

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

Anonymous Referee #2

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The paper "Towards an online-coupled chemistry-climate model: evaluation of COSMO-ART" by Knote et al is a model evaluation paper. Measurements used for the model evaluation include ground based observations of key gaseous and aerosol species satellite and ground based remote sensing products, aerosol chemical composition and size distribution. I suggest publication of this work, after minor revisions.

General comments

The positive aspects of this work are:

1)The evaluation methodology used is sound and complete: proper metrics are used and the validation includes validation of meteorology and chemistry both for gaseous and particulate matter

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- 2)The paper is well written and constructed without any obscure sections
- 3)There are generally adequate references in literature (see below specific comments)
- 4)The issues arising from the evaluation are discussed properly and plausible explanations are provided
- 5)Directions for future work are suggested, as a result of the evaluation work

The majority of the limitations in the parametrization and the implementation of the current modeling system (schemes, boundaries, etc) are already addressed and should be included in the next model update, as pointed by the authors.

Specific comments

In the conclusions is mentioned that: “The coupling to a meteorological core that is actively used and developed for both short-term weather forecasting as well as climate simulations is regarded as a key benefit.”

I guess that the meteorological core is the COSMO model. What about the external forcing? The current modeling system is externally forced by ECMWF-IFS: does IFS provide only operational weather forecasts or there is the possibility to provide also boundaries for long-term climate simulations? If a long term climate-chemistry simulation will be attempted in the future with COSMO-ART, how will it be externally forced? If the external forcing is provided by a different model (GCM) then we have a different modeling system, practically, which will have to be evaluated again. Please, refer to existing literature to investigate the importance of external meteorological forcing on climate-chemistry simulations. A common methodology to evaluate a climate-chemistry model is to perform at the beginning a perfect lateral boundary condition experiment for a present decade (i.e. forced by reanalysis which is as close to reality as possible) and then perform an identical simulation with the selected GMC coupled. Such an analysis reveals the impact of the external forcing on chemistry resulting from the induced large scale circulation patterns, which is supposed to be crucial aspect in

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long-term climate-air air quality simulations. I would tend to think that the characterization of the current modeling system as a climate-chemistry system is at the moment a bit pre-mature.

Technical corrections

Figure 3, Figure 5, Figure 8, Figure 11 could be re-sized to be more easily read.

Page 1836, line 20 & Page 1843, line 25-26: You could rephrase, I am afraid the judgment is too generous.

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