

Interactive comment on “A spectral nudging method for the ACCESS1.3 atmospheric model” **by P. Uhe and M. Thatcher**

Anonymous Referee #2

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1 General Comments

This paper describes the implementation of the spectral nudging method described in Thatcher & McGregor (2009) to the ACCESS1.3 model (which uses the Met Office Unified Model v7.3 as its atmospheric GCM). This development makes use of the code existing from the work by Telford *et al* (2008) which implemented a Newtonian relaxation nudging method at an earlier Unified Model version. ERA-Interim reanalysis is used to drive the model. The experimental design is sound, and the technique, which allows for variations in the length scale of the nudging, is desirable in a model such as the UM.

The paper is well written and has an appropriate number of references. The various
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methods of nudging (occasionally known as "specified dynamics") are also concisely explained and clear, and the reasoning for the use of a 1D filter to approximate a 2D filter is sound. However, the use of 500hPa air temperature as the only evaluation variable is not sufficient and the results section should be greatly expanded to present results from a number of variables. It is important that the variables include those which are directly affected by the nudging, and others (such as mean sea-level pressure or precipitation) which are not.

Thatcher and McGregor presented analysis of 5 variables (surface pressure, mean sea-level pressure, zonal wind, meridional wind, and air temperature), mainly presented in tables or as a change in the variable with time. Telford *et al* examined 6 (potential temperature, zonal wind, vertical wind, surface pressure, precipitation, and specific humidity) presented these as a mixture of tables, column plots, lat/long plots, and zonal-mean plots.

The model set up here is similar to Telford *et al*, where a set year-long integrations are performed. In Telford *et al* data was presented for October, January, and July, rather than as annual means. Given the similarity between this study and Telford *et al* (in terms of the model set up) I am surprised that a more detailed analysis similar to that presented in Telford *et al* was not performed.

Major revisions to the analysis section are required before this paper is suitable for publication in GMD.

2 Specific Comments

p 6682, line 10/p. 6686, line 20: while the behaviour of α is defined for the lower part of the atmosphere (near the boundary layer), what is not defined is how α is changed near the top of the atmosphere. The top panel from Figure 1 of Telford *et al* (nudging cut-off at level 50) would not apply here as ACCESS1.3 is in a 38-level configuration.

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Does the nudging occur all the way to the top of the model?

p 6682, line 19: As the model description section does come until 2.4, it is unclear why the reanalysis resolution has been changed to $1.875^\circ \times 1.25^\circ$ until we learn that it is an N96 model (as compared to the $N48/3.75^\circ \times 2.5^\circ$ model used by Telford et al).

p 6701, Figure 4: It is clear from this figure that there is a spin-up period of around 5-10 days or so. It is unclear if this spin-up period is also included in the other plots, which are all annual means. This could have an effect on these results. It would have been better to have performed a 13-month simulation and only used the final 12 months, or to take the approach of Telford *et al* and focus on specific months.

p 6691, section 3.4 (Nudging period): I would suggest that this section should come before the preceding results sections, as it explains why the choice of 1-hour ("hard nudging") has been used throughout this paper (whereas e.g. Telford *et al* used 6-hour "soft nudging").

3 Technical Corrections

p. 6680, line 8: This should probably be "University of Cambridge, U.K."

4 References

Marcus Thatcher and John L. McGregor: Using a Scale-Selective Filter for Dynamical Downscaling with the Conformal Cubic Atmospheric Model. *Mon. Wea. Rev.*, **137**, 1742–1752 (2009). doi: <http://dx.doi.org/10.1175/2008MWR2599.1>

Telford, P. J., Braesicke, P., Morgenstern, O., and Pyle, J. A.: Technical Note: Description and assessment of a nudged version of the new dynamics Unified Model, *Atmos.*

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