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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Regional air-quality forecasting for the Pacific Northwest using MOPITT/TERRA assimilated carbon monoxide MOZART-4 forecasts as a near real-time boundary condition" *by* F. L. Herron-Thorpe et al.

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(1) A discussion could be included to explain AIRPACT-3's treatment of layer-collapsing from WRF's vertical structure to CMAQ's 21 variable vertical layers. It can help the reader to appreciate the stringent mass consistency accuracy of chemical transport models (e.g. Byun 1999; Young et al. 2009)

The reviewer raised two important points here: 1) vertical layer collapsing; and 2) mass consistency. These two are related sometimes, but not always–mass consistency can

be an issue even without layer collapsing. Young et al (2009) that the referee cited cannot be used because it refers to newer versions of CMAQ than what's used by AIRPACT-3. For our simulations, we use the "denrate" advection scheme of Byun (1999), which ensures mass consistency by normalizing the concentrations by the ratio of the CMAQ advected density to that of the MCIP. According to Otte and Pleim (2010), "Layer collapsing will ensure mass conservation only when a CTM layer is comprised of no more than two meteorological model layers and when the layer interfaces of the CTM layers are coincident with layer interfaces from the meteorological model's vertical structure." In our simulations, 38 WRF vertical layers were interpolated to the 21 CMAQ vertical layers, with minimal layer collapsing from the surface to ∼700 mb and collapsing of three WRF layers per AIRPACT-3 layers above ∼ 700 mb, with the CMAQ vertical layers coincident with the WRF vertical levels.

We modified the text to reflect this discussion: "The 38 layers provided in these meteorological fields were interpolated to the 21 vertical layers used by AIRPACT-3, with minimal layer collapsing from the surface to ∼700 mb and collapsing of three WRF layers per AIRPACT-3 layer above ∼ 700 mb. The AIRPACT-3 vertical levels are coincident with the WRF levels to help ensure reasonable mass conservation (Otte and Pleim, 2010)."

(2) A stipulation of having achieved the 4 overall goals mentioned at the end of Section 1 may be more conspicuously written in the same enumerated order in the "Conclusion" section.

We have changed the order of the conclusion statements as suggested.

References: Byun, D. W. (1999), Dynamically Consistent Formulations in Meteorological and Air Quality Models for Multiscale Atmospheric Studies. Part II: Mass Conservation Issues, Journal of the Atmospheric Sciences, 56(21), 3808–3820, doi:10.1175/1520-0469(1999)056<3808:DCFIMA>2.0.CO;2. Otte, T. L., and J. E. Pleim (2010), The Meteorology-Chemistry Interface Processor (MCIP) for the CMAQ

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modeling system: updates through MCIPv3.4.1, Geoscientific Model Development, 3, 243–256, doi:10.5194/gmd-3-243-2010. Young J., J. Pleim J., R, Mathur (2009), Mass consistency improvement in CMAQ advection, 8th Annual Community Modeling and Analysis Conference, Chapel Hill October 19-21, 2009

Please also note the supplement to this comment:
http://www.atmos-chem-phys-discuss.net/12/C2164/2012/acpd-12-C2164-2012-supplement.zip

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Interactive comment on Atmos. Chem. Phys. Discuss., 12, 3695, 2012.