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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Comparison of the HadGEM2 climate-chemistry model against in-situ and SCIAMACHY atmospheric methane data" *by* G. D. Hayman et al.

Anonymous Referee #1

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This studied has evaluated wetland CH4 emission estimates from the UK community land model JULES by comparing model simulations with in-situ and satellite observations of atmospheric CH4 concentrations. Their results highlight the large uncertainties in the current estimates for wetland CH4 emissions, as well as the potential for using space-based observations of atmospheric CH4 columns to evaluate land surface models. This paper is well written, and very informative. It should be accepted for publication in ACP after some minor changes.

Major comments:

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1. The authors have shown that the HadGEM2 CH4 simulations have a much steeper fall-off in the upper troposphere and stratosphere than the (ACE/HALOE) observations, resulting in a model underestimation of XCH4 columns by about 50ppb when compared to SCIAMACHY retrievals. However, it is interesting to know the comparisons of the annual growth rates (as well as the annual cycles) derived from their un-constrained and constrained HadGEM2 XCH4 simulations, so that we can further understand how the issues with model CH4 simulations in the upper troposphere and stratosphere will affect the comparisons of model simulations with space-borne observations.

2. While the HadGEM2 run using JULES-GIEMS wetland emissions shows better agreement with in-situ observations, simulations forced by the FUNG emission inventory seem to score much higher in the comparisons against SCIAMACHY over Northern Hemisphere. Here, more detailed explanations are needed: for example, whether it is related to the transport model errors, or it is caused by the use of constrained HadGEM2 simulations.

Minor comments:

1. Line 16, Page 11: 'The WFM-DOAS algorithm is one of . . .'. Some introductions on the quality of the WFMFv2.3 XCH4 retrievals (such as the biases at different latitude bands) will be helpful.

2. Figure 3: I am not sure why sin(latitude) instead of latitude is chosen as x-axis. Also, it would be easier for the reader to see if the dots are connected with (coloured) dashed lines.

3. Line 24, Page 15: 'suggesting the annual pattern of non-wetland methane emissions may not be correct . . .', It will help the reader to understand if the authors can present the contributions from different emission categories to the observed CH4 concentrations over one or two selected sites.

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 12967, 2014.