Earth Syst. Dynam. Discuss., 1, C164–C166, 2011
www.earth-syst-dynam-discuss.net/1/C164/2011/

Earth System Dynamics Discussions

Interactive comment on "Estimating maximum global land surface wind power extractability and associated climatic consequences" *by* L. M. Miller et al.

L. M. Miller et al.

lmiller@bgc-jena.mpg.de

Received and published: 28 January 2011

Response to J.C. Bergmann "Comment on 'Estimating maximum global land surface wind power extractability and associated climatic consequences' by L.M. Miller, F. Gans, and A. Kleidon"

L.M. Miller, F. Gans, and A. Kleidon

A detailed response to J.C. Bergmann's comment is included as supplementary material.

We thank J.C. Bergmann for his clear and thorough comment. He identified 2 mathematical derivations that required minor modifications and noted several interesting points. The calculations and text of the final manuscript will reflect these alterations with our noted changes/comments related to this comment noted below.

Authors conclusions — We sincerely appreciate J.C. Bergmann's clear and concise comment. We also recognize his focus on the importance of atmospheric boundary layer (ABL) energetics to the global estimate of wind power extraction near the surface. By approaching the global estimate from a top-down (atmospheric wind power generation rate to extractable wind power) rather than bottom-up (wind turbine characteristics, wind velocity, and air density to extractable wind power) perspective, we are primarily

concerned with the generation rates of wind power in the global atmosphere and the associated response to wind power extraction.

This study explores how these generation rates are altered with additional drag in the atmospheric boundary layer. Our estimate is just that, an estimate, as by definition any model is a simplification of reality. In this case though, because of thermodynamic constraints on the conversion of solar radiation to wind and further thermodynamic constraints related to wind power extraction, we have clearly identified how extractable wind power does not infinitely increase with the spatial scale of wind turbine installations.

Through this comment response, and the resulting changes to the original manuscript, we hope that we have eased the main concern of J.C. Bergmann — the contribution of kinetic and potential wind energy above the ABL has been adequately included in the general circulation model sensitivities. His other comment points have also helped us to view our manuscript from a different perspective which we sincerely appreciate. The final manuscript will be substantiated by these contributions, allowing us to reinforce the fact that to quantify a global land-based estimate of near-surface wind power, the inclusion of the generation rate and its dependencies is critical.

Please also note the supplement to this comment:
http://www.earth-syst-dynam-discuss.net/1/C164/2011/esdd-1-C164-2011-supplement.pdf

---

Interactive comment on Earth Syst. Dynam. Discuss., 1, 169, 2010.