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Interactive comment on "Dependence of CO_2 advection patterns on wind direction on a gentle forested slope" *by* B. Heinesch et al.

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We recognize the importance of writing the boundary-layer budget equation in terms of the mixing ratio instead of mass density. Our aim was to present Equation 1 expressed in terms of the mixing ratio. For this, we do need, as mentioned by Dr. Kowalski, to extract the molar volume from the spatial integrations in the right-hand side (RHS) of equation 1 and 2. In this way, the molar volume does not appear in the definition of advection and the incompressibility hypothesis is not needed in the derivation of the four terms of the RHS. For the computation of the NEE in units of umol m-2 s-1, the sum of the integrated terms on the RHS of equation 1 is multiplied by the inverse of the molar volume (i.e. the molar density) which is supposed to be constant in the control volume. The numerical impact of this hypothesis is limited as the molar volume variations within the control volume are typically below 1% (postulating a background

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temperature of 288 K, a temperature variation within the control volume of 2 K and applying the ideal gas law gives a relative variation of Vm of 2/288 = 0.7%). In many publications, this unit conversion is often not even described, authors defining a NEE that should be expressed, looking at their introducing equations, in ppm m s-1 while results are presented in units of umol m2 s-1. In the revised manuscript, the equations 1 and 2 have been modified according to reviewer remark, without any influence on the numerical results presented because the computations had been made according to the new version of the equations. The references used when introducing the boundary-layer budget equation have been changed from Finnigan 1999, 2003 and Feigenwinter 2004 to Baldocchi 1988 because the former were expressing the budget in terms of mass density while the latter was expressing this budget in terms of mixing ratio. We thank Dr. Kowalski for having stressed this point and we will follow with great interest the debate that is now arising on this subject in the literature (comment on Finnigan 2006 by Kowalski, AFM, in press).

Interactive comment on Biogeosciences Discuss., 4, 4229, 2007.