Development of the LFRic regional, convective-scale model

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Next-generation models are being developed at the Met Office to enable them to harness the power brought by future supercomputer technologies. Central to this development is a new dynamical core, known as GungHo, and a new technical infrastructure, known as LFRic. In this talk, we examine how these form the basis for a new regional, convective-scale model.

The LFRic regional model is designed to build on the existing capabilities of the Met Office UM regional model such as the same one-way nesting in a driving model; the same rotated-pole, variable-resolution, lat-lon mesh; the same blending of lateral boundary conditions (LBCs); and the same UM physics. In addition, it brings new capabilities such as conservative flux-form transport, a more efficient multi-grid solver, and better useability when setting up meshes for new domains.

GungHo uses a mixed-finite-element spatial discretization and a semi-implicit time-stepping. These lead to the need to solve a mixed-solve, with Helmholtz preconditioner, which both need to be adapted to include lateral boundary conditions. Furthermore, the LFRic infrastructure has a ‘separation of concerns’ at his heart, which means that science code is separate from the computer optimization code; this leads to issues for dealing with the LBCs as it is not easy for the science code to identify which cells are near the boundary of the domain.

We also examine more recent model developments, such as the ability to deal with the steep-terrains that are present in high-resolution regional domains , the ability to use variable-resolution meshes and a comparison of two different flux-form finite-volume schemes – the Eulerian Method of Lines (MoL) scheme, and the Flux-Form Semi-Lagrangian (FFSL) scheme.

Bio:

Christine Johnson is a Senior Scientist in the Dynamics Research group at the Met Office and works on next-generation regional-modelling and data assimilation. She obtained her BSc and PhD degrees in Mathematics and Meteorology at the University of Reading, UK followed by a post-doctoral research fellowship at NCAR, Boulder, USA. In her spare time, Christine enjoys playing the piano.