Response to Reviewer 2

Thank you very much for your prompt and insightful review. We have carefully considered your suggestions and implemented further revisions to the manuscript. Which has significantly improved the quality of the manuscript. We have revised the manuscript according to your suggestions and will respond to your comments paragraph by paragraph. The comments are given below in black, our responses are in blue, and proposed changes to the manuscript are in red. Additional references are provided at the end of this document. The final revisions and specific locations corresponding to the manuscript will be marked uniformly after receiving feedback from other reviewers.

Response to Point 1:

The calculation method used in this paper is based on the method of Møller, O. (1965)., which appears relatively simple. If the authors can find similar studies that employ this "quasi double-precision" method for simulating atmospheric variables, it could demonstrate the advancement of this paper compared to existing research. Chen et al. (2024) and Vánˇa et al. (2016) did not use this method. If no similar studies are found, it could be stated that this paper is the first to do so, which could enhance its citation rate.

Thank you very much for your insightful comment. We greatly appreciate your valuable suggestion, which has significantly improved the manuscript. Following your suggestion, we have added a statement highlighting this novel application in both the “Introduction” and “Conclusion and Discussion” sections of the manuscript. We believe this addition provides important context for our work and clarifies its contribution to the field.

Introduction

The method of Moller (Quasi double-precision) has primarily been applied to the time integration of ordinary differential equations, as demonstrated in studies such as Thompson et al. (1970), Tomonori et al. (1995), and Dmitruk et al. (2023). The application of the Moller method to a realistic numerical model, as presented in this study, represents a novel contribution to the field, with no prior research exploring this specific implementation.

Conclusion and discussion

Although the Moller method (Quasi double-precision) has been extensively employed for the temporal integration of ordinary differential equations, its application within the context of realistic numerical models remains unexplored. This study addresses this gap by presenting a novel implementation of the Moller method, thereby expanding its scope and potential impact within the field.

Response to Point 3:

Regarding equations (6)-(9), it is suggested to select only one equation and present it in the form of Figure 2. This could be included as an appendix to specifically demonstrate the iterative calculation process. Because the pseudo-code in Fig. 3 is not sufficient to clearly explain the calculation process.

Thank you very much for your valuable suggestion. We appreciate your feedback and agree that providing an algorithmic description of the iterative process for one of the equations would enhance the clarity of our work. As your recommendation, we will select a representative equation and include a detailed algorithmic description of its iterative calculation process in the Supplement (see Figure 1). We believe this addition will be beneficial for readers who wish to gain a deeper understanding of the computational aspects of our method.

Supplement:

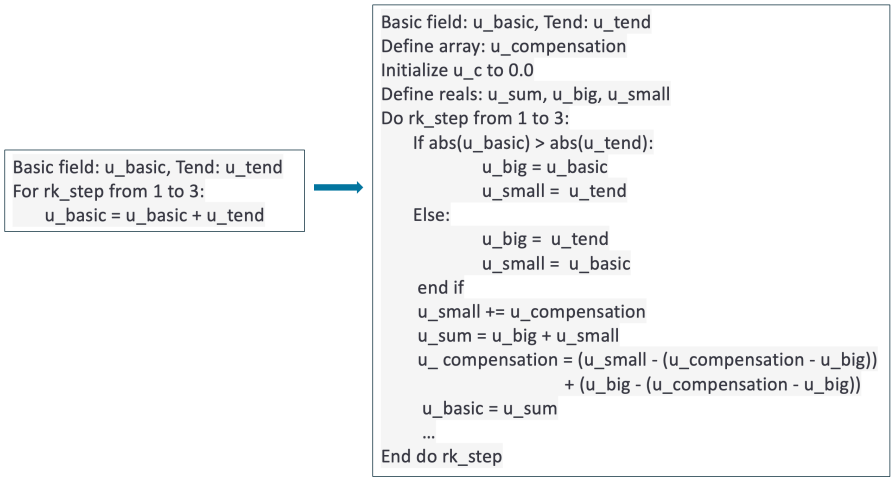

Figure 1. The pseudo-code for variable of U.

Response to Point 5:

If the authors intend to replace the existing Figures 4, 6, and 8 (in the manuscript) with these updated versions (Figures 4, 5, and 6), feedback from other editors and reviewers regarding the revised structure of the paper should be considered.

Thank you very much for your valuable suggestion. I appreciate your careful attention to detail. I will ensure that I obtain the consent of each reviewer and the editor before proceeding with the replacement of the figures, as you recommended.

The new figures:

There are several cases where figure legends and lines overlap, such as in Figure 3 in the review response.

Thank you very much for your valuable suggestion. We have completed the revisions as you recommended. The updated figures are as follows: Figure 2 (corresponding to Figure 3 in RC1) and Figure 3 (corresponding to Figure 5 in RC1).

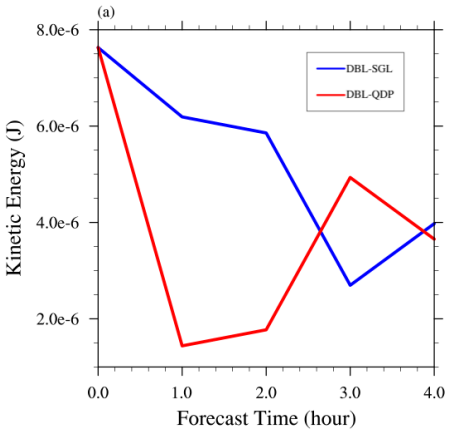

Figure 2. The temporal evolution of spatially averaged difference of kinetic energy between DBL and SGL, as well as difference between DBL and QDP in case of super-cell.

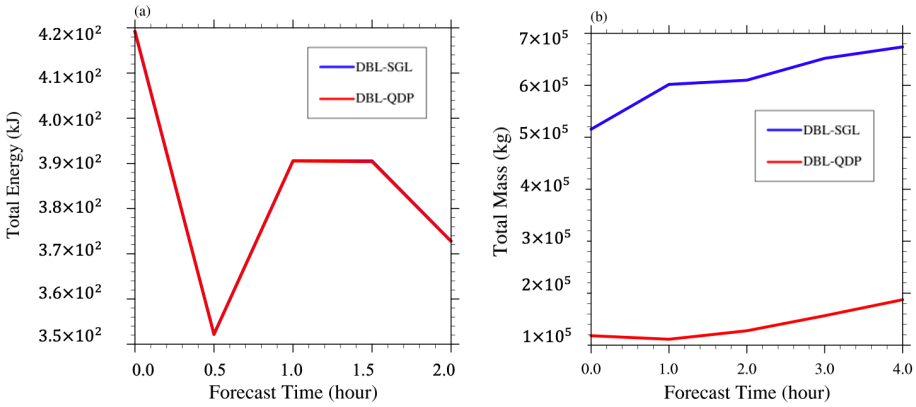

Figure 3. The temporal evolution of spatially averaged difference of (a) total energy, (b) total mass between DBL and SGL, as well as difference between DBL and QDP in case of super-cell.

Thompson., Robert, J.:Improving round-off in Runge-Kutta computations with Gill's method, Communications of the Acm, 13(12):739- 740.DOI:10.1145/362814.362823, 1970.

Tomonori, Kouya., Hideko, Nagasaka.: On the correction method of round-off errors in the Yang's Runge-Kutta method, The Japan Society for Industrial and Applied Methematics, 1995.

Dmitruk, B., Przemysaw, Stpiczyn´ski.:Improving accuracy of summation using parallel vectorized Kahan's and Gill-Mller algorithms, Con- currency and Computation: Practice and Experience, doi:10.1002/cpe.7763, 2023.