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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Reliable, robust and realistic: the three R's of next-generation land surface modelling" *by* I. C. Prentice et al.

Anonymous Referee #1

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Referee comment on Prentice et. 'Reliable, robust and realistic: the three R's of next-generation land surface modelling'

The study by Prentice et al. gives an overview of the evolution of land surface models (LSM) and identifies major problems the current generation of LSM are facing. The authors identify areas where improvements can be made by taking advantage of current knowledge. The author express their concerns about the low reliability of current LSMs due to an imbalance between complexity and reliability of LSM.

The authors promote three methods to guide the development of the next generation of LSM to counteract this imbalance: 1. Standardized benchmarking 2. the inclusion of multiple constraints 3. the use of stochastic parametrization of unresolved processes.

The author provide a comprehensive overview of the different aspects and give specific examples.

The study provides a comprehensive and balanced guideline for further model development. The authors base their arguments on multiple studies taking into account recent advances in different fields. Not all examples are discussed in detail, nonetheless the overview serves well the purpose of supporting the argumentation.

Personally, I think such clearly stated concerns about the undesirable route the current evolution of LSM took were long overdue. The discussed guidelines for further model developments make this study of great value for future developments.

It is well written and clearly structured.

Minor comments:

Changes in NPP affect the C balance on land more direct than changes in GPP. The derivation of NPP from GPP /(plant level photosynthesis) is a major uncertainty in LSM. This aspect is hardly discussed in the manuscript. The author may want to add a brief discussion on this and how the three proposed 'tools' can increase the reliability of simulated NPP.

The authors could add recent findings on the importance of mesophyll diffusion on carbon fluxes, for example Sun et al (2014) and references therein in the discussion of leaf processes.

P24812 L5: LSMs are also applied to assess the response to land use and land use change. This should be added.

P24832 L22: The co-ordination theory allows also to derive Vcmax as a function of leaf nitrogen. Thereby Vcmax can be derived dynamically from the state of the N cycle, rather than being a PFT-specific parameters (P 24829 L22).

Figures 1,2,3, and 6 would benefit from more comprehensive captions. The layout of

the figures is not fully consistent, for example the “atmosphere – land surface “ label is not always present. Several aspects of Figure 6 are not easy to interpret. Brief captions with a list of changes from the previous generation would be helpful in this respect.

Figure 7 would benefit too from a more comprehensive caption.

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 24811, 2014.