

## ***Interactive comment on “A description and evaluation of an air quality model nested within global and regional composition-climate models using MetUM” by Lucy S. Neal et al.***

**Anonymous Referee #2**

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This paper describes a modeling system that nests the UK air quality forecast model (AQUM) with one way nesting into a regional composition-climate model covering Europe (RCCM) (50 km resolution) which itself is nested into global composition-climate model (GCCM) (140 km resolution). Evaluation is performed over a 5 year period in a regional climate type application. The paper claims to present an initial attempt to develop a single modelling framework, by introducing a greater degree of consistency in the modelling. Unfortunately, this does not include photolysis and chemistry. Overall I think the paper is interesting and deserves publication. I would, however, suggest to change the wording a little, to only claim consistency with respect to meteorology, since it appears that the physics parameterizations that are used in the different model-

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ing systems are the same. This by itself is an important aspect of consistency, but this paper does not really provide proof for this. I did not grow up in an English-speaking country, so I leave any English corrections to reviewer 1. Overall the authors did a lot of work and summarize their work in this well written paper in a clear way. I therefore think this paper should be published with minor corrections. My main comments are:

Abstract, line3: You really only are more consistent with respect to the meteorological part of the modeling system. This should be stated.

Line 20/21: Where do you show that consistency between models is important? I believe you, but I do not see proof for this in your paper.

Introduction: You should find references for modeling systems that you cite: WRF-CMAQ, WRF-Chem, CESM, CESM-NCSU.

Section 2: A little table would be nice to get an easy look at what parameterizations and chemical modules are used. What atmospheric radiation scheme is used? You mention you have the capability to use radiative and microphysical feedbacks. Why did you switch them off? Is there any direct coupling of the convective parameterization to atmospheric radiation and photolysis? This could have a significant impact on Ozone evaluations (see also section 4.2.2). How complex is the aqueous phase chemistry that is being used (I am assuming you have some aqueous phase chemistry, since you allow for interaction with microphysics). For my understanding, in section 3 you mention that sea salt and dust emissions are computed interactively based on surface wind speed, but in section 2 you say that sea salt is diagnosed on ocean grid points. I am assuming that means sea salt is not advected or transported in any way? And there is no memory, so it is purely instantaneous and based only on wind speed? You also indicate that the missing proper treatment of sea salt could be a reason for poor performance of PM10 evaluation. Are there observations that can give you an idea on what the fraction of sea salt with respect to total PM10 is?