Atmos. Chem. Phys. Discuss., 5, S3893–S3896, 2005
www.atmos-chem-phys.org/acpd/5/S3893/
European Geosciences Union

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Modelling study of the impact of deep convection on the UTLS air composition – Part I: Analysis of ozone precursors" *by* V. Marécal et al.

Anonymous Referee #2

Received and published: 14 November 2005

General Comments

This paper, which is the first part of a series of two papers aiming to study the local impact of deep convection on the chemical composition of the Upper Troposphere and Lower Stratosphere (UTLS), is devoted to the analysis of ozone precursors in the UT/LS during a severe convective event over Barau, Brazil in February 2004.

The paper is well written and performed in a scientifically sound manner, however in its present state I do not think that the conclusions of the paper are of substantial enough to stand alone (see further comments below). I think it would be better to summarize

the results obtained in the present study and to include these in the second part of the article series.

A major weakness of the paper is that there are no observed vertical profiles available at the moment to evaluate the simulated ozone precursor fields, and for several of the precursors there are actually not any observations available at all. In that sense, the conclusions of this paper becomes speculative and not scientifically new. The indication that CO, NOx and NMVOCs can be transported from the surface to the UTLS region during deep convective events has already been concluded by previous meso-scale modeling studies (e.g. Wang and Prinn, 2000; Tulet et al, 2002).

In addition, the simulated case does not involve any case where the convective updraft intercepts the tropopause. Therefore, the paper does not actually consider the impact of deep convection on the lower stratosphere and one of the major aims of the study is hence not fulfilled.

Specific Comments

Page 9128, abstract: It is stated by the authors that the aim of the work is to study the local impact of deep convection on the UT/LS air composition. However, the LS is never really explicitly studied, it is only indicated that the transport of ozone precursors are likely to be of importance for the ozone budget in that region.

Page 9129, last paragraph: “The tropical UT and LS has not been fully documented yet”. Could the authors please specify more clearly what has and what has not been documented about the tropical UTLS. On page 9130, it is listed a number of studies focusing on the tropical UTLS region. There are also additional observational studies performed by e.g. Ridley et al. (2004) or Kley et al. (1996). The authors do not mention what has been concluded in previous model studies of tropical convection (e.g. Wang and Prinn ,2000) or deep convection over mid-latitudes (Tulet et al. 2002).

9131, fist paragraph: Related to the previous comment, the authors specify what is

ACPD

5, S3893–S3896, 2005

the focus of the present study, but fail to present how this work is related and/or new compared to previous studies.

Page 9135, line 12: The pH for the aqueous phase chemistry is set to 4.93, how sensitive are the results to this fixed pH?

Page 9135, last paragraph: Initialization of the chemistry fields, is the 15-day global simulation performed for the month of February 2001 or for some other time period?

Page 9136, statistical evaluation using surface observations: Modeled wind and temperature fields are compared with observations, but what about water vapor? Isn't specific humidity available from the ECMWF database? This should be a very important parameter for comparison.

Page 9137, comparison with radar observations: I am not convinced that the model "captures well the observed main rain patterns" as stated by the authors. There is much more precipitation south of Barau station in the model compared to the observations, and a more coherent band of precipitation north of Barau station in the observations compared to in the model. Can the authors perform some kind of statistical analysis for the precipitation as for the other meteorological parameters? For example a frequency distribution? Or at least compare mean values and standard deviations?

Page 9138, 2nd paragraph: As mentioned earlier, the aim of the paper is to study UTLS air composition but the simulated convective cells never reach the altitude above the tropopause.

Page 9138, results on ozone precursors: It would be interesting to see the importance of each ozone precursor on the total ozone production/destruction budget. How important is it to simulate the correct amount of transported NMVOCs in the UTLS region with respect to ozone production? Compared to e.g. simulating the correct LNOx produced? Or the correct photolysis rate of NO2?

Technical Corrections

ACPD

5, S3893–S3896, 2005

Page 9129, line 15: “The TTL extends from about 12-14 km..” change to “The tropical TTL extends from about 12-14 km..” Page 9132, line 3: “In broad terms, it can be summed up by a high pressure system..” change to “In broad terms, it can be summed up by a high surface pressure system..”

References

D. Kley, P. J. Crutzen, H. G. J. Smit, H. Vömel, S. J. Oltmans, H. Grassl, V. Ramanathan, Observations of Near-Zero Ozone Concentrations Over the Convective Pacific: Effects on Air Chemistry, Science, 274, 230-233 , 1996.

Ridley, B., E. Atlas, H. Selkirk, L. Pfister, D. Montzka, J. Walega, S. Donnelly, V. Stroud, E. Richard, K. Kelly, A. Tuck, T. Thompson, J. Reeves, D. Baumgardner, W.T. Rawlins, M. Mahoney, R. Herman, R. Friedl, F. Moore, E. Ray, J. Elkins, Convective transport of reactive constituents to the tropical and mid-latitude tropopause region: I. Observations. Atmospheric Environment, 38, 1259-1274, 2004.

Tulet, P., K. Suhre, C. Mari, F. Solmon, R. Rosset, Mixing of boundary layer and upper tropospheric ozone during a deep convective event over Western Europe. Atmospheric Environment, 36, 4491-4501, 2002.

Wang, C. and Prinn, R. G., On the role of deep convective clouds in tropospheric chemistry. J. Geophys. Res., 105, 22,209-22,297, 2000.

Interactive comment on Atmos. Chem. Phys. Discuss., 5, 9127, 2005.