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Biogeosciences Discussions

Interactive comment on "Relative effects of precipitation variability and warming on grassland ecosystem function" *by* P. A. Fay et al.

Anonymous Referee #3

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General Comments:

The manuscript presented by Fay et al. provides the results from a long-term experimental manipulation study on the effects of rainfall variability and warming on ecosystem functioning in temperate grassland in Kansas, USA. The subject of this study is highly relevant in the face of a changing climate and provides new insights on the ecosystem response to predicted increases in temperature and altered precipitation patterns. The authors use the unique long-term dataset to show that (1) the effects of interannual variability are larger than increased intra-annual rainfall variability, (2)

increased intra-annual rainfall variability reduced plant growth and the rates of leaf and soil CO2 fluxes, and (3) warming effects and rainfall effect occurred at different times of the year. The manuscript finally proposes a conceptual model for the coupling of rainfall variability and warming that provides the framework for further on this subject. In general, the manuscript is well written, concise and of high quality. However, some questions were arising and I would like to suggest some improvements to the authors that would increase the quality of the manuscript.

Specific Comments:

- Abstract: the abbreviation ANPP should be introduced with its first usage (l20)

- P6861, l1: I would suggest being careful with this statement as marine ecosystems exchange even larger quantities of C between biosphere and atmosphere (see e.g. Sarmiento & Gruber 2006).

- P6862, l12: I suppose rather affect than 'reduce' (as increases of these fluxes in response to increased variability have been reported as well)? Overall, I have the impression that this sentences provides no valuable information to the subject and most processes in ecosystems are 'water sensitive'.

- P6862, l16-19: The sentence appears confusing to me (widespread increase across biomes but increases and decreases etc. in grasslands), although I understand the point that the authors would like to make. Could the statement be improved for clarification?

- P6863, l6: What does the term 'tractable systems' imply here?

- P6863, l7: 'sizeable portion' – what does that mean and could the authors provide specific numbers (see e.g. Gilmanov et al. 2010; Wang and Fang 2009)?

- P6863, l11: ‘these systems’ – grasslands?

- P6863, l21: what does ‘relative responsiveness’ particularly refer to?

- P6863, l27ff: The hypotheses are formulated rather complicated and hard to understand by the reader (which makes it difficult to link the specific testing of the hypotheses later in the manuscript).

- P6864, l13: what’s the annual mean temperature at the site?

- P6866, l17: Confusing – TDR used and/or Tektronix cable tester (I am unaware of what it is)??

- P6867, l20ff: What was the canopy height at all (mean and range)?

- P6868, l17: Measurements of CO2 fluxes?

- P6868, l18: Please introduce abbreviation ‘ACO2’ with first usage.

- P6868, l18: How frequent was the IRGA calibrated?

- P6868, l21ff: Is this important when considering the quality filtering applied?

- P6871, l15: Differences in general or between treatments?

- P6872, l16: The differences reported for Tsoil are surprisingly small, are these based on daily/weekly averages?

- P6873, l14: The sub-heading does not fit to the content of the paragraph, which deals predominantly with canopy light levels

- P6873, l23: It might be useful to include the abbreviation in the heading (ANPP).

- P6875, l9f: What about exchanging the order of argument 2 and 3 to improve understanding?

- P6878, l7: Towards C4 plants (see e.g. Morgan et al. 2011, Nature)?

- P6878, l9: To what does ‘ecosystem processes’ refer to here?

- P6878, l10: What is the ‘statistical structure of rainfall inputs’?

- P6882, l25: I am not aware of the respective journal guidelines, but wouldn’t a subheading ‘Conclusions’ improve the clear structure of the manuscript?

- Fig. 3: Is the first graph (A) really needed and if yes, shouldn’t it content wise be a separate graph? Furthermore, the error bars of 1 SE are barely visible and my personal impression is that SD might be more appropriate to report here to get insights on intra-annual variability.

- Fig. 5: Axis caption appear rather small and hard to read here. Abbreviation ANPP needs to be explained in caption. Inconsistent panel numbering (vertical order priority compared to horizontal in Fig. 3).

- Fig. 6: It might be helpful for the reader when C3/C4 would be added in parenthesis behind the species.

- Fig. 7: The scaling of panel D (winter fluxes) substantially differs from the other panels and thus gives a false impression of rather high winter fluxes. I would suggest correcting the scaling or at least noting the different scaling in the caption.

- Fig. 8: Abbreviation ANPP needs to be explained in caption. ‘Regression statistics are shown in Table 1’ (missing word?): If the regression statistics are reported separately in Table 1, are both (table and figure) and really needed or provide redundant information? Furthermore, see comment on panel numbering in Fig. 5.

- Fig. 9: ANPP – abbreviation? Midseason aboveground only or including belowground as well?

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Technical Corrections:

- P6860, l18: increased soil temperature in 5 cm depth?

- P6868, l8: check spelling of ‘weighted’

- P6871, l11: larger/higher?

Interactive comment on Biogeosciences Discuss., 8, 6859, 2011.