Interactive comment on "Importance of crop varieties and management practices: evaluation of a process-based model for simulating CO2 and H2O fluxes at five European maize (Zea mays L.) sites" by L. Li et al.

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GENERAL COMMENTS

The paper presents a well-done modelling study of crop management impacts on carbon and water fluxes at a range of European sites. The study is novel, interesting and well presented, and fills an important gap - assessing interactions between crops, climate, hydrology, carbon and management. Several recent papers cite the need for such approaches, but there are very few studies which actually look at this. The paper assesses model performance in various aspects, and points out areas for future development. I recommend it is published subject to minor revisions, outlined below.

SPECIFIC COMMENTS

1. The introduction doesn't really adequately introduce the need to look at interactions between crops, climate and management, which is what the paper investigates; most of the discussion is on carbon only, and not water-related aspects. The authors could cite Falloon & Betts (2010) and references therein, where appropriate, and broaden the introduction to discuss crop-climate interactions more generally, supporting their approach.

Response: Introduction was revised as suggested.

2. Table 1 - it would be useful to add some summary environmental data e.g. mean annual temperature, precipitation, soil type/texture etc.

Response: Soil type (FAO classification), mean growing season (GS) temperature (Ta) and rainfall (Rain) were added to Table 1.

Table 1. Geographic information (longitude, Lon. and Latitude, Lat.), cropping year, soil type (FAO classification) and main growing season (GS) meteorological variables (temperature, Ta and rain) for five European maize sites.

Site	Full name	Country	Lon.	Lat.	Year	Soil type	GS Ta	GS Rain
DIJ	Dijkgraaf	Netherlands	5°38'E	51°59'N	2007	Haplic Gleysol	15.8	452.5
GRI	Grignon	France	1°58'E	48°51'N	2005	Luvisol	17.2	169.4
KLI	Klingenberg	Germany	13°31'E	50°53'N	2007	Gleysol	14.4	593.0
LAM	Lamasquère	France	1°24'E	43°50'N	2006	Luvisol on Alluvium	19.6	152.7
LAN	Langerak	Netherlands	6°21'E	53°24'N	2005	Eutric thaptohistic Fuvisol	17.0	403.4

3. Section 2.1 - it is unclear whether all sites have continuous maize in the data actually used for the modelling?

Response: The data have discontinuous maize rotation, and we picked up only year grown with maize for this study. This was clarified in Table 1 and in the revised text

"*Among the crop sites studied during the CarboEurope project we select the site-years for which maize was cultivated at least one year. This leads to select five sites each with one year of maize rotation (two sites in France, two sites in Netherlands and one in Germany)*".

4. Page 2919 line 25 - briefly describe what the CarboEuropeIP data filling method is.

Response: The gap-filling procedure consists in replacing missing values of NEE by average values under similar meteorological conditions within a time window of 67 d. Similar meteorological conditions are defined with global radiation, air temperature and vapour pressure deficit that must not deviate from the period to gap-fill by more than 50 W m^{-2}, 2.5°C, and 5.0 hPa, respectively. If no similar conditions were present within the time window, the length of the averaging window was increased.

5. Page 2921 - discussion of yield overestimation in general - is this related also to the absence of pest and disease impacts (presumably) in ORCHIDEE-STICS? Please clarify.

Response: The model underestimates maize yield at country scale in Europe. This was revised in the text.

6. Page 2928, line 21 - mention that the model mostly underestimates TER.

Response: "with obvious underestimation" was mentioned.

7. Page 2930, line 3 - can the assumption that climate differences modulate the NEE sensitivity to crop varieties amongst sites be tested, and quantitatively assessed?

Response: In ORCHIDEE-STICS, the varieties differ by their GDD requirements of the crop development stage during which leaves grow the most. Compared to the Control simulation variety parameters (CTRL), the total GDD requirement of the 2 other varieties used in the sensitivity study differ by +/-100 degree-days. Thus, this GDD difference impacts on the length of the period of maximal leaf growth (up to the maximal LAI) and consequently on the maximal LAI value reached during the growing period. When changing of crop variety, the date at which LAI is maximal (dmax) is shifted by +/- 6 days and the maximal LAI changes from 0.25 to 0.85 m2/m2 depending of the site. This spread in the response on maximal LAI value is attributed to different leaf growth rate simulated on each site and to the shift of dmax, but it can't explain the simulated NEE sensitivity to crop varieties amongst sites. In fact, the NEE sensitivity is best correlated with the mean value between CTRL and alternative variety of the maximal LAI. On the figure here below, we plot the mean LAI value (between CTRL and alternative variety) on the 5 studied sites against the sensitivity index of NEE to crop variety (Figure 12). We can see that the absolute values of sensitivity index of NEE to crop variety is closely related to the mean value of maximum LAI between the control and alternative variety (R^2=0.80).

Because the LAI value reached amongst site is mainly function of climate, we can confirm that the NEE sensitivity to crop varieties is driven by climate. Related description and figure were also provided in the revised manuscript.

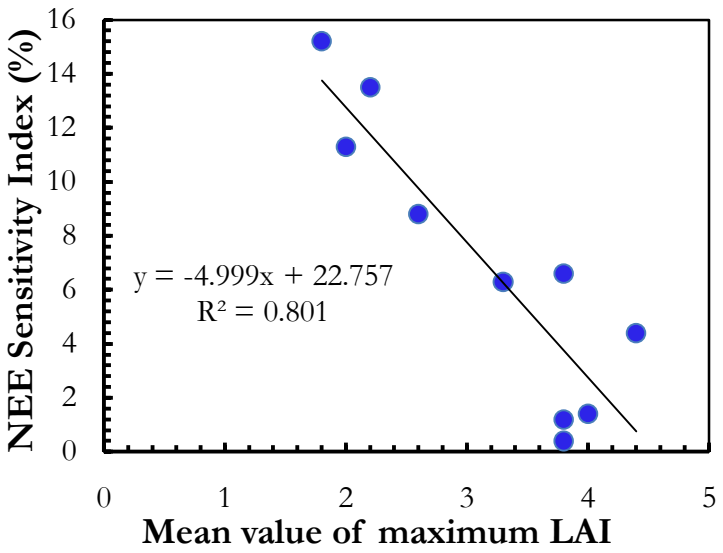

Figure R1. NEE sensitivity index vs. mean value of maximum LAI between the control and alternative variety. Two red triangle points are at LAM site.

8. Page 2933 line 27/28 - uncertainties in the response of soil respiration might also be important here (Falloon et al. 2011), and in the points made earlier on heterotrophic respiration.

Response: Suggested information was included into the manuscript after lines 27/28.

TECHNICAL COMMENTS

Abstract - line 5 - hydraulic - do you mean hydrological?

Response: "hydraulic" was changed to "hydrological".

REFERENCES

Falloon P.D., Betts R.A. 2010. Climate impacts on European agriculture and water management in the context of adaptation and mitigation - the importance of an integrated approach. Science of the Total Environment 408 (2010) 5667-5687 (doi 10.1016/j.scitotenv.2009.05.002).

Falloon PD, Jones CD, Ades M., Paul K 2011. Direct soil moisture controls of future global soil carbon changes; an important source of uncertainty. Global Biogeochemical Cycles, (accepted).