Geosci. Model Dev. Discuss.,
doi:10.5194/gmd-2016-31-AC3, 2016

Geoscientific Model Development Discussions
Open Access
EGU

Interactive comment on "Numerical framework and performance of the new multiple phase cloud microphysics scheme in RegCM4.5: precipitation, cloud microphysics and cloud radiative effects" *by* Rita Nogherotto et al.

Rita Nogherotto et al.

rnoghero@ictp.it

Received and published: 7 June 2016

First, we would like to thank all the reviewers for their careful reviews and constructive comments, which helped to improve the quality and clarity of the paper.

Anonymous Referee #3

The paper introduces a needed update to the moist physics in the RegCM4 community regional climate model, namely the inclusion of ice phase microphysics. Given the wide use of RegCM4 it is likely that this paper will be heavily referenced. The paper is well written and there are only a few minor changes needed to clarify and strengthen it.

Printer-friendly version

Discussion paper

1. There are many microphysical schemes in existence, some of which are more detailed than the scheme here and some less. It would be appropriate to discuss briefly the rationale for choosing this particular scheme for inclusion in RegCM4 compared to other options.

Essentially, we chose this particular microphysics scheme because of its robust fully implicit numerical framework that allows the use of longer timesteps and because it is based on the scheme used and widely tested in the ECMWF IFS forecasting system. This clarification is specified in the text in lines 105-109.

2. At line 68: Is there no rainwater evaporation in SUBEX?

Yes, SUBEX treats the rainwater evaporation, but being diagnostic it is considered to have an infinite fall speed and can not be advected.

3. Are any of the parameters in the new scheme known or suspected to be sensitive to grid spacing? Intuitively it would seem that some of the parameters (such as those in Equation 5) should approach limiting values for very small grid volumes and as such their most appropriate values could vary with grid spacing.

This comment is well taken. We have not yet carried out a full sensitivity analysis to model resolution, in particular for very high resolutions, which is in fact planned as the next step.

4. Line 195, "condensate" should be "condense."

Done.

5. The RHS of equation (12) simply works out to D, since alpha + (1-alpha) = 1. This does not seem correct. Are there missing subscripts or other corrections needed?

We thank the reviewer for the comment: there was a mistake in the equation, now corrected as follows:

$(\partial q\_x)/\partial t=\alpha(T)D\_x$

6. Line 205, regarding the four different autoconversion parameterizations: Are these user-selectable, or are different parameterizations invoked automatically by the scheme depending on the physical conditions?

The autoconversion parameterizations can be selected by the user. dded in the text: " The four parameterizations of autoconversion in the scheme, which can be selected by the user, employ different threshold functions: an “all-or-nothing” approach, described in ..."

7. Equation (14), the species for which ql and qcrit apply should be clarified. Typically the rate on the LHS applies to precipitation and the humidity on the right-hand side is cloud water, but this equation has ql on both the LHS and RHS implying a positive feedback (which seems unusual).

Done.

8. Line 244, The reference on IFS documentation does not appear in the list of references, or at least not under that title. Please give sufficient bibliographic information so that the reader can access this document.

We added in the text: " For a more detailed description of the parameterization of microphysical processes we refer the reader to the IFS Documentation, Cy40r1, Part IV: Physical Processes (online at https://software.ecmwf.int/wiki/display/IFS/Official+IFS+Documentation)."

Interactive comment on Geosci. Model Dev. Discuss., doi:10.5194/gmd-2016-31, 2016.

Printer-friendly version

Discussion paper