Biogeosciences Discuss., 6, C453–C456, 2009
www.biogeosciences-discuss.net/6/C453/2009/

Biogeosciences Discussions

Interactive comment on "Turbulence in a coastal Mediterranean area: surface fluxes and related parameters at Castel Porziano, Italy" *by* S. A. Cieslik et al.

Anonymous Referee #2

Received and published: 18 May 2009

Overall, this is a manuscript that describes the atmospheric surface layer turbulence above a dry Mediterranean macchia ecosystem characterized by rather complex topography and non-homogeneously distributed vegetation. The main purpose of this paper is to draw background knowledge for further in-depth analysis presented in other papers. Nevertheless the authors don't explain clearly how this paper support other results presented elsewhere. If the analysis presented in this paper is aimed to rank the quality of fluxes measured during the ACCENT/VOCBAS campaign for further ecophysiological studies, the description of turbulence should be improved and expanded in order to better understand the effect on turbulent fluxes of surface heterogeneity. There are two important aspects emerging from this study. One is the advection effect

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on some meteorological parameters (e.g. the vertical profile of water vapour density) and the second is the decoupling between the wind regime near the ground level and that at 6 m above ground level. These aspects need to be expanded in relation to the turbulent fluxes measured. A key issue that should be addressed is the degree of convergence between the measured turbulent fluxes of a scalar and the total flux between the ecosystem and the atmosphere. This kind of discussion would be helpful for a more correct use of measured fluxes in other contributions of the special issue. For the above reason, the paper can be accepted after major revision of the manuscript.

Specific comments:

1. Section 2. Turbulent fluxes were measured with different instruments deployed by three research groups. Even if the instruments were located at slightly different positions and elevation above ground, please specify if they were cross-checked among others in order to eliminate differences and describe the procedure used for it.

2. Section 2. A description of the methodology used to calculate eddy covariance fluxes is completely lacking. It is very important to understand whether the different groups involved used the same methodology to estimate eddy fluxes or not. If different methodologies for data processing were adopted, it would be helpful to evaluate the extent of differences due to methodologies.

3. Section 3: last paragraph and figure 2b. The authors cite the highest level of the vertical profile of absolute humidity at 9.5 m, but in figure 2b the highest level shown is 6 m. The behaviour of the vertical profile of absolute humidity raises the issue of the source area affecting the turbulent fluxes. Of course the source area affecting the point concentration is larger than that one for fluxes, but it should be helpful to calculate the footprint function for fluxes in order to eliminate data influenced from areas other than the ecosystem studied. In this respect, the footprint function should be estimated at the three levels: 3.8, 6 and 9.5 m.

4. Section 3. Turbulent fluxes of a scalar measured by eddy covariance technique are

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often underestimated when the atmosphere is under stable stratification. The analysis of the relationship between friction velocity and flux at night is a common way to detect the presence of this underestimation. This kind of analysis should be included in the manuscript in order to rank the quality of fluxes in the different atmospheric conditions.

5. Section 3. From 09:00 a.m. to 01:00 p.m. the wind direction near ground is different from that one at 9.5 m. This wind decoupling between 3.8 m and 9.5 m could be a barrier for the vertical transport of a scalar. Indeed some quantity of a scalar emitted from the vegetation and soil could be not transported until the highest level by turbulence since it could be horizontally displaced by advection. A discussion about the effect of this wind decoupling could be helpful to understand to which extent the turbulent fluxes measured by eddy covariance technique are representative of the real ecosystem exchange.

6. Section 3. The fulfilment of the constant flux hypothesis is demonstrated by comparison of fluxes of the same scalar at three measurement levels. Figure 6 shows the result of this comparison. To complete this discussion it could be useful to report the differences in a quantitative manner and analyze the relationship between the flux vertical gradient and the atmospheric stability condition. A complementary way to verify the fulfilment of constant flux hypothesis is the estimation of integral turbulence characteristics as described in Foken and Wichura 1996. This approach allows also the detection of additional turbulence caused by obstacles or generated by the measuring device itself, so it could be used to expand the discussion about the turbulence characteristics at Castelporziano site.

7. Section 3, page 3362, last paragraph. How was the ground heat flux value used for estimation of the energy balance closure calculated? Which sign convention was used for ground heat flux? Is the energy balance closure constant at the three measuring levels?

Technical comments:

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1. Section 2, line 22: temperature and relative humidity probe model 50Y is manufactured by Vaisala.

2. Section 3, line 1 and 2: the sense of the sentence is not clear.

3. Section 3, line 6: “where s ist he. . .”, maybe you mean “where s is the. . .”.

Interactive comment on Biogeosciences Discuss., 6, 3355, 2009.