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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Pathways of PFOA to the Arctic: variabilities and contributions of oceanic currents and atmospheric transport and chemistry sources" *by* I. Stemmler and G. Lammel

Anonymous Referee #2

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Pathways of PFOA to the Arctic: variabilities and contributions of oceanic currents and atmospheric transport and chemistry sources by I.Stemmler and G.Lammel

The paper describes PFOA release experiments with a fully coupled 3-D OCGM with included 2-D top soil, vegetation and sea ice compartments. The authors find a dominant oceanic pathway for PFOA to the Arctic.

All in all the paper is a good contribution to the discussion of pollutant pathways to high latitudes, here specifically PFOA. I recommend publication after the authors have taken care of a number of issue as listed below.

General

The model used is fully coupled, which means that it does not simulate a 'real' time period w.r. to the physical environment. This should be stated more clearly. Also the consequences of this fact for the interpretation of the results from both rather short (14 years and 4 years) experiments should be discussed more intense, e.g. how representative is the 4yr experiment given the known interannual to decadal variability in the atmospheric circulation (e.g. AO, NAO ...)

The motivation for the two experiments, their expected benefit and problems should be addressed, too.

Detailed remarks:

p 11585 l 22:

I do not understand what you want to say with 'fully covered', 'sum of AOT and ATC experiments'?

p 11585 l 25:

'Background concentrations'...do you mean 'initial concentrations'?

p 11586 l 15 ff:

The use of both, log KOC and KOC values, in the ms is confusing, please explain and then use only one of both throughout the ms.

p 11587 l 15ff:

What is meant with 'coarse emission scenario', if the predicted distributions are very different from reality in the source latitudes, how can we expect them to be of any use even further away from the source?

p 11587 l 19ff:

The seasonal cycle seems to be significant, of which value are the snapshot-like model-observations comparisons, esp. since there is no information if the model shows a

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similar seasonal cycle as the observations? Discuss this please and include thoughts on interannual variability.

Would it be possible to present a table or map instead of listing ?

P 11589

l9 ff:

Please explain the abbreviations 'AO, etc' for the stations.

17 ff:

The text is somewhat cryptic:

'the subsurface is explained...' ??

Which 'independent deep water current' are you talking about, the Denmark Strait Overflow Water? Is this a hypothesis or what leads you to this conclusion? Please be more specific!

I cannot see a 'similar stratification', AO2 is completely different, AO1 differs at depth and also shows different levels.

I am missing a discussion of the sense/no-sense of such a localized (point wise) comparison of observations and data. This is very difficult to interpret, and observations are very sparse.

Please discuss what 'can' we learn from this comparison and what 'do' we learn from it.

p 11594

l15 ff:

How can a result covering just fourteen years of arbitrary atmospheric circulation be used to draw the conclusions? With regard to the oceanic flow this is even more ques-

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tionable than for the atmospheric one.

p 11595 and ff

Your use of the word 'transport' is sometime misleading, please chose words which clearly discriminate between the water transport and the transport of PFOA.

Again, the discussion of specific years or periods is problematic since the time is just determined by your source function, not the flow fields. This has to be critically discussed at least.

l 4/5:

Why does the Norwegian Coastal Current carry 50-80% ? It is fed by Baltic Sea outflow and Norwegian runoff. What does the general comparison with 'other pollutants' tell us, since they may have completely different source distributions?

l 9:

Do you mean the overflow? Please be more concrete. 'This outflow...' which one, the subsurfce flow? What about the surface, is there no outflow?

l16-18

I do not understand this sentence.

p 11596

l 7:

which 'inflow' the total?

l 12:

What do you mean by 'diverging inflow patterns'?

l 14:

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you are discussing experiment AOT, the reference to a 54 experiment (the 'spin up which produced the initial conditions?) is unclear here.

p 11597

l 1 ff

It is not possible that an imbalance of 1 Sv exists in the complete volume fluxes for the Arctic basins over a year (you can easily calculate what kind of sea level change would result from that). The fluxes must be balanced on short time scales. Either you made an error in the calculation of the fluxes or the model does not fulfill mass conservation (which I do not presume).

Fig. 8:

Mention the meaning of the two KAC values in the caption. The reader is lost otherwise. Please chose different names (e.g. KOC1, KOC2)

Fig. 9:

Please show a map with the sections.

I guess the black line is the volume transport, please say so!

Minor issues:

At several places in the ms I find question marks, which is exactly how I think about them. Please replace them.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 11577, 2010.