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High-resolution global climate modelling: the UPSCALE project, a large-simulation campaign

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Abstract. The UPSCALE (UK on PRACE: weather-resolving Simulations of Climate for globAL Environmental risk) project constructed and ran an ensemble of HadGEM3 (Hadley Centre Global Environment Model 3) atmosphere-only global climate simulations over the period 1985–2011, at resolutions of N512 (25 km), N216 (60 km) and N96 (130 km) as used in current global weather forecasting, seasonal prediction and climate modelling respectively. Alongside these present climate simulations a parallel ensemble looking at extremes of future climate was run, using a time-slice methodology to consider conditions at the end of this century.

These simulations were primarily performed using a 144 million core hour, single year grant of computing time from PRACE (the Partnership for Advanced Computing in Europe) in 2012, with additional resources supplied by the Natural Environment Research Council (NERC) and the Met Office. Almost 400 terabytes of simulation data were generated on the HERMIT supercomputer at the High Performance Computing Center Stuttgart (HLRS), and transferred to the JASMIN super-data cluster provided by the Science and Technology Facilities Council Centre for Data Archival (STFC CEDA) for analysis and storage.

In this paper we describe the implementation of the project, present the technical challenges in terms of optimisation, data output, transfer and storage that such a project involves and include details of the model configuration and the composition of the UPSCALE data set. This data set is available for scientific analysis to allow assessment of the value of model resolution in both present and potential future climate conditions.

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