Compact, Performance-Portable Semi-Lagrangian Methods for E3SM

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Abstract

The newly renewed ASCR/BER partnership SciDAC Project, *Non-hydrostatic dynamics with characteristic discontinuous Galerkin methods*, develops semi-Lagrangian (SL) algorithms and associated software for passive tracer transport in E3SM that are both (a) tailored for the advanced architectures of current and anticipated DOE LCF computing platforms and (b) provably successful at achieving the fundamental required traits of a climate model's transport scheme: conservation, accuracy, tracer consistency, shape preservation, and computational efficiency. Integrating SL transport into E3SM frequently requires algorithmic improvements in other parts of the code (time stepping, in particular) and exposes opportunities for investigating non-hydrostatic effects and radiative-convective equilibrium at high resolution. In this talk, we examine the impacts and applications of this work on the E3SM Atmosphere Model's (EAM) version 2 and discuss ongoing work with MPAS-Ocean targeted at the version 3 biogeochemistry science campaign.