

## ***Interactive comment on “Impact of droughts on the C-cycle in European vegetation: a probabilistic risk analysis using six vegetation models” by M. Van Oijen et al.***

**Anonymous Referee #1**

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### General comments

This interesting manuscript attempts to quantify both vulnerability and risk of climate change effects on European ecosystems—mostly with respect to their carbon fluxes—decomposing risk into its constituent factors. (This is standard in fields like engineering, but quite novel for ecosystem modeling.) Specifically, the authors run six different vegetation/ecosystem models for the late 20th and 21st centuries and combine the results with drought hazard to carry out their risk analysis. This is interesting and important work, novel, and appropriate for Biogeosciences. The ms is very well written

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and methods generally clear, and I think both the NDVI comparison and sensitivity analyses are useful and well done.

There are a few problems. Most importantly, there are serious limitations to the models being used that need to be listed as weaknesses of the analysis—for example, vegetation change (migration, acclimation, adaptation) are almost certainly not simulated, and could be significant factors affecting ecosystem risk. This isn't the fault of van Oijen et al., of course, but is a potentially serious limitation and needs to be addressed.

Second, it would be interesting (but optional) to see a bit more analysis of the factors affecting NEP risk – the text says this is explored, but it isn't, not much. See comments below.

In summary, this is a strong, well-written, and interesting ms that needs minor to moderate revisions.

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### Specific comments

1. Page 8327, line 14: “risk of. . .”
2. P. 8329, l. 16-24: perhaps add a sentence why these four fluxes and one stock were chosen
3. P. 8330, l. 6: clarify units of this -1 value, and what it means (1 s.d. I think)
4. P. 8333, l. 24: or vegetation change/migration/adaptation?
5. P. 8341, l. 21: again clarify what this means
6. P. 8344, l. 17-25: might be interesting to see a plot of NEP vulnerability/risk versus NPP v/r and/or RH v/r, i.e. an x-y plot with each point representing a grid cell? Or some other visual summary of how well these are correlated spatially
7. P. 8346, l. 11: should be Table 3?

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8. P. 8347, l. 6-8: this isn't really done here, not much, except a bit on bottom of p. 8348. See #6 above
9. Discussion generally could be condensed a bit (10%?); there's lots of restating of results
10. Table 2: hard to pick out italic font; perhaps use underline instead?
11. Figure 6: really nicely presented!

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