Biogeosciences Discuss., 4, S317–S319, 2007
www.biogeosciences-discuss.net/4/S317/2007/

Biogeosciences Discussions

Interactive comment on "Methanol exchange between grassland and the atmosphere" *by* A. Brunner et al.

A. Brunner et al.

Received and published: 16 April 2007

We thank the referee for his very careful reading of the manuscript and the detailed comments. We agree with all technical comments and the suggestions concerning the text formulation, ad we will modify the text accordingly. In the following we respond individually to the scientific comments and questions. Whenever the referee is cited, the text has been written inside quotation marks.

"Section 2.3: Eddy covariance method: As I understand, the eddy covariance method calculates the covariance between the instantaneous fluctuation of a scalar and the vertical wind velocity. Here, the authors interpolate the concentration dataset between consecutive datapoints (e.g. 0.7-1.3s) and calculate the covariance in a subsequent step (e.g. eq. 1). This is mathematically not consistent and probably biases the flux calculations on longer time intervals. The flux calculation should be performed for the true (non interpolated) dataset. This bias could be much more than corrections made due to high-frequency damping described later on." It is true that the interpolation of datapoints between the disjunct measurements causes a certain high-frequency damping effect. However, the quantitative effect is much less dramatic than assumed by the reviewer. In particular, it is smaller than the high-frequency damping caused by other factors. The effect is anyway included in our damping correction because we determined the total damping empirically (see also answer to Referee #1).

"Page 138, line 20 cc: How does advection influence the concentration fluctuation?" We cannot exclude that advection of nearby anthropogenic sources influences the diurnal course of methanol concentrations. But as we pointed out, the methanol emissions from the agricultural fields together with reasonable assumptions about the diurnal course of the boundary layer height are sufficient to explain the major fluctuations of the methanol concentration. It indicates that advection of nearby anthropogenic sources is unlikely to play a dominant role (see also answer to Referee #1).

"Section 4.2: How do these fluxes compare to measurements reported by Schade and Custer (Atmospheric Environment, Volume 38, Issue 36, November 2004, Pages 6105- 6114)? Can methanol emissions from soil be ignored or could they contribute a significant amount to the methanol flux?" Schade and Custer (2004) reported methanol fluxes from the bare ploughed soil in the range of 0 to 0.20 mgC m-2 h-1, which were measured during the hottest weeks of the heat wave of the summer 2003. Compared to the methanol fluxes we measured above the intensive and the extensive grassland these fluxes make up 18% and 9%, respectively. Assuming that under less extreme climatic conditions methanol fluxes from soil are smaller, these percentages would be smaller and can reasonably be ignored.

"Section 4.3: Figure 6 and eq. 3. It would be more helpful to plot y(t) vs LAI, since this is used to parameterize the flux model." We added a figure showing y(t) vs LAI (new Fig. 11).

“Page 143/144: line 25 cc: Why compare only the intensively managed grassland to Galbally and Kirstine? Galbally and Kirstine (2002) assume that natural grasslands dominate on a global scale. Therefore I would suspect that the extensively managed grassland would be more realistic to compare with Galbally and Kirstine (2002).” The emission model of Galbally and Kirstine (2002) uses a methanol emission/NPP ratio for grasses of 0.024% and 0.11% for other higher plants. We found a methanol emission/NPP ratio of 0.024% for the intensive field and a ratio of 0.048% for the extensive field. Thus the ratio we found for the intensive field, which mainly consists of grasses (graminoids) corresponds exactly to what Galbally and Kistine (2002) use in their emission model. The ratio we found for the extensive field (0.048%) lies between the value for grasses only and the one for higher plants.

“Page 144, line 10: Methanol fluxes at night. What about the storage term? Wouldn’t the storage term be more important than the turbulent term during nighttime?” From Fig. 4 we can assume a typical concentration change during night of $<$4 ppb per hour. ($<$1 ppt s-1). This corresponds to a storage change flux below the measurement height of $<$0.04 nmol m-2 s-1. Thus the storage term can be generally neglected.

“Figure 11: Present same analysis for extensive field and add a second panel showing how the model reproduces methanol emissions from the extensive field.” We added figure 11 b (new Fig. 12 b) which shows the measured and the calculated methanol fluxes for the extensive field.

Interactive comment on Biogeosciences Discuss., 4, 125, 2007.