**Title:**

A 2-D framework for accelerating the development of physics schemes in high resolution global modeling

**Authors:**

Ryuji Yoshida, Takanobu Yamaguchi, and Graham Feingold (CIRES UCB, NOAA CSL)

**Abstract:**

It has been shown that an increase in both horizontal and vertical resolution can improve representation of low-level clouds in global models. However, an increase in resolution carries an enormous increase in the cost of computations and in output size. This becomes prohibitive in the model development stage because numerous tests are required to assess the performance of new schemes, and performance should be assessed in a similar domain and at similar resolution to the target simulations. We approach this problem by applying a 2-D Hadley circulation model that includes a large range of scale interactions, and resolves clouds – including low clouds – better than a single column model or coarse-grid global model. By neglecting the zonal extension, we can save computation time, and easily increase model resolution and the number of test cases. In a simulation using 8 km horizontal grid spacing with 128 vertical levels in a domain from the North- to the South-pole, a three-year integration can be carried out with only 300 node-hours on a supercomputer. The results show realistic features of the Hadley circulation. We have developed an offline domain-nesting tool to downscale simulations to a mesh approaching LES resolution (250 m). Lastly, implementation of a parallelized Framework for Improvement by Vertical Enhancement (FIVE; Yamaguchi et al. 2017) into this 2-D framework is being performed to improve vertical resolution and computational efficiency. We expect this 2-D framework to rapidly accelerate the development of physics schemes in climate models.

(242 words/ limit 250 words)