measuring site represent "natural background ozone" (only) attributable to the transport from the stratosphere and ozone production from natural emissions, because tropospheric ozone increased on a hemispheric (at least intercontinental) scale since World War II. However, it is justified to assume that the difference between the two sectors are caused by the ozone production in the North China plain, which is the most important message in the paper (comp. comments 1 and 6); 14) Line 13, p. 9148: It is not completely clear, how the "daily accumulated contribution of 240 ppb.hr" is calculated. Please specify; 15) Line 25, p. 9148: The reviewer suggests to replace: "Because of inactivity of photochemical production in winter" by "Photochemical ozone production in the Planetary Boundary layer is very small in winter and therefore higher NOx concentration in the SW sector leads to chemical ozone destruction (gas titration, i.e. reaction of NO with O3) explaining lower ozone concentration in the polluted sector than in the regional background air". Conclusions: 16) Line 7-8, p. 9149: Sentence starting with "Influenced by ..." could be changed to "Surface ozone concentrations at SDZ show some unique properties because of its location and the surrounding topography"; 17) Comment to line 15, p. 9149: In order to verify the interpretation of the SDZ measurements, the reviewer recommends additional ozone (and possibly precursor measurements) South East and close to Miyun. During days of strong photochemical

ACPD

8, S4601–S4604, 2008

Interactive Comment

activity one might expect that ozone peaking values occur earlier in the day at this site than at SDZ station, similar as reported in A.S.H. Prévôt, J. Staehelin, G.L. Kok, R.D. Schillawski, B. Neininger, T. Staffelbach, and A. Neftel: The Milan phootoxidant plume, J. geophys. Res., 102, 23,375-23,388 (1997).

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 9139, 2008.

ACPD

8, S4601–S4604, 2008

Interactive Comment