

Response to the Comments of Referee #2

Dear Referee #2:

We are particularly grateful for your careful reading, and for giving us many constructive comments of this work!

According to the comments and suggestions, we have tried our best to improve the previous manuscript ESSD-2022-80 ([SGD-SM 2.0: An Improved Seamless Global Daily Soil Moisture Long-term Dataset From 2002 to 2022](#)). An item-by-item response follows.

Once again, we are particularly grateful for your careful reading and constructive comments. Thanks very much for your time.

Best regards,

Qiang Zhang

General comments:

This manuscript presents a novel study on use of three sensors to reconstruct SGD-SM 2.0 products. One of the novel aspects of this study is that global daily precipitation products are wisely assimilated into the proposed LSTM-CNN, to fill gaps in daily soil moisture products. This methodology represents a substantial advancement in generating global soil moisture products that synergistically incorporate soil moisture and its closely associated hydrological variable, precipitation from the last precipitation satellite. The improved SGD-SM 2.0 product has been shown to outperform the previous SGD-SM 1.0 product in terms of accuracy and time-series consistency. I recommend accepting this wonderful work after minor revision.

Response: We are particularly grateful to the reviewer for his/her detailed suggestions! According to the comments, we have tried our best to improve the previous manuscript. An item-by-item response to each constructive comment follows.

Major comments:

Q2.1: *Page 2 Line 24: AMSR2 and WindSat products in caption (a) and (b) are incorrect.*

Response: Thanks for this comment. In Fig. 1, two sub captions of original soil moisture products of AMSR-E and WindSat are incorrect. We have revised this mistake in current version.

Q2.2: *Page 3 Line 64: Word ‘description’ is repetitive in this sentence.*

Response: Thanks for reviewer’s careful checking. We have revised this sentence as “Sect. 2 provides a description of products and data used in this work” in current version.

Q2.3: *Page 5 Line 101: IMERG precipitation products should be given the full name.*

Response: Thanks for this suggestion. We have given the full name of IMERG (Integrated Multi-satellitE Retrievals for GPM) in Section 2.2.

Q2.4: *Page 9 Line 185: Why did the authors use the global land mask M_L in the loss function?*

Response: Thanks for this meaningful query. The global soil moisture uniformity and local soil moisture heterogeneity are both taken into consideration in the proposed LSTM-CNN reconstructing model. Therefore, we use the global land mask M_L in the loss function to better reconstruct the gap regions. We have supplemented these explanations in Section 3.1.

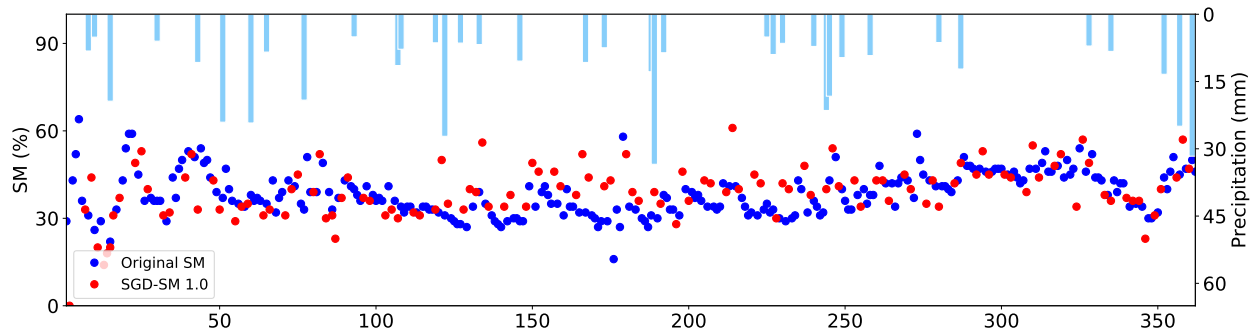
Q2.5: *Page 12 Line 215: ‘drawing into global daily precipitation products’ should be revised as ‘fusing global daily precipitation products.’*

Response: Thanks for mentioning this issue. We have revised this sentence as “Through fusing global daily precipitation products, SGD-SM 2.0 can consider the sporadic extreme weather condition for single day.” in Section 4.1.

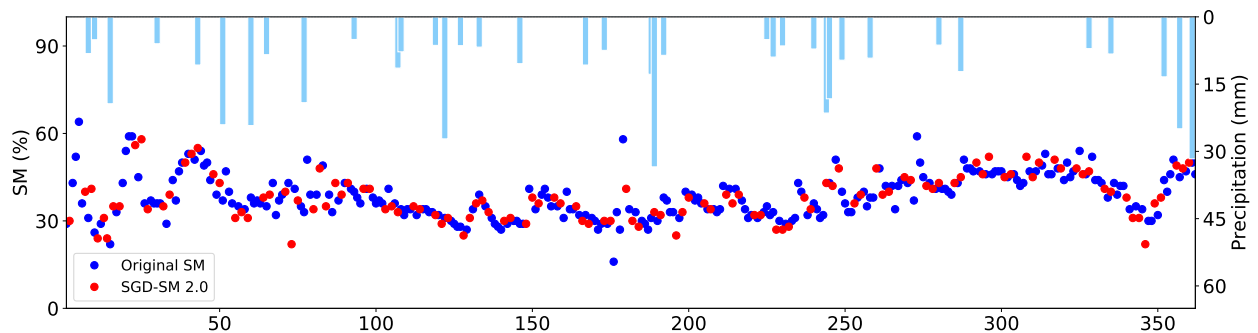
Q2.6: *Page 16 Line 281: The authors claimed that the reconstructed SGD-SM 2.0 points behave more consecutive around their adjacent original soil moistures points than SGD-SM 1.0. More explanations need to be given for this attribute.*

Response: Thanks for this suggestion. Compared with SGD-SM 1.0, SGD-SM 2.0 outperforms on time-series consistency in Fig. 11(a) and (b). The reconstructed SGD-SM 2.0 points behave

more consecutive around their adjacent original soil moisture points than SGD-SM 1.0. While SGD-SM 1.0 exists discrete problem in Fig. 11(a), to some degree. Benefiting from the data fusion of daily precipitation information, the proposed LSTM module can extract time-series features for filling the gaps and missing regions in daily soil moisture products. Therefore, SGD-SM 2.0 can be effectively utilized for global hydrology monitoring analyzing at fine temporal scale, rather than the traditional monthly or yearly averaging operation.



(a) Time-series daily original soil moisture, SGD-SM 1.0, and precipitation results in 2013



(b) Time-series daily original soil moisture, SGD-SM 2.0, and precipitation results in 2013

Fig. 11. Time-series daily original soil moisture, SGD-SM 1.0/2.0, and precipitation results at location (48.875°N, 140.375°E) in 2013.

Q2.7: Page 17 Line 297: *Data availability. Current descriptions about SGD-SM 2.0 in the website are not Data availability. The authors may want to supplement specific information for possible users.*

Response: Thanks for this comment. We have supplemented more specific information for SGD-

SM 2.0 at <https://doi.org/10.5281/zenodo.6041561>.

The screenshot shows the Zenodo dataset page for SGD-SM 2.0. The header includes the Zenodo logo, a search bar, and navigation links for Upload and Communities. The user profile is whuqzhang@gmail.com. The dataset is dated June 7, 2022, and is labeled as a Dataset with Open Access. Action buttons for Edit and New version are visible. The dataset title is SGD-SM 2.0, created by Qiang Zhang and Qiangqiang Yuan. The description states that this dataset improves upon SGD-SM 1.0 by extending the application scope to 2002-2022, assimilating precipitation data, and using an LSTM-CNN model. Key features include a long-term dataset, 7115 NetCDF4 files, application codes on GitHub, a homepage, and processing by Qiang Zhang. Statistics show 190 views and 309 downloads. The dataset is indexed in OpenAIRE. A preview button is located at the bottom left, and the publication date is June 7, 2022.

June 7, 2022

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Publication date: June 7, 2022

Preview

SGD-SM 2.0

Qiang Zhang; Qiangqiang Yuan

To overcome the disadvantages of previous **SGD-SM 1.0**, we develop an improved seamless global daily soil moisture (**SGD-SM 2.0**) dataset for the years 2002-2022. The main improvements and contributions of **SGD-SM 2.0** are listed as follows:

- Compared with SGD-SM 1.0 (from 2013 to 2019), the application scope of SGD-SM 2.0 can be enlarged from 2002 to 2022.
- SGD-SM 2.0 assimilates auxiliary precipitation information, to consider the sudden extreme weather condition.
- SGD-SM 2.0 develops an integrated LSTM-CNN to fill the gaps and missing regions in global daily products.

More Descriptions:

- This is An improved seamless global daily soil moisture long-term (2002-2022) dataset.
- These daily products include 7115 global soil moisture NetCDF4 files (Both original and reconstructed data), starting from Jun 23, 2002 to Feb 05, 2022.
- Application Codes: <https://github.com/qzhang95/SGD-SM>
- Homepage: <https://qzhang95.github.io>
- Processed by Qiang Zhang (whuqzhang@gmail.com)

Current descriptions about SGD-SM 2.0 at the website <https://doi.org/10.5281/zenodo.6041561>.