Referee #3

***Response**:* We would like to extend our sincere gratitude for taking the time to review our manuscript and for accepting it as is. We are pleased that the revised version meets your expectations, and we appreciate your support and positive assessment. Thank you again for your time and for contributing to the quality of our manuscript.

Referee #4

Soil wetness and atmospheric dryness have critical impacts on ecosystem productivity and vegetation carbon uptake, yet the relationships are complex. The authors conducted various statistical analysis to explore the complex interactions between them to derive a comprehensive understanding. A lot of analyses have been conducted rigorously to investigate the correlation and the causal links. The authors have revised the manuscript corresponding to comments from previous reviewers, I think the manuscript is in a good shape, and only have a few minor suggestions:

***Response**:* We appreciate your positive assessment of our revised manuscript and your recognition of the rigorous analyses we conducted to explore the intricate relationship between soil wetness, atmospheric dryness, and vegetation carbon uptake. We also thank you for recognizing our efforts in responding to previous reviewers' comments. Your feedback has been invaluable in shaping our revisions and strengthening our manuscript. Below, we provide a more detailed, point-by-point response to your comments. The point to point changes can be found on lines 65, 82, 114, 116 and 234.

***Comment** (L65):* "What are the critical features are responsible for between-catchment differences", remove the second "are".
***Response**:* Thank you for pointing this out. We have removed the extra "are" in the revised manuscript in Line 65.

***Comment** (Eqn. 1):* Remove the "+" in front of DS.
***Response**:* We have removed the extraneous "+" symbol from the equation.

***Comment** (L116):* Usually it is baseflow and event flow, surface runoff and subsurface runoff. It could be confusing to use baseflow and surface runoff, as subsurface runoff isn't necessarily baseflow (e.g., subsurface stormflow). Or you can use fast flow and slow flow corresponding to the two-step partitioning.
***Response**:* Thank you for this clarification. We have replaced "baseflow" and "surface runoff" with "slow runoff" and "fast runoff" to reflect the two-step partitioning in Line 116.

***Comment**:* It could be helpful to add some sub-titles in the Results section, and discussion section as well if applicable.
***Response**:* We appreciate this suggestion. However, we prefer to keep the Results and

Discussion as continuous sections to present a clear, uninterrupted narrative. We have structured the text in a way that introduces the key findings in a logical flow without explicit sub-headings. We hope this approach helps readers follow the arguments smoothly.

Comment *(L235):* It helps to include the Granger causality test results used for decision, i.e., p-values.
Response*:* There is no enough space, and not necessary either, to include the p-values for all the catchments involved in this study. We included the criteria "p-values < 0.05" in Line 234 in the revised manuscript to clarify how we determined the significance of the Granger causality results.

Comment *(L265):* I may have missed somewhere, the "occurrence" of what? Maximum Wetness and GPP? It helps to state in Section 3.2.
Response*:* Thank you for the suggestion. The "occurrence" refers to the average timing of the dominant seasonal month, whether we are discussing soil wetness or GPP. Specifically, for soil wetness, it denotes the average time of occurrence for the dominant wetness season, whereas for GPP, it denotes the average time of occurrence of the dominant GPP season. This have been discussed under the "Circularity statistics" subsection in Section 3.2. See Lines 180-183.