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Earth System Dynamics
Discussions

Interactive comment on "Taxonomies for structuring models for World-Earth system analysis of the Anthropocene: subsystems, their interactions and social-ecological feedback loops" *by* Jonathan F. Donges et al.

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This review has been posted on behalf of Reviewer 2.

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This manuscript addresses a highly relevant topic on how to foster the integration of the social dimension in mathematical and computer models up to the planetary scale. A specific focus is set on how to take into account the relevant social-ecological feedbacks. It fits well in the scope of the journal. The proposed taxonomy (including the

types of interactions between the subsystems) takes adequately the existing range of global environmental change models into account and classifies them. In addition it enables to reveal subsystems and interactions which are important but underrepresented in global scale models. Therefore this paper can serve as a fruitful starting point for a more structured approach to guide the future development for such types of highly needed models. However I see major points which have to be addressed in a revised version of this manuscript:

1. The three guidelines in constructing the taxonomy are partly not well explained, e.g. what do you mean by "compactness". In addition have these guidelines actually been tested? I ask that, because they are afterwards only mentioned in the conclusion section again.

2. The type of content of the subsections 3.1. – 3.9 is differing. I would suggest to offer results in each section for the same set of questions, such as: examples, what is reached, what are open challenges, at which levels are the current models prevalent (global yes or no).

3. Make more explicit what the added value of the presented example model for this paper is. Is it just to illustrate how a simple model could look like which includes interactions from almost all classes of the subsystems of the taxonomic scheme?

4. The text includes a number of assumptions where references which underpin the respective statement are missing (such as P2L21, P6L17ff), more examples below. Please add references.

In addition I have further comments for the different sections:

Abstract: - The term "World-Earth model" is not familiar to the readers. It is only explained later in the introduction. Perhaps a short explanation in the abstract could be helpful. The same holds for the term "higher-order taxonomies". Introduction:

- P3L5-6: The second half of the sentence is not comprehensible to me.

- P3L14: I think a number of ecologists (e.g. behavioural ecologists) would doubt that “laws of nature” govern for instance how animals behave. I understand the point you want to make. Perhaps add a footnote which points this out shortly.

- P3L27: delete “computer”? According to L24/L25 it holds for both types of models: mathematical and computer simulation models.

- P4L11: I suggest to give a reference to the term “safe and just operating space for humanity”.

- P5L2: The term “mechanism” is defined, but never used in the paper. Section 2:

- P6L17: “Growing reliance on model-based insights for global decision making”: please give references for that.

- P7L15: Add a reference for “deep future” studies. Where comes the term from?

- P7L24: You describe “these models have tended to be small-scale, context-specific. . .”. There are counterexamples (such as LPJ or large scale forest models). Hence, I suggest to mention these examples.

- P8L7: “Our approach can bring much-needed clarity and transparency about the role of such models. . .” – this statement is not substantiated in the paper to my point of view. Section 3:

- P9L29: It could be helpful to add a short paragraph in this paper how the taxonomy have proven to be helpful building the copan:CORE framework.

- Figure 2: I find it not self-explanatory, why certain interaction examples are assigned to a certain category, for instance why “needs” is in MET CUL. I suggest to explain at least those in the text.

- P12L23: Make sure that all abbreviations in the text are once spelled out and the abbreviation is written in parentheses (e.g. ESM or later BAU)

- P13L11 Use the same spelling in the whole manuscript: Noösphere, Noosphere

- P14L19: “may be subsystems from ENV, MET or CUL”. To my understanding “or CUL” has to be deleted, since the relationship CUL- CUL feedback loops seems not to be included.

- P14L24: Give examples what you mean by 3-loops. For me it is unclear how you get 11 taxa.

Section 4: - P18 Figure 4: Add the parameter values for which the graphs are generated, in particular for the adjustment of time preferences. Reason: I would like to see all necessary information that the reader may recalculate the results.

- Twice in the caption of Figure 4 “S” instead of “C” is used.

Section 5: - P19L21: I do not see how the provided framework may be helpful as “a blueprint for constructing alternative taxonomies.” This statement needs to be substantiated.

Appendix: - P27L3: Eqs 1 and 2.

- P27L27: You call both gamma and s(c) damage factor. I suggest to be more precise and to not use the same name for (slightly) different elements of the equations.

- P27L28: Be more precise throughout the Appendix and add the (t) with the C

- P28L13: Check the size of the parentheses for better understanding: I have impression that left of G it should be a large parenthesis

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