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Biogeosciences Discussions

Interactive comment on "Detecting impacts of extreme events with ecological in-situ monitoring networks" *by* Miguel D. Mahecha et al.

Anonymous Referee #2

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This study looks at the detectability of extreme events using existing ecological networks and numerical experiments. I think there is some sound science here but several issues (many are language-related) need to be addressed to make this suitable for publication in BG. Specific comments follow...

P1L10: I'd like some other yardstick to gauge why I might care about the largest 8 vs. largest 39 events. How many sigma departures? Something more than a simple number would help the abstract. Right now the reader has little idea if these are only statistically as opposed to scientifically interesting.

P2L13: To a large extent is unnecessarily vague. Please add some actual information here.

P2L14: Fix the double ecosystem functioning.

P3L3: Please redo your objectives. It's just poorly written, I have no idea where we're going from here–until I re-read this paragraph the third time. That is twice too many. A simple declarative roadmap would be most helpful here.

P4L14: What do you mean considered? Did you use it or not? If I consider traveling to London over the weekend I may or may not go. That is not what you mean to imply here?

P5Fig2: Unclear. Especially the "within each mesh cell" bit. Why are the central dots and assigned percentiles interesting?

P6L1: I'm not sure I see your argument for local vs. global thresholds. Several EO products normalize by location to obviate this issue. And, of course, you do not define "implausible and undesired".

P6L16: How this characteristic FAPAR anomaly is assigned is still a mystery... You never say how the estimation occurs.

P622: If you want clusters why not cluster the MSC directly? And I'm curious how this improves upon other maps of similarity. Why not use MODIS PFTs as is. Or Koeppen-Geiger. What have you gained by this exercise?

P6L11: How well do the top 3 work?

P7Fig3; How is "we may classify an event as extreme in one ecosystem that would be considered part of the normal variability elsewhere" interesting? This is hardly new information! And there are no percentiles here?

P7Fig4: I like this. Good visualization of the sparse network detection problem!

P8L3: Would like an example of z here.

P8L1: Here the reader is confused. You spend much time on the PCA/cluster bit such that your similarity mask allows for spatially non-contiguous blocks. But here we are doing direct neighbors? While I think I understand the thought process here it needs

additional detail. One might wonder why bother with PCA/cluster if you are doing direct neighbors as, for nearby cells, once can reasonably "assume a similar responsiveness to some extreme event " (from P8L11).

P9L2: Did you look at this alternative? As I read on I have the impression that your workflow has so many tunable (hyper)parameters that I am already doubting the results from this one set on offer. Did you do some grid search? Across algorithms and hyperparameters? You can tweak how you arrive at the clusters, how you set thresholds (still unclear), and the z and tau params?

P9L5: Still unclear on the threshold. I like this list of settings. It's a much needed distillation of the methods above. Your grain size concept here is more informative than the above figure.

P10Fig5: Maybe it's a language thing but if b is anomaly while is it labeled as (reduction of m2 with FAPAR = 1? Fix the missing) in any event. Also, why does 103 get a black line? (I read on and see this point is discussed but do put this [briefly] in the caption as well.)

P10L1: So Fig 8? What about Fig 6 and 7?

P10L8: How is this different. Seems like the same message here. Also, "that one would need to inflate in-situ networks by orders of magnitude to detect small scale events at comparable rates than large-scale extremes" is hardly new insight. We've known this for some time. If the Earth is hit by a large asteroid, a single sensor will be just fine. If several smaller objects rain down more sensors are needed to track them all. You are just restating common sense here.

P10L14: Here you address a departure from an idealized case and invoke spatiotemporal correlation. This is fine but I would outsource this to an Appendix and state in the main text that deviations in detection probabilities relative to theoretical expectations are driven by spatiotemporal structure in the dataframe and move on. This really

breaks the story as written. An alternative is to include this issue in your objectives as another question. It reads tacked on in any event as is.

P13L18: Same above comment applies here. Here you might frame this as a means to more efficiently design a network. This could foreshadow your conclusions a bit better too.

P14Fig7: If caution is warranted, why show it? Also, why are the edges black. The band across Fenno-Scandinavia is odd. Does your workflow simply create such zones at the domain edge?

P15L5: "We therefore ranked the largest 100 events detectable in continental US by their integrated FAPAR anomalies." I still am missing some information on if these are ecologically relevant. Why should a network be configured to detect a class of anomaly (no matter how real, in a numerical sense) that has no impact on land ecosystems? I am not saying that is the case here but you never really address this point. Put another way, an FAPAR departure does not linearly map onto, say, a carbon/water/energy anomaly.

P16Fig8: Percentile ranges from some bootstrap scheme? How many times? I don't recall seeing that. Also, at this point in the paper I see two options. You either explicitly retool this as technical note (that means shortening the paper; this is the easier path forward). *OR* You embrace FLUXNET as is. That is, on Fig8 why not add the other regional networks, the 2015LaThuile? What level of anomaly can we detect with what we have? How does this vary across the globe? Is, say, India better covered than Africa? What can we learn about optimal designed networks and how does that vary based on the type of anomaly we wish to detect. You can do all this, it's the same workflow, FAPAR is global, and tower coordinates are public domain. You could use greenness/NDVI to get back to 1982 and address some methodological shortcomings as well. To be clear, I am not asking you to write the paper I'd maybe like to write. I dislike that in reviews and would not advocate that herein. My point is that as is you

have, in the main, a technical paper. So either embrace the technical note idea (again, the straightforward path) or grow the scope and relevance (this would entail more but would likely be more impactful on the field). As is the paper sits awkwardly between. (In all fairness, some of this thought on my part is motivated by language issues herein.)

FigA4/5: Why does the legend obscure the lines?

AppB: This needs to be better incorporated in the paper. Right now, it really reads as an add-on that yields but marginal insight.

Language: This article suffers from several language faux pas and other overall awkwardness. For example, in P1L11 we read "These finding are". This is of course quite wrong. See the double detect on P3L4. Or, "The paper is based on three main pillars" (same location). This reads more like a Socratic discourse; not so much a BG paper. See FigureA2, specifically "fore" vs. "for". There are many others; some in specific comments. But overall there are too many and I (mostly) stopped after the Introduction. Please have this article proofread by a native (or native-level) speaker of English before resubmission. The language issues are an unneeded distraction from the actual science. One stylistic quibble is that the paper reads like a math exercise in search of a case study. I would have rather read a paper that seeks to improve our detection abilities wrt extremes in land systems.

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