**Atmospheric
Chemistry
and Physics
Discussions**

Interactive comment on "

Source attribution of the changes in atmospheric methane for 2006–2008" *by* P. Bousquet et al.

Anonymous Referee #1

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This study makes an important contribution to our understanding of the dominant controls on the global methane cycle and their variations in recent years. A few attempts have been made to investigate the causes of the renewed increase of methane starting in 2007 using measurements only (in-situ and satellite). The added value of this study, as clearly demonstrated in the last figure, is to use a modeling approach that takes into account atmospheric transport. Overall, the approach that is taken is rather straightforward and defensible. The results look reasonably internally consistent. The authors are wise enough to limit the discussion to latitude bands, since the robustness of inversion results usually quickly reduces going towards smaller scales. However, it would have been interesting if the discussion had elaborated a bit more on the role of

e.g. Asia/North America regarding anomalies of northern wetlands and South America/ Africa/Indonesia regarding tropical wetlands. At least the results Orchidee should provide some information on the expected relative importance of these regions. If the inversions aren't robust enough to verify these estimates that would be worth mentioning too. Below are a few suggestions for clarification and improvement as well as some comments that need to be addressed to make this paper ready for publication in ACP.

GENERAL COMMENTS

Target period

It is not really clear for what target periods INV1 and INV2 are run. Are the reference period and analyzed period 2006-2008 part of the same inversion? Why was INV2 run for an extended period into the first part of 2009 and not INV1? The extension seems a prerequisite for analyzing the year 2008. The requirement of S4 for valid measurements along the period 1984-2008, suggests a much longer target period. If not, why should the stations cover 1984? Information about the applied target period is critical to judge, for example, if the reduced emissions in 2006 could have a relation with the initial condition of a possible 2006-2008 inversion. The 2006 minimum is an interesting finding, which in my opinion deserves some further discussion. What could have caused it if the wetland model suggests there should rather have been a positive anomaly?

Anthropogenic emissions

The trend in the anthropogenic emissions receives little attention. The reference to Olivier and Berdowski suggests that a rather outdated anthropogenic emission inventory was used as prior. It is mentioned that according to EDGAR4 these emissions should have increased significantly in recent years. However, the results in Table 2 suggest only minor changes. Can the inversion results be reconciled with the anthropogenic emission estimates or not?

Pulse experiment

These results provide a convincing explanation of why the inversion-derived emission anomalies are largest in the tropics. Looking closer, however, a few questions remain. Why are the concentrations rescaled on an equal area grid? The response of a 1 Tg pulse on the concentrations doesn't involve any area per grid conversions, does it? If so please provide further explanation. Else, it is not clear why the pulse has been transported for 1 year, after which most of the signal has dispersed already. Looking closer at the plot, hot spots are visible that suggest a much shorter transport time. The caption mentions 'cumulative', but if all the plumes are added their sum must end up much higher than a few ppb/TgCH4. This confusion must be resolved.

MINOR COMMENTS

p. 27608: The 150% uncertainty applies to monthly fluxes?

p. 27608: Flux filter: doesn't this procedure affect the much better resolved annual fluxes?

Table 1: why are the results of INV2 scaled to those of INV1? (one could just take out the mean?) Are the scaled results used as reference for calculating INV2 anomalies in subsequent tables?

Table 1: several numbers are left out with the argument that regional anomalies are small, but this table does not deal with anomalies ..(?).

Table 1: Do the results for INV1 represent the mean of the 11 experiments?

TECHNICAL CORRECTIONS

p. 27607, line 8: remove "of"

p. 27608, line 3: "3" instead of 'tree' (=arbre!)

p. 27609, line 24: "as" the transport model

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p. 27611, line 4: "This" makes an average . . .

p. 27613, line 20: "for" three main reasons

p. 27616, line 14: "In fine" ?

p. 27618, line 21: wetlands are assimilated to peatlands?

p. 27618, line 23: "accumulation" . . . "to provide" substrate . . .

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 27603, 2010.