Atmos. Chem. Phys. Discuss., 2, S358–S361, 2002
www.atmos-chem-phys.org/acpd/2/S358/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "On the origin of tropospheric O_3 over the Indian Ocean during the winter monsoon: African biomass burning vs. stratosphere-troposphere exchange" *by* A. T. J. de Laat

T. Mandal

tuhin@mpch-mainz.mpg.de

Received and published: 5 September 2002

As a parcipitant of FFP-INDOEX-1998, the actual launcher of the ozonesondes and having experience in the data analysis with INDOEX-FFP1998, I have some comments on the data of the above mention paper. de Laat has presented only 15 profiles whereas total number of ozonesonde launched over Indian Ocean during FFP INDOEX-1998 were 26 out of which 15 profiles are ECC type provided by Dieter Kley and Herman G.J Smit and 11 profiles are MBM (modified Brewer Mast) type by Indian Meterological Department. The quality of Indian ozonesonde data has been assessed by several times even during the FFP-INDOEX-1998 [Smit and Kley, 1998, reference

therein]. Figure 1 in Peshin etal [2001] shows the comparison between ECC and MBM showing similar profiles during INDOEX 1998 but some differences during INDOEX 1999. Generally, the JOISE [Thouret et al 1998;Smit and Kley, 1998] intercomparison shows that the relative deviation of Indian sondes is typically witin (10-20)% whereas, it was within 10% with respect to ECC sondes in third WMO intercomparison, 1991. The precision error is of about (10-15)%. The main point is that some important features may be missed if one considers only 15 ozone profiles rather than total 26 ozone profiles launched during INDOEX-FFP-1998. Dr. de Laat is certainly welcome to use both the ECC and MBM data, as long as all the data PIs are consulted and properly acknowledged (which unfortunately has not yet been done). If we deeply analyze the paper by de Laat then one can find the model profiles are not similar to the observed profiles as claimed by de Laat. For example sonde-3 model has smooth value and could not capture the microstructure and enhancement within 5-10 km. Same as true for sonde 4, and others. Moreover it has overestimated in case of sonde 14 in the middle troposphere. Figure 2a in Mandal et al [1999] and Figure 9 in Peshin etal [2001] then it is clearly show that large O3 persists even ˜120 ppbv in the troposphere in most of the continental profiles in the southern hemisphere. Moreover the tongue like feature as observed in onward journey [Mandal et al, 1999] clearly suggests the stratosphere-troposphere exchange within the region 10-15 S which is just within subsidence zone of ITCZ. So de Laat claimed little stratopsheric contribution (20%) to the total tropospheric ozone except 13, 14 which is not true. Moreover sonde 13, 14 are very near the Indian subcontinent so the large tropospheric ozone may be just outflow from the Indian subcontinent rather than the stratopsheric intrusion. One can see the comparison between the continental and marine profiles in figure 7 [Peshin et al, 2001] and figure 7b [Mandal et al, 1999]. It resembles the north-south gradient at surface as shown by Lal et al [1998]. The relationship between ozone and carbonmonoxide with stratospheric / tropospheric origin is not clear here as shown by de Laat. The relationship between ozone and CO varies with height, time, space e.g., very low ozone and large CO is observed in Sabble Island [Parrish et al, 1998]. Consider sonde 1 where surface CO is

ACPD

2, S358–S361, 2002

150 ppbv and middle troposheric value is ˜100 ppbv, one can expect that upward transport may answer the presence of large CO in the middle troposphere. Same as true for 2-14. But sonde 6 and 7 are some kind of exception as surface CO is less than 50 ppbv which can not contribute to the large middle tropospheric CO. So we must treat them very carefully. de Laat has shown in figure 6 that north of the equator has less precipitation compared to the south of equator. So due to reduced photolysis rates and washout of ozone precursor, the ozone concentration in troposphere in the southern side of equator should be low unless there is STE mechanism plays role. de Laat has given the concept that north of the equator i.e., central Africa has produced ozone and its precursor and then advected to the south of the equator to enhance the middle tropospheric ozone. The concept is here "mix and then cook". But figure 9 in Peshin et al [2001] shows that La Renioun[21.06S,55.48E], Ascension Islands[7.98S,14.42E] and Nairobi[1.27S,36.38E] shows the presence of large ozone even upto 120 ppbv in the troposphere, which does not support the less ozone in the troposphere in the southern side of the equator. On the other hand, if one compares the figure 2a in Mandal [1999] and the figure 9 in Peshin et al [2001] then it can be concluded that flow of tropospheric ozone from the southern side of the equator rather than flow from the northern side of the equator with the concept of "Mix and Cook".This support the hypothesis of Zachariasse et al [2000] where trajectory analysis shows the flow from the southern side of the equator as explained for the sonde 6 and sonde 7. So "Mix and Cook" concept has to be checked with the entire set of ozone profiles. Moreover the the tongue like feature in total ozone which is originated in the East Asia in figure 6 in Mandal et al [1999] shows increament of total ozone of 20 Dobson Unit could be another reason for mid tropospheric ozone maxima. Here the gradient is shown from east Asia rather Central Africa. The location of model high ozone in figure 8a and Figure 8b in de Laat is shown in the southern tips of Africa [30 S, 24E]. The ozone profiles over La Renioun, Ascension Islands and Nairobi, which are close to Africa (see data at http:// code916.gsfc.nasa / Data services /SHADOZ) show high ozone in middle troposphere. But model analysis do not provide such information. Does this model reproduce this?

ACPD

2, S358–S361, 2002

If not, it is hard to trust the results of high ozone at in the southern tips of Afirca [30 S, 24E] and to trust that it would be better downward during INDOEX. Finally, de Laat has left out the sonde 15 from table and figure although he has mentioned that there is large discrepency between model and observation. The reason is not clear here.

References. Lal, S., M. Naja, and A. Jayaraman, " Ozone in the marine boundary Layer over the tropical Indian Ocean", JGR, 103, 18,907-18917, 1998.

Mandal, T.K., D. Kley, H.G.J Smit, S.K.Srivastav, S.K.Peshin and A.P.Mitra, "vertical distribution of ozone over the Indian Ocean (15N-15S) during the First Field Phase INDOEX-1998, Current Science, 76, 938-943, 1999

Parrish, D.D, M. Trainer, J.S.Holloway, J.E. Yee, G.L. Forbes, J.L.Moody, "Relationships between ozone and carbon monoxide at surface sites in the North Atlantic region", JGR, 103, 13357-13376, 1998.

Peshin, S.K., T.K.Mandal, H.G.J Smit, S.K.Srivastav, and A.P.Mitra, "Observations of vertical distribution of tropospheric ozone over Indian Ocean and its comparison with continental profiles during INDOEX-FFP-1998 and IFP-1999 , Current Science (suppliment), 80,197-208,2001.

Smit H.G.J and D. Kley, JOSIE: The 1996 WMO International intercomparison of ozonesondes under quasi flight conditions in the environmental simulation chamber at Jülich, WMO/IGAC-Report, WMO Global Atmosphere Watch report series, No. 130 (Technical Document No. 926). World Meteorological Organization, Geneva, 1998. Zachariasse, M., P.F.J. Velthoven, H.G.J. Smit, J. Lelieveld, T.K.Mandal, and H. Kelder, "Influence of stratosphere-troposphere exchange on tropospheric ozone over the tropical Indian Ocean during the winter monsoon, JGR, 105, 15,403-15,416, 2000.

Interactive comment on Atmos. Chem. Phys. Discuss., 2, 943, 2002.