

“SMPD: A soil moisture-based precipitation downscaling method for high-resolution daily satellite precipitation estimation” by He et al.

Overall comments:

This aims of this study are very clear and significant. Precipitation dataset with fine spatio-temporal resolutions are of importance for climatological and meteorological investigations and applications. The method seems to be novelty, while the accuracy of the results have not achieved significant improvements. Considering the high standards of *HESS*, there are still various aspects needing to be greatly improved.

Specific comments:

1. Title: what are the capitals, SMPD, standing for? Please label them.
2. Title: would it be possible for downscaling the IMERG at hourly or half-hourly scale? For this point, I would like to recommend you some references:

The first comparisons of IMERG and the downscaled results based on IMERG in hydrological utility over the Ganjiang River basin, *Water*, 10 (1392), 1–15, DOI: 10.3390/w10101392.

AERA5-Asia: A long-term Asian precipitation dataset (0.1° , 1 hourly, 1951 - 2015, Asia) anchoring the ERA5-Land under the total volume control by APHRODITE, *Bulletin of American Meteorological Society*, *Bulletin of American Meteorological Society*, 103 (4) DOI: 10.1175/BAMS-D-20-0328. 1.

AIMERG: a new Asian precipitation dataset (0.1° /half-hourly, 2000 - 2015) by calibrating GPM IMERG at daily scale using APHRODITE, *Earth System Science Data*, 12(3): 1525–1544, DOI: 10.5194/essd-2019-250.

Calibrating GPM IMERG Late-Run product using ground-based CPC daily precipitation data: a case study in the Beijing-Tianjin-Hebei urban agglomeration, *Remote Sensing Letters*, 12:9, 848–858. DOI: 10.1080/2150704X.2021.1942576.

3. Introduction: this part demonstrates that the authors have not comprehensively known the key spatial downscaling investigations, and the writings is really not good. Please reorganize and rewrite it.

A Spatial Data Mining Algorithm for Downscaling TMPA 3B43 V7 Data over the Qinghai-Tibet Plateau with the Effect of Systematic Anomalies Removed. *Remote Sensing of Environment* 200: 378–395. DOI: 10.1016/j.rse.2017.08.023

Respective Advantages of “Top-Down” Based GPM IMERG and “Bottom-Up” Based SM2RAIN-ASCAT Precipitation Products Over the Tibetan Plateau, *Journal of Geophysical Research: Atmospheres*, 126, e2020JD033946. DOI: <https://doi.org/10.1029/2020JD033946>.

Spatially Downscaling IMERG at Daily Scale using Machine Learning Approaches over Zhejiang, Southeastern China, *Frontiers in Earth Science*, 8:146. DOI: 10.3389/feart.2020.00146.

Long Term Precipitation Estimates Generated by a Downscaling Calibration Procedure Over the Tibetan Plateau From 1983 to 2015. *Earth and Space Science*, 6, 2180–2199. DOI: 10.1029/2019EA000657.

A new approach for obtaining precipitation estimates with finer spatial resolution at daily scale based on TMPA V7 data over the Tibetan Plateau, *International Journal of Remote Sensing*, 40:22, 8465–8483. DOI:10.1080/01431161.2019.1612118.

Downscaling Annual Precipitation with TMPA and Land Surface Characteristics in China. *International Journal of Climatology* 37: 5017–5119. DOI: 10.1002/joc.2017.37.issue-15.

4. Datasets-IMERG: Various investigations have been done to exploiting the potential errors in IMERG. If the authors point out some potential error sources of IMERG, it is much better.

Do ERA5 and ERA5-Land Precipitation Estimates Outperform Satellite-based Precipitation Products? A Comprehensive Comparison between State-of-the-art Model-based and Satellite-based Precipitation Products over Mainland China. *Journal of Hydrology*, 605: 127353, DOI: 10.1016/j.jhydrol.2021.127353.

5. Datasets-SSM: how do you think that whether the too coarse spatial resolution of CCI SSM data, 0.25 deg, have negative efforts in downscaling IMERG at 0.1 deg or not?
6. Datasets-NDVI: how do you think that whether the too coarse temporal resolution of CCI SSM data, 16-day, have negative efforts in downscaling IMERG at daily scale or not?
7. Validation: why did not using the POD index, which is a very common index evaluating precipitation datasets.

Quantitative Evaluations and Error Source Analysis of Fengyun-2-Based and GPM-Based Precipitation Products over Mainland China in Summer, 2018, *Remote Sensing*, 11(24):2992. DOI: 10.3390/rs11242992.

Spatiotemporal Assessments on the Satellite -Based Precipitation Products From Fengyun and GPM Over the Yunnan -Kweichow Plateau, China. *Earth and Space Science*, 7, e2019EA000857. DOI: 10.1029/2019EA000857

8. Results: The idea of Fig.3 is not very clear.
9. Results: the downscaled results on 20171210 in the central part seems have anomalies, why?
10. Discussion: would it be possible to analyze the potential error sources of the downscaled results?
11. The English writings are also greatly needed to be improved.

12. Last but most important one: would you like to use some traditional method as a comparison with your proposed method, SMPD?