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Towards energy-efficient nonoscillatory forward-in-time integrations on lat-lon grids

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The design of the next-generation weather prediction models calls for new algorithmic approaches allowing for robust integrations of atmospheric flow over complex orography at sub-km resolutions. These need to be accompanied by efficient implementations exposing multi-level parallelism, capable to run on modern supercomputing architectures. Here we present the recent advances in the energy-efficient implementation of the consistent soundproof/implicit compressible EULAG dynamical core of the COSMO weather prediction framework. Based on the experiences of the atmospheric dwarfs developed within H2020 ESCAPE project, we develop efficient, architecture agnostic implementations of fully three-dimensional MPDATA advection schemes and generalized diffusion operator in curvilinear coordinates and spherical geometry. We compare optimized Fortran implementation with preliminary C++ implementation employing the Gridtools library, allowing for integrations on CPU and GPU while maintaining single source code.