

Major comment

The topic is relevant to the Earth and environmental science community served by EGU sphere because nocturnal CO₂ uptake remains poorly constrained in dryland carbon budgets, and a cross-site synthesis could make a useful contribution. The manuscript also assembles a potentially valuable dataset and attempts to connect physical and chemical controls.

The present analysis, however, does not yet support the title's claim that it explains a generation mechanism. The evidence consists of observational data extracted from heterogeneous studies, many predictors vary mainly between studies or sites, and several analyses appear to treat clustered observations as independent. Contradictory definitions and sign interpretations for ΔT , F_s , and the texture ratio further prevent a stable interpretation of the reported effects. The annual carbon calculation also appears to apply a full-year, 24-hour multiplier to a nocturnal flux. These issues affect the principal conclusions and require substantial reanalysis and reframing.

1. lines 8–23; Discussion, lines 243–307: Could the authors describe the proposed physicochemical mechanism as a conceptual framework supported by cross-study associations, rather than as a demonstrated causal mechanism, and revise the title, abstract, and conclusions accordingly?
2. lines 65–126: Could the authors add the search date, screening procedure, data-selection rules, study/site hierarchy, and complete model settings so that readers can understand how the 563 observations were selected and analysed?
3. lines 145–211 and, lines 243–285; Figs. 3, 5, 8, and 9: Could the authors use one texture variable throughout, either ' $\ln(\text{clay/sand})$ ' or ' $\ln(\text{sand/clay})$ ', and check all signs and interpretations of ΔT and negative F_s so that “stronger uptake” has one consistent meaning?
4. lines 220–236: Could the authors correct the annual conversion of nocturnal F_s , state the assumed number of nighttime hours and uptake days, and present the NEE and soil-respiration comparisons as illustrative estimates unless the quantities are directly comparable?
5. Lines 310–314; Supplement, Table I: Could the authors provide a machine-readable dataset and analysis code, reconcile the supplement with the reference list, and use one consistent Data and code availability statement?

Minor comment

1. Lines 18–20, Revise “suggested exerted pronounced effects” and “results ad previous studies”; both phrases are grammatically incomplete.
2. Line 100, Rename Section 2.3 because the heading repeats “Data Extraction”; “Statistical analysis” would be more accurate.
3. Lines 124–126, Correct “Fisher ‘s C” and list and cite all R packages used for the LMM, RF, hierarchical partitioning, and SEM.
4. Lines 139–140, Replace “obvious discrepancy” with “statistically significant differences.”
5. Lines 153–156, Correct the Fig. 3 caption because the displayed legend uses red for positive correlations and blue for negative correlations.
6. Lines 164–168, Describe ‘%IncMSE’ as predictive variable importance rather than “explanatory capacity,” and state whether it was calculated from out-of-bag predictions.
7. Lines 180–182, Correct the Fig. 5 caption to match the panel order and use the same soil-texture ratio as the figure.
8. Lines 193–195, Remove the stray “(c)” after “subsequent analyses” and identify the test used for EC.
9. Lines 209–213 and 279–285, Reconcile the ΔT path coefficient, which is 0.249 in the Results and Fig. 9 but 0.2741 in the Discussion.
10. Lines 223–225, Correct “NEE acrossed” and use either ‘ yr^{-1} ’ or ‘ a^{-1} ’ consistently.
11. Lines 228–230, Correct the soil-respiration unit from ‘ s^{-11} ’ to ‘ s^{-1} ’.
12. Lines 257–266, Standardize the chemical notation, charges, subscripts, equilibrium arrows, and reaction numbering.
13. Lines 306–309, Correct “labelingto” and specify which carbon pools the proposed ^{13}C experiment would measure.
14. After line 309, Add a concise Conclusion that answers the stated objectives and distinguishes observed associations from proposed mechanisms.
15. Lines 316–319, Reconcile “Yao Gao” in the author list with “Yang Gao” in the contribution statement.