

## Answers to Anonymous Referee #4

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

Author's answers are in regular.

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

### Major comments:

**1. The authors use the NLDAS-1 forcing data and results to test the SECHIBA model and study the uncertainties in rainfall forcing data, while Xia et al. (2012, JGR, 10.1029/2011JD016048) already published their results on NLDAS-2 which built upon the NLDAS-1 through increasing the accuracy and consistency of the forcing data, upgrading the land surface model code and parameters, and extending the study from a 3-year (1997–1999) to a 30-year (1979–2008) time window. I suggest the authors to check the results of Xia et al. (2012, JGR, 10.1029/2011JD016048) and try to compare their results with NLDAS-2.**

Thank you for the comment. As we did not perform our simulation with the new NLDAS datasets for the new time period, we cannot compare our results with Xia et al. (2012). However, we add this text at the end of section 3.1 (after line 4 page 5053 or line 229-236 pages 10-11) to point out that contrasting results can be obtained between Mitchell & al. (2004) and Xia et al. (2012).

*We note that after the completion of our study, a new comparison between observations and results from the same models has been published (Xia et al., 2012b). These new simulations have been performed where the accuracy and consistency of the forcing data have been increased (NLDAS-2), the four LSMs code upgraded and the study time period extended to 30 years (1979-2008) (Xia et al., 2012a). Contrasting results are obtained between this last study (Xia et al., 2012b) compared to the previous ones (Mitchell et al., 2004). Xia et al. (2012b) found that Noah model overestimates mean annual runoff (and thus underestimates mean annual evapotranspiration) as SAC and VIC results are the closest to the observations.*

**2. The authors mention in Page 5051 line 7 that “the impact of the difference in soil texture between simulation and observation on soil moisture content has not been tested”, but why? I agree the statement in Page 5060 line 14 that “the study of the impact of soil texture on soil moisture content is a reliable perspective”. In the paper, the authors do not describe the parameters in the model related to the soil texture, which I think can be very important to determine the field capacity, as well as affect the simulation of soil moisture and runoff.**

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.*

### Specific comments

**1. In the section of model description, for the reason that the SECHIBA model is not familiar to me, the description in the manuscript is difficult for me to understand the flow chart of SECHIBA simulation. For example, in the model, how to determine the drainage (D)? How to calculate the potential evaporation (Epot)? Can the authors rewrite and rearrange this part to make the model clear for the readers?**

We add some references that can be useful to the reader who want to get details about:

\* drainage between the two layers (line 85 page 4 of the new version): Ducharne et al., 1997; Dümenil et al., 1992; Rowntree et al., 1994.

- Dümenil, L., and Todini, E.: A rainfall-runoff scheme for use in the Hamburg climate model, In: J. O'Kane (ed.) *Advances in theoretical Hydrological Hydrology, A tribute to James Dooge*, V.1 of *European Geophysical Society Series on Hydrological Sciences*, Elsevier, 129--157, 1992.

- Ducharne, A., Laval, K., and Polcher, J.: Sensitivity of the hydrological cycle to the parameterization of soil hydrology in a GCM, *Clim. Dynam.*, 14, 307--327, 1997.

- Rowntree, P.R. and Lean, J.: Validation of hydrological schemes for climate models against catchment data, *J. Hydrol.*, 155, 301--323, 1994.

\* potential evaporation (line 109 page 6 of the new version): Budyko (1956)

Budyko, M. I., *Heat Balance of the Earth Surface* (in Russian), 255 pp., *Gidrometeoizdat*, St.Petersburg, Russia, 1956.

Moreover, Section 2.2.3 is now better organized and the section that describes ET computations is rewritten for more clarity (cf: recommendation 2 of the reviewer 3 and recommendation 4 of the reviewer 2).

**2. The authors compared the model simulation over Illinois and Kaskaskia river, which are not familiar to me, can the author describe the location of the two study area more clear (e.g. Figure out the area or location on the map)?**

We add Fig.1 representing locations of the Illinois state, the Kaskaskia river and Venedy station.