Reviewer Report

Date: September 10, 2025

Reviewer: Sara Sayyadi

Overall Assessment

The revision addresses several structural and figure requests. However, three technical areas remain insufficiently justified or documented: (i) the choice and implications of a 10 m gauge length (GL) for low-frequency DAS; (ii) the documentation and alignment of in-situ soil-moisture observations with DAS metrics; and (iii) limits of daily dv/v stacks and depth sensitivity. Addressing these items would materially improve reproducibility and interpretation.

Major Comments

1) Gauge-length choice and effective spatial resolution

The methods state a 10 m gauge length (GL) and channel-averaging over ~10 m prior to integrating strain-rate. Please justify this choice and quantify how it affects both sensitivity to meter-scale variability and comparisons with point sensors.

Requested actions:

• Provide a rationale for selecting 10 m GL (SNR/stability vs spatial resolution).

• Quantify the effective along-fiber spatial response (e.g., GL convolution kernel and its width/FWHM).

• Include a short re-processing test with a smaller GL (e.g., 2.5–5 m) or a forward model, to illustrate amplitude/phase biases for localized signals.

• Revise any language claiming sub-meter resolution; with 1 m spacing and 10 m GL, the smallest resolvable feature is on the order of 10 m along fiber.

• Clarify implications for comparing DAS (spatial average along GL) against point soil-moisture sensors.

2) Soil-moisture observations and integration with DAS

The interpretation relies on moisture-driven mechanisms, but the sensor documentation and the coupling to DAS can be made crisper.

Requested actions:

• Explicitly list sensor types/models, measured variables (VWC, SWP), depths, sampling cadence, and distance to the cable.

• Describe calibration/QA and any screening of out-of-range values.

• State how soil-moisture series are aligned with DAS metrics: daily medians for dv/v vs sub-daily series for low-frequency strain/strain-rate; interpolation and gap handling.

• Justify the depths used in comparisons (e.g., shallow composite 0.15–0.40 m vs multi-depth 0.15–1.0 m).

• Summarize simple correlations/lag analyses between moisture indices (and effective stress) and DAS metrics, noting spatial variability.

• If one sensor cluster failed at some point, note reliance on the remaining cluster and any implications.

3) dv/v temporal resolution and depth sensitivity

dv/v is computed from daily noise stacks; such products cannot substantiate intraday variability. Also, depth sensitivity of the 8–16 Hz band should be explicitly related to the moisture sensors used.

Requested actions:

• State explicitly that dv/v is daily and avoid intraday claims unless sub-daily processing is added.

• Provide a concise depth-sensitivity summary for the analyzed band and reconcile with the chosen moisture depths.

4) Instrument/cable low-frequency response and temperature/drift

Thermal strain is estimated to be small and no correction is applied. Please also describe potential interrogator/cable LF response and drift controls when integrating strain-rate.

Requested actions:

• Specify cable construction (tight-buffer vs loose-tube, jacket, burial details) and discuss implications for LF response.

• Include a brief check comparing strain-rate with the temporal derivative of temperature over selected windows to assess instrument-related contributions.

• Summarize detrending/high-pass choices used to mitigate integration drift and how robustness was verified.

Minor / Editorial

• Appendix: correct “Index of fraction” → “Index of refraction.”

• After Figure 3 caption: ensure the next paragraph begins with a capitalized “Hourly …”.

• Consider adding cable specs (make/type) in Methods §3.2 for completeness.

• Ensure all instances of resolution claims are consistent with the stated GL and spacing.

Minor language/clarity – around L180 (soil-moisture paragraph after Fig. 3)
The current wording is understandable but could be tighter and more precise (e.g., SWP "decreases" → "becomes more negative"), and the historical citation after "Pearson" isn't needed here.

Suggested replacement text:
"**Soil moisture closely tracked rainfall:** VWC increased during infiltration, while SWP became more negative. Measurements from EMM_1 and EMM_2 were highly correlated for both variables (Pearson's r>0.9r>0.9r>0.9), indicating that either site can serve as a representative indicator of regional soil-moisture dynamics."

Consider rephrasing the following sections for clarity and consistency:

- **A) Results — Soil-moisture paragraph (after Fig. 3, ~L175–L186).**
  Suggested replacement:
  Soil moisture closely tracked rainfall: volumetric water content (VWC) rose during infiltration, while soil-water potential (SWP) became more negative. Measurements from EMM_1 and EMM_2 were highly correlated for both variables (Pearson's $r > 0.9$), indicating that either site can serve as a representative indicator of regional soil-moisture dynamics.
- **B) Methods — Soil moisture (Section 4.2 "In situ Soil Moisture Measurements", ~L170–L176 starter lines; drop-in fits immediately after).**
  Suggested replacement:
  Volumetric water content (VWC) and soil-water potential (SWP) were measured at 0.15–1.0 m depth (10-min cadence) near the buried cable. We screened outliers, computed daily medians to match dv/v stacks, and used both a shallow composite (0.15–0.40 m) and a multi-depth composite (0.15–1.0 m) to assess sensitivity to depth selection.
- **C) Conclusion — resolution claim (the "In conclusion…" sentence, ~L403–L407; the number** 405 **appears at line end).**
  Suggested replacement:
  We integrate traditional seismic wave analysis with continuous monitoring of quasi-static deformation using DAS to track moisture-driven hydromechanical changes, achieving meter-scale along-cable resolution with a 10 m gauge length.