Interactive comment on "Improving soil moisture and runoff simulations over Europe using a high-resolution data-assimilation modeling framework" *by* Bibi S. Naz et al.

Anonymous Referee #1

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General comments The manuscript aims to demonstrate that a high resolution data-assimilation modelling framework allows improving soil moisture and runoff simulations at a continental scale. Thus, it addresses a question within the scopes of the journal. Aims of the work are overall clearly outlined and supported by references. I suggest to better justify the choices of models and datasets and temporal domain (2000-2006). Data-assimilation results are compared to open-loop simulations to quantitatively assess this improvement basing on root mean square error and mean bias error estimates with respect to CCI SM data. Overall results are well supported by figures and graphs. However, I would suggest the Authors to give a more detailed explanation for differences in overestimate and underestimate between the regions and between the

seasons (particularly in par. 3.1.1). It seems that this part has been deepened more for runoff than for soil moisture. Besides I would suggest the Authors to better explain if and how results can be affected by spatial resolution differences in the data. The advancements described in this study would benefit from a quantitative or qualitative comparison with other studies claiming the use of data assimilation for improving soil moisture and runoff simulations, to assess if the obtained results are satisfying. My recommendation is to accept the manuscript with minor review.

Specific comments Page 2 Line 32 and Page 6 Line 2: I would suggest to add spatial resolution in km, as done is other sections of the text Page 2 Lines 18-27: I think sentences here are a bit contradictory. I would suggest the Authors to better clarify what is commonly done in the state of the art and what is rarely done (and eventually why it is rarely done), in order to better highlight element of novelties of this work. Figure 1b: I would suggest to use a discretized legend as it represents different classes Page 4 Lines 2-3: the Authors state that "CLM3.5 was used in this study, instead of its most recent version, to keep the modelling framework consistent to Kurtz et al. (2016)." Would it be possible to hypothesize some advantages or disadvantages in using CLM most recent versions? Page 5 Line 9: I would suggest to briefly explain how this conversion is done or at least provide a reference? Page 6 Lines 12-15: Would it be possible to perform the inverse resampling (from 0.0275° to 0.25°) and compare results with the one from 0.0275° to 0.25°? The same could be said for runoff rates (paragraph 2.3.3) Page 7 Line 27: Is it possible that Authors refer to another figure? Page 10 Line 3: "CLM-DA reduces the runoff bias compared to CLM-OL". Evidence of this is in Figure 9, not in Figure 7. It would suggest the author to better clarify this point or remove it (as it is already stated in line 20) I suggest to add a table similar to Table 1 also for soil moisture.

Technical corrections Page 1 Line 31: Western et al., 2002 has to be changed with Western et al., 2004 according to references Page 2 Line 16: bracket missing after "…Clark et al., 2011)" Page 2 Line 25: López et al., 2016 is missing in the references

and there is a repetition of the name in the text Page 2 Line 28: Rains et al., 2017 is missing in the references Page 3 Line 28: remove comma before brackets Page 4 Line 9: remove the semicolon before bracket Page 4 Lines 12-27: I think this sentence is too long, thus I would split it into different sentences maybe one for each formula Page 5 Lines 30-31: Wahl et al. 2017 is missing in the references Page 6 Line 13: Jones, 1999 is missing in the references Page 6 Line 19: remove full stop after brackets Page 9 Line 28: replace Decker and Zeng, 2009 with Zeng and Decker, 2009, as for references Page 11 Lines 32-33: I think that Authors mean "it is preferable to account for additional model parameter uncertainties that shows a high sensitivity towards runoff" instead of "it is preferable to account for additional model parameter uncertainties towards runoff that shows a high sensitivity" Page 12 Line 12: Remove "This study showed that", as it is a repetition of the above line Page 12 Line 30: "The improvement in peak runoff could be OF particular importance in the management of extreme events such as flooding" Page 14 Line 7: reference missing in the text Page 15 Line 9: reference missing in the text Page 17 Line 18: reference missing in the text Page 19 Line 31: replace 998 with 1998 Page 20 Line 34: year of publication should be after doi, as for the other references Page 21 Line 8: reference missing in the text Figure 2c: better if months initials are in English

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