Geosci. Model Dev. Discuss.,
doi:10.5194/gmd-2016-190-RC2, 2016

Geoscientific Model Development Discussions

Interactive comment on "Air quality modelling in the Berlin-Brandenburg region using WRF-Chem v3.7.1: sensitivity to resolution of model grid and input data" *by* Friderike Kuik et al.

Anonymous Referee #2

Received and published: 7 October 2016

In this study the authors applied the WRF-Chem model with various configurations to simulate air quality in the Berlin-Brandenburg region. The impact of the grid resolution, the urban canopy parameterization in WRF and the spatial resolution of the anthropogenic emission inventory on the model performance were studied. It is crucial to develop and evaluate the state of the art air quality modeling tools for large urban areas, where complex meteorology and anthropogenic emissions make it harder to accurately predict air pollution. The authors used a large amount of measurement data to evaluate the simulated meteorological and chemistry variables. I think the paper deserves publication in GMD after addressing the following comments:

You used the RADM2 mechanism. This mechanism doesn't include several impor-

tant biogenic VOCs, therefore it usually underestimates ozone compared to such gas chemistry mechanisms as RACM. I suggest this point to be discussed in the paper.

You used 35 vertical levels, how thick is the first layer? You did simulations as high as 1km resolution, which certainly helps to capture spatial variability of the urban canopy and anthropogenic emissions in more detail. However, the vertical resolution remained the same. I think relatively coarse vertical resolution could explain some of the model deficiencies, especially the nighttime bias in the model.

Chapter 2.1- doesn't the ERA-INTERIM have 61 vertical levels?

2.2- WRF also uses more updated MODIS LU dataset. Here the USGS LU data is mentioned only.

2.4- The stack height could be small, but the plume injection height due to buoyancy and momentum is higher. I think this could explain some of the NOx overestimations by the model at nighttime, when all the NOx from the point sources are emitted into shallow boundary layers.

In WRF-Chem the vertical mixing of the chemical species are done somewhat differently than the meteorological fields. Did you consider testing sensitivity of the vertical mixing of the chemical species to various parameters/assumptions? The treatment of vertical mixing of the chemical species can explain some of the high NOx bias at night.

In addition, I suggest showing vertical profiles or x-sections of the chemical species (e.g. NOx) to illustrate how deep the species were mixed in the model, especially during nighttime.

Can you show model-obs. comparisons similar to Figure 11 for NOy (if measurements are available) as well? The paper doesn't show any evaluations for CO, biogenic VOCs such as isoprene etc.

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