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Towards Compressed Super–Parameterization: Test of NAM–SCA under Single–Column GCM Configurations

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The NAM–SCA (nonhydrostatic anelastic model with segmentally–constant approximation) is a type of cloud–resolving model (CRM) with a highly–inhomogeneous distribution of finite volumes of highly varying sizes in a horizontal direction under a two–dimensional geometrical configuration. These finite–volume positions and sizes are dynamically adapted with time so that a best performance is achieved with a relatively limited number of finite volumes. The concept can be compared with "compression" techniques used for digital images. The physics are also limited only to a minimum microphysics.

The present paper reports implementation of NAM–SCA into a single column version of global atmospheric models as a *compressed super–parameterization*, and discusses various implementations. ECHAM and ACCESS are chosen as the host models. A stand–alone single–column model (SCM) is also developed, in which the other physics are prescribed by observations. A simple radiation scheme is also added as required.

Overall, it is found that, under this configuration, the lowest–resolution ($\Delta x = 16$ km) NAM–SCA with the smallest domain size ($L = 32$ km) often works the best. Neither increase of resolution or domain size does not lead to a better performance until both cross thresholds ($\Delta x \leq 1$ km, $L \geq 256$ km). The result suggest that even a simple parameterization (with a small degree of freedom) can perform in a reliable manner as long as it is constructed in physically consistent manner. Especially, the mesoscale organization is not necessarily a key for successful parameterization as long as only the domain–averaged outputs are in concern as the case for the standard parameterizations.