Atmos. Chem. Phys. Discuss., 10, C2243–C2246, 2010
www.atmos-chem-phys-discuss.net/10/C2243/2010/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Climate impact on airborne particulate matter concentrations in California using seven year analysis periods" *by* A. Mahmud et al.

Anonymous Referee #2

Received and published: 29 April 2010

The paper is dealing with coupling of CTM UCD/CIT to downscaling simulations using WRF driven by outputs from GCM of NCAR/DOE PCM with the purpose to provide very high resolution study of climate change impact on air quality in California for selected time slice of the mid-century 2047-2053 against the control period 2000-2006. Although this kind of evaluation seems to be up-to-date trend and thus it is worth to publish such an assessment, especially when (concerning the pollutants very thoroughly provided), there are several caveats of the presented study.

The major objection I have is against the modeling strategy proposed and used. When talking on climate impacts using model downscaling I would expect the rigorous RCM

strategy using driving GCM fields only for driving boundary conditions of the nested model and uninterrupted run for whole periods studied. The strategy of 17 days (finally -4 for evaluation) of simulation (initialized from coarse resolution data) and then 25 days skipped as my opinion does not allow the development of high resolution local feedbacks and patterns of surface processes, hydrological cycle etc. For RCM usually spin-up of at least a year is recommended. The averaging across those 9 time segments could be even affected by their selection, i.e. is there the same number of days in all seasons? Maybe at least say 15 days of each month to simulate and others 15 skipped to capture more reliable the annual cycle. When applying this method on present climate, it is rather close to the air-quality regional reanalysis concept, but for that purpose probably no need to run 17 days. It is not clear whether the present climate simulation uses observed SST or ocean data from coupled GCM. Finally, the chemical boundary condition in the regional simulation should be taken from some outer model as well to provide the proper climate signal, this is not clear from the paper. I understand the effort to keep the simulation within some framework of the resources, but without the assessment of the impact of the criticized simplifications, e.g. by comparison of the results, time series etc. from both methods for at least a year of simulation (after proper spin-up) further statistical analysis of air pollutants concentration become a bit vague. The similar full RCM study with coupled CTM in quite high resolution of 10 km in Central Europe has been performed by Halenka et al. (2008, 2010a, b) assessing of climate change impact on air quality for decadal time slices 2041-2050 and 2091-2100 against 1991-2000.

Further comments:

It would help for understanding if clearly stated both in abstract and the methods description that there is off-line coupling with no feedback of the chemistry to climate simulation concept applied. Similarly, to avoid confusing, it should be clearly pointed out in the abstract and the description that only climate effects are considered, that means that basiline 2000 emissions are used for future, as finally the reader can find in

the Summary. However, is that valid for biogenic emissions as well or do they account climate change signal (temperature, radiation, etc.)?

As for the periods chosen and their relation to ENSO, if I accept the period of ENSO could be 3-8 years as mentioned in the paper, then 7 year time slice might have problem in this region, e.g. when having two El Nino phases and one La Nina, which could be discussed based on GCM simulation or from observation if present run driven by observed SST. By the way, from 2000-2006 conditions it is clear that prevailing warm episodes appeared (http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/ensostuff/ensoyears.shtml).

No doubt it is legitimate to use whatever GCM , especially when contributing and compared within the IPCC assessment. However, some information on PCM validation as well as the validation of the downscaling system should be given. As one can see at http://www.climatewizard.org/tnc/FutureClimateModels.html, PCM climate signal for the region underestimate the temperature change through all the year and all the scenarios presented (B1, A1B, A2), precipitation signal is overestimated except for summer in A2 scenario with respect to the ensemble of IPCC AR4 models while CCSM model is far closer to this ensemble. Then one could doubt what the consistency of PCM with CCSM mean, the difference between the A2 and business as usual scenario in GHG concentration for mid-century won't be so big I would say.

As for the excess of ventilation predicted used for accounting for under-prediction of PM2.5, as my opinion not necessarily this has to occur both in present and future conditions. It might depend on circulation types changes as well which would need more detailed analysis.

In discussion of results presented in Fig. 3 the authors confuse the reader when mentioning predicted concentrations describing the present state while throughout the text this means future period.

There is no information on the other outer domains of WRF (size, height, ...) in the

text or/and in the scheme. All figures and legends, axis descriptions etc. seems to me mostly to be too small for clear viewing both in the maps and graphs, in graphs of Fig. 4 it is not easy to distinguish between modeled and observed results.

Finally, I would like to see this paper published in the ACP journal, but I would say that the above mentioned points should be addressed a bit more thoroughly.

Halenka, T., Huszár, P., and Belda, M., Regional climate change impacts on air quality in CECILIA EC 6FP Project. In: Air Pollution Modelling and its Application XIX, Borrego, C., Miranda, A.I. (Eds.), Springer, ISBN 978-1-4020-8451-5, 577-585, 2008.
Halenka, T., Huszár, P., and Belda, M., Validation of coupled regional climate chemistry simulation in CECILIA EC FP6 Project. In: Air Pollution Modelling and its Application XX, Steyn, D.G., Rao, S.T. (Eds.), Springer, ISBN 978-90-481-3810-4, 439-443, 2010.
Halenka, T., Huszár, P., and Belda, M., Regional climate change impacts on air quality in high resolution. In: Air Pollution Modelling and its Application XX, Steyn, D.G., Rao, S.T. (Eds.), Springer, ISBN 978-90-481-3810-4, 515-518, 2010.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 2985, 2010.