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Towards A compressed Super-Parameterization

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Representations of the physical processes in global models are not easy, because those processes are more than often of the scales not at all resolved by a model. Hence, needs for parameterizations arise, and that is exactly where the main difficulty resides.

In this respect, the question of the physical representations becomes much simpler if the resolution of a model is much higher thus these physical processes can be included into the model without parameterizations. That is the main idea of the super-parameterization proposed by W. W. Grabowski et al., and the idea is more fully realized as a global-scale cloud-resolving modelling at Japanese Earth Simulator. However huge computer resources are required for such approaches.

The author has been working on the model that bridges a gap between the cloud-resolving model (CRM) and parameterizations over last two years. It applies a segmentally-constant approximation (SCA) on the standard CRM system: it reduces to a fully-prognostic massflux model (without closure) in the limit of high truncation (approximation), and to a full CRM in the limit of weak truncation (approximation).

The second limit may be considered as more attractive because it provides a numerically efficient CRM under a flexible refinement of the segmentally-constant segments. In this limit, this CRM-SCA can be considered as a finite-element model with a flexible distribution of the elements. Simple activation and deactivation conditions are introduced, which enables to add fine elements by following evolution of convection, and at the same time automatically remove non-active elements with time. The preliminary results with such a "compressed" super-parameterization will be presented.