ROUTINE CHECKS OF MODEL CONSISTENCY ON TERRESTRIAL CARBON SINK COMPONENTS

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The components of terrestrial carbon sink are estimated by means of models. Many different models are possible for any given component, and no criterion exists to pick one model over another [*Cramer and Field*, 1999]. Instead, the models form an ensemble, which is assumed to be a consistent estimator of the terrestrial carbon sink and its components -- that is, to be converging to the quantities being estimated as the number of models grows. Is this assumption close to reality? Are confidence intervals shrinking? To answer this question we need regular checks of model consistency based on well-agreed methodology.

A biosphere model is a geographical extension of an ecosystem model, and so modeling ecosystems at global scale we are facing the same problem as at the local scale -- structural uncertainty. The structural uncertainty includes competing conceptual frameworks, lack of agreement on model structure, ambiguous definitions of system boundaries, inadequate description of significant processes *[Manning et al*, 2004]. The typical approach to this problem is assessing the maturity of the underlying science through retrospection of modeling efforts [*Oikawa*, 2007]. This displays either consensus building or paradigm shift. Here, we present a case study of a consistency check performed using the software freely provided by the Office for Global Environmental Database (OGED). A process-based model explaining spatial gradations in plant productivity (NPP) was earlier compared to empirical models [*Alexandrov et al*, 2002]. The consistency check displays the effect of including this model into the ensemble of three empirical models: confidence intervals for mean values of NPP estimates are shrinking in the case of low-productive regions, and stretching in the case of high-productive regions, Fig 1. The case study shows that the divergence of model estimates characterizes the research horizons, not the uncertainty in the current knowledge. The current knowledge is represented by the mean value of the model estimates, which uncertainty is characterized by the confidence interval. The confidence interval of the mean value may be decreasing despite increasing divergence of model estimates. Thus, 'routine checks of model consistency' is the modeling focus that would be essential for building consensus on the extent of carbon sequestration efforts.

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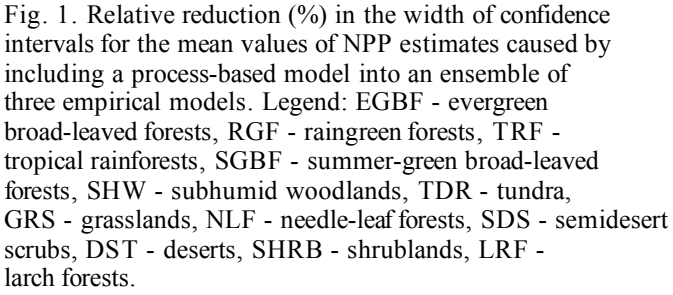

Fig. 1. Relative reduction (%) in the width of confidence intervals for the mean values of NPP estimates caused by including a process-based model into an ensemble of three empirical models. Legend: EGBF - evergreen broad-leaved forests, RGF - raingreen forests, TRF - tropical rainforests, SGBF - summer-green broad-leaved forests, SHW - subhumid woodlands, TDR - tundra, GRS - grasslands, NLF - needle-leaf forests, SDS - semidesert scrubs, DST - deserts, SHRB - shrublands, LRF - larch forests.