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Atmospheric Chemistry and Physics Discussions

Interactive comment on "WRF-Chem simulations in the Amazon region during wet and dry season transitions: evaluation of methane models and wetland inundation maps" *by* V. Beck et al.

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Specific comments From the evaluation of the meteorological performance of the WRF model against observations in section 4.1 we can see that significant model errors (vertical diffusion, convection) occur that will influence the transport of methane and the underlying couple flux models due to biases in temperature and most importantly rainfall (both timing and absolute values). The overestimation of rainfall with a factor of two will of course bias the inundation models in this region to a large extent. The influence of this bias on the water tables and sensitivity for the corresponding calculated methane emissions should be quantified. It could well be that biases in vertical

transport now get balanced by contrasting biases in emissions, leading to erroneous conclusions on emission estimates.

A comparison of the daily precipitation and the daily CH4 fluxes for different regions of the Amazon (Western Amazon, Eastern Amazon, and Amazon mainstream) reveals that the direct influence of the precipitation on the CH4 fluxes is almost negligible. A deeper insight into the CH4 wetland emission models shows that:

1) for the Walter Wetland Model the height water table is only included in the hydrological model, which separates oxic from the anoxic layers in which CH4 is produced. However, the number of anoxic layers is not the most dominant factors for magnitude of the CH4 fluxes. This is the soil temperature (cf. sensitivity studies in Walter and Heimann, 2000).

2) In the Kaplan Wetland emission model the soil moisture is not dependent on the WRF precipitation, as the soil moisture was replaced by the GPNR datasat (which is based on TRMM data) for the WRF simulations. Therefore, no bias occuring from WRF precipitation on the CH4 fluxes is applicable.

I would prefer to completely leave out the Keppler et al (2006) based CH4 emissions from the paper.

The Keppler et al. (2006) based CH4 emissions were completely removed from the paper.

The selection of "good" and "bad" flights (section 4.3.2) is not made transparent and should be based on objective criteria. There is a large risk of biasing the results by using evaluations based on "expert" evaluation of data by the eye.

As it is difficult to quantitatively evaluate the comparison of precipitation patterns, we decided to used "expert evaluation" of the data by eye. As we applied the same criteria to each flight, the risk of biasing results is reduced. The criteria are made more transparent now in sect. 4.3.2.

From the description in the paper it is completely unclear how the adjustment of the wetland fluxes in section 4.3.3 has been carried out. We could assume that a LSQ fit has been carried out to find a best fitting adjustment factor for the wetland flux, but this need to be explained. Also the uncertainty of these factors should be evaluated, as well as the gain in forward performance (biases, r2) of the WRF modelled mixing ratios after applying these updated factors.

We have calculated uncertainties of the scaling factors in the following way: as the scaling factors are derived as a ratio of two terms, the observation based wetland contribution (observed CH4 mixing ratio minus the sum of simulated contributions from all other sources and the background) and the modelled wetland contribution, the statistical uncertainties of each term was propagated, taking into account that the time series are auto-correlated (the number of degrees of freedom is less than the number of individual data points. Resulting uncertainties range from 4% to 21 % for the different simulations. We have added this information in the revised text. As the impact of scaling the wetland contribution on model-observation correlations is negligible, we have not included this.

Technical comments 22827-1+22838-7 significantly -> substantially

Corrected accordingly

22837-4 To present the work in the paper as an "inverse modelling framework" is stretching things too far, only forward modelling is being presented.

A forward and inverse modelling framework was implemented. However, this paper refers only to the forward modelling as stated in the following sentence. Reference to the complete forward and inverse modelling framework in Beck (2012) is given now later in the text.

22845-2 describe PREP_CHEM_SRC-1.0 (standard WRF-Chem emission preprocessor fortran source code)

A short general description is included now, while the detailed description of the main parts of the pre-processor used in the paper were already included.

22857-22+29 significant: state significance level

Significant changed to substantial

22861-22 factor two -> factor of two

Changed accordingly

22862-10 As last -> As a last

Changed accordingly

22862-20 denotes -> predicts

Changed accordingly

22864-11 state -> conclude

Changed accordingly

22864-17 Should better read something like: From comparison with the aircraft observations we conclude that the choice of the wetland inundation map that defines the distribution of the inundated areas is more important than the choice of the wetland model.

Changed accordingly

22864-21 significantly Âż> state significance level or change: significantly -> substantially

Changed to substantially

22866-10 unclear, please rephrase

Sentence is now rephrased.

22866-14 allow for -> put on

Changed accordingly

Figures 1-5 are too low resolution and almost all too small.

All figures will be provided in high resolution for the final publishing process

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Interactive comment on Atmos. Chem. Phys. Discuss., 12, 22835, 2012.