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Geoscientific Model Development Discussions

Interactive comment on "WRF-CMAQ two-way coupled system with aerosol feedback: software development and preliminary results" *by* D. C. Wong et al.

Anonymous Referee #2

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Additionally to my comments below, I would like to start by saying that the online coupling of WRF-CMAQ should be considered of great importance in particular for the regulatory community, which is why I strongly favor publishing this paper. Although this reviewer could live without the reruns that may be necessary because of my first major comment below (1), considering these comments in my opinion would make this paper much more useful.

(1) The primary driver especially for the qir quality community has not been the need for the direct and indirect effect, but rather the introduction of significant errors for the air quality simulation because of the offline approach, in particular with the continuous

increase in horizontal resolution. This paper would have been of much higher quality – in my opinion – if that would have been the focus. A good thorough explanation of how the coupler works (I agree with reviewer that not enough explanation is given), and then some examples of how the aq-simulations change as the coupling interval is increased. And that would best be handled without FDDA, since FDDA has a strong diffusive tendency, effectively decreasing the resolution. It is o.k. to add the aerosol direct effect as a positive impact, at least when intense pollution is present. (2) It should also be pointed out that even though the use of the coupler is a big step to more consistency and probably will be a large improvement for transport predictions on high resolutions, the overall system still has many inconsistencies, since different algorithms are being used for advection and physical parameterizations. This is a very significant shortcoming for applications with the aerosol indirect effect. When explicit aqueous phase and microphysics start interacting, it is not desirable to have different transport for tracers and hydrometeors. Explanations of what is done in CMAQ for physics lacks. The authors mention "vertical transport" following ACM2, I suppose that means boundary layer sub grid scale transport, not advection, not convection. If this paper is a description on software development, please be more specific.

Pg. 2420, line 16

What do you mean with " at the science process level" ?

Pg. 2420, line 23

Please add Skamarock 2008 to the WRF reference (you can leave Michalakes et al in there additionally)

Pg 2421, line 11

"may not be physically realistic". This statement is a bit harsh for this reviewer. You may want to use something like "errors maybe introduced" or such.

Pg 2422, line 4 "1-30km". You may want to add"1-30km, but WRF is also being used

on Large Eddy Simulation Scale (dx 100m or smaller) as well as on global scales" You can probably find references on the NCAR WEB.

Pg 2422, line 9

And "may" include turbulent. . ..

Pg. 2424, line 23 What numerical effects would you see on the WRF domain boundaries and not on the CMAQ domain boundaries? Why is there a difference?

Pg 2425

The RSL / RSL-LITE discussion is useless, since RSL-LITE is not used anymore in WRF (since years). If you are not using RSL for CMAQ then you should explain differences better if you want to make a point. This could also be an interesting part of the paper – if more detail and attention is given to it. What does using a coupler do to parallel performance. The table 2 would be much more interesting if a comparison would focus on parallel performance (not CAM versus RRTMG), maybe a difference to WRF could be shown (it can also be found on the NCAR WEBsite for the CONUS domain with 12km horizontal resolution !). A speedup of 2.3 when going from 32 to 128 processors on this type of domain is not very good. WRF scales much better, even with fewer computations in general. Where is the bottleneck, and can it be improved. Is the coupler the issue, or is the CMAQ parallelization deficient.

Pg 2429, line 19

Those scaling numbers do not look good to this reviewer. (also Pg 2434, line 27)

Pg 2430, paragraph 1

Needs more info on what is done in CMAQ. What physics are diferent, what info is used from

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Interactive comment on Geosci. Model Dev. Discuss., 4, 2417, 2011.