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Biogeosciences Discussions

Interactive comment on "Observed and modelled ecosystem respiration and gross primary production of a grassland in southwestern France" *by* C. Albergel et al.

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The authors thank the anonymous referee #1 for his/her review of the manuscript and for the fruitful comments. For an easier comprehension, general comments of the referee are also reported (1.XX).

1.1 [One of the main concerns is that the authors used only one site to calibrate and validate the model. This is introducing some circularity since the model is validated on the same data used in the parameterization (e.g. Fig3). Given the availability of multiple eddy covariance sites I would strongly recommend to test the model using data measured at other sites to validate the generalization capacity of the new formulation.]

Response 1.1 This paper has two main objectives: assessing a new parameterisation of ecosystem respiration in the ISBA-A-gs model, and present the (unpublished) SMOSREX flux data set before making it available to the community. The latter objective was not enough emphasised in the abstract and this will be corrected. Regarding the first objective, we agree that, eventually, more sites are to be used, over different biomes and climates, but this is out of the scope of this study. Other sites will be investigated in another study. Another reason to focus on the SMOSREX site is that these data are used in a paper submitted to HESS (Albergel et al. 2010, http://www.hydrol-earth-syst-sci-discuss.net/7/1705/2010/hessd-7-1705-2010.html) dealing with the evaluation of a land data assimilation system (LDAS), in particular the evaluation of the impact of data assimilation on the simulated fluxes. Prior to the LDAS study, it was necessary to consolidate the Reco simulations for this particular site. This will be better explained in the Introduction section.

1.2 [The f(Wg) factor proposed assumes a linear effect of water availability on respiration and doesn't consider the fact that water excess also affect respiration due to anaerobic conditions (e.g. Skopp et al 1990).]

Response 1.2 Accounting for the limitation of soil respiration by excess soil moisture conditions is important (e.g. Skopp et al. 1990). Indeed, anaerobic conditions due to water excess limit the decomposition of organic matter and, as a consequence the release of carbon dioxide. This effect is accounted for in the ISBA-CC model (Gibelin et al. 2008). In this study, the f(wg) factor is applied to the ecosystem respiration, not to the soil respiration, which is not explicitly calculated by ISBA-A-gs. An attempt was made to apply more complex f(wg) Reco functions, including functions similar to the formulation used in ISBA-CC for soil respiration (Gibelin et al. 2008), without significantly impacting the statistical scores.

1.3 [References should be provided for the eddy covariance processing, in particular 1) move the sentence at P436L23-25 at page 435 to explain why a quite small wind-sector has been used 2) explain how the u* threshold has been estimated since this filter is affecting strongly the night time data availability for the model calibration 3) since the model has 5 minutes time resolution (P433L6) explain how the eddy data have been processed (5 minutes also for eddy data??).]

Response 1.3 Yes, we agree. The sentence of P436L23-25 will be moved to P435. The u* threshold value is site-specific. Several values were used and a value of 0.16 ms-1 was found to give the best scores (i.e. those presented in Table 2). The observed eddy correlation fluxes are averaged over a 30 minute period. Although the model time step for solving the land-atmosphere exchange processes is 5 minutes, the model simulations are analysed using 30 minute intervals.

1.4 [P435L15: since only nigh-time data are used to parameterize the model, Fig.1 should present also the distribution of nigh-time data to verify how much they are representative (for T and Wg) of the pooled data (i.e. is it ok to apply a night-time-parameterization to daytime conditions?).]

Response 1.4 We agree, Fig. 1 will be modified. The nighttime pdf will be superimposed to the pdf of the pooled data set.

1.5 [P436L18 and L20: should be Hz and not GHz. It is also not clear from the code reported which IRGA model is used. I would suggest to use "LI7000" or "LI6262" if you used a close-path and "LI7500" if you used an open-path.]

Response 1.5 The IRGA model used at the SMOSREX site is an open-path LI7500 (Foken, 2008). Indeed, the open-path technique is more subjected to the influence of meteorological conditions like rain or dew than the close-path technique. This will be mentioned in the text.

Foken, T.: Measurement of meteorological elements, in: Micrometeorology, Springer-Verlag, 188-217, 2008.

1.6 [P439L23-28: give an explanation why excluding water deposition periods improves the model-measurements fitting. Is it due to problems in the eddy covariance method-

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ology (e.g. open-path IRGA) or due to a not correct simulation of respiration after an increase of water deposition (e.g. due to difficulties to model respiration pulses in dry conditions, anaerobic conditions if above the FC, ...)?]

Response 1.6 Excluding water deposition periods permits to eliminate noisy open-path IRGA eddy covariance observations. Indeed, the nocturnal Reco observations are much more scattered in water deposition conditions than for a dry surface (standard deviation values of 3.24 micromol m-2 s-1, and 1.71 micromol m-2 s-1, respectively). The filtering process might also exclude incorrect simulations of Reco caused by the difficulty to model respiration with the simple Eq. (4), especially in wet conditions (anaerobic limitation of soil respiration above field capacity) and dry conditions (respiration pulses following the rewetting of the soil). However, separate analysis (not shown) has concluded that the distribution of the model difference with the observations during water deposition situations does not vary much from wet to dry soil moisture conditions.

1.7 [P440L9-14 and Fig.3: comparing these two days (July and October) there are other factors changing in addition to Wg (plant physiology, T, probably LAI etc.). Two days in the same period and with similar T should be used to remove other factors that could potentially contribute to explain the differences.]

Response 1.7 The objective of Fig. 3 is to show the impact of using either Eq. (1) or Eq. (4) on the simulated NEE in contrasting soil moisture, soil temperature and LAI conditions. The measured wg, T2 and LAI on 14 July 2004, at 1200 UTC, and on 26 October 2004 ("25 October 2004" on P440L13 and in Fig. 3 is a typo), at 1200 UTC, are: 0.14 m3m-3, 292.0 K, 1.3 m2m-2 and 0.35 m3m-3, 289.6 K, 0.6 m2m-2, respectively. Indeed, Fig. 3 does not show the impact of soil moisture on the simulated NEE, only, as stated on P440L9-14. This sentence will be reworded.

1.8 [Fig.5: the figure is not very useful since it is difficult to really compare data and model outputs.]

Response 1.8 We agree that the comparison between model and observation in Fig. 5

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is qualitative. However, a quantitative comparison is made in Table 4. The usefulness of Fig. 5 is to show the ability of the model to reproduce the diurnal cycle. In order to improve the clarity of Fig. 5, four days will be presented instead of six days.

1.9 [Fig 6: not clear is in this plot Eq1 or Eq4 have been used. Also this figure is not simple to analyze, I would suggest create one single plot with the cumulative curves of the three variables.]

Response 1.9 In Fig. 6, Eq. (4) is used. This will be mentioned in the figure caption. We agree that presenting cumulative curves of GPP, Reco and NEE is more suitable to appreciate the interannual variability. In particular, cumulative Reco curves show that accounting for soil moisture in Eq. (4) strongly reduces the interannual variability of Reco. With Eq. (1), the curves tend to diverge from June onward (not shown), in response to the large interannual variability of soil temperature at summertime. With Eq. (4) the various cumulative Reco curves are more similar. Fig. 6 will be modified accordingly.

Interactive comment on Biogeosciences Discuss., 7, 429, 2010.