Atmos. Chem. Phys. Discuss.,
doi:10.5194/acp-2016-752-RC2, 2016

Atmospheric Chemistry and Physics Discussions
Open Access
EGU

Interactive comment on "Increasing boreal wetland emissions inferred from reductions in atmospheric CH_4 seasonal cycle" *by* J. M. Barlow et al.

Anonymous Referee #2

Received and published: 4 October 2016

This study investigates trends in the seasonal cycle amplitude in long-term CH4 records from high-latitude measurement sites to investigate trends in emissions from natural wetlands. The analysis leads to the conclusion that high latitude wetland emissions must have increased by at least 0.7%/yr. This in itself is a very relevant and significant finding. However, as will be explained below, it remains unclear how this number is derived and what it really means. In addition, the description is difficult to follow as at jumps back and forth between different topics. Overall, significant revisions will be needed to make this study acceptable for publication in ACP.

GENERAL COMMENTS

To use the observed seasonal cycle amplitude in northern latitudes to investigate

Printer-friendly version

Discussion paper

changes in wetland emissions sounds like a logical idea, but it should first be tested if it works. The authors do the experiment needed for that, but don't draw any conclusion from the answer. Table 1 shows the change in seasonal amplitude when natural emissions are increased in the model. The assumption is that seasonal cycle amplitudes reduce as wetland emissions increase, but the model shows this only for BRW. This is the only station where the observed trend is significant and the relationship holds. Indeed, looking at the numbers, I conclude that the trend of 0.7%/yr is based only in this site. The corresponding emission trend of 5Tg/30 year is an extrapolation of this percentage to the whole boreal-arctic. To derive such an estimate from just a single site is brave, but this is true even more so if the approach is essentially falsified at the 6 other sites that are analyzed. It could even be worse: The authors analyze the impact of sampling by wind sector. It remains unclear, however, if the trend in Table 1 is only for the clean marine air sector or also for the locally influenced continental sector. In the latter case the extrapolation to the whole boreal-arctic would certainly be invalid. Just to use the un-flagged flask data from Barrow would not be sufficient I'm afraid. Interestingly the authors notice that the seasonal amplitude is not very sensitive to wetland emissions. In that case, why is it used as a metric in the first place? Wouldn't it have been better to use the asymmetry of the shoulder seasons or something like that? Looking at Figure 13, the emission does maximize near the seasonal cycle minimum. However, the signal tends to increase with the integral of the emissions, i.e. as summertime emissions fill the arctic reservoir. Due to the atmospheric mix of these emissions you expect that the integrated signal becomes more representative of the whole arctic as the season progresses. Indeed the impact of wetlands is more similar across the sites near week 40, than week 30. It indicates that the seasonal minimum may make the method overly sensitive to regional influences.

The TM5 model has the nice characteristic that its transport is linear. Therefore you only need a single run with increasing wetland emissions to calculate the impact of any trend that is a multiple of that trend. Looking at Table 1 one can easily check if this is the case. It is for BRW, but not for any of the other sites. Something must have gone wrong.

Many plots are presented, several of which don't seem needed to support the conclusions, but could be made available as supplementary material. Actually, there seems to be confusion between appendices and supplementary information. On the other hand, if all information in the appendices would move to supplementary material then the main text would not be self-contained anymore. Some significant restructuring is needed to solve this issue. When prioritizing figures, a new one is needed to demonstrate the performance of the wavelet method. Other tools have been used in the past. Moreover, the claim is made that the wavelet method is better than the Fourier transform method, but none of this is demonstrated. It should be shown how well the method works, especially given the need for some substantial data padding and gap filling.

SPECIFIC COMMENTS

page 13, line 433: How can a trend in seasonal amplitude be most clear in the annual component of a time series?

page 14, line 445: With is MERRA T2m regressed against?

page 14, line 460: The model could also be sampled for offshore conditions for, example, by choosing 1 grid box further into sea.

Table 1: Some table notes are needed to explain the numbers in the various columns without having to search the mean text for explanation (plus minus represents what?).

Figure 2, middle panels: The most visual jump in color is between the end and the beginning of the year, whereas those weeks are close together in time. The color bar should be made 'circular'.

Figure 2: The purpose of this figure is not really clear. We know that the signature of d13C is depleted in this range. It would be more relevant to see any trend in seasonality. Since this information can probably not be obtained from the data, I wonder what it is that we learn here.

Figure 3: What causes the vertical line structure in this figure? It seems like every day in the year is smoothed with the same day in other years. What is done and why?

Figure 5: How can imputed data seem to be out of the range of adjacent measured data?

Figure 9: What is on the y-axes here? Don't you need two y-axes for CH4 and number of days?

Figure 12: What combinations of low and high cut offs are used? (I mean, if one is varied, then what is the other?)

TECHNICAL CORRECTIONS

page 4, line 126: 'get been getting'

page 5, line 132: 'Figure 1b' i.o. 'Figure 1'

page 10, line 332: 'run the model run'

page 11, line 373: '09:00-17:00 location'

page 13, line 433: 'mainly' i.o. 'main'

Figure 1a: missing labels on the x-axis

Figure 7: Explain the legend in the right panels.

Figure 17: What is 'Magnitude (Unit)'?

Interactive comment on Atmos. Chem. Phys. Discuss., doi:10.5194/acp-2016-752, 2016.