Geosci. Model Dev. Discuss., 3, C789–C792, 2011
www.geosci-model-dev-discuss.net/3/C789/2011/

Geoscientific Model Development Discussions

Interactive comment on "A multi-resolution assessment of the Community Multiscale Air Quality (CMAQ) Model v4.7 wet deposition estimates for 2002–2006" *by* K. W. Appel et al.

Anonymous Referee #2

Received and published: 11 February 2011

Review of: A multi-resolution assessment of the Community Multiscale Air Quality (CMAQ) Model v4.7 wet deposition estimates for 2002–2006 by K. W. Appel et al.

General The paper describes a carefully undertaken multi-year study to simulate wet deposition of sulphur and nitrogen and comparison with measurements at a national scale in the US. The model generally achieves good agreement with measurements. The authors have analysed a number of important issues which can affect model correlation with measurements of wet deposition. These include: - The influence of model resolution on correlation with measurements. It is well known that the formation of precipitation, particularly in upland areas is sensitive to the resolution of the meteorological

model - Comparison with different areas (cleaner-western and more polluted-eastern) of the country - The influence of precipitation correction. This represents an interesting way forward for simulation of wet deposition as precipitation can be measured accurately at a large number of sites whereas accurate simulation of precipitation remains a challenge - Seasonal variation in correlation of wet deposition measurements. - Correlation for different chemical components (sulphate, nitrate and ammonium.

My main criticism is that I found the paper quite difficult to read. There are a large number of statistics included in the text and the six tables, each with 90 numbers, present the reader with an excess of data to digest. One suggestion worth considering would be to re-structure section 3 and instead of

3.2 SO=4 wet deposition 3.3 NH+4 wet deposition 3.4 NO−3 wet deposition

replace this with (i.e. the topics listed above)

3.2 model resolution 3.3 precipitation correction 3.4 seasonal variation 3.5 chemical compound

Subject to some work to re-structure the text in a form more accessible to a general reader I am pleased to recommend the paper for publication

Specific comments

Page 2321: Can some details be provided of the rain chemistry collectors? Are they wet only collectors? Is site precipitation independently measured with a standard ground level rain gauge? Does snowfall make a significant contribution to annual precipitation at some of these sites and how is it measured? Have the rain gauges been assessed for their collection efficiency of precipitation?

Page 2322: Adjusting the wet deposition according to the error in the modelled precipitation when compared with measurements is a reasonable procedure. Precipitation can be measured accurately whereas model estimates of precipitation in upland areas are known to be associated with considerable uncertainty. Looking beyond valida-

tion of the model at the measurement sites, are wet deposition maps corrected using measurement-based interpolated precipitation maps?

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While the precipitation estimates for the 12-km and 36-km East simulations have similar patterns in their bias, the precipitation estimates for the 12-km simulation are consistently higher than those of the 36-km East simulation

The NMB for the 36-km East and 36-km West simulations was typically slightly larger than the 12-km East simulation, with annual NMB generally ranging between $\pm$11% for the five year period.

These statements appear contradictory. Is this a difference between seasonal and annual statistics? Some clarification would be helpful.

Fig.1 The scale for the western US values is given on the right y-axis. The left hand scale is a factor of 20 higher than that on the right. It is surprising that wet deposition in the eastern US is approximately twenty times that in the west. Can the authors comment on the reasons for these very large differences?

Fig. 2. SO4 wet deposition NMB for the 12-km CMAQ simulation (red diamonds), 36-km East CMAQ simulation (blue squares) and the 36-km West CMAQ simulation (dashed; yellow triangles). Figure caption needs correction for dotted/full lines and colours

Page 2325: The bias for the 12-km (36-km East) CMAQ simulation is highest in the winter. . .

12 km or 36 km?

3.2 SO4 wet deposition 3.3 NH4 wet deposition 3.4 NO3 wet deposition

I found these sections hard to read. It was difficult to extract a straightforward message from the large numbers of statistics.

Tables 1-8. These 8 tables (each with 90 numbers) contain an excess of information which is superfluous to the reader. I suggest simplifying the tabulated data. The seasonal story is certainly interesting. Is it necessary to repeat the information five times over for each year? There isn't much analysis of annual variation of meteorology and wet deposition in the text so perhaps just the five year averages can be tabulated?

Please also note the supplement to this comment:
http://www.geosci-model-dev-discuss.net/3/C789/2011/gmdd-3-C789-2011-supplement.pdf

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Interactive comment on Geosci. Model Dev. Discuss., 3, 2315, 2010.