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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Modeling atmospheric CO_2 concentration profiles and fluxes above sloping terrain at a boreal site" *by* T. Aalto et al.

Anonymous Referee #2

Received and published: 25 November 2005

General comments:

In this paper a local scale transport and vegetation model is used to study the representativness of CO2 measurements above a subarctic hilly region in Finland. By for example comparing the results of the local model with the background results of a regional CO2 model the influence of the local topography and land use is assessed. The study is highly relevant as part of the CO2 monitoring network is located in complex terrain, which so far not is well-represented in current models. The paper analyses the problems related to such measurements and gives recommendations that can be used in future studies. The generality of the results is, however, limited by the fact that the model simulations only cover one day. For example could the conditions related to dif-

ferent weather types have been interesting to investigate and might also have influence on the conclusions of this paper. All in all, this is a well-written paper that addresses important issues in carbon cycle research and the paper should therefore be published in ACP. I suggest a few minor revisions in the following.

Specific comments:

In section 2.2 the input at the lateral boundaries is described. Please make it clear if this includes the upper boundary of the local scale model. During some weather conditions one would expect the CO2 concentration above 3 km to have potential influence at a hill site. If this was investigated in the study you could maybe included a comment on this in the paper.

As far as I could see the uncertainty of the flux measurements are not discussed? It might be worth including standard deviation or "error bars" on the flux measurements in Fig. 7?

In section 3.3 the CO2 fluxes are discussed. In the end of the section the following is written: "Ambient conditions at the flux site were, however, quite similar to other areas in the region. When the vegetation flux submodel was applied to the whole region using flux site reference values instead of those given individually for each grid cell by the atmospheric model, the obtained fluxes for the region were in 15% of the 3-D model result." I am not sure I understand this, please reformulate and give a possible explanation for this difference between flux model and 3-D model.

In section 4 it should be more clear when the model results and when the measurements are discussed.

Could you include a comment on the generality of the results - how robust are the results? Would you expect major differences if the model was run for a different day?

Technical corrections: P10029 L9 and L16 type units the same way as in the rest of the paper. L23 include "the" before sun. L24 Include (Ri) after Richardson. L28 and L1

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P10030. Please include e.g. “i.e. 410 m a.s.l” after 100 m so it is easier to compare the two levels given. L3 please indicate if the 150 m difference is a decrease/increase. L5 smaller should be lower. P10031 L18 space missing after CO2. P10032 L8 During the last two hours .... - of what? Please reformulate. P10035 description of expression A3. v1=v ? and z0w=z0h ? please check all expressions for misspelling of variables.

References:

Turnipseed et al. (2004) and Eneroth et al. (2005) could not be found in the list. Is there any reference to Dang et al. (1997) in the text ?

Figures:

Fig. 3: Please use ppm as unit - like in the text. Fig. 4: Would is be possible to have the same scale on the x-axis? It is hard to compare now. Fig. 5: Change unit to ppm.

Interactive comment on Atmos. Chem. Phys. Discuss., 5, 10019, 2005.