Biogeosciences Discussions

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Comment on bg-2022-186

Anonymous Referee #2

Referee comment on "Upscaling dryland carbon and water fluxes with artificial neural networks of optical, thermal, and microwave satellite remote sensing" by Matthew P. Dannenberg et al., Biogeosciences Discuss., https://doi.org/10.5194/bg-2022-186-RC2, 2022

Review for “Upscaling dryland carbon and water fluxes with artificial neural networks of optical, thermal, and microwave satellite remote sensing” by Dannenberg et al.

Dannenberg et al. present an approach for estimating dryland GPP, NEE, and ET by training an artificial neural network (ANN) with remote sensing signals (optical vegetation indices, thermal observations, and microwave soil moisture/temperature). The study is novel, scientifically sound, well written and within the scope of Biogeosciences. I would recommend this paper for publication but have a few revisions I think should be addressed, mainly around paper presentation and clarification on methodology.

Minor Concerns:

- The structure of the introduction and methods have some overlapping material. For example, the fourth paragraph of the introduction in lines 63-72 mentions that plant physiological responses are not necessarily reflected in optical signals, but this paragraph doesn’t make the connection between optical VI’s that are sensitive to

greenness specifically. Discussion of 'greeness'-based metrics failing comes later in the methods section in lines 141-155 but I think it would be useful to draw the connection earlier in the introduction. In addition, the same paragraph in lines 63-72 says "microwave, thermal, and visible wavelengths can capture complementary information about plant and ecosystem stress that is unattainable from optical VIs alone". An explanation as to WHY these indices are useful is available in the methods but could be moved further to the introduction.

- The final paragraph of the introduction could be rephrased to make the hypothesis/study aim clearer. Specifically, the first sentence states, "Here, we develop and test an approach for data-driven prediction of a full suite of carbon and water fluxes that are specially adapted for drylands using…" but I think this can be much stronger to highlight the value of the study. Something along the lines of, "We aim to improve the prediction of GPP, NEE, and ET based on remotely sensed metrics by using…"
- Somewhere in the methods should include the number of test/train data points used.
- The final paragraph of the methods discusses the authors approach for testing the importance of predictor variables. Has this approach been used in other studies? Some validation of this approach or references for more information would be useful.
- The color palette of figures could be adjusted to follow more a 'intuitive' color scheme e.g. dark green for ENF – this is not critical but might help with figure readability.

Line edits:

Line 37: intensity of water limitation feels like awkward phrasing

Line 53: It might make more sense to move this like to the end of the last paragraph so someone scanning the paper could easily find "First, Second, Third" in the three paragraphs talking about the unique nature of drylands.

Line 54: It might be nice to define mesic

Line 59: “the effects of soil moisture stress…” but it’s the effects of ALL soil moisture right?

Lines 53-60: I found this paragraph a little difficult to follow as several sentences are quite long. I think it would be worth revisiting for clarity.

Line 67: Satellite-based estimates of fPAR should still be fine, it’s just that the plants aren’t responding to the increase in light by being more photosynthetically active. I would rephrase this.

Line 88: ‘however’ is unnecessary

Line 90: can be more specific with ‘uniqueness’

Line 91: ‘other places and other types of ecosystems’ seems redundant

Line 94: ‘for example’ is unnecessary

Line 97-100: I would rephrase to put the emphasis on the finding of the study, not the author, and just present the citation at the end.

Lines 113-117: References to sections might be useful

Line 117: ‘global-scale estimates’ – of ecosystem fluxes?

Line 185: ‘compositing’ is confusing and maybe incorrect?

Line 192: this statement deserves a citation

Line 194: ‘… predictions of multiple variables.’ Deserves a citation

Line 210: here could be a good place to include the number of test/train data points

Line 328: ‘Interestingly’ is unnecessary

Line 333: ‘However’ is unnecessary

Line 340: ‘modeling’ feels like the wrong term to use here – I think predicting or estimating would be more accurate since modeling implies process based (to me).

Line 403: ‘thermal data’ – it might be better to say LST here?

Figure 2: I think it would be useful to say what the input variables are in the figure (not just the outputs)

Figure 3: the + indicator is a bit difficult to see/compare with the bars – it might be easier to see in black or a different shape.

Figures 5, 6: I think it would be useful to indicate on the figures somewhere which sites fall under which land cover classification category

Figure 7: It’s unclear to me what the lines in a and c are

Figure 8: Do the lines connecting the scatter points represent anything? If not I would remove