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Interactive comment on "SGD-SM: Generating Seamless Global Daily AMSR2 Soil Moisture Long-term Productions (2013–2019)" *by* Qiang Zhang et al.

Anonymous Referee #3

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The complete satellite-based soil moisture products in space and in long time series can be assimilated to land surface models to generate spatiotemporal soil moisture at the global scale for climate/weather predictions and surface physical property retrieval. In this paper, the author generated the seamless Global Daily Advanced Microwave Scanning Radiometer 2 (AMSR 2) Soil Moisture (SGD-SM) products by using the developed 3D spatiotemporal partial convolutional neural network (CNN), which filled the gap of AMSR2 soil moisture products due to limitations of satellite orbit coverage and soil moisture retrieval algorithms. Assessing the quality of SGD-SM products was carried out by means of in-situ validation, time-series validation and the validation in selected missing regions. Furthermore, it showed that the SGD-SM) products had

improved R and RMSE by comparisons to those based on the time-series averaging.

Although it is enough to understand what 'went on', the scientific and English expressions are poor. Authors need to first go through the whole manuscript and make it readable. Meanwhile, the literature review is not very related to the deep learning method that the authors mentioned and used in this paper. The methodology part is not clear enough to follow. Considering the important applications of the complete products at the global scale, this review suggests to reconsider the paper after major revisions.

Major and minor comments are listed in blow and others please find them in the attachment.

Major comments: 1. Please revise the title. See the attachment.

2. Please give the definition of 'context information' and 'context consistency' used in this paper.

3. In lines 44-45, please explain who is 'the best observed value'. Please confirm 'a best single-point' or 'best single-points'.

4. In line 51, please give the definition of 'invalid land regions'.

5. In lines 55-58, please briefly introduce the advantage/weakness of the mentioned methods in the reference for fillings gaps of soil moisture products. The current literature review is just like a list and not informative to induce the developed method that you used in your study.

6. In lines 64-69, information like 'a new strategy to solve incomplete...obtain the global gap-filling' express the same meaning. The content in a), b) and c) sounds casual and is not concise in the scientific meaning. Most importantly, please state the reason why do you use the current deep learning method, although we know it is a hot topic. Since you mentioned deep learning theory, can authors give a literature review of soil moisture product gap-filling? I suggest to rewrite lines 48-65 to present a better

literature review and the motivation of your work.

7. In line 70, please explain why the AMSR2 soil moisture products are focused, such as its availability in long time series compared to other satellite soil moisture products.

8. In lines 70-83, it seems that 'a novel 3-D spatiotemporal partial convolutional neural network, global-local loss function' appears suddenly. I suggest to briefly explain them a bit when they are first mentioned. Meanwhile, the objective part presents the content in the Conclusions. They are different, please revise.

9. In line 97, please specify the uncertainty of soil moisture. What do you really refer to? Is it the uncertainty from the soil moisture retrieval algorithm or others?

10. In line 114, please give the spatial distribution of (the used) in-situ soil moisture networks.

11. In line 117, please do you mean descending and ascending data for 'neighboring in-situ hourly values'?

12. The Methodology part is not clear and neat. In line 125, what is 'the loss convergent model'. It appears also suddenly. I suggest to rewrite the overall descriptions of the method, and clearly explain every step and their relations in a logical way. Please present the following sections in a more clear way. There are lots of numbers mentioned, like T-4, T+4, 3*3*3 (what does 3 mean?), 11 layers, 90, 0.1 during the training procedure, 128, 210, 300, 0.001, etc. I question their rationalities, please give the reason for each. In line 190, I am not sure about the relation between loss function and learning parameters? By the way, who is the learning parameter in this study? In line 208, "After building up this unified loss function, the presented reconstructing model employs Adam algorithm as the gradient descent strategy, The number of batch size in this model is fixed as 128 for network training. The total epochs and initial learning 210 rate are determined as 300 and 0.001, respectively. Starting every 30 epochs, the learning rate is degraded through decay coefficient 0.5." Please explain a bit in a clear

way, it is very difficult for laymen to understand 'epoches, Adam algorithms and the gradient descent strategy'.

13. At the beginning of section 4, please put the doi related content in the section of 'Data availability'. Additionally, please remove the duplicate information that is already mentioned in the Method. Please only present your results in the Result section.

14. Figure 10, the original patch shows almost the same as the reconstructed. Do you mean the original patch is missing here? I am sorry if I misunderstand.

15. Figure 12, no black circles.

16. Please describe uncertainties in this generated SGD-SM product.

Minor comments 1. Please follow "Manuscript composition (https://www.earth-system-science-data.net/submission.html#manuscriptcomposition)" to make all related, e.g., Data availability as a separate section and use Sect accord with regulations.

2. Use 'besides' too many times in a scientific paper.

3. In line 20, I do not think EAS CCI is a sensor. Please revise.

4. 'products' not 'Production'

Please also note the supplement to this comment:
https://essd.copernicus.org/preprints/essd-2020-353/essd-2020-353-RC3-supplement.pdf

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Interactive comment on Earth Syst. Sci. Data Discuss., https://doi.org/10.5194/essd-2020-353, 2020.