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Interactive comment on "Sequential assimilation of satellite-derived vegetation and soil moisture products using SURFEX_v8.0: LDAS-Monde assessment over the Euro-Mediterranean area" *by* Clément Albergel et al.

Anonymous Referee #1

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Review on the paper entitled "Sequential assimilation of satellite-derived vegetation and soil moisture products using SURFEX_v8.0: LDAS-Monde assessment over the Euro-Mediterranean area" by Albergel et al.

This paper presents the LDAS-Monde data assimilation system and it evaluate results over Europe. Results are well presented, showing interesting consistent impact of the data assimilation on soil moisture, LAI and hydrological variables such as discharge. It is a innovative study of high interest for the community because it presents multi-variate data assimilation in a coupled land surface and river routing model. The paper is very

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clearly written and very well presented. I recommend the paper to be published after the minor comments below are accounted for.

Page 1, lines 12-13: The first sentence of the abstract should be reformulated to clarify the two objectives of the paper which are testing LDAS-Monde and improving monitoring. It does not make sense to says that LDAS-Monde "is tested ... to increase monitoring accuracy...". Testing itself only allows to evaluate and to asses monitoring accuracy.

Page 2 line 31: Replace "Assimilation impact shows that" by "results show that"

Page 2 line 33: "The assimilation impact's evaluation is succesfully carried out using...". It is not clear what succesfully means here. Is it that it worked technically or that it is a comprehensive evaluation using different data sets, or the results show good performance?. I would just replace by "A comprehensive evaluation of the assimilation impact is conducted using ..."

Page 6, line 147: replace "depth" by "deep"

Page 8 equation 5: it is not clear what ti and ti+1 are. ti must be the analysis time, but "+1" needs to be clarified: time step? analysis window length?

Page 8, 219: "WFDEI originates from the ECMWF ERA-Interim reanalysis (Dee et al., 2011) with a spatial resolution of 0.5": replace with by "interpolated to" otherwise it gives the impression that ERA-Interim is at 0.5 degrees resolution which is wrong.

Page 9, line 3: reformulate the sentence to avoid parenthesis (confusing because they do not correspond to mathematical formulation in this case): Where SSMm, SSMo, σm and σo correspond to the model and observation means and standard deviations, respectively.

Page 10 line 270: replace "background" by "equivalent of the observation"

Page 11 line 310: Here the time is a mean time for a given month, whereas earlier

in the paper "t" was used for instantaneous time. Replace "time t" by "month mt" or something like that.

Page 11 line 310, and page 19 lines 518, 521: replace " Eff. " by "Eff"

Page 13 line 356: "))"

Page 13 lines368-370: "Soil moisture observational and background errors are also scaled by the model soil moisture range, assuming that there is linear relationship between the soil moisture errors and the dynamic range. This was already said lines 354-356. Avoid repetition.

Page 14 table1: "Earth2Observe" by "EartH2Observe" and define NIT.

Page 14 line 377-380: This is not clear. The Jacobian values study could be done using the background forecasts of the analysis experiment. Please clarify.

Page 14 line 390: "section 222" by "section 2.2.2"

Page 14 392-395 and figure 2: It is not clear how the monthly LAI correlation are computed with one observation every ten days.

Page 16 lines 426-429: "Sensitivity of LAI to changes in soil moisture (Table 2, bottom rows) is generally weaker than that of SSM (Table 2 top rows) suggesting that although control variables related to soil moisture will be impacted by the assimilation of LAI, they would be even more impacted by the assimilation of SSM." It is not possible to directly compare jacobians values of dSSM/dW (top row) and dLAI/dw (bottom) as they don't have the same unit at all. So, the logic of this sentence does not work. The authors should elaborate the analysis of the table results to come to the conclusion that SSM assimilation should have more impact than LAI assimilation.

Page 17: lines 451-452: just say "January", "June" and "October" to be consistent with the wording used just above (eg line 444) to present this figure. The figure caption makes it clear that it is for the multi-year period.

Interactive comment

Page 18: line 500: "Areas where positive analysis increments were found for LAI (Figure 5) are marked by a decrease in drainage and runoff (in red on Figure 9) while evapotranspiration increases (in blue Figure 9)." It is not that systematic: drainage and runoff impact is more patchy than LAI increments. I would replace "are marked by" by "tend to correspond to"

Page 19, line 516 and Figure 10 caption: "46.0858 N-3.21641E" is it necessary to give 5 digits? It is finer than the model resolution and if the purpose is the traceability of the observed GY location is there an site id number that could be used instead? It would be clearer in the paper to stick to two digits latitude-longitude information (as in line 523 for the discharge).

Figure 14: not discussed in the paper

Page 20 line 552-555 and Figure 12: I would expect figure 12 d and l to be identical as they are both indicated to show 'analysis-Model' evapotranspiration. Please clarify.

Page 21: line 569: 'the observation operator is the very thin top layer' this is not correct. Replace by 'the model equivalent was the very thin top layer'. Also replace "that is a thick layer" by "that was a thick layer" to be consistent with the first part of the sentence line 568.