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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Differences between downscaling with spectral and grid nudging using WRF" *by* P. Liu et al.

Anonymous Referee #2

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The paper reports findings in using the WRF model to perform regional climate simulations with two different nudging methods, a skill to further exert large-scale influence into regional model integrations besides using these data as boundary conditions. The large-scale data field adopted is NCAR-NCEP reanalysis data. In order to evaluate the small-scale performance of the model, the high-resolution NARR data set was also used. Four month-long cases in different seasons have been tested. A conclusion is reached that using the spectral nudging would offer a better balance between modeled large-scale and fine-scale features than grid nudging. The topic is definitely good for ACP and the reported findings should be informative to the community of both atmospheric chemistry and regional climate. The paper is also relatively well written except for a few points to be commented below.

The authors discussed the spectral versus grid nudging. However, to make the case more complete perhaps they could describe the no-nudging results as well. Another missing information is the procedure in performing both temporal and spatial average to derive Table 1 and 2, and related results. Are these temporal means and standard deviations of domain averages, or otherwise? If it is the former, perhaps the spatial distributions of monthly mean or alike should be provided (similar to Figure 4).

In Page 1195, first 6 lines (the last paragraph of Section 2), the authors described to which variables the nudging had been applied. They might want to further indicate whether these decisions are made based on previous study (with reference) or not. Curious about nudging on pressure field, the geopotential field is nudged in spectral nudging, not in grid nudging, could this affect the model performance?

It was described in Page 1196 Line 22 that the NCEP/NCAR data was interpolated into WRF's fine-resolution grids, what is the interpolation method? In the next page it was mentioned that these interpolated data would be aggregated again back to coarse resolution for large-scale comparison. Is this really necessary? Can the field back to 2.5x2.5 degree converge to the original field? It seems that only a linear interpolation could reach this but the linear interpolation would not create an ideal fine-resolution field.

Page 1197, the second paragraph generally discusses how to use the consistency between NARR and NCEP/NCAR data in large-scale and small-scale to judge the model's performance. However, the consistency between these two datasets at least in small scale seems irrelevant to the issue. A direct evaluation using NARR and WRF fine-resolution results should be sufficient for the small-scale features.

The comparison of modeled convective cloud and accumulated precipitation is discussed in the second paragraph in p.1200. The authors made a conclusion that spectral nudging provided better results on both variables in the compared case. It appears not so simple at least for precipitation. Over east costal land area, while both the spec-

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tral and grid nudging overestimated precipitation comparing to NARR data, the grid nudging seems doing so to a much lesser extent. By the way, both variables reflect the model performance in handling subgrid scale processes. The authors might want to discuss further the reason behind this result, e.g., why KE nudging in certain method could affect subgrid scale convection and precipitation more effectively, assuming the same convective parameterization along with other relevant schemes were used.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 1191, 2012.