Atmos. Chem. Phys. Discuss., 12, C1814–C1816, 2012
www.atmos-chem-phys-discuss.net/12/C1814/2012/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Study of the diurnal variability of atmospheric chemistry with respect to boundary layer dynamics during DOMINO" *by* B. J. H. van Stratum et al.

Anonymous Referee #1

Received and published: 24 April 2012

Overall, I think that this is a substantial contribution to the study of the behavior of trace reactive species in the ABL, and I recommend publication. In addition to the comments below, I have a couple of other more general comments. First, there seems to be no mention of the height at which the measurements were made. Were they in the surface layer? If so, they may be considerably different from the mixed layer average. I suggest a bit of discussion of this question. Second, the mixed layer approach does not explicitly take into account higher-order moments, and particularly the segregation of the chemical species which can affect the reaction rates. Again I suggest a discussion to point out the effects of this.

Specific Comments:

I suggest a modified title along the lines of, "A case study of diurnal variability of chemically active species during DOMINO using a mixed-layer model of the boundary layer"

Define acronyms (e.g. MXLCH, DOMINO, MOZART, TROFEE, HUMPPA-COPEC) when they are first used, both in the abstract and the text.

p. 2, Fig. 1 caption: On the right side the chemistry. . .

p. 3, Eq. 4: There is a sign inconsistency here: In (4), w_s is positive upward while in the subsequent definition it is positive downward.

p. 3, r. col. l. 7 from bot.: . . .in Fig. 1, for no source/sink terms, entrainment will. . .

p.5, r. col., l. 6 from bot.: . . .relatively. . .

p.5, r. col., bot.: . . .mixed-layer growth by about...

p. 6, r. col., l. 19: I suggest a rewording of this sentence: Given the differences between the observations, the box model and MXLCH with both reaction schemes, we have shown that ABL dynamics play a key role in reproducing and understanding the measured mixing ratios.

p. 6, l. col., l. 17 from bot.: . . .and H_2O_2 concentrations in Fig. 5.

p. 6, r. col. l. 10 from bot.: This means that. . .

p. 7, r. col., l. 13 from bot.: This demonstrates that even without entrainment. . .

p. 8, r. col., 2nd last para.: I suggest rewriting as follows: For Da_s >= 10, the influence of ABL dynamics is negligible and Eq. (8) reduces to only the chemical contributions. In contrast, DaS <= 0.1 indicates that the contribtion of chemical reactions is relatively small compared to ABL dynamics or large-scale forcing. For 0.1 <= DaS <= 10 chemistry and dynamics interact and both the dynamical and chemical terms of Eq. (8) needs to be taken into account. Using MXLCH, we are able to calculate the time scales

of turbulence and thus indicate the relative importance of dynamics and chemistry.

p. 9, l. col., l. 1: . . .of the ABl, \tau_t, increases. . . l. 2: The slowest reaching species, CO, has a time scale on the order of 10 days, resulting in DaS âĽł 0.1. This indicates that CO is mainly controlled by atmospheric turbulence and transport. In contrast, OH has a time scale of seconds or less, resulting in DaS âĽń 10. This confirms the findings shown in Fig. 6d, where the OH budget was mainly determined by the chemical transformations.

p. 9, l. col., l. 10 from bot.: . . .measured with the 23 November values on the order of. . .

p. 9, r. col., l. 4 from bot.: the box model underestimates O3 mixing ratio.

p. 10, r. col., l. 6: . . .expensive alternative to complex. . .

p. 10, s. col., l. 8 from bot.: . . .relatively O3-rich and NO2 poor air originating. . . l. 3 from bot.: . . .chemically active species...

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 6519, 2012.