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Interactive Comment

Interactive comment on "Chemical sensing of plant stress at the ecosystem scale" *by* T. Karl et al.

T. Karl et al.

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We thank Holst (2008) for helpful comments. Our detailed response to his review is summarized below.

Chapter 2 (Methods): I would prefer to start with the field site description (2.4) as 2.1 to 2.3 refer to measurement heights or vegetation species that should already be given in the site description. Could you add some information about the detection limit of the GC-MS?

Response: We will implement the suggested changes and additions

Some basic information (tree height, set-up for 'environmental data' used for analysis) about the measurement site is missing. A web link is given, but contains only limited information (e.g. mostly information about the number and heights of turbulence measurements). For example, no information about the canopy height is given in the paper, which would be necessary to interpret the measurement heights of the profiles (i.e. Fig 2 a,b). It was not clear to me, if the height scale in Fig. 2 c,d was the same as in Fig. 2 a,b or not (repeat the height scale on the right). Furthermore, the colour scale in Fig. 2a might show temporal behaviour of the concentration, but hardly resolves vertical differences.

Response: We will add more information including canopy height in the Methods section, but note that the canopy height has been indicated previously in figure 2 D which shows the plant area index. The vertical scale is the same on all 4 panels. Concentration measurements were also conducted above the canopy and thus panel A and B extend beyond the canopy height. The source profile and plant area index only extend to the top of the canopy by definition. Daytime concentration gradients are shown in Figure 2B, resolving vertical differences that might be hard to depict in Figure 2A

You give a very short introduction to other systems run at the site (2.4), and data from this instrumentation is used during analysis (i.e. radiation (profiles), air, leaf & soil temperature, wind vector profiles, ...), but it is not clear to me what is based on measurements and what is modelled or estimated. This is crucial as you use this data to calculate the MeSA and MT fluxes and needs to be clarified.

Response: Basically only leaf temperatures are calculated (as described in section 2.6), all other variables were measured. MeSA and MT fluxes were calculated based on turbulence data, which is now specifically stated in the methods section. We also added more information on sensors in the Methods section

Chapter 2.5 (flux calculation): As the site was equipped with several EC-systems for measuring the H_2O & CO_2 fluxes directly, profiles for CO_2 and H_2O concentration might be available as well. Therefore, it could be useful to test the scheme for calculating the VOC fluxes by calculating fluxes for H_2O and CO_2 as well and compare to measured values to validate the transport model.

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Response: We agree that a comparison between EC and gradient data is useful to test the accuracy of the dispersion model. We have done this in detail previously for VOC EC and gradient measurements (see ref. Karl et al., 2004) –we found that the measured turbulence profile is the most important parameter. During CHATS we have measurements of the turbulence profile throughout the canopy. As part of the CHATS program there will be a suite of papers on dispersion modeling including forward LES modeling. These papers will focus on source and sink distributions of CO_2 and H_2O and address the raised issue for inert trace gases. Since these papers will be published separately, we believe that a detailed validation of the dispersion model based on CO_2 and H_2O (which we performed during a previous study for VOCs) is beyond the scope of this paper.

Chapter 3 (results): In the results section, I have several comments based on Fig 3. First, it refers to soil temperature instead of VPD. Furthermore, I rather would refer to a volumetric water content (VWC) instead of RHsoil (if I assume it is TDRdata) as it is commonly used. In this context, you are talking about 'drought stress' with 'drought' usually understood as a long period of water shortage. If possible, you should add some information to compare the status of the water supply with (i.e. wilting point). Please, provide an information about the corresponding height of the mixing ratio shown in Fig. 3b. Would it be useful to add radiation data, i.e. PAR, to the panel? R^2 given in the text (p.2390, l.3) does not correspond to R^2 given in Fig.4c. In l. 17 (p.2390) it should read 'deltaT' and '(17)' should be replaced by a reference (p.2391, l.20).

Response: We will change RHSoil to VWC and correct the label for VPD. We don't believe PAR data will add any significant information to the figure which is already busy; the study was conducted in California where large scale subsidence due to the subtropical high resulted in cloudless conditions for most of the campaign. Instead we plot the water stress factor Ks as an indication of water limitation. By definition Ks is 0 when the permanent wilting point is reached and remains 1 as long as water availability

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is not limited. The permanent wilting point occurs at about 0.1. Ks was calculated based on VWC, the permanent wilting point (0.1), a depletion factor (p) for walnut (0.5) and the field capacity (fc) inferred after the irrigation system resumed (JD146). It is noted that the planned watering cycle was delayed by 2 weeks due to a malfunctioning irrigation system. The corresponding height of concentrations shown in Figure 3 was at canopy top (11 m). We will correct the typo for R2, change deltaT and add reference (17).

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