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Interactive comment on "Analyzing numerics of bulk microphysics schemes in Community models: warm rain processes" *by* I. Sednev and S. Menon

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We would like to thank all referees for reviewing our paper entitled "Analyzing numerics of bulk microphysics schemes in Community models: Warm rain processes".

The need for refereed papers that discuss numerics and stability of finite-difference schemes used in the different components of Community models becomes evident because of a lack of relevant publications on this topic over two decades. For example, numerics used in bulk microphysics schemes in atmospheric models of different scales was out of the focus of modeling community for many years. Our paper is the first attempt to draw attention to the problem.

While working on the paper we carefully analyzed the source of FORTRAN codes for numerous bulk microphysics schemes implemented in WRF and CAM models. This analysis makes our paper very different from other papers on bulk microphysics that usually provide a description of a new scheme or an improvement to an existing one as well as comparison of results from an "old" and "improved" schemes. As our analysis of the source codes shows, these codes very often rely on assumptions whose mathematical and physical meanings have never been publicly discussed. Moreover, stability of finite-difference schemes in bulk microphysics has been occasionally analyzed in detail in refereed papers.

Using "reverse engineering" (e.g. translating the source code lines into corresponding finite-difference equations), we reveal that the codes under consideration use an explicit Eulerian time integration framework to advance governing microphysical differential equations. In our paper we provide a proof of an existence of a unique positive-definite stable numerical solution in an explicit Eulerian time integration framework. We also derive a general analytical condition that determines existence of this solution and that remains valid regardless of parameterizations for warm rain processes used in BLK schemes under consideration in an explicit Eulerian time integration framework. The theoretical nature of our paper implies the need to consider different types of equations and mathematical notations. All this makes a perception of the content our paper and its presentation style questionable for a few of the reviewers who appear to not be familiar with many of the standard concepts used in finite-difference schemes.

We carefully analyzed all comments even though a few of these comments are outside the scope of our paper or unjustified. We answered in detail all Referee Comments and Short Comments. We have revised the abstract as suggested by one of the reviewers. We have also accepted a few referees' suggestions, and it led to improvements in the presentation style of our paper. At the same time, we disagree with numerous reviewers' comments that rely on the so called "" technique, whose quintessence, in contrary to our analysis, is an extrapolation of an existence of a numerical positive

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solution to a time interval where this solution does not exist. In our revised paper we try to differentiate the relevance of each subsection more clearly as requested.

In summary, we have revised our paper taking into account relevant reviewers' concerns, and we hope the revised paper, edited for grammatically correct English and conciseness, is suitable for GMD.

Interactive comment on Geosci. Model Dev. Discuss., 4, 1403, 2011.