Answer letter for “A probabilistic risk assessment for the vulnerability of the European carbon cycle to extreme events: the ecosystem perspective” by S. Rolinski et al.

Letter to editor,

Dear Dr José M. Moreno,

Thank you your consideration and the discussion of the manuscript. We changed several parts of the manuscript in order to incorporate your and the reviewer comments as described below. A mark-up version highlighting all changes made in the text is given separately as supplement.

Detailed answers to your review:

I acknowledge the discussion and responses provided by the authors to the comments submitted by the reviewers. Indeed, the reviewers identified a number of shortcomings and limitations of the paper that need attention, as acknowledged in your response to them. I look forward to receiving a revised version considering all the points raised by the reviewers, following the argumentation provided in your response to them. In doing so, let me stress some of the main points raised by the reviewers:
1. The issue of model data vs. experimental data and the limitations thereon need to be fully captured in your presentation of the approach and discussion.
We introduced on the one hand more detail in the description of the model to provide better insight of its abilities and, on the other hand, discussed the current possibilities for the application of the concept to experimental data and which limitations the resulting interpretation is facing. This is incorporated into the text as well as the appendix (see below on the restructuring of the manuscript).

2. The suitability of the DGVM models to fully capture future changes in ecosystem vulnerability, as a result of responses to both press-type situations (e.g., cumulative drought) or extreme events.
We decided to remove the results based on future projections from the manuscript. Although we are fully confident that the results are valid in the sense that they provide valuable insight in future ecosystem behaviour, they are not essential for the introduction of the ecosystem vulnerability concept in the current manuscript. Following the recommendation to straighten the manuscript to a few ideas, these results are omitted.

3. Limitations of model processes related to fire in Europe.
Also here, we broadened the description of the model in the methods section to be more specific of the fire-related processes and input data. Additionally, the current state of validating the fire module within an intercomparison is described in the discussion section.

Finally, both reviewers mentioned that the text needs major reworking to make it more precise and readable.

In order to achieve better readability, we changed the structure of manuscript in several respects:
- all future simulationswere removed,
- the text concentrates solely on results using the SPEI,
- results for other environmental drivers were moved to the appendix,
- to clarify the introduction of the vulnerability concept, the method section was subdivided intoa section on the general framework including the euqations and the system and environmental variables. The methods include now the intput data, the model description and protocol.

Reviewer 1

Points raised by reviewer 1 were
1) the use of simulation results for discussing ecosystem vulnerability and the distinction between the effects of single extremes and the long-term behaviour.
We tried to be more specific about the role of extreme events in our concept. This is reflected in the slightly changed title and in section 2 on page 3 or the last paragraph of 2.2 In the discussion this topic is taken up in the third paragraph on page 7 or in the third paragraph of 5.3 on page 8.
2) the bias-correction of the climate data set for the future projection.
We removed the future projection results but details of this topic are given in Beer et al. (2014) from whom we used the climate forcing.
3) the validity of the fire module.
More details are now given in the model description (page 5) especially on the considered input data and their temporal resolution and in the discussion at page 10.

Reviewer 2

Points raised by reviewer 2 were
1) readibility
In order to focus better on the presentation of the ecosystem vulnerability concept, we removed the additional application to a future period and to other environmental variables than the SPEI from the main body of the manuscript. Results with other environmental variables are summarized in an appendix. We rewrote the manuscript thoroughly for better readibility and engaged a native speaker for proofreading.
2) clarification of the use of experimental and simulated data
This topic is also raised by reviewer 1 under item 1.
3) clarification of the impact of model underlying assumptions on ecosystem behaviour
We tried to give more insight into the model structure and processes in the description (section 3.2) addressing this point specifically in the first paragraph on page 5.