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Interactive comment on "Multi-variable evaluation of land surface processes in forced and coupled modes reveals new error sources to the simulated water cycle in the IPSL climate model" *by* Hiroki Mizuochi et al.

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Received and published: 26 November 2020

This is a well written paper reporting the multi-variable evaluation of land surface processes in ORCHIDEE land surface model (land component of the IPSL climate model) under different simulation modes (either forcing by WFDEI or coupled with LMDZ). The research mainly covered that in-depth evaluation of four interlinked essential climate variables (e.g., surface soil moisture, evapotranspiration, leaf area index, and albedo) using various reference datasets (ESA CCI, upscaled FLUXNET, GIMSS 3g and MODIS products), and factor analysis is also conducted by several factors (e.g.,

plant functional type, leaf area index, irrigation, precipitation, slope, snow water equivalent, and evapotranspiration). I have several comments or suggestions for improvements and recommend publishing the paper after improving minor parts.

Minor comments

1) Line 120: there is specific information about the layer depth in the LSM. It is necessary to describe that information to notify which layer is defined as surface soil moisture.

2) Line 182: the comparison with both the forced and coupled simulations are conducted for 7 years (1993-1999: period 1). It would be clearer to compare the surface soil moisture against ESACCI and SMOS without dividing the period. If the forced simulation would be extended to 2014, that would be possible. The extending offline simulation seems to be possible because the essential datasets (e.g., ERA-Interim and monthly GPCC) used to force the land surface model are also available until 2014. Then, it seems that surface soil moisture is simply validated during 2010-2014.

3) Figure S5: it seems that the definition of subperiod 1 should be corrected to "1993-1999".

4) In many captions in main manuscript and supplementary, there is notation of "Temporally averaged". Does it mean "annual averaged"? It is necessary to be clear the validation season for each variable.

5) There is no description about the statistically significant test. It is needed in Section 2.

6) Figure 3: this figure represents the temporal correlation coefficient with monthly time series. Based on the explanation of Figure 4, the temporal correlation of surface soil moisture over 60N-90N is calculated by only using JJA monthly dataset. If it is correct, such a description should be added in the text.

7) In several Supplementary Figures, the information of the evaluation period and season for each dataset and variable is missed. It should be clearly notated.

8) Line 199: there is inconsistence in the evaluation period between the manuscript (1987-2009) and Figure S2 (1987-2006).

9) Lines 238-239: the impact of the chosen period would be marginal in terms of global mean aspect, but in the regional scale it is not likely to be limited.

10) Line 279: notation of "Figure 2E, F" is not matched to the description. It would be corrected to "Figure 2D, E".

11) Lines 290-291: the sentence of "the coupled ET was negatively biased" is not matched to Figure 2E in which the ET bias seems to be positive. In other words, the maritime region shows the positive feedback between precipitation and ET such as the Congo.

12) The positive bias of LAI is supported by the underestimation of LAI in the reference, but there is no discussion for the negative bias of the LAI. If the description is added, it would be helpful to understand the other aspect of the result.

13) If there is nothing of the description of the yearly variation, Figure 5 could be changed to showing the seasonal cycle only (e.g., Figure 4).

14) Figure 8B, Figure 6 E, F: the result of LAI mean bias in the forced and the coupled simulations is totally same to each other against each class even though there is difference in the non-classified result (notated to "all").

15) In the comparison of surface soil moisture with ESACCI and SMOS reference datasets, these two datasets have spatially and temporally different missing point. For even validation, even if any dataset is missed among them, all data should be excluded. Does it do that?

16) Line 414: the listed references for the SMAP product is not appropriate. Entekhabi et al. (2010) is the originated reference of the SMAP.

Entekhabi, D., Njoku, E. G., O'Neill, P. E., Kellogg, K. H., Crow, W. T., Edelstein, W. N.,

... & Kimball, J. (2010). The soil moisture active passive (SMAP) mission. Proceedings of the IEEE, 98(5), 704-716.

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Discussion paper