Biogeosciences Discuss., 6, C1024–C1026, 2009
www.biogeosciences-discuss.net/6/C1024/2009/

Biogeosciences Discussions

Interactive comment on "Towards global empirical upscaling of FLUXNET eddy covariance observations: validation of a model tree ensemble approach using a biosphere model" *by* M. Jung et al.

Anonymous Referee #1

Received and published: 5 July 2009

Jung Reichstein and Bondeau test a model tree ensemble technique against LPJmL simulations and were able to explain most of the spatiotemporal patterns in the model output using the ensemble tree compared to individual model trees. This approach is proposed to be a global benchmark for FLUXNET scaling challenges.

The approach is interesting and it appears to be powerful, and my biggest concerns involve how the concepts of scale and scaling are applied here. Take for example the definition from Jarvis (1995): 'The scaling process involves taking information at one scale and using it to derive processes at another scale'. The important term here

processes. Different processes dominate at different scales, and these feed back to said processes at smaller scales. To continue with quotes from Jarvis (1995), "A large canopy conductance stabilizes transpiration by reducing the sensible heat flux and thus the rate of growth of the convective boundary layer (implying more moisture in the boundary layer and less transpiration as a result, my addition). Thus there are additional negative feedback pathways at the large scale that tend to stabilize water vapour and CO2 fluxes further against changes in canopy conductance." In this passage we already have implicitly leaf-level, canopy and regional scale processes, their determinants, and feedbacks. Attempts to model these processes at various scales from leaf to region include CANOAK (Baldocchi et al. 2002), and representative studies that take this more rigorous view of upscaling include (Albertson et al. 2001; Anderson et al. 2003; Kustas and Norman 2000).

In this paper the focus is mostly on extrapolation, which is part of upscaling, but it is not the complete picture and the paper should not present itself as such. The tree approach does consider the processes at different scales in the correlative sense (p. 5274 line 12), but not the feedbacks. Ultimately it is not a complete scaling exercise, but semantics aside the approach is interesting, it introduces some good analytical tools, and will certainly contribute to the science. I recommend accepting the paper with major revisions.

Some pseudocode or links to references that include pseudocode would be useful for a relatively novel technique that is proposed for broad use. The authors also need to ask themselves if an interested colleague who is new to this approach could replicate the procedure given the information in the Methods section. I would argue that they couldn't and that more detail needs to be placed in the Methods section as to what the authors are doing, why, and how to implement it.

The details on p. 5286 line 15 (and afterwards) about interannual variability are interesting. I understand why little emphasis is placed by the algorithm on replicating interannual variability if the variance is less, but this variance is probably more impor-

tant to long term ecosystem and therefore carbon cycle dynamics. Is there a way to weight the tree approach to improve its ability to replicate the interannual variability? The points on memory/lag effects are also important to note. Is there a way for the ensemble tree modelling approach to include lags? I am not proposing that the authors need to do this here, but a discussion on how to improve the ensemble tree approach, more than just a discussion of why it works less-well in some cases, is important to keep the science moving forward.

The paper could be better-referenced in sections (e.g. section 3.2 and elsewhere in the Results and Discussion section if it is to be a true discussion). On p. 5287 line 15, how do the Canadian and European towers help constrain Siberian fluxes? Is this a feature of the model tree approach or LPJ?

Tables and Figures: Use full sentences in the table legends.

References Albertson JD, Kustas WP, Scanlon TM (2001) Large eddy simulation over heterogeneous terrain with remotely sensed land surface conditions. Water Resources Research 37:1939-1953 Anderson MC, Kustas WP, Norman JM (2003) Upscaling and downscalingâĂŤa regional view of the soil–plant–atmosphere continuum. Agronomy Journal 95:1408-1423 Baldocchi DD, Wilson KB, Gu L (2002) How the environment, canopy structure and canopy physiological functioning influence carbon, water and energy fluxes of a temperate broad-leaved deciduous forest - an assessment with the biophysical model CANOAK. Tree Physiology 22:1065-1077 Jarvis PG (1995) Scaling processes and problems. Plant, Cell and Environment 18:1079-1089 Kustas WP, Norman JM (2000) Evaluating the effects of subpixel heterogeneity on pixel average fluxes. Remote Sensing of Environment 74:327-342

Interactive comment on Biogeosciences Discuss., 6, 5271, 2009.