Atmos. Chem. Phys. Discuss., 6, S5829–S5832, 2006
www.atmos-chem-phys-discuss.net/6/S5829/2006/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Isentropic advection and convective lifting of water vapor in the UT– LS as observed over Brazil (22° S) in February 2004 by in situ high-resolution measurements of H_2O, CH_4, O_3 and temperature" *by* G. Durry et al.

Anonymous Referee #5

Received and published: 30 December 2006

This paper presents two sounding results of micro-SDLA sensor together with ECC and O3-SSS ozonesondes. The micro-SDLA sensor is a diode laser spectrometer which measures H2O, CH4, and CO2 with a substantially high temporal resolution (160 ms, if I understand correctly). This is a quite new, very interesting sensor, and reminds me about the so-called temperature sheets measured with special French thermometer sondes and very thin echoing layers measured with atmospheric radars (e.g., Luce et al., Ann. Geophys., 2001). It would be very interesting to make simultaneous micro-SDLA soundings together with these instruments to investigate the role of turbulence

in the atmosphere. One suggestion to the sensor development is that a high-sensitivity thermometer should be placed in the micro-SDLA gondola so that the high-resolution trace gas and temperature measurements can be compared directly and that relative humidity can be calculated with a high resolution.

The authors try to interpret the obtained profiles around the tropopause as influenced by isentropic and convective transport. Due to the limited number of the measured profiles, however, the discussion is not conclusive. Also, it seems CH4 and CO2 data are not effectively used in the analysis. I am rather reluctant to suggest this paper to be published in ACP as its present form. More comments below.

One problem is the "TTL" (tropical tropopause layer) that authors mention and define by using temperature and ozone profiles. The ozone distribution around the tropical tropopause has a clear, global wave-one structure on average, and in the South American region, the ozone in the upper troposphere has a positive vertical gradient "on average" (e.g., Thompson et al., JGR, 2003). On the other hand, there are active cumulonimbus clouds which reach substantially high altitudes (16-17 km as authors also mentioned). These facts suggest that the "TTL" defined by ozone profiles may have little meaning in terms of vertical transport at least at this observation location.

Also, the latitude of 22S is not in the deep tropics but rather in subtropics where active lateral stratosphere-troposphere exchange is occurring (as authors also pointed out). Therefore, I am afraid that comparing the results with equatorial measurements (Voemel et al., 2002) may not be very relevant.

The manuscript could focus more on the tracer-tracer relationship around the tropical tropopause and emphasize and propose the importance of this new technique for process studies near the tropopause regions. Not only advection but also mixing and turbulence should be able to be investigated with the data.

Some minor comments.

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Title:

The title is confusing. In the text the authors discuss the role of isentropic advection and convective lifting for different cases. But, this title gives an impression that the two processes are working at the same time.

2. Instrument:

Again, the sensor itself is very unique and interesting. The simultaneous measurement of temperature is essential especially for water vapor measurements (to get RH). How was the altitude or pressure measured? By GPS, or the piggy-back ozonesondes? The whole instrumentation (including the ones for ozone, temperature, etc.) should be described in this section.

3.1 Brief overview of the meteorological situations :

According to the doppler radar echos, the cloud tops were estimated at 16-17 km or the above. These altitude should be the bottom of "TTL" where vertical (deep) transport is negligible.

3.2 Location of the TTL for both flights :

Upper tropospheric ozone is controlled by various processes, not only by deep convection. Therefore, one needs careful consideration when using ozone to think about "TTL." See my major comments above.

3.3 H2O and CH4 in the UT-LS :

The tracer-tracer correlation should be investigated for particular layers/regions. Relative humidity ("supersaturation") is investigated here, but which temperature data did the authors use, ozonesonde or independent RS90/RS80 radiosondes?

3.4 Ozone in the UT-LS :

Ozone measurements in Fig. 5 are very variable. How do the authors explain, for ex-

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ample, the difference among ECC-23, ECC-24, and O3SSS-24? How is the accuracy of O3SSS?

4.1 Intrusions of extratropical air into the UT-LS :

CH4 and H2O should generally be correlated near the tropopause. How do the authors explain the anticorrelation for SF2, around 400K potential temperature level?

4.2 Vertical transport by convection into the TTL for SF4 :

The authors mention about lightning NOx. Is it really plausible by considering the ozone production rate by the lightning NOx? The rate may be too small. At page 12486, lines 3-5, the authors use the term "delay." Is this delay on the order of minutes, hours, or days?

Interactive comment on Atmos. Chem. Phys. Discuss., 6, 12469, 2006.