

## ***Interactive comment on “The European CO<sub>2</sub>, CO, CH<sub>4</sub> and N<sub>2</sub>O balance between 2001 and 2005” by S. Luyssaert et al.***

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This is an excellent account of the European GHG balance, using the most detailed and up to date data available from multiple sources. I recommend it be accepted for publication, subject to the following comments being addressed:

Section 1: “GHG balance must be estimated by at least two independent approaches”  
Is this an over-statement? Could an alternative estimated be derived by using all the bottom-up information as constraints in the top-down inversion method?

Table 1: Check references. Should these all be listed in the supplementary material?  
eg Grassi is missing from the reference list. Should Bryne be Byrne (component 2I?)

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From Table 1 it appears 2a and b are independent estimates of NEE, but Eq(2) and Figure(2) suggest they are gross components of NEE, perhaps GPP and ecosystem respiration? This needs to be clearer.

Table 1: 2fgh: Is this supposed to be net land use change emissions? (Component title is a little unclear).

In general, Equations 1-10 are difficult to read. The use of terms “1a etc. . .” is not appropriate for inclusion in equations. The numbers and letters could appear as subscripts on variables, eg f1a (f for flux). A little more explanation of each equation in the preceding text might be helpful. Otherwise each equation requires a taxing term-by-term cross-referencing of Table 1 and Figure 2, which themselves could be a little clearer (see eg the two comments above). Omit “-“ on the left hand side of each equation, unless it is meant as a minus sign. Equation 9: A sign “+” is missing between 6d and 2ab. What is the significance of grouping terms in parentheses in Equation 9? Many terms are common to both the inventory- and flux-based approaches. Attention should be brought to these and the consequences for independence of the estimates evaluated.

Sections 1 and 2.3 : replace “confronted with” by “compared to”

Section 2.6: qualify “interannual variability”. Is this 1 s.d.?

Section 2.6: “balance sheets” does not have a precise meaning here.

Section 3.1: “interannual variability hints at the sensitivity of the land surface to climate variability”: Reword to be more specific.

Section 3.1 “Contrary to our observations . . .” Your observations of what? This sentence does not make sense.

Section 3.2.2. The uncertainty estimate of about 50% on the flux-based estimates of NEE seems quite generous. From Jung et al. 2011, “With a modeling efficiency of 0.32 and an RMSE of 197 g C m<sup>-2</sup> yr<sup>-1</sup> the among-site variability of NEE is

poorly reproduced by MTE, particularly for sites that are strong carbon sinks. Clearly, we are lacking determinants of mean NEE in the predictors for MTE such as soil and biomass pools, disturbances, ecosystem age, management activities and land use history.” Also, the flux-based NEE inherently has no information on temperature or CO<sub>2</sub> trends which are key determinants of mean NEE.

Section 3.4. “Applying the Bayesian theorem..” Please explain how Bayes’ theorem was applied here.

Section 3.5, p2027 Replace “Afforestation doubled the sink strength by...” to “Afforestation doubled the sink strength to...”

Section 3.5, Table 5: It would be helpful to have the absolute sink strength for each land-use type listed in Table 5.

Section 4: In the priority list of C-balance components which should be addressed to reduce uncertainty in the overall budget, could you be more prescriptive (rather than ending the list with etc.)?

Section 4: Can you return to the hypothesis of an increasing European C-sink, which was introduced in Section 1?

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Interactive comment on Biogeosciences Discuss., 9, 2005, 2012.

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