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Interactive comment on "High resolution global climate modelling; the UPSCALE project, a large simulation campaign" *by* M. S. Mizielinski et al.

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We thank the second referee for their review, noting the importance of this work and their suggestions for improvements in the computation analysis sections. The comments made and questions posed by the review are responded to below.

Segment sizes

When the radiation or convection routines are called, the calculation within each MPI task is divided up into batches of work, known as "segments" in the MetUM, that are passed to one of the OpenMP threads within the MPI task. The segment size denotes

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the number of grid points passed in each batch to the routine in question, with the results from each segment combined before proceeding to the next model physics component.

The large-scale saw tooth pattern shown in Fig. 4 arises from load balancing the segments of processing work within the convection routines. As the segment size is increased, the time taken for the routine to complete increases as each segment occupies an OpenMP thread for a longer period of time and if the number of segments does not divide equally into the number of threads, some threads are under-worked. A sudden fall in the time taken for a the routine to complete occurs when the number of segments divides equally into the number of available OpenMP threads.

The term “memory management overhead” refers to the time taken to transfer data between main memory and the various levels of cache within a CPU.

The different routines using segment sizes (long wave radiation, short wave radiation, and convection) each process different volumes of data in order to complete their calculation, so the optimal segment size can be different in order optimally use the CPU cache.

We will modify section 2.2.3 in order to make this clearer.

Production versus testing performance

We have been unable to determine the exact cause of the performance difference, but have been advised that it is most likely to be the contention for IO. This will be clarified in the text.

Grid point storms (GPSs)

The strategy for avoiding grid point storms was to restart the model from the beginning of the month in which it failed, or the previous month if the GPS occurred early enough in the month such that we could see it spinning up in time series of the maximum vertical velocity in the atmosphere or the dynamics solver iteration count. When the model was restarted the targeted diffusion of vertical velocity threshold was reduced from 1.0 to 0.5 ms^{-1} and run for one month before returning to the default parameters. If that perturbation was not sufficient to avoid the numerical failure the number of convection calls per time step was increased from two to three. If neither of these methods evaded the GPS, then the model would be restarted from the second dump before the failure with both parameters perturbed, with the defaults restored after one month.

All changes to the parameters were logged and time series of the parameters are available to users of the data set.

An appendix will be added to the paper describing this procedure.

ENDGAME performance in Future Climate

We have had no problems running an future climate configuration of the MetUM with the ENDGAME dynamical core at N512 (25km) for five simulated years on an IBM Power 7. Data for coarser resolutions under this future climate scenario is not available, but we feel it is reasonable to expect them to be similarly stable.

We will amend the text to reflect this.

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Fraction of job failures due to GPS, slow I/O, system trouble

Unfortunately we do not have the information required to calculate estimates of these fractions.

Scaling with constant OpenMP threading

The scaling of the MetUM to these processor counts is not possible without blending MPI and OpenMP, noted in section 2.2.1, and the changing mixture of these two parallelisation schemes reflects how they would be implemented in a production configuration.

Reproducibility of results

Statistical reproducibility in this sense is tested by analysing the resulting climatologies and comparing results with observations, making use of observational uncertainty and natural variability. This approach allows us to verify whether two simulations are statistically equivalent by measuring how the inter ensemble spread compares to observational uncertainty and/or natural variability.

The reproducibility referred to on page 577 is the exact bit reproducibility desired in many parts of climate science, e.g. when running on different platforms, which in principle allows additional data (either at higher frequency or for different diagnostic fields) to be produced from a known evolution of the simulation.

Interactive comment on Geosci. Model Dev. Discuss., 7, 563, 2014.