Coupling UKCA to GungHo/LFRic

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V1.0 January 2015

Background

A new dynamical core, called GungHo!, is being developed to replace ENDGame and rather than retro-fitting it into the existing Unified Model, a whole new software infrastructure (LFRic) is being designed alongside the new dynamical core. The new model will move to using a Finite Element Method, will involve a move away from a lat-lon grid and will be implemented within a new software infrastructure. Ben Shipway has already scoped out the implications of coupling the various physics codes to LFRic but both UKCA and JULES were excluded from his assessment. As a result, a discussion meeting was held on 15th January 2015 to kick start an assessment of the implications of GungHo!/LFRic for UKCA. These are summarised in the next section. The timescale for early AMIP-type runs will be End 2017/Early 2018, although these test simulations will exclude both the land surface and UKCA. It was thought that with the improved scalability that ENDGame provides, LFRic might not need to become operational until the mid-2020s.

Implications of GungHo!/LFRic for UKCA

- D1 will disappear and GungHo! will be based on a FEM such that fields within each gridbox are represented as a continuous function rather than having discrete values. This will require a whole new interface between UKCA and the atmosphere. The OASIS coupler will not be suitable.
- The requirement of a new interface provides a good opportunity to re-design the coupling, perhaps considering different options other than end-of-timestep coupling, separate code repository, flexibility in terms of resolution, contracts between sections built within the code, to name a few. It was generally agreed that keeping the UKCA code self-contained would be beneficial, rather than spreading UKCA code among the other physics routines.
- Physics codes are considering adopting a "physics grid" such that fields would be transformed from their FEM representation into fields with discrete values on the physics grid. UKCA could adopt a similar approach.
- There will also be a general move towards "column-based" algorithms. Currently, the JWCRP-funded work proposed to implement OpenMP within GLOMAP-mode involves passing a flexible/tunable number of columns to UKCA_AERO_CTRL and so, will be LFRic-friendly. A similar approach will be required for the chemistry but again, this is in the JWCRP (Mark Richardson's) work plan.
- Given the usefulness of idealised and/or simple tracers in diagnosing problems with ENDGAME's conservation scheme, it seems beneficial to both UKCA and GungoHo! to implement such tracers at an early stage. This could be a good first step in also re-designing the atmosphere-UKCA interface. Age of air and a simple two-species chemistry scheme (e.g. http://www.geosci-model-dev-discuss.net/7/8769/2014/gmdd-7-8769-2014.pdf) seem like potential choices.

Further Actions

Agreed action to have a follow-up discussion between Luke, Fiona, Ben, Richard Hill, and Marc Stringer to be held in 3 months time.