

Anonymous Referee #1

The manuscript presents results of mesocosm study of two sets of vegetation samples, representing two stages of fen development: Sphagnum-dominated community and the one invaded by *Molinia caerulea*. The empirical models predicting gross primary production, respiration and methane emission are calibrated. The larger productivity and greenhouse gas emissions from *Molinia* are demonstrated. Despite well-known limitations of using mesocosm-derived vegetation characteristics for natural ecosystems, the study provides useful contribution to our knowledge of carbon budget of wetlands. I have no general concerns on the paper. There are some specific comments, that hopefully can serve to improvement of the paper quality:

1) I recommend to add a photo of mesocosm experiment setup.

- I have some photos of this experimental setup but the quality of these photographs are poor

2) “*Molinia caerulea* appeared in May and increased up to 60% of mesocosms ...” What is the variable with the value 60%? Area, mass?

- It has been modified as follows : “covered up to 60% of the mesocosm area on”

3) “Here, CO₂ and CH₄ fluxes were measured once or twice per week during the growing season (April-October 2015 and April-June 2016) and every two weeks during the winter (November 2015-March 2016)”. Please speculate on the possible effects of diurnal cycle on long-term averages of carbon budget of samples, which you are missing with this measurement frequency.

- Information have been added

4) In eq. (2), I guess, ER should go to zero when $M_{\text{leaves}}=0$, as respiration is hardly possible without leaves.

- Even when $M_{\text{leaves}}=0$, the ER can still be important. Indeed, when *Molinia* leaves turn into litters, the decomposition of the litter can induce important CO₂ emissions.

5) “The only significant differences concerns the GHG fluxes with more important fluxes in Sphagnum + *Molinia* ...” Not clear what do you mean by “important” here.

- It has been modified as follows : “with higher fluxes”

6) “To calculate annual emissions, we run our models with 15 minutes time step using continuous weather and vegetation data.” Please justify the application of models(1-9) calibrated on daytime measurements only (or may be not only daytime, but you don’t indicate the times of measurements in 2.1-2.2 sections) to the annual period.

- Added

7) In eq. (6), methane emission is dependent on temperature as T_f , whereas in numerous wetland models temperature effect on emission (production) is represented by $q(T/10)$ term. Please, justify your choice.

- Temperature and WTL are often reported to impact the CH₄ emissions. So believe, it is important to include both parameters in the model. Concerning the relation with the temperature, we used the same that used for the ER as the $q(T/10)$ do not improve the models

8) In Table 1, there are no cases denoted by “*” and “***”.

- Indeed, it have been removed from the legend

9) In eq. (1) and (2) I would denote a, b and c differently, as they get different values.

- The a, b and c parameters was used in both equation to compared the sensitivity of the fluxes to the WTL and temperature (with a and c) and we believed it is easier to understand and compare by using the same letters.

10) "In both vegetation covers, the ER was maximum in July and minimum in January February (Table 1, Fig. 1a)." Table 1 does not provide information on seasonality.

- Indeed, it have been removed

11) "These increases are linked to Sphagnum growth and the number of Molinia caerulea leaves, respectively." Why GPPmax should depend on leaves area, whereas the latter is already included in (4) as separate multiplier?

- An increase of the photosynthesizing plant material (of the leave area) allows to have a higher photosynthetic capacity represents here by the GPPmax (sentences have been added in section 2.3.2 and in, the discussion)

12) "Parameter d connected to the WTL had an opposite sign in the two vegetation covers. This difference was difficult to interpret as the large variation of parameter e shifted the relationship between parameter d and the WTL." Please be more elaborate in this explanation, as it is not readily understandable at the moment.

- This part have been removing