This work extends the research conducted by Mortezazadeh and Wang in 2017. In this study, the sweep method is further validated through a series of idealized tests, including 2D vortex simulations and Hadley-like meridional circulation, as well as an Atmospheric methane-like tracer test and global model forecasts. This manuscript demonstrates that the sweep method can significantly reduce computational costs by approximately 15% without compromising accuracy. This improvement is achieved by implementing two 3rd-order backward and forward polynomial interpolation schemes over two consecutive time steps, as opposed to using a 4th-order interpolation method. The results presented in this manuscript are intriguing and robust, supporting its acceptance for publication with only minor revisions.

We would like to extend our sincere thanks to the reviewer for the positive and insightful comments regarding our manuscript. We are pleased that the reviewer acknowledges the extension and validation of our work.

1. In Figure 3(b) and 4(b), the black dotted line represents the mass error after every two time steps. To enhance clarity, consider changing the label from "Error after two time steps" to "Error every two time steps."

   Thanks for the comment. We have replaced "Error after two time steps" with "Error every two time steps" in the revised manuscript.

2. It is essential to delve into the motivation behind and the conclusions drawn from the 2D vortex tests. Further discussions are warranted to provide a comprehensive understanding of their significance.

   Here to clarify the main motivation behind using the 2D case has been explained and added to the paper (page 7):

   “The main reason of choosing the 2D case was showing the oscillation in the mass error for sweep interpolation. In this case, the oscillation is obvious and helps explain the behavior of sweep interpolation. The same behavior has been seen in the other test cases (see next sections). For this case, the normalized infinity norm error ($E_\infty = \frac{\max|cubic - sweep|}{\max|cubic|}$)=0.001.”

   Further explanation about this case has been provided into the next comment.

3. Figure 3a illustrates that the error distribution of the 2D vortex simulations is less noisy outside the vortex region when using the sweep method. Is this observed reduction in noise attributed to the method's capability to minimize

dispersion and dissipation errors? Additional clarification on this matter would be beneficial.

As we discussed in Section 3.4, we did observe an improvement in bias error when utilizing the sweep interpolation method. One plausible explanation for the observed reduction in noise, particularly outside the vortex region in Figure 3a, is that lower order Lagrange interpolations, as employed in the sweep method, tend to generate fewer oscillation and dispersion errors. While this is a plausible explanation, we must acknowledge that confirming this hypothesis would require further in-depth investigation, which falls beyond the scope of the current paper. We intend to explore this in our future research endeavors.

To provide greater clarity, we have incorporated the following explanation into the manuscript:
"Figure 3(a) shows that the error distribution associated with the sweep interpolation is less noisy compared with the cubic interpolation error, especially outside the vortex region, which could be explained by the fact that the lower order Lagrange interpolation used in the sweep algorithm generates less spurious oscillations compared to the standard cubic interpolation."

4. Section 3.3, pertaining to the Atmospheric methane-like tracer experiment, lacks a clear description of the experiment's design. While information on resolution and time steps is provided, it would be beneficial to include more detailed descriptions.

   We appreciate reviewer's feedback. In this specific experiment, there are no physics or chemical production and sinks, which is why there are limited additional details to provide. For improved clarity, we have updated the section to include the following description:

   "In this test case, we compare 48-hour forecasts of atmospheric methane (CH4) like passive tracer (without chemical productions and sinks) using sweep interpolation and cubic interpolation. These experiments were performed with the global version of GEM NWP model using a 30-minute time step and 105 [km] horizontal resolution resulting in a maximal courant number of 4.7. The height of the model top was chosen to be at 0.1 hPa and 84 vertical levels were used. The vertical grid resolution is non-uniform as a result of the choice of vertical coordinate which is based on the logarithm of the hydrostatic pressure (Husain et al., 2020). The methane-like experiment was initialized from a climatology based on a multi-year simulation performed with the GEM model. The model employs a simplified approach, in which methane production and loss are predetermined based on present-day conditions (Prather et al., 2012). Figure 5(a) presents meridional cross sections of CH4 at the end of day 1. Solutions from both interpolators look qualitatively the same, and the sweep interpolation provides acceptable results in comparison with cubic interpolation. Figure 5(b) shows the mass error over 24 hours. It shows that both cubic and sweep interpolations could control the error and keep its range below 0.005% after 48 time steps of simulation. Here, the normalized infinity norm error is $E_{\infty} = 0.018$."