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Interactive comment on "Effect of smoke on the transmissivity of photosynthetically active radiation inside the canopy" *by* M. Yamasoe et al.

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First of all, the authors would like to thank for the referee comments and suggestions. In fact, the hourly-mean basis analysis allowed a more detailed study, helping clarifying some unclear issues, although further studies are still needed to better understand this complex relationship involving smoke aerosol particles and vegetation photosynthesis.

General comments 1. Figure 2 presented originally at the manuscript will be replaced by the new Figure 3 in the MS. In this new figure, hourly mean aerosol optical depth at 500 nm is presented from 1 September to 15 November 2002 (Figure 3.a). It is possible to observe the cleansing of the atmosphere after rain events, presented in Figure 3.b, for the months of September and October. Three-hourly rain rate estimates were provided by TRMM (Tropical Rainfall Measuring Mission) using algorithm

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3B42, based on a combination between microwave and infrared precipitation estimates (http://trmm.gsfc.nasa.gov/3b42.html). Hourly mean vapor pressure deficit is presented in Figure 3.c. There is also a tendency of decreasing values toward the end of the dry season and the onset of the wet season.

2. Taking into account the referee's suggestion, a similar approach used by Gu et al., 1999 was considered. Results are now presented in hourly basis analysis. As explained in the manuscript, since measurements and calculations of PAR irradiance were conducted at time steps of one minute, hourly mean values and standard deviations of the mean were calculated for measured (Em ,sm) and simulated (Ec ,sc) data. Simulated PAR irradiance was calculated using hourly mean values of AOD. In order to filter cloudy data, firstly mean values from measurements with large standard deviations were discarded (sm/Em $>$ 0.25) as well as data for which the ratio between mean values of PAR from measurements and from calculations was lower than 0.70. The choice of those thresholds was based on sensitivity studies according to the variability of aerosol optical depth on a time scale of one hour. Those numbers were obtained considering the worse scenario, for which AOD presented the highest variability. Numerical simulations of PAR at one minute time step were performed with hourly-mean AOD plus or minus one standard deviation for the worse scenario and comparisons between these calculations were performed. Mean (Ec) and standard deviation (sc) for the irradiances calculated with the highest (Ech) and lowest (Ecl) AOD values were determined. Ratios Ecl/Ech were always larger than 0.70 and the ratio sc/Ec was lower than 0.25. For the remaining data base, a linear fit based on the least squares method was performed. Theoretically, if the correct aerosol optical depth is used in the numerical simulations, measured and calculated PAR should result in a linear fit with slope equal one and intercept zero. If data is normally distributed around the best fit, all data should not be far from the linear fit for more than three standard deviations. Thus, this criterion was also used to eliminate possibly cloud-contaminated data. After this screening, 66% of data is one standard deviation far from the fit and 96% two standard deviations far. The resulting reduced chi-square (chi-square-red) is 1.08. The number

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of degrees of freedom in this case is 178, thus, there is a 90% probability that the resultant reduced chi-square should be in the interval 0.83 $<$ chi-square-red $<$ 1.18. The adjusted fit is presented in Figure 5 (in the MS). An index to quantify cloudy or smoky conditions relative to clear sky atmosphere was defined. This index is similar to the "relative irradiance" proposed by Gu et al., 1999 and Schafer et al., 2002: fB=E/Eo where E is the hourly-mean measured PAR irradiance and Eo is the equivalent clear sky value. The clear sky value was determined numerically considering aerosol optical depth equal 0.05 at 550 nm.

3. Reference of Young et al. (1983) was included in the MS. 4. No, the authors understand that, as discussed in the Supporting Online Matter of Gu et al. (2003) mentioned by the referee, the advantage of diffuse radiation is that it can reach more leaves, since it is transferred down from all directions. 5. The reference of Gu et al. (1999) was included in the MS. 6. Although the experiment was conducted during the dry season, no significant effect of soil water storage on NEE was observed. Unfortunately it was not possible to evaluate the effect of soil temperature, since no measurement of this variable was performed during this field experiment. A comment was added to the MS referring to this missing analysis. On the other hand, it was observed that water vapor pressure deficit (VPD) affected the results, with a decrease in NEE (less negative values) as VPD increased.

Minor comments: 1. Since the analysis is now based on hourly-mean values, this 10% threshold does not apply. Cloud-contaminated events were identified according to a least squares fitting analysis as discussed previously. 2. Phrase was completely modified. 3. Yes. The observed decrease in turbulent fluxes is correlated with the less radiation available due to the aerosol loading increase. Although this phrase was removed from the MS, as discussed by Koren et al. (2004), if the aerosol layer reduces the amount of radiation reaching the surface, cooling it, as well as warming the atmosphere due to absorption of solar radiation, this causes a stabilization of the atmosphere, with warm air above a cooler surface. 4. The discussion was changed. The analysis is conducted in terms of availability of PAR radiation at the top of the canopy (Figures 7 and 8 in the MS. 5. Figure 8 was removed. 6. Figure 9 was removed.

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