

This manuscript presents a timely and valuable global long-term dataset of optimized SMOS 40° brightness temperatures (TB), together with the corresponding soil moisture (SM) and vegetation optical depth (VOD) retrievals. It is also the first study to provide SM and VOD products derived from SMOS single-angle information. This represents an important advance, as it complements currently available multi-angular products and facilitates cross-comparison and potential fusion with SMAP-based datasets. Overall, the study is interesting, and the manuscript is well written. The dataset is publicly available, and the validation is extensive, including in situ observations as well as independent satellite and reanalysis products, which fits well within the scope of ESSD. I am positive about the overall contribution; however, before considering publication, several points could be clarified to further strengthen the manuscript:

1. There are too many acronyms throughout the manuscript. Acronyms like IB_HR_mono_SMOSIB, IC_multi_SMOS, etc., are essential but can be challenging for readers to track. Please consider adding a small glossary table in the supplement defining these key acronyms.
2. Lines 179-180 state: “The GLDAS SM (kg/m^2) was also transformed into volumetric unit (m^3/m^3), with daily average SM computed for analysis”. Please correct “GLDAS SM” to “GLDAS-Noah SM” for precision. Furthermore, please specify the method used to convert the units from kg/m^2 to volumetric SM (m^3/m^3).
3. Please add labels (e.g., a, b, c, d) to each subplot in Figure 3 for easier referencing and to ensure consistency with the figure caption descriptions.
4. Table 2: The “Scene_Flags” layer is a useful inclusion. For greater clarity, please reference or briefly describe the specific criteria for flags like “moderate Topography” (e.g., stating the specific slope range used) in the supplement or somewhere. Besides, the soil roughness map is very important for this manuscript; was that included in the published dataset?
5. While using Canopy Water Content (CWC) to validate VOD temporal dynamics is innovative (Section 2.3), the manuscript currently lacks justification for choosing this specific CWC product. Please provide a brief rationale. Besides, please clarify the native spatial resolution of the CWC product. If it is finer than 25km, please explain the aggregation method used to match the SMOS-IB 25km grid.
6. The in-situ validation relies on the ISMN, which exhibits a highly non-uniform global distribution (Fig. 1), characterized by dense coverage in North America and Europe but sparse sampling in other regions. Please include a dedicated paragraph in the Discussion section acknowledging this representativeness bias. Discuss the implications for users and suggest how future validation efforts could complement this global assessment.
7. How were the inherent mismatches handled regarding different satellite overpass times versus observed SM times, and differing native spatial resolutions between products? Please clarify the methodology by detailing the temporal compositing

approach, spatial aggregation methods, and the specific temporal windows used for matching different datasets.

8. Regarding the Triple Collocation Analysis (TCA) method, SM anomalies were computed using a 35-day moving window. Please clarify the rationale behind choosing a 35-day window. Is this choice based on specific references or sensitivity analysis?

9. Please explain how the high-frequency TB variations (SDHF) were computed. It is suggested to add a short description in the Methodology section to clarify this process for readers.

10. In Figure 4, the unit for Kelvin should be capitalized “K”, not lowercase “k”. In Figure 6, subplot (d1), please correct the display of percentages, as the numbers are currently overlapping and unreadable.

11. Figure 7 requires several corrections. There appears to be a labeling error, as subplot (f) seems to be duplicated; please ensure each panel is uniquely identified. Additionally, the histogram subplots (i), (j), and (k) are currently not cited anywhere in the main text. Please double-check their necessity. Besides, for consistency with other figures in the manuscript, it is suggested to change the legend orientation from horizontal to vertical.

12. Please carefully check the reference list for formatting consistency. For instance, some journal names are currently capitalized in full while others are abbreviated. Please ensure all references adhere strictly to the journal’s specific formatting guidelines.