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Interactive comment on "Gap-Free Global Annual Soil Moisture: 15 km Grids for 1991–2018" *by* Mario Guevara et al.

Anonymous Referee #2

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1. Limited usefulness of an annual average soil moisture. Some gap filled values i.e. over areas of permanent ice are not physically realistic. 2. Incorrectly referenced CCI dataset i.e. L51, 72 (as per terms&conditions https://www.esa-soilmoisture-cci.org/node/236) + manuscript does not specify which CCI product was used (passive, actice or combined). In L96: I believe the authors meant v4.7, there is no CCI SM v4.9. 3. Unnecessary level of detail in the abstract, numerical results could be saved for the end. 4. The number of used in situ ISMN records (n=13376) seems very high, nowhere does the manuscript state which sensor depths from ISMN records were selected for the validation. (As acknowledged in L65, satellited soil moisture represents 0-5cm and so only relevant in situ records should be included). 5. The overall correlation with in situ records of the original CCI dataset (L25-27 again, no

product specified) is said to be 0.3 which is much lower than the correlation values available from the official CCI product website, validation report and what a quick validation (https://qa4sm.eu/result/8098cf4a-726b-4f56-a4cb-fb180c884c5c/) all suggest (r=~0.5). If annual mean values were validated, how were the means taken, was there a number of available observations threshold for a pixel in the CCI dataset before a mean was taken? Or could annual means be computed with at least a single observation? The same goes for in situ reference data. The selection of included in situ sensor depths would also affect the correlation metrics. 6. The 10-line Fig 2 caption repeats the preceeding text exactly; repetitive wording in other figure captions (i.e. Fig 5). 7. Section 2.2 it is unclear to me whether the model was entirely built around annualy aggregated CCI values. 8. Section 2.4: not sure if validation against a mixture of soil moisture and rainfall observations is a good approach... Later L372-373 read "The use of precipitation data for areas of the world where no in situ soil moisture validation data is supported by work of Gruber et al., (2020)." - I found no such information in the quoted paper, moreover Fig 1 shows that the used in situ rainfall stations often overlap with the soil moisture ones, contradicting that statement (unless they all don't overlap temporally). I believe 'available' is also missing from the quoted sentence. 9. The source of the precipitation records is not explained until L366 even though these data are mentioned several times before. As they are mentioned and mapped (Fig 1) together with in situ soil moisture it is easy to assume the authors refer to in situ precipitation measurements from ISMN. L162 and L368 seem to be using 'records' and 'sites' interchangeably, which is incorrect. 10. ISMN is a dynamic dataset and an access/download data would be useful. What are the 8,080 ISMN tables mentioned in L361? Confused by this number. From how many stations were the 13376 records derived? Which networks were selected and why. Again, what reference depths were included. 11. L68- there is also 1km surface soil moisture over Europe https://land.copernicus.eu/global/products/ssm

2020.