Dear Reviewer, thank you for finding time to read our article and present your comments that helped to improve the manuscript. Please find our responses below.

Author responses to Reviewer 2 comments

Major Comments:

Section 2 describes the governing equations. The paper relies to some degree on reader's familiarity with the particular approach followed in SL-AV. For this reason this section needs few modifications to improve its clarity. In particular:

1. Eq (1). It is mentioned that it is derived by applying $k\cdot\nabla\times$ to the momentum equations. I think that it would be better to start from (and explicitly write) the original form of momentum equations that give Eq (1). This must be Eq (3). In this case lines 5-10 need some re-arrangement so that description evolves from the simpler to the more complex form. It is not very clear where the coefficient $B(\eta)p_s$ /$(A(\eta)p_0 + B(\eta)p_s)$ comes from and would be helpful to guide the reader on this. I wonder if the Rochas, 1990 reference is available through a web-link? If that is so please provide it.

Answer: We introduced the requested changes in Sect. 1 (see Eq. 1 and disscussion next to it in the revised manuscript). Unfortunately, we cannot find ref. Rochas, 1990 through the web. However, it seems that Temperton, 1997 repeated the principal information from Rochas, 1990, so we include this link in the revised manuscript.

2. Please add some information on how you derived Eq (6). I assume that this equation is the analogue of Eq (15) of McDonald and Haugen 1993 if you consider T_v?

Answer: The information on derivation of thermodynamic equation for T_v is added in the revised manuscript (please see discussion before Eq. 6).

3. Continuity equation (8). Please explain how is this derived from original Eq (2) of McDonald and Haugen 1993 or any other form you may have considered.

Answer: Done, please see Eqs. 8,9 of the revised manuscript and theirs discussion.

In the topics of implementation and numerical experiments I have the following questions/comments:

1. Please comment somewhere in the paper on the efficiency/scalability of their proposed approach compared with other similar hydrostatic spectral semi-Lagrangian approaches on reduced Gaussian grids where transpositions are also necessary for the Fourier/Legendre transforms.

Answer: The following comment is added at the end of Sect. 8 of revised manuscript.

2. For the experiments in section 9, the timestep used is 1200s reduced by a resolution depending factor c as the resolution increases. What is the maximum CFL in these experiments? Given that SISL timestepping is used the model should be able to run stably at max CFL larger than 1 (e.g. 5) without loss of accuracy.

Answer: We followed the recommendation of (Jablonowski and Williamson 2006) to test the model in its operational configuration. However, the time-step values consistent with operational practice in the presented idealized test lead to only moderate advective CFL numbers, so we repeated the experiments with time-steps up to 3 times larger and obtained very similar results. The information on the large-time step experiments is included in the revised version of manuscript (Sect. 9.1, Sect. 9.2). Nevertheless, it should be mentioned that the magnitude of non-linear terms of discretized equations is the real stability challenge for SISL models, not the advective CFL. We believe that the magnitude of non-linear terms in J&W2006 test is similar to typical values for real troposphere, thus it is very hard to be stable in this experiment with time-step providing really amazing advective CFL of > 5.

3. Is there a standard verification comparison (e.g. 500hPa geopotential height RMSE / Anomaly Correlation Coefficient) between fixed and reduced SL-AV20 model on real forecast cases available? If such comparison exists I would recommend to include it to strengthen the validation part of the paper.

Answer: The current operational version of SL-AV20 does not use reduced grid. Unfortunately, there is no computer resources currently available to make necessary parallel runs for complete testing and tuning of reduced grid version (current HMCR resources are limited just to 50 Tflops peak) . So, we'd better not to build up on the individual forecasts results and leave the detailed comparison of regular and reduced grid configurations performance in real-flow forecasting to be the matter of future work . Anyway, next SLAV version will not be able to run properly without reduced grid.

Minor comments:

I think that the fact that this is a hydrostatic dynamical core should appear very early in the text and in the abstract.
1. Line 8: “test cases”
2. page 2, lines 4-5. I think that for “computational efficiency” we want to achieve a solution at a given accuracy at the shortest possible time for a given number of processors.
3. page 2, line 8: perhaps “few kilometers” is meant instead of “first kilometers”?
4. page 2, line 16: “cost” instead of “pattern”?
5. page 21, line 9: “deterministic”

Answer: All points are corrected, thank you very much.