Biogeosciences Discuss., 9, C5726–C5728, 2012
www.biogeosciences-discuss.net/9/C5726/2012/

Biogeosciences Discussions

Interactive comment on "Multiple observation types reduce uncertainty in Australia's terrestrial carbon and water cycles" *by* V. Haverd et al.

Anonymous Referee #2

Received and published: 19 November 2012

Haverd et al present results from an analysis using multiple data constraints in combination with model-data fusion techniques and a process based model to estimate carbon and water cycling over Australia. I really enjoyed the manuscript – it is not only one of the few large scale attempts to use advanced techniques for merging models with data, but appears well execute and presented. I have mostly minor suggestions for improvement, but also some more serious concerns regarding the treatment and propagation of uncertainty, detailed below.

Page 12183 Line 5: Is it useful to cite this website? Clarify exactly where the numbers 0.9-3.1 PgC come from.

Page 12185 Line 1:5. Explain in more detail what these 'instabilities' were. Also explain the Thornley problem used to justify holding the ratio GPP to NPP constant. What is

the implication of these simplifications on the results? I'm guessing the main problem stems from there not being any information in the data sets you are using that can constrain these processes, so you end up with high equifinality and thus 'instability' when you extrapolate to larger regions. Whatever the problem is, the paper would be a lot stronger if you identified it and discussed implications, rather than just saying there was one.

Page 12220: Line 1:2. Remove 'enable' Line 3: 'Assumed fixed. with' Line 14: 'Soil C pools are

Page 12186: Line 12: Setting k equal to 0.5 is equivalent to assuming a spherical leaf angle distribution? Should this change by biome?

Page 12187: Line 2: MODIS spans the observation period of the flux data, but so too does AVHRR. So why use MODIS?

Page 12191: Line 14: It's not clear why this sequential optimization was necessary, (i.e. how it reduced the computational burden, and to what extent) and whether it affects the results. The problem with doing it in this way is that uncertainty in CABLE-SLI is not being propagated through to CASA-CNP. It appears that CASA-CNP is being driven with just one parameter set form CABLE-SLI (output from the optimum set), which ignores the variability generated from CABLE-SLI driven by all the other equally plausible parameter combinations (and thus equally plausible but potentially very different CABLE-SLI output). The question is, are you quantifying the true joint uncertainty of the two models?

Page 12192: Line 14. Uncertainty in model predictions also stems from model structural error, not just parameter and forcing data uncertainties. This is not a problem for your approach, as the model structural uncertainties are mapped to parameter uncertainties, but should be acknowledged. All the data estimates used as constraints have associated uncertainties. The net effect of having uncertainty in data, and propagating that uncertainty through to the model parameters, as opposed to ignoring it, is an

increase in uncertainty in model projections (to match the uncertainty in the observations). This can be particularly important when extrapolating in space/time. To quote Raupach 2005: "..., providing data and allowing another researcher to provide the uncertainty is indistinguishable from allowing the second researcher to make up the data in the first place." I.e., data is relatively useless without information on how accurate it is. Are the authors greatly underestimating the uncertainty in their projections by not taking into account measurement uncertainty?

Page 12193: Line 7: CACA-CNP

Page 12194: Line 6: "faithfuly" -> accurately?

Page 12203: Line 14: 'shows plots'

Page 12205: Line 29. Cite the article which reports this drop in sea level (and attributes it to increased water storage in Australia, among others). http://www.agu.org/pubs/crossref/2012/2012GL053055.shtml

Page 12206: Line 4: Although the anomaly of 0.5Pg is indeed very large compared to the mean global sink, did it lead to large respiratory losses in subsequent years? It is likely a very fast cycle compared to the slower cycle of mean annual NEP.

Figures 12,13,14 It would be great to see these figures of mean values accompanied by maps of the associated uncertainties. Does model uncertainty very spatially, and what can that tell us about the design of future data collection networks?

Interactive comment on Biogeosciences Discuss., 9, 12181, 2012.