

Biogeosciences Discuss., referee comment RC1
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Comment on bg-2022-16

Anonymous Referee #1

Referee comment on "Accounting for non-rainfall moisture and temperature improves litter decay model performance in a fog-dominated dryland system" by J. Robert Logan et al., Biogeosciences Discuss., <https://doi.org/10.5194/bg-2022-16-RC1>, 2022

The paper addresses effects of non-rainfall moisture on rates of litter decomposition, which is an important pathway of litter degradation in dryland system. Solely considering sparse rainfall is inadequate because it does not account for moisture delivery through air saturated water in form of dew and fog. The paper details a 30 months desert litter decomposition experiment. Along periodical litter harvest, environmental data (moisture, temperature has been measured). Analysis with a broad palette of temperature and moisture functions shows that there is an important impact of soil moisture.

I like this paper a lot, it effectively combines a thought-through experimental setup (moisture delivery gradient, quite long-term) with appropriate modeling experiments. I like the use of different functions to reduce effects of the functional forms (for example in that an optimum temperature maximum may impact temperature effects at higher temperature). The paper also points to critical limits of Earth system models.

There are just a few minor comments that came to my mind when reading the paper.

- I am wondering to what degree this type of experiment could also help with litter decomposition in more moist system. Typically, models would consider soil moisture that does not reflect the moisture in the surface litter. Could this experiment inform this too?
- Difference between older senesced vs. new senesced litter: I think that difference could be a bit more leveraged – the main difference is that older litter may be a bit more populated with decomposers – could this be a way to address the importance of colonization, and how we need to think about that in decomposition? Can that difference be a bit more discussed? What was the motivation behind this doubling of the data – is there an objective going with that?

Detailed/Technical/Minor comments

L85: While technically correct, many today assume with the Bayesian approach the inference of a parameter uncertainty range – which is here not provided (and not necessary). Perhaps use Bayesian/Maximum Likelihood approach?

Methods: What function was used to optimize – minimize R2 and standard normal distribution or any other functional form (Gamma etc.) This may be in the provided code (which admittedly I have not reviewed), but it would be good to mention it explicitly in the paper.

L138: strictly speaking, this integral of the linear decomposition model is only correct when $g(t)$ and $h(t)$ are constants between beginning and end of time interval.

Figure 1 /Table 1 and related method text: I really appreciate the authors effort to evaluate different functional forms of $g(t)$ and $h(t)$

L 273: Please add unit (yr⁻¹) to the effective decay rate numbers

Reporting of AIC scores: I think for many of the readers it would be helpful to mention in at least one of the figure captions that you aim to minimize the AIC scores

Figure 6: is it clear that the figure represent some sort of probability density distributions of AIC scores?

Figure 5A: Please change the Litter Type legend to “Early Stage” and “Late Stage”.

The conclusions drawn are carefully laid out, based on carefully laid out evidence, without overstating. I like that!