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Hydrology and Earth System Sciences Discussions

Interactive comment on "Impact of precipitation and land biophysical variables on the simulated discharge of European and Mediterranean rivers" *by* C. Szczypta et al.

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The authors thank the anonymous reviewer #2 for his/her review of the manuscript and for his/her comments.

2.1 [P. 5438. The whole article is very rich in information; hence I believe that a more detailed abstract is required.]

RESPONSE 2.1

Yes. The objectives of this study could be more clearly expressed in the Abstract by

rewording the first sentence of the Abstract as:

“This study investigates the impact on river discharge simulations of errors in the precipitation forcing, together with changes in the representation of vegetation variables and of plant transpiration. The most recent European Centre for Medium-Range Weather Forecasts reanalysis (ERA-Interim) is used to drive the Interactions between Soil Biosphere and Atmosphere - Total Runoff Intergrating Pathways (ISBA-TRIP) continental hydrological system over Europe and the Mediterranean basin over the 1991–2008 period. As ERA-Interim tends to underestimate precipitation, a number of precipitation corrections are proposed.”

2.2 [P. 5438. Acronyms are sometimes detailed (e.g. LAI, GRDC) sometimes not (e.g. ERA-, ISBA, TRIP, GPCC), please be consistent.]

RESPONSE 2.2

Yes. This will be corrected in the final version of the paper.

2.3 [P. 5438. ‘3-hourly’, ‘at a spatial resolution of 0.5’, the first sentence is long, does the reader need this level of detail in the abstract?]

RESPONSE 2.3

Yes. These details could be removed (see RESPONSE 2.1).

2.4 [P. 5438. “Several versions of the representation of evapotranspiration in the ISBA land surface model are used to simulate the runoff which is converted into river discharge by the TRIP river routing model.” Evapotranspiration is one element, amongst many others, you use to simulate the runoff. Did you mean ‘the impact of various representation of the evapotranspiration in the ISBA land surface model on runoff simulation is assesses. The latter is then converted into river discharge by the TRIP river routing model’?]

RESPONSE 2.4

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Yes. The second sentence of the Abstract could be reworded as:

“The impact on TRIP river discharge simulations of various representations of the evapotranspiration in the ISBA land surface model is assessed.”

2.5 [P. 5438. ‘[. . .] from the Global [. . .]’]

RESPONSE 2.5

Abstract, L. 14: “[. . .] of the Global [. . .]” could be replaced by “[. . .] from the Global [. . .]”

2.6 [P. 5438. It is not clear to me, which kind of LAI the original ISBA model is using? Are both ISBA and its A-gs version using the same ERA-Interim dataset?]

RESPONSE 2.6

Abstract, L. 9: this sentence could be reworded as

“The latter is either driven by a satellite-derived climatology of the Leaf Area Index (LAI), like ISBA, or performs prognostic LAI simulations.”

2.7 [P. 5438, L.16-17: ‘On the other hand, the use of the ISBA-A-gs model allows [. . .]’, do you mean ISBA-A-gs with interactive LAI, as in the previous sentence? L.18-19: Does ISBA-A-gs driven by a satellite derived climatology produces better simulation at springtime than the interactive LAI version of ISBA-A-gs or than the original ISBA model? Did you try to drive the original ISBA model with this satellite derived climatology of the LAI? [the answer is found but later, slide 5441, please mention it earlier]

RESPONSE 2.7

- Abstract, L. 16-17: with or without interactive LAI.

2.8 [P. 5438, L. 23. See also Ciais et al. (2005) in Nature for the 2003 drought over Europe.]

RESPONSE 2.8

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Yes.

REFERENCE:

Ciais, P., Reichstein, M., Viovy, N., Granier, A., Ogée, J., Allard, V., Aubinet, M., Buchmann, N., Bernhofer, C., Carrara, A., Chevallier, F., De Noblet, N., Friend, A. D., Friedlingstein, P., Grünwald, T., Heinesch, B., Keronen, P., Knohl, A., Krinner, G., Loustau, D., Manca, G., Matteucci, G., Miglietta, F., Ourcival, J. M., Papale, D., Pilegaard, K., Rambal, S., Seufert, G., Soussana, J. F., Sanz, M. J., Schulze, E. D., Vesala, T., and Valentini, R.: Europe-wide reduction in primary productivity caused by the heat and drought in 2003, Nature, 437, 529–533, doi:10.1038/nature03972, 2005.

2.9 [P. 5438, L. 26. Please consider to remove '[. . .] on the considered area' as drought could also impact areas not affected by drought (e.g. migratory flow).]

RESPONSE 2.9

Yes.

2.10 [P. 5439, L. 20. Please consider replacing '[. . .] it is important to build monitoring systems of the land surface variables and of the hydrological variables over this region' by '[. . .] it is particularly of interest to build monitoring systems of the land surface and hydrological variables over this region'.]

RESPONSE 2.10

In response to Reviewer 1 comments, this part of Sect. 1 could be rephrased as:

"The Mediterranean basin will probably be affected by climate change to a large extent (Gibelin and Déqué, 2003; Giorgi, 2006; Planton et al., 2012). The fourth assessment report of the Intergovernmental Panel on Climate Change (IPCC) emphasized that over Europe and Mediterranean areas, the annual mean temperature of the air is likely to increase more than the global mean. In most Mediterranean regions, this trend would be associated with a decrease of the annual precipitation (Christensen et al., 2007).

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In this context, it is important to build monitoring systems of the land surface variables and of the hydrological variables over this region, able to describe extreme climatic events such as droughts and to analyze their severity with respect to past droughts.".

2.11 [P. 5440, L. 4. Please also refer to Dee et al. (2011) for ERA-Interim.]

RESPONSE 2.11

Yes.

2.12 [P. 5440, L. 5. '[. . .] evapotranspiration, surface runoff and drainage']

RESPONSE 2.12

Yes.

2.13 [P. 5440, L. 5. 'unbiased' does not seem correct to me, please double check or use 'none biases' (also in other parts of the manuscript).]

RESPONSE 2.13

Yes. The "unbias" verb will be replaced by "bias correct".

2.14 [P. 5440, L. 10. suggestion; '[. . .] based on a dense network of in situ observations'.]

RESPONSE 2.14

Yes, 'based on in situ observation' could be replaced by 'based on a dense network of in situ observations'.

2.15 [P. 5440, L. 14-16. This is for me a 'key sentence' of the study, it could be further developed. If I understood well, the two major goals of this study are (i) reduce the bias of ERA-I precipitation using additional/different sources of data and validate the resulting data set through river discharge simulation, (ii) test different LSM configuration driven the best atmospheric forcing obtained.]

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RESPONSE 2.15

Yes. The third paragraph of Sect. 1 could be reworded as:

"The two major objectives of this study are: (1) reduce the bias of the ERA-I precipitation using ancillary data and validate the bias-corrected precipitation through river discharge simulations, (2) test different LSM configurations driven by the best available atmospheric forcing."

2.16 [P. 5440, L. 19-20. '[. . .] which is partly based on ground observations' what is the other parts GPCC is based on?]

RESPONSE 2.16

The sentence could be replaced by "[. . .] which is based on ground observations and on satellite data."

2.17 [P. 5441, L. 12-14. This information is already given few lines above, as this article is rather dense, I don't think that you should repeat things. Please consider to remove this sentence and improve the description of section 2 (L.4-5).

RESPONSE 2.17

Yes. This sentence could be deleted.

2.18 [P. 5441, L. 16-18. In the same way, sentence L.16-18 does not provide new information but the call to figure 1.]

RESPONSE 2.18

The authors think that it is important to call Fig. 1 at the beginning of Sect. 2 and to give the period and spatial resolution of the study. Figure 1 presents the study area and this first paragraph details that this area is composed by 8142 land grid cells.

2.19 [P. 5441, L. 16-17. ISBA-TRIP is referred either to a model or a system, please be consistent.]

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RESPONSE 2.19

Yes. “ISBA-TRIP model” could be replaced by “ISBA-TRIP system” throughout the paper.

2.20 [P. 5441, L. 21. ‘[. . .] and is updated in near-real-time (with a delay of approximately one month)’.]

RESPONSE 2.20

Yes.

2.21 [P. 5442, L. 7. Please update reference to Dee et al. (2011) in QJRMS Dee, D.P., S.M. Uppala, A.J. Simmons, P. Berrisford, P. Poli, S obayashi, U. Andrae, M.A. Balmaseda, G. Balsamo, P. Bauer, P. Bechtold, A.C.M. Beljaar, L. van de Berg, J. Bidlot, N. Bormann, C. Delsol, R. Dragani, M. Fuentes, A.J. Geer, L. Haimberger, S.B. Healy, H. Hersbach, E.V. Holm, L. Isaksen, P. Kallberg, M. Kohler, M. Matricardi, A.P. McNally, B.M. Monge- Sanz , J.-J.Morcrette, B.-K. Park, C. Peubey, P. de Rosnay, C. Tavolato, J.-N. Thépaut and F. Vitart, 2011: The ERA-Interim reanalysis: configuration and performance of the data assimilation system. Q. J. R. Meteorol. Soc. 137, 553–597. DOI:10.1002/qj.828.]

RESPONSE 2.21

Yes.

2.22 [P. 5443, L. 9. ‘[. . .] to perform a correction [. . .]’ could be ‘[. . .] to correct [. . .]’. Please replace ‘this product’ by ‘GPCC product’ for a better readability.]

RESPONSE 2.22

Yes.

2.23 [P. 5443, L. 15-16 and Table 1. Readers definitely need such a Table, however I believe that it could be improved. In the text ERA-I, ERA-I-R, . . .etc refer to ECMWF

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latest reanalysis and its modifications while in Table 1 they are considered as simulation name, please be consistent. In the same way 'GPCP-rescaled precipitation' and 'GPCC-unbiased precipitation' should be noted as something like 'modification applied to ERA-I reanalysis'. Simulation names are not clear to me, all your simulations are driven by ERA-I (or ERA-I + modification), why STD, AST and NIT do not have the word 'ERA-xx'? Looking only at Table 1 it is possible to see: - ERA-I-RG: GPCP-rescaled precipitation + GPCC unbiased precipitation + LSM(ISBA-A-gs)+LAI(ISBA-A-gs), - NIT: GPCP-rescaled precipitation + GPCC-unbiased precipitation + LSM(ISBA-A-gs)+LAI(ISBA-A-gs). Then based on this Table there is no differences between simulations 'ERA-I-RG' and 'NIT' for the readers.]

RESPONSE 2.23

Indeed, ERA-I-RG and NIT represent the same experiment. For the sake of clarity, this will be indicated in the caption of Table 1.

2.24 [P. 5443, L. 18. 'is a collection' (?)]

RESPONSE 2.24

Yes.

2.25 [P. 5443, L. 22. Do you mean with continuous observations for a 5-yr period?]

RESPONSE 2.25

No. The observations had not to be continuous within this period.

2.26 [P. 5446, L. 1-2. "As for ISBA, it is possible to drive ISBA-A-gs with the ECOCLIMAP seasonal LAI climatology" I don't think that is was mentioned earlier that ISBA is driven with the ECOCLIMAP seasonal LAI climatology.]

RESPONSE 2.26

Indeed. The following sentence could be added at the end of Sect. 2.3.1:

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'The ISBA LSM uses a satellite-derived seasonal climatology of LAI provided by the ECOCLIMAP look-up tables..'

2.27 [P. 5446, L. 13-25. What about simulations named ERA-I, ERA-I-R, ERA-I-G and ERA-I-RG in Table 1?]

RESPONSE 2.27

Yes. The used precipitation data set could be indicated L. 20-25.

2.28 [P. 5447. The three items described here should be mentioned earlier as they sound like some goals of your study.]

RESPONSE 2.28

The main goals of the study could be better described in the abstract (see Response 2.1) and in the introduction Section (see Response 2.15).

2.29 [P. 5448. You could complete the description of Eff: A value of 0 indicates that the predictions of the system are as accurate as using the mean of the observed data. Negative values occur if the observed mean is a better predictor that your system output.]

RESPONSE 2.29

Yes.

2.30 [Discussion Section. The main contribution of your study are not highlighted enough, this section is a bit confusing to me. While section 4.1.&2. rely on your results, 4.3 presents more an interpretation of possible perspectives. I am also missing some structures, e.g. section 4.3; 4.3.1 deals with LAI as well as 4.3.3 but 4.3.2 is with regard to precipitation.]

RESPONSE 2.30

Section 4 is a discussion section aiming at interpreting the results presented in Sect.

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3 and linking to past results. Concrete and quantitative information is provided based on the results of Sect. 3, together with three new figures (Figures 12, 13 and 14). In particular, the possible causes of mismatch between model and observations are listed in Sect. 4.1 and Sect. 4.2. The main conclusion is that a number of model shortcomings exist (e.g. delay in the leaf onset, misrepresentation of snow) and Sect. 4.3 investigates possible solutions.

2.31 [P. 5461, L. 21-22. '[. . .]model driven by surface ERA-I atmospheric variables,' Please rephrase this sentence.]

RESPONSE 2.31

This sentence could be rephrased as :

"River discharge simulations by the coupled ISBA-TRIP system were evaluated in this study. They were driven by surface ERA-I atmospheric variables".

2.32 [Figures 2, 6, 7-12]

These figures will be reprocessed accordingly.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 9, 5437, 2012.