

Steppeler, J., J. Li, F. Fang, and J. Zhu, 2021: The o2o3 Local Galerkin method using a differentiable flux representation. *J. Meteor. Soc. Japan*, **99**, <http://doi.org/10.2151/jmsj.2021-077>.

Plain Language Summary: Local Galerkin methods, in particular the spectral elements (SE) solve the difficulty in classic Galerkin methods for applying to multiprocessor system and have been found to be scalable up to millions of processors. The present study investigates improvements of SE under the name o2o3 which substitutes the irregular Gauss-Lobatto grid in SE by a regular collocation grid to compute Galerkin integrals with the potential to improve the computational efficiency and simplify the physical parameterization.

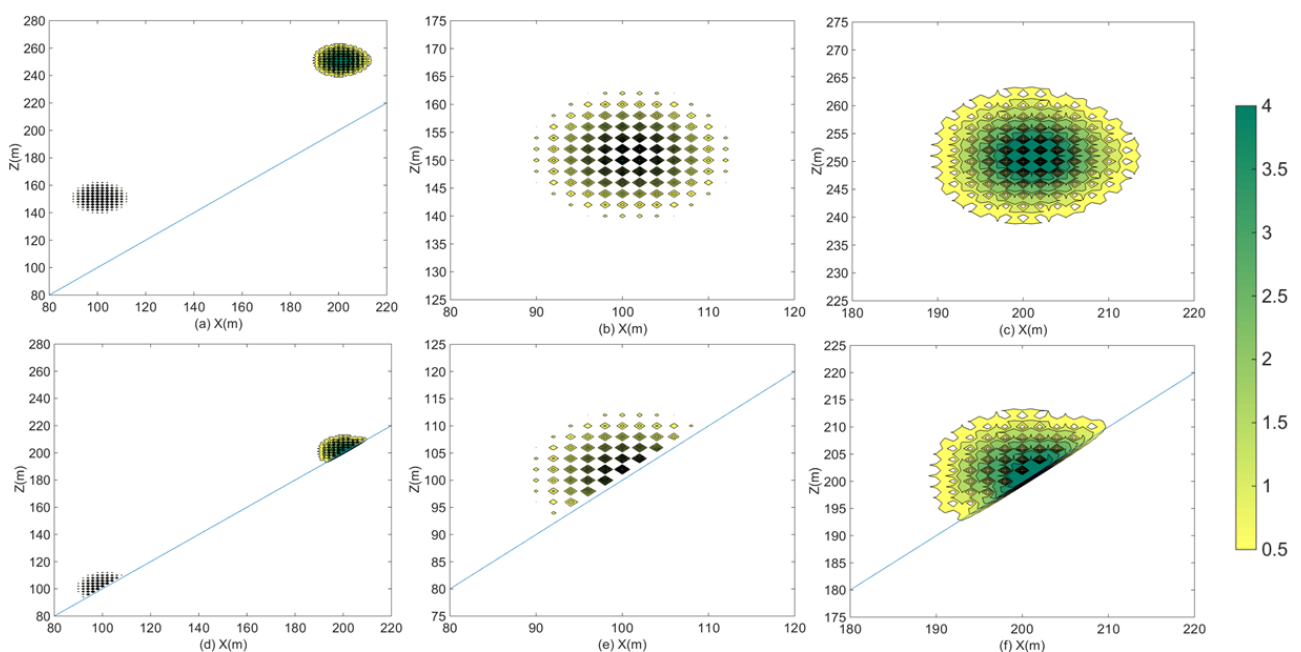


Figure 1. Advection along a mountain represented by a straight line. The left column shows the initial and forecasted field. The middle column is a magnified view of the initial field. The unused amplitudes of the sparse grid are unchanged. The right column is the forecasted field showing the grid sparseness. Strong noise patterns seen by some researches with cut cells are absent.

- The accuracy of o2o3 is comparable to that of third-order SE (SE3) as a result of the constructed superconvergence.
- Compared with SE3, o2o3 utilizes a regular grid enabling to use a larger time step with the potential to generate sparse grids and improve the computational efficiency even when parameterizing physical processes.
- o2o3 is suitable to formulate lower boundary conditions for irregular surfaces, thus allowing to formulate the high-order cut-cell approximation.