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ESCAPE 2: Energy-efficient SCalable Algorithms for weather and climate Prediction at Exascale

Friday, 24 September 2021 08:40 (20 minutes)

In the simulation of complex multi-scale flow problems, such as those arising in weather and climate modelling, one of the biggest challenges is to satisfy operational requirements in terms of time-to-solution and available energy without compromising the accuracy and stability of the solution. These competing factors require extreme computational capabilities in conjunction with state-of-the-art algorithms that can optimally suit the targeted underlying hardware while improving the convergence to the desired solution. The European Centre for Medium Range Weather Forecasts (ECMWF) is leading the ESCAPE projects funded by Horizon 2020 under initiative Future and Emerging Technologies in High Performance Computing. The participating models are broken down into smaller building blocks called dwarfs. These are then optimised for different hardware architectures and alternative algorithms are investigated. It was shown that GPU optimisation which takes full advantage of NVLink interconnect can provide a massive speedup (23x for spectral transform and 57x for MPDATA) if all computations are run on the GPU. This work enabled ECMWF to use the GPUs of the Summit supercomputer in 1km simulations. This talk will give an overview of the optimisations required to achieve good performance on Summit and the results obtained.

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