Geosci. Model Dev. Discuss.,
https://doi.org/10.5194/gmd-2018-257-RC1, 2019

Geoscientific Model Development Discussions

Interactive comment on "Use an idealized protocol to assess the nesting procedure in regional climate modelling" *by* Shan Li et al.

Anonymous Referee #1

Received and published: 12 January 2019

I have read this paper several times and I cannot determine from the manuscript whether the authors have used Newtonian relaxation around the perimeter of the RCM domain (ie Davies 1976) or in its interior (eg von Storch et al. 2000). Neither the model description nor the experimental design discussion helps clarify this issue. For example, the authors state "RCM is of constrained modeling with nudging applied at the lateral boundaries" (pg 2,lines 6-7), which makes it seem like they are employing the standard Davies approach. However, in the very next sentence the authors state, "Nudging is a simple operation that can be realized by adding a "Newtonian relaxation" in the dynamical equations governing the evolution of wind, temperature and humidity (Drobinski, 2015)." (pg 2, lines 7-8). The reference to Drobinski (2015) would seem to indicate that they are using Newtonian relaxation "everywhere" in the interior of the

RCM domain as this was the central point of discussion in that earlier study.

Clarity on this issue is central to the current study. I would ask that the authors revise their paper indicating more clearly the details of their model configuration and their experimental design. In doing this they also need to indicate, the temporal resolution of the "GCM" driving data and its potential influence on their results; the nature of the blending region (ie the Davies type nudging that is specified around the perimeter of the RCM domain) including its width, profile of strength, and the variables nudge in this region.

Additionally, if the authors are driving the RCM with 6hr GCM forcing (it is not stated), which is most common (ie CMIP5/CORDEX), they need to explain why they feel it is appropriate to nudge the RCM with tau=1.5hr. The instantaneous (6hr) snapshots of GCM winds and temperatures are solutions to both the GCM and RCM governing equations. These GCM forcing fields, however, must be interpolated down to the time step of the RCM. Such interpolated fields "are not" solutions of the GCM/RCM. Forcing the model strongly towards these interpolated fields (ie by using a value of tau well below the 6hr GCM update frequency) would force winds and temperatures into the RCM that are not solutions (ie unbalanced on the largest scales). This would excite gravity waves and produce variance structure, which is presumably captured in the authors analysis. Ideally, the value of tau should be longer than the time that the GCM driving data is updated (eg 6hr).

For these reasons I recommend major revision of this paper prior to me being able to provide a review.

References ———-

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