Atmos. Chem. Phys. Discuss., 11, C14686–C14689, 2012
www.atmos-chem-phys-discuss.net/11/C14686/2012/

Atmospheric Chemistry and Physics Discussions

ACPD

11, C14686–C14689, 2012

Interactive Comment

Interactive comment on "Some issues in uncertainty quantification and parameter tuning: a case study of convective parameterization scheme in the WRF regional climate model" *by* B. Yang et al.

Anonymous Referee #2

Received and published: 25 January 2012

Summary:

This study applies a novel approach to understand the sensitivity of regional climate simulations to input parameters of the model parameterizations schemes. Specifically, simulations with the Weather Research and Forecasting (WRF) model over the Southern Great Plains region are examined in their sensitivity to five key input parameters to the Kain-Fritsch convection scheme. One product of this sensitivity study is identification of an optimal combination of input parameters. This combination optimal for one region is then shown to also improve simulations in another climate regime and at

another model grid spacing, thereby identifying a more robust set of input parameters than currently used in the default version.

The technique to efficiently sample input parameters is both novel, valid and will be of interest to the wider weather and climate modeling community as a tool that allows for a comprehensive exploration of uncertainty. This study provides new insights into the important topic of understanding of uncertainty and given the popularity of the WRF model for regional climate modeling, this paper provides an important contribution. The subject matter is appropriate for Atmospheric Chemistry and Physics and is worth being published.

The paper is well written. The abstract can be understood without reading the paper first, and summarizes the main results. The introduction includes a comprehensive review of previously published work that provides motivation for this study. The methodology is sound. The final section includes some discussion of the wider implications of the results, in particular for multi-scale modeling. I recommend this paper for publication after some comments (detailed below) have been addressed. These comments can by addressed by including brief discussions on likely outcomes, rather than performing additional experiments which are beyond the scope of the paper.

Specific Comments

1) Make it clear to the reader whether the goal of the study is to produce the 'best' simulation or to understand uncertainty. Perhaps the latter is the goal and the former is a product of the technique?

2) As stated in the manuscript, it will be interesting to apply the MVFSA to other climate regimes. It is perhaps a little premature to generally conclude that MVFSA results are transferable across processes, given that the two climate regimes considered were both convection-dominated regimes. In addition, the default parameter set resulted in positive precipitation bias in both these regimes. It will be useful to include a brief discussion on the likelihood of the MVFSA result performing similarly well in a regime

ACPD

11, C14686–C14689, 2012

Interactive Comment

with a low precipitation bias when using the default parameter set.

3) Mention briefly the expected impact of observational uncertainty on your technique and results.

4) Five key input parameters to the Kain-Fritsch convection scheme are considered. Is there any objective guidance on the a priori choice of input parameters to examine? A related question is how to decide the range of values to examine. Figure 4 (top) suggests that there may be even greater improvement for values of Pd and Pe beyond the selected range.

5) An important result of the study is that the optimal combination of input parameters at one horizontal grid spacing also improves the simulation at another horizontal grid spacing. Given that aspects of the convection scheme are sensitive to the vertical profile, what is the likelihood that the optimal combination will also work well across different vertical resolutions?

6) It is clear that the optimal parameter set will depend on the variable used to assess skill. This study uses precipitation, which is inherently noisy and provides a hard test of the method. Please discuss the likelihood that using wind or geopotential height would result in more robust parameter sets.

7) An interesting result of the paper is that reduction of precipitation intensity biases also improves the spatial pattern of precipitation. This should be emphasized.

8) Figures 8 and 9 show the impact of the optimal parameter set on other variables but are the changes in the right direction i.e. closer to the observations?

9) I recommend citing a similar study that looks at efficient sampling of input parameters. How does the MVFSA compare to the approach used in this study?:

Hacker, J. P., S.-Y. Ha, C. Snyder, J. Berner, F. A. Eckel, M. Pocernich, J. Schramm and X. Wang, 2011: The U.S. Air Force Weather Agency's mesoscale ensemble: Scientific description and performance results. Tellus , 63 , 625-641. doi: 10.1111/j.1600-

ACPD

11, C14686–C14689, 2012

0870.2010.00497.

10) In Eqn (4), model biases are assumed to be spatially and temporally uncorrelated. Is the likely violation of this assumption acceptable?

11) Is the impact of going from 25 km to 12 km grid spacing (both using the default input parameters) a bigger improvement than going from 25 km with default parameters to 25 km using optimal parameters? It is beyond the scope of the current paper but it would be interesting to run MVFSA on both resolutions to look at the differences in parameter PDFs.

Typing Errors: 1) Section 3.4, line 7. Change ‘compute intensive’ to ‘computationally intensive’.

2) Page 31792, line 20. Change ‘has investigated’ to ‘has been investigated’.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 31769, 2011.

ACPD

11, C14686–C14689, 2012

Interactive Comment