18–22 September 2017, Pula, Croatia
ECSS2017-148

The role of vertical grid spacing in the simulation of storms

Jorge A. Martins (1), Ana F. G. Conceição (1), Leila D. Martins (1), Marcos V. B. Moraes (1), Thais Fujita (1), Anderson P. Rudke (1), Marília M. Eiras (1), Veronika S. Brand (2), Sameh A. A. Rafee (2), Ricardo Hallak (2), and Edmilson D. Freitas (2)

(1) Universidade Tecnológica Federal do Paraná, Londrina, PR, Brazil (jmartins@utfpr.edu.br), (2) Universidade de São Paulo, Instituto de Astronomia, Geofísica e Ciências Atmosféricas, Departamento de Ciências Atmosféricas, São Paulo, SP, Brazil

Physical parameterizations are very sensitivity to the resolution chosen for the simulation of storms. Particularly, the vertical resolution is crucial for the correct representation of the microphysical processes. Horizontal resolution can also contribute to a better representation of spatial distribution of developing cells. However, computational costs are very dependent upon both horizontal and vertical resolutions. In this work, numerical experiments were performed with BRAMS model in order to evaluate the performance of a new approach to distribute the spacing between adjacent layers. Traditionally, vertical grid spacing is assumed growing vertically at a constant ratio between the thicknesses of adjacent layers, usually set at about 1.1. In this work we adopted a vertical profile in which the layer thickness increased following two exponential functions, one starting at the ground and the other at about 7 km altitude. This proposed approach for vertical grid spacing structure has high vertical resolution near the ground, and maintains a good resolution above cloud base. With the purpose of testing the sensitivity with respect to the vertical grid spacing, a wet and hot bubble was activated without topography, wind or surface characteristics, emphasizing the cloud microphysical aspects. Several experiments with different number of vertical layers were tested in order to obtain the best possible description with the least number of vertical levels. The results showed that changes in the number of vertical layers do not produce different values in precipitation fields when the new approach is applied. Otherwise, in the traditional approach, the precipitation fields tend to show different values with changing number of vertical levels. In this case, only when a high number of vertical layers is used the results tend to be similar to the ones produced by new approach. The findings of this work suggest that important microphysical processes, such as cloud droplet activation, collision-coalescence growth, and production of secondary ice particles, depends critically on the vertical resolution of the model and are well represented by the proposed approach.