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Interactive comment on "Autotrophic component of soil respiration is repressed by drought more than the heterotrophic one in a dry grassland" *by* J. Balogh et al.

Anonymous Referee #1

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General comments

This paper presents soil CO2 efflux and 13C isotope data from a 182-day period between May and November 2013 from a dry grassland in Hungary. Soil CO2 efflux and its isotopic composition were measured with an automated IRGA system and an infrared laser absorption analyzer, respectively, using the dynamic chamber method. In addition to total soil respiration, also pure heterotrophic soil respiration as well as heterotrophic plus fungal respiration were determined, using root & fungal hyphae excluding and only root excluding tubes, respectively. They found that in dry periods the autotrophic (rhizospheric) component of soil respiration, which was calculated from the

difference between total and heterotrophic soil respiration, was reduced the most, i.e. the most sensitive to drought.

While the topic is very timely, and the findings would be of high interest to the scientific readership, unfortunately this work fails to comply with minimum scientific standards in its core measurements. While total soil respiration was determined with six chambers, and the corresponding isotopic signatures with at least three chambers, the two component fluxes (heterotrophic only and heterotrophic plus fungal respiration) were determined only with two chambers, and the corresponding isotopic ratios even with ONE chamber only! Given the fact that the isotopic data and the conclusions drawn from them play a key role in this paper, this is by far not an acceptable methodology. Furthermore, the chambers used for the measurements were extremely small (19.6 cm2 surface area) and can thus by no means be regarded as representative for the grassland, in particular as a comparison was made with EC measurements of a footprint which was several orders of magnitude higher than the area covered by the chambers. Thirdly, at least according to what can be extracted from the Materials and Methods section, the chambers were permanently placed at the same spot for at least half a year, without changing regularly between at least two alternating positions, which should be standard for long-term measurements with chambers. In addition, the chambers had vent holes with a total area of barely 1 cm2, which "allowed precipitation to drip into the chambers". If there was no funnel on top of the chambers with the same basal area as the chambers, directing the precipitation into the chamber, this would mean that 95% of the precipitation would have been excluded from the chamber and by this also from the soil below. Finally, there might have been an unspecified contribution of a C4 grass between 5-10%, which might have biased the isotopic data to a degree which might make any statement on isotopic signatures of the different component fluxes invalid.

To summarize, on the basis of the methodology used and the data presented unfortunately I cannot recommend this paper for publication. For more specific comments see

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below.

Specific comments

p. 16888, l. 3-13: This paragraph about isotopic signatures does not provide enough insight into the potentials and limits of the isotopic approach. This should be described in more detail, especially for sites with no or only very small isotopic disequilibrium between plants and SOM.

p. 16888, l. 12: Here it should be described HOW this restriction of heterotrophic respiration to deeper soil layers could change d13C of soil CO2 efflux. A kinetic diffusional effect would only be transient, until a new equilibrium between CO2 formation at the deeper soil layer and CO2 efflux at the surface has been established.

p. 16888, l. 21-22: The reasoning for using an isotopic approach is not sufficiently clear at this stage.

p. 16889, l. 8: The dimensions of the tubes are missing.

p. 16889, l. 12: Until this point it is not known that there is an EC tower at the site.

p. 16889, l. 22: CRDS needs to be defined here.

p. 16889, l. 22-23: It is not clear whether the EC footprint included the area covered by the SRS.

p. 16889, l. 24-25: Here it sounds as if the area covered by the SRS is not included in the EC footprint, but was only similar in soil characteristics and vegetation composition and cover. Furthermore it is not clear which methodology was used to make sure that the soil characteristics and vegetation composition were comparable between the two locations.

p. 16891, l. 2-3: A diameter of the chambers of 5 cm, i.e. a surface area of 19.6 cm2, is extremely small and by far not representative for a larger area, given the very limited number of chambers.

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p. 16891, l. 6-8: If the chambers cover an area of about 20 cm2, but if the vent holes only have an total opening of about 1 cm2, that means that precipitation reaching the soil surface inside the chamber will be reduced by 95%!

p. 16891, l. 8-14: Again unclear: In the first part it says that the chambers can be applied without cutting the plants, so that there is no disruption of transport processes within the plants, and then later it says that the respiration chambers did not contain standing aboveground plant material. Were the plants then cut within the chamber area, or were the chambers placed at vegetation-free spots? And if so, how far away were the next plants?

p. 16891, l. 16-18: Two chambers for soil CO2 efflux measurements, and only one chamber for isotope measurements for each soil respiration component is clearly not enough to make any scientifically sound statement on differences between the different components.

p. 16893, l. 19: Of which linear correlation? More information and R2 values are needed here.

p. 16893, l. 19-20: The derivation of the relationship is unclear. Shouldn't d13CRre be plotted against Rrme/Rsoil?

p. 16893, l. 22: How were these daily contributions estimated?

p. 16893, l. 23-24: Unclear what this cross-correlation should reveal.

p. 16894, l. 2-4: This means that the microbial analyses were only done half a year after the end of the measurement period. How representative are those data?

p. 16894, l. 24-25: How could the Keeling approach give similar results as the chamber-based measurement, given that the ecosystem respiration contains also the aboveground part, which the chambers do not.

p. 16894, l. 26-27: Unclear why this should be an advantage.

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p. 16895, l. 5-8: Unclear, which d13C value for the C4 respiration component was used for this uncertainty estimate.

Interactive comment on Biogeosciences Discuss., 12, 16885, 2015.