

## ***Interactive comment on “JULES-BE: representation of bioenergy crops and harvesting in the Joint UK Land Environment Simulator vn5.1” by Emma W. Littleton et al.***

### **Anonymous Referee #1**

Received and published: 3 October 2019

This study implemented Miscanthus into JULES-BE based on site observations from Lincolnshire, UK and a global bioenergy yield dataset. Future simulation was conducted to evaluate the implication of explicit representation of bioenergy crops for climate mitigation. Three simulations were carried to demonstrate the utilization of the new harvesting scheme in JULE-BE.

Miscanthus is one of the most important perennial bioenergy crops that are proposed as biofuel feedstocks for climate mitigation purposes in future scenarios, in particular for the Shared Socio-economic Pathways (SSPs) of the Coupled Model Intercomparison Project Phase 6 (CMIP6). Given the projected biofuel expansion at a global scale,

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this study constitutes an important step to explicitly represent bioenergy crops in land surface modeling to assess the implications of large-scale bioenergy expansion on water and carbon cycling.

However, there are a number of suggested comments that should be addressed prior to acceptance. For example, model configurations were not well described. A sensitivity analysis is missing. More discussions on the mismatch between simulation and observation is in need. My main concerns are:

1. Page 2, On line 10-15: Several ESMs have represented bioenergy crops. Therefore, it will be better to conclude and compare what has been implemented in other ESMs.
2. The methods section lacks description for model configuration. For example, it is not clear how the authors chose the initial conditions?
3. Page 5, line 24: Have you done any sensitivity analysis for the parameters?
4. Page 6, line 25: can you justify the consistency between the forcing used to drive the future simulation in this study and the forcing used to drive IMAGE 3.0 to generate the RCP2.6-SSP2 scenario?
5. Page 7, Line 25 and Figure 2, the simulated LAI is much lower than the observations, can you adjust some more parameters based on observations or add more discussions on the potential reasons?
6. Page 6, line 9: Only meteorological and soil properties data were mentioned. It will be great if the authors can also add some descriptions for the validation dataset here. For example, I can see it has some missing periods for the observed LAIs in Figure 2. And how about the land management practice for Miscanthus at this site? Why the durations for soil properties (2009-2010), meteorology (2006-2013), and model validation (2008-2013 for GPP, 2011-2013 for LAI) are inconsistent?
7. Table 3: the authors listed parameters values for C4 grass and Miscanthus for comparison purposes. Can you add more results from C4 grass (e.g., GPP, LAI, NEE)

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to have a better sense of the difference between these two PFTs?

8. Figure 2: why the modelled LAI maintained a very high value until the next year and then suddenly became zero (e.g., around Feb 2012)? Especially give GPP did not exhibit similar behaviors in Figure 3.

Specific comments: Page 1, Line 12: it will be better if the authors can specify the model name here rather than at line 20.

Page 1, line 17: what is the missing model component?

Page 2, Line 15: change "global scale" to "global scales"

Page 2, Line 34: what is "TRIFFID"? You only mentioned it later.

Page 6, line 5: it was mentioned that "net ecosystem exchange of CO<sub>2</sub> was measured at the Lincolnshire site", so why not show the comparison results for NEE?

Page 6, line 27: it will be great if the authors can specify RCP and SSP.

Page 6, line 10: what are the main soil properties you are concerned with? Do they have significant changes during the simulation period?

Page 9, Line 27: it will be great if you have individual titles for the Discussion part to summarize the main findings and limitations of this study.

Page 11, Line 9: several other studies have implemented bioenergy crops into Earth system models. It should be the first step to get such processes implemented in JULES rather than Earth system models.

Page 11, Conclusion: can you discuss more implications of this study?

Table 2: do you have any ranges for these parameters?

Figure 4: rather than having two subplots show the observation and simulation results, could you add two more figures showing their spatial difference? Or report their spatial correlations?

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Interactive comment on Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2019-175>, 2019.

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