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Biogeosciences Discussions

Interactive comment on "Regional scale modelling of meteorology and CO_2 for the Cabauw tall tower, The Netherlands" *by* L. F. Tolk et al.

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Dear dr. R. Ahmadov,

We would like to thank you for giving useful suggestions and advices with regard to the content of our manuscript. We have taken all of them into account and provided clarifying answers as well as a number of changes in the text and figures. The corrections included in the revised paper are listed below.

On behalf of all authors, Lieselotte Tolk

Section 2.2: For vertical diffusion, we used the turbulence scheme as described in section 2 of Hong and Pan (1996). This scheme uses a non-local turbulence parameterization within the convective boundary layer. In our simulations with RAMS we

applied this non-local scheme also to the CO2-transport. Cumulus convection was not parameterized in the simulations. This is added to the text and the description of vertical diffusion is slightly extended.

Section 3.2: Rams uses LAI in the determination of the vegetation fraction and the energy fluxes from the vegetation to the canopy. In the current model settings LAI is thus fully used in the energy flux calculations, but not for CO2 flux calculations. We used the MODIS LAI database, this specification is added to section 2.2 and table 1.

Section 4.2: Changes in respiration were due to changes in the temperature. This led to a systematic change in the flux with a RMSE of 0.63 μmol m-2 s-1 which is accounted for in the CO2 mixing ratio change estimate. The change in assimilation due to cloud formation had a RMSE of 0.29 μmol m-2 s-1 and the mean change over the full period near to zero. Changes in assimilation and respiration are uncorrelated (correlation of -0.07), which gives a total standard deviation of the flux change of 0.69 μmol m-2 s-1. Hence, the extra correction needed for changes in the assimilation fluxes will be small compared with the correction for respiration (in the order of <0.05 ppm). This is added to the text in section 4.2.

We added to figure 4 the vertical profiles of the CO2 concentrations for Cabauw, including the observed CO2 mixing ratios of the tall tower up to 200m.

Section 5: The difference in the surface energy fluxes caused a change in the vertical mixing and the horizontal advection. Just attributing the uncertainty in the CO2 mixing ratio due to uncertainty in the surface energy fluxes to a change in PBL height is indeed too simple. The consequent changes in advection are added to the explanation of the change in CO2 mixing ratio with a reference to Lin and Gerbig (2005), as are the shallow and deep convection. The wind change had a standard deviation of 0.85 and 0.98 m s-1 in u and v direction, respectively, which suggests that the simulated change in CO2 mixing ratios is influenced by changes in advection that resulted from the changes in vertical mixing. The interplay of changing horizontal and vertical trans-

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port due surface energy flux uncertainty can explain an important part of the errors found in previous studies at a coarser resolution. We changed this in the text in the abstract, section 1, 4.2 and 5.

Figure 4 and 5 are enlarged.

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