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Earth System Dynamics Discussions

Interactive comment on "Detecting hotspots of atmosphere-vegetation interaction via slowing down – Part 2: Application to a global climate model" *by* S. Bathiany et al.

Anonymous Referee #2

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In Part 1 of this two-part paper, the authors introduce a new method for detecting the regions in an extended system where abrupt transitions causally originate ("hot spots"). Here, in this second part, the authors apply this method to detect hot spots associated with simulated transitions in Holocene vegetation coverage in the coupled climate-vegetation model PlaSim-VECODE.

Since the hot spot detection method can not easily be applied directly to the full coupled model, the authors instead apply the method to a simpler regression model using parameters fitted from the full model. The results from the regression model are then used to interpret results from the more complex full model.

This approach is novel in that it extends previous work on early warning signals to an extended, spatially inhomegenous coupled system. I am sure that it will lead to new insights in to the vulnerability of regions of the Earth system to global change or at the very least improvements in our understanding of Earth system models. I recommend that it be published with minor revisions.

I ask the authors to elaborate somewhat in their Discussion on the challenges associated with applying this approach elsewhere. Please elaborate specifically on the technical challenges for applying it directly to a full model. Also, the vegetation model VECODE is quite simple, would they expect similar results with a more complex vegetation model? Another issue is one of scale. Here, PlaSim-VECODE has been run at T21 resolution, are there challenges associated with applying this approach at higher spatial resolution?

Considering that ESD has no specific page limits or figure charges, I would suggest that the authors include a version of Figure 2 from Part 1 of this paper to make things easier for the reader.

Also, for the sake of clarity, please choose a set of terms and use them consistently throughout the paper. For example, I would consistently refer to the simpler model as the "regression model". Also, please decide between referring to multiple equilibria and multiple steady states. At the coupled climate system is inherently a non-equilibrium system, kept far from equilibrium by the flux of solar radiation, I would prefer references to states rather than equlibria. However, if the authors prefer to maintain consistency with other parts of the literature, that is their prerogative. I merely ask that they decide on one set of terminology or the other.

Interactive comment on Earth Syst. Dynam. Discuss., 3, 683, 2012.