

***Interactive comment on “The European
CO₂, CO, CH₄ and
N₂O balance between 2001 and 2005”
by S. Luyssaert et al.***

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Referee 1

MAIN CRITICAL COMMENTS

1. The tone was overly optimistic. For example, in the Abstract we are told that the comparison of the three main methods ‘increases our confidence that current European GHG balances are accurate’; but when the confidence interval of the three estimates is compared we see that the uncertainty is huge (42, 15 and 33% respectively). Given this uncertainty, I think it is unwise to make such an optimistic statement.

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We have rephrased this statement as follows: ‘...increases our confidence that the processes underlying the European GHG budget are well understood and reasonably sampled’.

2. There is some confusion about statements relating to carbon only and statements relating to the totality of greenhouse gases. The standard method of writing greenhouse gas units as CO₂-eq is followed but the logic is not always right. An example is the first sentence of the introduction. We are told that on a global basis, terrestrial ecosystems have absorbed about 30% of anthropogenic emissions but the two papers cited in support refer only to carbon dioxide. This loose terminology should not occur in a science paper. The authors should check carefully the manuscript for further instances of this.

The manuscript was checked and the GHG species was specified when this seemed relevant.

3. page 2012 line 10: the inversion approach needs to be better described: it involves a transport model as well but this is not stated.

This sentence was rephrased as ‘Atmospheric inversions used in this study are Bayesian Synthesis Inversions (Enting, 2002) which combine a priori knowledge of CO₂ fluxes, including natural sources and sinks and fossil fuel CO₂ emissions, with atmospheric CO₂ concentration measurements made at around 100 stations of the surface network and a transport model.’

4. I cannot see how forest fires are taken into account

Emissions from forest fires are shown as f_{2d} (CO₂), f_{2d'} (CO), f_{2d''}(CH₄) and f_{2d'''}(N₂O) and are accounted for equations 2, 42 6, 7a and 9. No changes were made to the text except the explanations asked for by reviewer 2 : ‘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

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themselves could be a little clearer (see eg the two comments above)'.

5. The IPCC methodology cannot be expected to produce the same result as the methodology based on atmospheric measurement. This is because it is based on recording changes from year to year, rather than having the exact value of emissions; for example: even if the change in land use is properly recorded the IPCC method does not take into account any variation in the source/sink strength of vegetation caused by extreme weather (the drought of 2003 is an example). Likewise, the CO₂ and CH₄ fluxes over wetlands are poorly known whereas the IPCC method provides only standard data based on earlier research. This defect in the comparison should be acknowledged.

This defect is now acknowledged in a new section 4 'outlook'

6. I find it hard to believe that inland waters are a hotspot for C sequestration. The manuscript should be evaluated by a specialist in that area. No-one on the list of authors is a specialist aquatic bio-geochemist as far as I know.

First the reference system was clarified in a new paragraph: 'Irrespective of its mitigation potential, the classification of an ecosystem (or C-pool) as 'sink' or 'source' may depend on whether an in-situ or atmospheric reference is used. A difference classification is typically caused by the magnitude of the lateral C-fluxes. From the atmospheric point of view, croplands and geological pools are CO₂ sinks as they take up CO₂ for respectively growth and weathering. However, from an in-situ perspective the same croplands and geological pools will be sources: current cropland management in Europe results in decreasing soil C-stocks and weathering dissolves C that is subsequently being lost in run-off and drainage. The opposite happens in landfills and inland waters, where despite the fact that these land and product uses emit GHG to the atmosphere, the in-situ C-pool is currently increasing in respectively the product pool and sediments. This terminological ambiguity is absent for European forests, grasslands and peatlands which are sinks, irrespective of the perspective. Fossil fuels are

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sources from both an in-situ and atmospheric point of view. As the mitigation potential is more closely linked to the in-situ perspective, we used the in-situ perspective to classify ecosystems and pools as sink or sources.'

Several of the co-authors call themselves aquatic bio-geochemist nevertheless they agree that labelling inland waters as 'hotspots' is at least confusing given some specificities of riverine systems.

7. Presentation of the results. The framework diagram in Fig 2 should be developed to show the individual fluxes. This would be useful to policymakers: as well as having Fig 2 as it is, have another version (Fig 4) wherein the codes are replaced by actual fluxes, with a code (variable number of asterisks?) to show where the different methods disagree by a stated percentage.

A figure showing the fluxes and two estimates for the stock-changes has now been included (Fig 4)

WHAT'S MISSING There needs to be a forward looking section to say how the uncertainties can be reduced in future, by having more atmospheric measurements. It would also be interesting to suggest whether the estimated can be somehow downscaled to country level.

A whole new 'outlook' section containing six paragraphs has been added.

MINOR EDITORIAL CORRECTIONS 2008 insert 'of greenhouse gases' after 'emissions' 2008 line 19 'and us such' do you mean 'as much as' 2009 line 23 is 'potential' really needed (I don't see what it means) 2011 line 17 insert 'the' before 'subject' 2012 lines 14, 21 'Where' should be 'where' as it isn't a new sentence 2012 line 15 insert 'of' before 'the different' 2014 line 2 some words seem to be lost 2014 equation 9 changes its font-size on the continuation line 2018 line 20 be consistent with the symbol for degree. 2019 line 18 'is expected assigning' isn't grammatical 2022 replace 'none existent' with 'non-existent' 2026 line 24 something wrong here at 'Zaehle'

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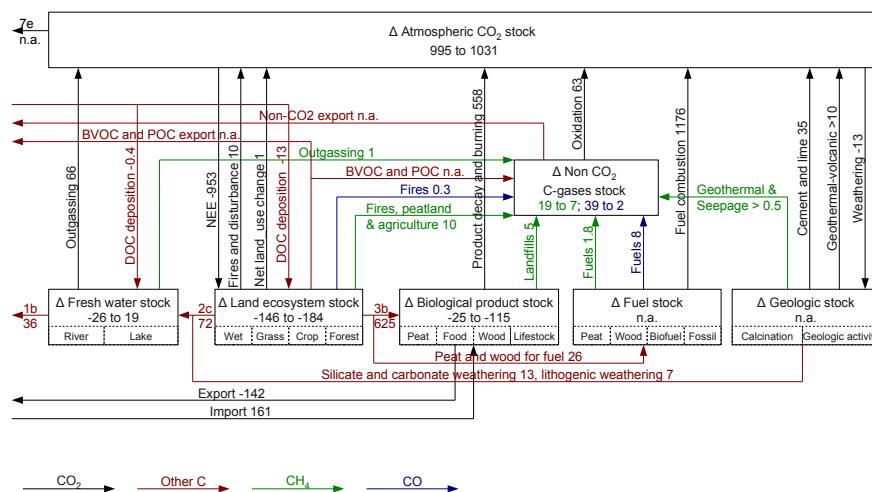


Fig. 1.

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