

Interactive comment on “Physical injury stimulates aerobic methane emissions from terrestrial plants” by Z.-P. Wang et al.

Z.-P. Wang et al.

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We thank editor and referees for your constructive comments. Our responses to each comment are provided below.

Editor comments: The manuscript has been received favorable comments by two reviewers which both suggest that minor revisions will be necessary to make the paper acceptable for publication in Biogeosciences. I concur with the reviewers suggestions and will accept the paper provided their comments, as well as mine, are taken appropriately in account. Please provide a point-by-point reply to these comments along with any revised manuscript. Response: Thank you very much. We revised the text in detail based on these comments.

(1) p. 1404, l. 2: add "harvesting" Response: Done.

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(2) p. 1406, l. 12-13: "... injury and hypoxia on CH4 emissions from 10 species ..."
Response: Done.

(3) p. 1407, l. 18: add more detail on the time it took to collect plants and transport them to the laboratory; how were the plants transported and stored ?
Response: We added this information in the revised text.

(4) methods: describe blank tests here.
Response: We added this description in the revised text.

Referee #1 This is a well prepared manuscript that makes some useful contributions to the intense debate about aerobic methane production in plant foliage. A number of minor points are noted below which I suggest would enhance the manuscript. I agree with the comments of Anonymous Referee 2.
Response: Thanks.

P1404 L17 ..a variety OF environmental stresses. Insert of
Response: Done.

P1405 L7-8 Add the new references suggested by Ref 2
Response: Done.

L9 Not all these studies used stable isotopes which the statement implies.
Response: Done.

L14 The observations reported by Frankenberg et al (2005) have now been qualified by further investigation and published by Frankenberg et al (2008) GRL doi: 10.1029/2008GL034300. This new citation should be included as it explains a problem with the conclusions of the earlier manuscript.
Response: Done.

P1406 L 11 Suggested addition ..may be affected by O2 availability OR ANY STRESS LEADING TO ROS PRODUCTION.
Response: Done.

L18 semi-arid Insert hyphen
Response: Done.

P1407 L 24 Do you mean that EACH individual twig came from a different individual plant? This is not quite clear.
Response: Twigs from different plants were mixed and added to bottles randomly. This is clarified in the revised text.

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L26 Do you mean silicon sealant rather than silica? Response: Yes. We used silicone sealant; in the revised text.

P1409 L2 I believe that multiple range/comparison tests are performed after a One-way ANOVA between treatments but this is not clearly stated. Please explain in full if an ANOVA was used, state the SAS Procedure used and if ANOVA provide details of the overall test significance. Response: Done.

L15 Why are the hypoxic tests only 16 hours versus 24 h for the aerobic tests? Response: Different experiments were used to plot Figure 1 and Figure 2. As shown in Fig. 2, both aerobic and hypoxic incubations were the same duration.

P1410 L16 State species referred to here Response: Done.

P1411 L3 Please explain why these xerophytes would be particularly susceptible to hypoxia. Response: Hydrophytes sometimes grow in hypoxic conditions, but xerophytes always grow in aerobic conditions. Thus, xerophytes would probably be particularly susceptible to hypoxia stress. We clarified this in the revised text.

Section 4.2 The generation of ROS from the respiratory ET chain is very different in mechanism and cellular location from the UV-driven cleavage of methyl groups suggested in earlier publications. This point should be made here. Response: Done.

P1412 L9 involve rather than revolve Response: Done.

P1413 I recommend some slightly more cautious wording e.g. L3 Functional types CAN emit SOME CH4 Response: Done.

L13 considerable is rather too strong. I would recommend replacing this with e.g. an important component of aerobic methane emissions. This leaves the magnitude open to question. Response: Thank you for the constructive comment. We revised it in the revised text.

L18 yes it could be important but it would be more cautious to say that it could be

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MORE important allowing for an as yet unknown global magnitude and significance. Response: ;Could be; allows that it might not be important at all, so we do not think additional caution is required. Furthermore, we are not making any comparison and it would be unclear what it could be ;more; important than.

Table 1 footnotes: during 17-18 August not in (but detached) not detachment initially AMBIENT CH₄ concentration in air Insert ambient Emission values are means.. not Emission is mean.. Response: Done.

Over what period are these rates calculated in Table 1 and Figures, especially since it is stated that not all species emit continuously over the experimental period. How is this dealt with in the rate calculations? Response: Table 1 footnote and Figure captions showed the time intervals for the rate calculations, e.g., approximately 24 h in Table 1, 24 h in Figure 1, and 16 h in Figure 2. We observed previously (Wang et al. 2008) that only hydrophytes emitted CH₄ discontinuously because they emitted a pulse of microbial CH₄ stored in their stems. Xerophytes either emitted CH₄ continuously or did not emit CH₄ at all. Therefore, we assume that all species examined in this study emitted CH₄ continuously, as shown in Fig. 1 and 2.

Fig 1 label: Uncut, stem end sealed not sealing As above do you really mean silica or silicone sealant? If the later you should identify in the text as some sealants produce methane. Response: We used silicone sealant. We detected no CH₄ emission from silicone sealant.

The figure captions should state at what point the rates in part (b) of the figures are calculated. Response: Done.

Fig 3. You only need to label symbols as cut/uncut and it is clearer if you just label each box in larger font as Aerobic/Hypoxic. Response: Done.

Referee #2 General comments: The paper by Wang et al. examines the effect of physi-

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cal injury on methane emission from several plant species collected in the grasslands of Inner Mongolia. The authors have observed enhanced methane emissions from some plant species (*Artemisia*) when they were physically injured. Apart from the fact that aerobic methane emissions from plants is a topic that is currently under much debate in the scientific community the paper is of high interest because it adds new information about possible stress factors that might be involved in the production of methane from plants. I found the manuscript to be well written and clearly presented. In particular the introduction adequately details the current state of our knowledge about aerobic methane emissions from plants and addresses interesting questions regarding climate change. Although the data set presented by Wang et al. is rather limited it is worthy to be published in Biogeosciences. However, a few minor details in the text and in the presentation of the data should be revised: Response: Thanks.

Specific comments: Introduction, page 1405, line 7: For completeness the authors should include the recent papers by Nisbet et al. (Proc. R. Soc. B., 2009) and Brüggemann et al. (New Phytologist, 2009). The paper of Nisbet et al. reports about transpiration that might explain part of the observation of aerobic methane emissions from plants. Furthermore Nisbet et al. claim that they have found no evidence for a biochemical pathway of methane formation in plants. However, Brüggemann et al. provide evidence for nonmicrobial aerobic methane emission from poplar shoot cultures under low-light conditions. Response: Done.

Page 1411, line 24: ...had a carbon isotope signature consistent with plant pectin...should be changed into ...had a carbon isotope signature consistent with methoxyl groups of plant pectin... Response: Done.

Page 1419, Figure 2a: The authors should indicate that aerobic experiments were conducted in laboratory air including around 2ppm methane whereas hypoxic experiments were conducted in methane free nitrogen. Response: The following sentence was added. ¶ Initial CH₄ concentrations were approximately 1.9 and 0 ppmv in aerobic and hypoxic experiments, respectively.¶

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