Solutions of 3-D coordinate surfaces of an orthogonal terrain-following coordinate and its preliminary 2-D advection experiments

Jinxi Li*[1], Yiyuan Li[1] and Bin Wang[1,2]

[1] State Key Laboratory of Numerical Modeling for Atmospheric Sciences and Geophysical Fluid Dynamics, Institute of Atmospheric Physics, Chinese Academy of Sciences, Beijing, China, 100029

[2] Ministry of Education Key Laboratory for Earth System Modeling, and Center for Earth System Science, Tsinghua University, Beijing, China, 100084

Abstract

An orthogonal terrain-following coordinate (OS coordinate) was taken by Li et al. (2013) to tackle the advection errors in the classic σ coordinate. A series of 2-D linear advection experiments using bell-shaped terrain had been implemented to analyze the effect of the OS coordinate of reducing the advection errors. In this study, we further investigate the OS coordinate. First, we give out the numerical solutions of the OS coordinate surfaces in 3-D and then we implement new advection experiments using wavelike terrain to analyze the OS coordinate tackling the steep terrain. Finally, we compare the results of advection tests using the OS coordinate and the associated hybrid σ coordinate to investigate the distinct impact of the “orthogonal grid” of the OS coordinate in terms of the advection errors. The experimental results show that the OS coordinate have better performance than the classic σ coordinate near steep terrain, and the orthogonal grid can reduce the advection errors.

*Corresponding author : ljx2311@outlook.com