

Hydrol. Earth Syst. Sci. Discuss., author comment AC1  
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## Reply on RC1

Lorenzo Alfieri et al.

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Author comment on "High-resolution satellite products improve hydrological modeling in northern Italy" by Lorenzo Alfieri et al., Hydrol. Earth Syst. Sci. Discuss.,  
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### Reply to Referee #1

We thank the reviewer for his/her time in reading our manuscript and for the overall positive evaluation received. We do not disagree with any of the reviewer's comments so the vast majority of those have resulted in an addition to the text or to a change. Our reply to each comment is shown below, interspersed with the reviewer's comments. We noted that a revised manuscript version is not yet required at this stage, hence to make replies clearer we include below portions of modified/updated sentences that will be used in the revised manuscript version.

### General comments

I have troubles with the GLEAM data. Please state very explicit if you are using PET (potential ET) or AET (actual ET) and for what purpose. I assume Fig3 shows AET, but as model forcing you likely use PET. The spatial pattern in Fig3 is hard to interpret as I am not sure about what variable is shown. GLEAM estimates AET and I wonder why it has not been included in the data assimilation (or calibration), similar to SM and snow depth? Please be more explicit and state that the GLEAM scenario uses PET from GLEAM. If I understood this correctly.

Reply:

We agree with the reviewer and added some details to improve the understanding on the use of evaporation data. We have added to the manuscript that "Alternatively, both actual and potential evaporation can be provided as dynamic input, where the latter is used to estimate actual evaporation from lakes and reservoirs. In such case wind speed maps are not needed by the model." We have also clarified that "For this work, GLEAM was applied over the entire Po River Basin to produce both potential and actual evaporation estimates at 1 km resolution." The use of actual evaporation in Figure 3 has also been specified in the figure caption.

I would also like to hear the authors reasoning on why snow depth data and SM data was used in a data assimilation framework and not utilized in the calibration instead?

Reply:

Upon the reviewer's comment we have added In Sect 4.3: "It is worth noting that soil moisture and snow depth data were not used in this experiment because they are not model input variables but rather assimilation variables, hence the calibration procedure described in section 3.2 would not be directly applicable."

Figure 10: After reading the paper, I am still unsure what forcing data was used for the baseline run. Especially for the PET data I am quite unsure. I have a hard time understanding the last three experiments. For example PE is never defined and I am left guessing what the abbreviation means. If I understand the three last experiments correct, the model has been recalibrated, but why does the calibration performance not improve?

Reply:

To clarify the meaning of PE and Q, we have added in the caption of Figure 10 " In the three rightmost columns, PE stands for precipitation and evaporation, while Q stands for discharge." A table was inserted in the supplement material (Table S4) to clarify the datasets used in each model run. The calibration with satellite derived PE provided similar or slightly deteriorated performance in comparison with the original calibration because the high quality and resolution of in-situ hydro-meteorological data enable a more realistic search of the optimal parameter set in comparison to the use of satellite data, even when the model is then forced by the same satellite data used in calibration.

### **Specific comments**

An additional fifth point to the benefits of EO data to enhance hydrological models:

Improved parametrizations (Many examples out there... such as: <https://doi.org/10.5194/hess-22-1299-2018>).

Reply:

We agree and have clarified that one key benefit is "3) as benchmark data for model calibration and improved parameterization". The suggested reference was added and cited in the Introduction section.

Page 3 line 85. Please explain what is meant by soil capacity.

Reply:

The sentence was improved and now reads: "for soil texture identification, we applied the USDA method (Shirazi and Boersma, 1984) using the ISRIC SoilGrids (Hengl et al., 2017) global maps of the fractions of sand and clay, combined with the ESA CCI SoilMoisture (Dorigo et al., 2017) global map of soil porosity."

The Continuum model is mentioned in section 2.1. and 2.2 prior to its introduction.

Reply:

The text has been changed to make it more consistent and omitting the model name before it is described in section 3.1, unless strictly necessary. In fact, this comment is partly in contrast with a comment by Reviewer #3 who asked for additional clarifications about why Continuum was used in this work at an early stage in the article, hence we have added in the introduction that Continuum is "CIMA's distributed hydrological model"