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Geoscientific Model Development Discussions

Interactive comment on "Towards an online-coupled chemistry-climate model: evaluation of COSMO-ART" *by* C. Knote et al.

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Anonymous Referee #3

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R3.1) Knote et al. have made a thourough evaluation of an online-coupled regional air quality/ meteorology model, including a large set of observations, some of them used for the first time. Model performance is assessed for different seasons and for a large number of species. The paper is well within the scope of GMD, and the presentation quality is high. I was nominated to act as a referee only recently, after the first two reviews and a short comment had already been published, and I feel I do not have much to add to the comprehensive set of comments. Most of the comments seem to

have been carefully addressed in the replies by the authors. I will not engage in the discussion whether or not the model performance is overstated. Similar discussions have been ongoing for years and as long as we don't have a commonly accepted way of judging model performance, there are mainly two things that are important: (known) important processes that are missing in the model have to be clearly identified, and the skill score of the model has to be quantified to the extend possible so that the experienced reader can assess the performance against other similar studies, many of which are now found in the literature. As pointed out in earlier reviews, this model system is not complete (e.g. the absence of wet removal is an important lack!). However, this is made clear at several places in the manuscript and is also implied in the title. GMD is dedicated to the description, development and evaluation of numerical models of the Earth System and its components. The question is as to when the stage of model development is appropriate for a peer-reviewed publication. The current version of COSMO-ART is sufficiently advanced, has been used within research, and a detailed evaluation seems in order. The paper is at least on par with a typical 'model development or technical paper' which is among the main GMD purposes. This model evaluation is an important landmark for use in current research activities where the model is already applied. I will try not to repeat comments that have already been made and addressed. I suggest publication after the following minor issues have been resolved:

We are grateful for the reviewer's comments and suggestions.

R3.2) Abstract, first line: It's been some time since I was a modeler, but isn't a 'chemical transport model' offline by definition? Would it be better to say 'The regional online integrated chemistry and meteorology model COSMO-ART...'

It seems that for regional models treating chemistry and aerosols additionally to meteorology the definition is not as clear as it is for global models (chemistry transport models vs. chemistry climate models). The amount of discussion about "online" vs. "offline" coupling going on in the regional modeling community at the moment suggests that

both are different types of “CTMs”. As, on the other hand, the two types might be used to pursue quite different goals (climate change research vs. compliance with legislation assessments), one could justify a qualitative distinction such as proposed by the reviewer as well. From our impression of the current understanding of “CTM” in the modelling community we do think our description of COSMO-ART should be accurate and understandable for the readers. Also, as we outline the distinction between “online” and “offline” in the introduction / methods section this should also become clear for non-modellers, and we hence prefer to remain with our formulation.

R3.3) p.1815, l.15: write "by up to"

The sentence now reads: “This is still a commonly used module, although Fast et al. (2009) showed that this scheme underpredicts SOA concentrations by up to a factor of 10 in very polluted regions.”

R3.4) p.1816: "While this gives more realistic aerosol concentrations at the boundaries, the total inflow will still be underestimated." I don’t quite understand why this approach necessarily should lead to underestimation. If trivial, please add a sentence.

We have added: “In this work we will show that simulated particulate matter concentrations are often underestimated, which will also be the case for boundary conditions based on such a simulation.”

R3.5) p.1817: "lowest level at 10m" - do you mean centered at 10m, or is this the layer thickness? (important for AQ modelling)

This should refer to the layer midpoint. We have added the information about layer thickness: “[...] with the lowest level at 10 m (layer thickness: 20 m) and ranging up [...]”

R3.6) p.1817, l.21: write "AIRBASE (European AIR quality dataBASE, http://airbase.eionet.europa.eu/) data provide" or "AIRBASE (European AIR quality dataBASE, http://airbase.eionet.europa.eu/) provides"

We have chosen the second option.

R3.7) p.1818, l.2: I’d replace ’reasoned by’ with ’related to’ in this case. ’reasoned by’ sounds philosophical (also some other occurrences, but that’s not critical).

We have changed the sentence accordingly: “As discrepancies between modelled and measured values might be related to the type and location of a measurement station [...]” Also, we have reviewed the other occasions of “reasoned by” and changed: p. 1821, l. 11-12: “The negative bias in summer 2006 might be related to an unrealistic initialization of soil moisture.” p. 1844, l. 14-15: “Some discrepancies found are more likely related to the simulation setup rather than the model system itself.”

R3.8) p.1818, l.9: remove ’via’, add comma before ’and’

Changed accordingly, sentence now reads: “classes ranging from very clean stations (“rural/remote”),stations with very variable pollution levels (“rural/coastal”) 10, and stations representative for a larger area (“rural”), up to stations with a strong influence of large urban areas in their vincinity (“suburban/urban”).”

R3.9) p.1820: ’typically springlike’ -> ’typical of spring’ (or only ’springlike’)

We chose “typical of spring”.

R3.10) p.1821, l.16: ’data was used’ -> ’data were used’ p.1822, ’hours 12:00–18:00 LT’ - remove hours, write ’local time’

The incorrect use of “data” (plural) with verbs in singular was changed on several occasions. “LT” was changed to “local time”.

R3.11) p.1823, l.15: ’An overestimation of SO2 emissions in the TNO/MACC inventory’ - is it an established fact that SO2 emissions have been overestimated by TNO/MACC? - If not, write ’A possible overestimation...’

Changed, the sentence now reads: “A possible overestimation of SO2 emissions in the TNO/MACC inventory can also contribute to the observed mismatch.”

R3.12) p.1826, l.12: ’13:30 LT, approx. 12:30 UTC over Europe’

We are not sure what the reviewer wanted to suggest by this comment, but based on comment R3.10) we have changed LT to “local time”.

R3.13) p.1830, bottom: ’Both, MODIS and AERONET data, are’ - remove commas ’To capture the onset of a cloud is difficult to determine, so’ -> ’Capturing the onset of a cloud is difficult, so’

We have changed the sentence according to the reviewer’s suggestion.

R3.14) p.1834, l.13: ’occurence’ -> ’occurrence’

Changed.

R3.15) p.1839, l.19: ’Thus is it’ -> ’Thus it is’

Changed.

R3.16) p.1841, l.12: ’compared the’ -> ’compared to the’

Changed.

R3.17) p.1842: "and could have as result considered" doesn’t sound right, rephrase.

The new text reads: “However, their study did not consider modern new particle formation parameterizations. As a result they could have considered at least some of the particle precursors as primary emissions.”

R3.18) p.1843, l.9: write ’suggests’

Changed.

R3.19) Fig.8 is borderline small. Consider dividing.

Figure 8 has been already revised due to comments from reviewer 1 (R1.37) and should be much easier to read now.

Interactive comment on Geosci. Model Dev. Discuss., 4, 1809, 2011.