**Unprecedented scales with ECMWF’s medium-range weather prediction model**

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**Abstract**

ECMWF’s INCITE19 computing resource allocation on Summit will pave the way towards answering fundamental questions on the future design of global circulation models, and the Integrated Forecasting System (IFS or "the European Model") in particular. Firstly, the current spectral transform model (hydrostatic or non-hydrostatic) is scaled across the largest possible allocation of IBM Power9 nodes at 1.25km resolution to assess its scalability properties. This is compared to the currently developed finite-volume module (FVM, nonhydrostatic) of the IFS operating on the identical grid. Secondly, building on the Weather & Climate Dwarfs (mini-applications), that have been pioneered as part of the 'Energy-efficient Scalable Algorithms for Weather Prediction at Exascale' (ESCAPE) project, especially the spherical harmonics transform, the MPDATA advection transport and the cloud microphysics parametrization, we aim to enhance the scalability of both models and use these dwarfs for targeted experimentation towards optimal exploitation of Summit features, exploiting memory, interconnect, and cluster size resources that are not available anywhere else in the world.