

Interactive comment on “Detectability of Arctic methane sources at six sites performing continuous atmospheric measurements” by Thibaud Thonat et al.

Anonymous Referee #1

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General comments

This manuscript describes results of a modelling study of Arctic methane emissions using the CHIMERE chemical transport model. Simulated enhancements in methane from Arctic sources are compared with daily averaged methane mole fraction measurements from 6 sites for the year 2012. The impact of different sources at each of the 6 sites is quantified. Sensitivity tests have been carried out to compare different wetland and freshwater emissions and impact of methane sinks.

As the authors note Arctic methane emissions are uncertain and vulnerable to increase causing feedbacks as the region warms so the suggested improvements to fit emissions to observations are of importance. There have been other recently published re-

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gional model studies comparing methane model simulations with observations at Arctic stations (e.g. Warwick et al., 2016; Berchet et al., 2016 in Atmos. Chem. Phys.) but this manuscript has some new results such as consideration of freshwater emissions model and study of the effect of the methane sink, often not considered in regional scale methane models, which improves the correlation with observations.

The manuscript is written clearly with very few technical corrections required. The figures are also clear and discussion of the results is thorough.

I list below some comments and suggestions for minor modifications to the manuscript.

Specific comments

Line 79 and later. What is the status of the Poulter et al. (submitted) publication which is referred to several times? If this has not been published then some more detail will be required regarding the wetland emissions taken from that manuscript.

Introduction. It would be interesting to note the global and Arctic estimated methane emissions to give perspective to the size of emissions from this region.

Line 178. Why was the year 2012 chosen?

Line 189. Note (and perhaps give reasons for) also the long periods of missing data at Zeppelin, Pallas and Cherski.

Line 193. Why was just background data selected for Barrow and Pallas. Could you give details of the criterion used to filter the data? Were all data included for the other sites or were they filtered at all?

Line 236. Have you assumed anthropogenic emissions are constant all year? Is this realistic? Are emissions expected to be higher in the winter due to more emissions from fossil fuels for heating purposes? Would we expect seasonality in gas extraction in Russia?

Line 261. Does Orchidee include any emissions from wetlands in winter which accord-

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ing to Zona et al., 2016 may be significant?

Line 701. You could also bring in a discussion of Warwick et al., 2016 here. That paper found a closer agreement between modelled and measured methane mole fraction and isotopic composition at Arctic sites by delaying the seasonality in wetland emissions.

Table 1: Why don't Alert and Tiksi have both altitude and intake height? What do the numbers in that column refer to for those sites?

Technical corrections

Line 57. Schwietzke is misspelt.

Line 117. The 2.9 Tg CH₄ yr⁻¹ should be referred to as an estimated annual emission for the ESAS rather than a measured flux.

Line 152. Missing full stop at the end of this line.

Line 183. Earth System Research Laboratory (add the word Research)

Line 197. Integrated is misspelt.

Thompson et al. has now been published in Atmos. Chem. Phys. so this reference should be updated.

Figure 1: It would be helpful if some of the gridlines were labelled with longitudes and latitudes.

Interactive comment on Atmos. Chem. Phys. Discuss., doi:10.5194/acp-2017-169, 2017.