# *Interactive comment on* "The 1-way on-line coupled model system MECO(n) – Part 4: Chemical evaluation (based on MESSy v2.52)" *by* M. Mertens et al.

**Anonymous Referee #2**

Received and published: 13 July 2016

General comments:

This paper describes a new nested, coupled system for chemistry climate modelling, which has online coupling of the nested grids. This paper evaluates the gas phase tropospheric chemistry in this new model in comparison to the coarser resolution model and to observations. I think this paper is successful in its aims of describing and evaluating the new model. Subject to my minor comments below, I recommend this paper is accepted.

Specific comments:

A point with respect to rainbow colour scales – there is a good argument for not using

them, as they artificially distort the field that they are visualizing, and they also cause problems for people with colour blindness. I recommend changing the rainbow colour scales to ones that do not suffer from these flaws. See here for more about this: http://www.climate-lab-book.ac.uk/2014/end-of-the-rainbow/

P1 line 21: This sentence is awkward and difficult to read: Especially, as some of the relevant processes (for example tropospheric ozone chemistry) are non-linear, it is desirable to resolve smaller scales, since with finer resolution the capabilities of chemistry-climate models in simulating species like ozone or nitrogen dioxide can be enhanced. Possible alternative: It is desirable to resolve smaller scales because finer resolution chemistry-climate models can simulate species like ozone or nitrogen dioxide better, as some of the relevant processes are non-linear (for example tropospheric ozone chemistry).

P7L4: This sentence is awkward and hard to understand: To allow for a fair comparison between EMAC and COSMO/MESSy always the value of the model layer which is nearest to the elevation of the station is selected. Suggested alternative: To allow for a fair comparison between EMAC and COSMO/MESSy, the value of the model layer which is nearest to the elevation of the station is always selected.

P7L32: "The maximum over the Mediterranean sea is underestimated in COSMO(50km)/MESSy. EMAC simulates a higher extend of this maximum, which better corresponds to the satellite measurements." The word "extend" should be "extent". I also don't agree with this when I look at fig 3. What is meant by a "higher extent"? Higher in altitude – which we cannot see in this figure? Higher latitudes – which doesn't agree with what I can see from the figure? Larger figures with a better colour scale may help to show the reader what you are trying to convey here. The same applies to the following statement about the Alps, as it's hard to see details over such a small region.

Sec 4.1: How good are the satellite retrievals? Is there any bias that may account for some of the differences – eg a difference between the land and sea? I am not an

expert in satellite retrievals, so I think a sentence or two about whether there are any biases in the satellite data would be helpful here.

Sec 4.2.1 on Taylor diagrams. I don't think you explain anywhere what the x axis is on the Taylor diagram. Have I also understood correctly that the EMAC model does better according to the metrics described in this section than the COSMO/MESSy model? If this is the case then maybe some commentary to explain why this is would be good here. Or to refer forward to a section where you discuss this.

Sec 4.5: I assume the unit "a" means "annum". It took me a few seconds to work this out, and it isn't explicitly stated anywhere. I would have uses "years" or abbreviated to "y" or "yr", as this seems to be the convention in the literature. I don't know if GMD have a policy on this. Unless the reader has a good feel for what numbers to expect for the methane lifetime, the numbers in this section are not very helpful, in my opinion. Most non-specialists will simply know that the methane lifetime is approx 10 years globally, however the numbers in this section are very different to that. Some context or literature values would help here.

Technical corrections:

Abstract, Line 15: Change to: "In comparison with observations, both EMAC and COSMO/MESSy show strengths and weaknesses."

P2L18 – "consistence" should be "consistency "

P4L15 remove second comma: "Thus, it is desirable that all. . ."

P7L5: Rearrange to: This is very important, especially in mountainous terrain, as COSMO/MESSy resolves the topography much better. B7L8: suggest adding a comma before the word measurements to make this sentence a bit clearer

Caption fig 5: please specify that the middle row is for June 2008

P9L28: missing "in"

C3

P12L10: Remove first comma: "In order to check if the vertical distribution of ozone is well simulated, . . ."

P16L8: Remove first comma: "To investigate if we can. . ." P16L16: "In addition, also" – you don't need both of these terms in this sentence P16L17: "of" should be "off" P16L28: remove second comma: "Furthermore, it is well known that the. . ."

P17L15: The word "especially" seems a bit out of place to me here. Suggest "Particularly" instead. P17L23: Again, "especially" seems out of place here. Suggest "particularly," or "in particular,". Later in this sentence "as by the coarser" should be "than by the coarser"

P17L26: "good" should be "well" P17L27: Another sentence beginning with especially – perhaps you wish to keep this one, however I'd remove the word as the sentence works as well without it. P17L28: Sentence starting with "The comparison" – remove the first comma. The final "to" should be "too". P17L32: remove first comma

C4