Atmos. Chem. Phys. Discuss., 10, C9792–C9795, 2010
www.atmos-chem-phys-discuss.net/10/C9792/2010/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Volatile organic compound emissions from *Larrea tridentata* (creosotebush)" *by* K. Jardine et al.

Anonymous Referee #2

Received and published: 16 November 2010

Jardine et al. report on leaf gas exchange and ambient concentrations measurements on creosote bush in Arizona during the 2009 summer monsoon. Their major findings are that they confirmed emissions of several compounds that are known to be contained in the resins of this plant species or measured with leaf gas exchange methods (albeit generally at lower rates) and in addition the authors were able to show sizeable emissions of compounds never detected before from creosote bush or even from few other terrestrial plants. In summary, the authors show that on a dry weight basis creosote bush may be emitting more compoungs at higher rates than previously thought, which has implications for local air quality. These data are very valuable given that VOC fluxes from desert ecosystems are understudied as compared to temperate (in particular forest) ecosystems.

I nevertheless believe substantial additional work will be required in order to make this paper acceptable for publication in ACP. In particular I object on the overly descriptive nature of the paper which is (in my view) inappropriate for ACP. The paper is merely a listing of compounds detected and emission rates measured without offering insights into the ecology/physiology of the observed emissions. Surely modellers need to know which compounds are emitted, but as well will they need to know which factors are governing these emissions in order to represent these in the models. The graphical presentation of the data, which reminds me of figures prepared for a lab meeting, reinforces this impression. In order for the diurnal courses to make sense we need to know about potential environmental driving factors such as temperature, radiation, vapour pressure deficit and so forth. In addition it would be helpful to see diurnal courses of photosynthesis and stomatal conductance – the authors used an infrared gas analyser (Fig. 1) so I presume they are able to calculate leaf CO2 and H2O fluxes. An important question to answer in my view would be the one of which role stomatal conductance plays in the observed emission patterns or are these driven simply by temperature and radiation (which will be of importance for extrapolating to dry season conditions). In order to get a better feeling about the magnitude of emissions it might be worth considering plotting more compounds within one panel (possibly also in a cumulated fashion). Similar arguments apply for the ambient concentrations – here in addition it would be helpful to see wind direction and have an idea about the concentration footprint (anthropogenic sources in particular). Generally the story line on the ambient concentrations is poorly (if at all) linked to the leaf gas exchange measurements because no ecosystem-scale flux data are reported and (untested) hypothesis about boundary layer development have to be invoked. From the setup (sonic anemometer and intake for ambient air samples on tower) I suppose that VOC fluxes can be calculated using some disjunct approach. If so, I would strongly suggest to merge these data into the paper in order to make it more significant. Given the claimed large total VOC carbon emissions on a dry weight basis it would be also interesting to compare these with the magnitude of CO2 fluxes - from the data you present I get the impression that

dealing with stress consumes a much larger fraction of the (probably comparatively small) CO2 assimilation of this plant species as compared to temperate ones which is ecologically interesting. Whether emissions from this ecosystem are indeed significant can only be assessed when scaled up to a ground area basis and integrated over a longer time frame (at least a dry season but preferably an annual cycle).

Detailed comments: (1) p. 17117: here we are lacking a statement of the research objectives/hypothesis; note that the hypothesis formulated in l. 20-22 can not be tested with the present data but would need additional measurements during the dry season (2) p. 17118, l. 7: use SI units throughout the paper and in the supplementary material (3) p. 17119, l. 10: in my experience detaching branches and twigs may easily lead to artefacts in terms of the magnitude and composition of emitted VOCs – have the authors checked their data for such effects? (4) p. 17120, l. 6: agree 100% (5) p. 17120, l. 22-p. 17121 l. 6: should go into methods section (6) p. 17121, l. 8-9: are Figs. 5-13 showing all the same days – what about the other days? (7) p. 17121, l. 10: what is driving these strong diurnal patterns? (8) p. 17121, l. 15-16: this would imply growth to take place during the night – any data to back up this hypothesis? (9) p. 17121, l. 29: a sonic anemometer measures the speed of sound from which the so-called sonic temperature may be calculated; the latter is very close to virtual temperature; calculating air temperature requires an estimate of air humidity; very often air temperatures calculated with sonic anemometers may exhibit several degrees offset (which is not a problem for eddy covariance though were the average is subtracted anyhow) (10) p. 17122, l. 6: what are the causes for the factor of 10 variation? (11) p. 17122, l. 19: were plants flowering during the experiment? (12) p. 17122, l. 21-22: how did you quantify the loss of these compounds? (13) p. 17123, l. 13: what is (wet & dry) nitrogen deposition to this site? (14) p. 17123, l. 14 and 17: you need to convert the leaf area values to ground area for this comparison to make sense (15) p. 17129, l. 1-4: in order to really judge whether emissions are substantial we need to know (i) about values on a ground area basis and (ii) integrated over at least one wet and dry cycle, preferably over the course of a year. (16) p. 17130, l. 15-17: previously

you mentioned no obvious signs of stress! (17) Table 1: for printing in b&w I would suggest to use different graphical means of grouping data (18) Fig. 1: would profit from using more standardised symbols; e.g. what do the little arrows on VOC standard and zero air represent? (19) supplementary material: essential methodological information should be moved into the main paper

---

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 17113, 2010.