

### Answers to Anonymous Referee #3

Reviewer's comments are in **bold**.

Author's answers are in regular.

Author's additions/modifications in the text are in *italic*.

#### General comments:

**1) The manuscript should be carefully re-read by a native English speaking scientific colleague. Many sentences are vague and unclear and make reading of the manuscript very uneasy. Section 2 should be rewritten. A large number of experiments are conducted and it is important that the experiments design is clearly exposed to ensure the results are clearly understood.**

The experiments design (section 2.3.) is now clearer exposed and particularly the choice of the PFT to start our study for comparison with observations. In order to better explain the methodology, we modify the text from line 8 to 22 of page 5051 (or line 153-176 pages 8 and 9 of the new version):

*Initially, the distribution of vegetation in SECHIBA is prescribed by the vegetation map. This distribution is compared with the vegetation cover on which the measurements were performed. Each measurement station is associated with the corresponding grid cell of the model, according to the coordinate of the station (see Table 3 in Appendix) as in Fig.5. The vegetation cover of the map differs from the one on which the measurements were performed (i.e. grass cover). Fig. 5a shows that few grid cells of the model are covered by grassland (grid cells containing stations 9, 11 and 82) and less than 10% of their area is covered by this PFT. The prevailing type of vegetation over Illinois in the vegetation map is the PFT "C3 crops" type. Eight grid cells containing stations are covered by the PFT "C3 crops" at least by 90% (no. 1, 5, 6, 8, 9, 13, 15 and 16) according to Fig. 5b. Consequently, a direct comparison cannot be established between results of integrated simulated soil moisture over the grid cell and the measurements, until the proportion of one PFT is not above 90%. So the first objective is to gradually transform "C3 crops" PFT (that is prescribed in the model) in "C3 grassland" PFT on these grid cells to be closer to the experimental conditions (Sect. 3.2.1.). This allows a better agreement with the local characteristics of the vegetation cover on which the measurements were performed, and an evaluation of the weight of each parameters that have been modified in the model on simulated soil moisture.*

*For the control simulation (SECH1, see Table 2), we start the study from the distribution of vegetation imposed by the vegetation map over the eight grid cells containing high proportion of "C3 crops". First, gradual changes of crops parameters (LAI<sub>max</sub> (SECH2), root extraction parameter *cv* and crop height (SECH3) are performed. Then, we prescribed "C3 grassland" PFT over all the grid cells (SECH4) and a test of the new ET computation (see Sect. 2.2.3, SECH5) is performed to be closely related to the experimental conditions over a grass cover. At each step, [...]*

**2) Section 2.2.3 is particularly unclear and difficult to understand. The English writing should be improved and the text should be re-organised to define the terms before the equations. It is confusing to use  $q_v$  for intercepted water fluxes (kg/m<sup>2</sup>/s),  $q_v'$  for intercepted water (kg/m<sup>2</sup>),  $q_{vmax}$  in (kg/m<sup>2</sup>) maximum interception reservoir, while the letter "q" is already used for soil water (kg/m<sup>2</sup>). Using a range of subreview.docscripts and superscripts is just adding to the confusion since it is not used consistently. Different letters should be used for interception reservoir, water fluxes and soil moisture reservoir. The use of the superscript "old" for T and E should be explained in the text.**

You are completely right. The section that describes ET computations is rewritten and better organized.

The new notation is:

- $X_v$  for the flux of water intercepted by the cover (instead of  $q_v$ )
- $x_v$  for the amount of water received by the leaf (instead of  $q'_v$ )
- $x_v^{\max}$  for the maximal amount of intercepted water (instead of  $q_v^{\max}$ )
- $\alpha$  for the interception loss reservoir coefficient (instead of  $q_{cst}$ )

We decide to delete the superscript “old” for the ET terms from the initial parametrization. The superscript “new” is used for the new parametrization.

**3) Section 2.3: This section also lacks of clarity. It is supposed to describe the experimental design, but it starts with a description of the Global Soil Moisture data base. Text from P5050 line 13 to P5051 line16, should be in a separate section dedicated to the validation data bases and validation approach. In this section the experiments description is not complete and it leaves the reader confused about the experimental design. The complete description of SECH 6 for example is provided much later in section 3.2.2 when the results are presented. Providing a table that summaries the experiments in Section 2.3 would greatly clarify the paper.**

We re-organize this section. Now, we have two sections (see pages 8 and 9 in the new version):

### *3. Experimental design*

*The ability of the model [...] under the applied forcing.*

### *4. Soil moisture database*

*Soil moisture data used in this study is part of the Global Soil Moisture Database [...] cannot be studied here.*

Table 2 is added in the new version, listing each simulation with its numerical settings.

### Specific comments

**P5046, line 12: The link between the soil texture maps and the soil hydrology parameterization is not clear in the paper. Is the soil texture used in SECHIBA? If not this sentence should be removed.**

Soil texture is not used in the 2-layer version. The hydrology parameterization is linked to soil texture only in the 11-layer version. Sorry for this mistake.

The sentence lines 11 and 12 page 5046 is removed.

The sentence line 5-8 page 5051 (or lines 197-199 page 9-10 of the new version) is substituted by this one :

*[...] is the predominant soil texture. In the 2-layer hydrology version of SECHIBA, soil texture is not taken into account so its impact on soil moisture content cannot be studied here.*

**P 5046: what does "version HEAD 2007-2008" means? Why is the initial version of SECHIBA associated to a version number 2007-2008 while the first reference of SECHIBA cited in the paper is dated 1993?**

You are right, version HEAD 2007-2008 is removed from the text.

**P5050 L9: Acronyms of the four models Noah, VIC, Mosaic and SAC must be defined. Since results from these four models are presented some information and at least a reference should be given for each model.**

We add in the text (line 9 page 5050 or line 145-149 page 8 in the new version) the definition of the

acronyms and the references for each model :

[...] with four LSMs (NOAH (National Centers for Environmental Prediction, Oregon State, University Air Force, Hydrology Lab, Betts et al., 1997 ; Chen et al., 1997; Ek et al., 2003), VIC (Variable Infiltration Capacity LSM, Liang et al., 1994; Wood et al., 1997), MOSAIC (Koster and Suarez, 1994, 1996 ; Koster et al., 2000) and SAC (Sacramento Soil Water Accounting Model, Burnash et al., 1973 ; Burnash, 1995)) during the numerical [...]

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- Chen, T. H., Jankic, Z., and Mitchell, K.: Impact of atmospheric surface-layer parameterizations in the new land-surface scheme of the NCEP mesoscale Eta model, *Boundary Layer Meteorol.*, 85, 391--421, doi:10.1023/A:1000531001463, 1997.

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- Wood, E. F., Lettenmaier, D. P., Liang, X., Nijssen, B., and Wetzel, S. W.: Hydrological modeling of continental-scale basins, *Annu. Rev. Earth Planet. Sci.*, 25, 279--300, doi:10.1146/annurev.earth.25.1.279, 1997

#### Technical comments

##### **P5053: 'observations'**

Corrected in the text

**Figure 1: Please indicate axis names. The caption is not clear it should be rewritten. For example: « Monthly mean (a) and monthly (b) precipitation (mm/d) for NLDAS (black line) and in situ data (dashed line), for 1997-1999. »**

Corrected in the figure and the caption

**Figure 6: put (a) and (b) above each sub-figure (used in the caption).**

Corrected in this figure and also for Figs. 1, 9, 10 and 12. Thank you for this comment.

**Figure 7: "1997-1999 mean LAI seasonal cycle simulated from SECH1 and SECH2, averaged**

**for the 8 validation grid cells (see section 2.3).**

Corrected in the caption