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Geoscientific Model Development Discussions

Interactive comment on "Air quality in the Kathmandu Valley: WRF and WRF-Chem simulations of meteorology and black carbon concentrations" *by* Andrea Mues et al.

Anonymous Referee #2

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This paper presents an evaluation of a modelling experiment of the meteorology and the surface concentrations of black carbon (BC) in a region of South Asia and Nepal, the Kathmandu Valley. The authors apply the WRFv3.5.1 meteorological model and the WRF-Chemv3.5.1 online meteorology-chemistry model over two domains centred over the Kathmandu Valley, the region of study. High-resolution simulations are conducted for the first half of 2013 year covering the same period of the experimental campaign SusKat-ABC. Emissions from EDGAR HTAP v2.2 database and an updated estimation over the Kathmandu Valley are used for the chemistry, and the meteorology is initialized with ERA-Interim meteorological reanalysis.

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Although the objective of the study is of relevance for the scientific community (complexity of the region, high concentration of pollutants, lack of modelling efforts conducted in the area) the objectives, methodology and results presented in the manuscript do not fulfil the scope of the Geoscientific Model Development Journal. No model developments are presented nor discussed in the manuscript, although the authors claim that they have introduced relevant improvements to the WRF-Chem model, and the work is mainly an evaluation exercise of preliminary results with the WRF-Chem model perturbing global emissions available over the region. The experiments need a much in depth work in the emissions applied to run the full-chemistry of WRF-Chem. It is criticisable the use of a global inventory as EDGAR HTAP v2.2 to run a high-resolution mesoscale chemistry model as WRF-Chem at 3 km x 3 km horizontal resolution without significantly complementing the inventory with more detailed data (improving emission sectors and temporal profiles). From the results, it is clear that a significant lack in emission sources is the main limitation of the study, although an initial effort is done including the estimation of emissions of the Kathmandu Valley from Mues et al. (2017). Relevant emissions for BC that should be refined from HTAP data for India and Nepal domains are those associated with biomass burning, emissions from stoves, kerosene lamps, flaring gas or open burning of domestic waste. Current global aerosol models present large underestimations of AOD and BC surface concentrations in South Asia and the region of study, being most of the systems based on HTAP emissions (i.e., AEROCOM phase III experiment). A mesoscale chemistry model with such emissions won't be able to reproduce the huge concentrations of BC without a significant work in emission estimates. Without proper emissions the discussion of BC dispersion will be fault of information.

A part from the BC experiment, the first part of the manuscript is devoted to the evaluation of wind, temperature, relative humidity, mixing height and precipitation of the WRFv3.5.1 model applied over the region of study. The authors use a small set of observations available in the region, and discuss the results based on averages for the period of study. Again, there is no model development in this work and no clear recom-

mendations for improving the meteorological model can be raised from the discussion. Although the analysis with monthly averages and daily means simplifies the description of results, no clear outcomes can be derived from the analysis.

In my opinion, this paper deserves a major revision before considering to be published in Geoscientific Model Development. The authors should consider introducing a more clear description of the model developments done, significantly improve the emissions used with WRF-Chem, and extend the meteorological analysis to present contributions that improve the meteorological model. I do not consider that specific comments are needed at this stage if the previous considerations are not addressed in a revised manuscript.

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