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CONSERVATIVE MULTI-MOMENT CHARACTERISTIC GALERKIN TRANSPORT ON THE SPHERE

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A newly developed transport scheme [1] for passive tracer advection on the sphere is presented. The scheme's design prioritizes computational performance and efficiency, particularly with respect to next-generation heterogeneous computing environments, by 1) employing spatially local numerical methods and 2) using large time steps relative to the advective CFL constraint. At each time step, a standard discontinuous Galerkin mesh is transported forward in time along the flow characteristics; a semi-Lagrangian incremental remap procedure updates the solution on the mesh at each time step using a locally constructed overlap mesh and conservative quadrature. Constrained density reconstruction [2] assures shape preservation and tracer consistency. Results from several standard tracer transport test cases are presented. The scheme's performance is compared to the current method employed by the U.S. Dept. of Energy's E3SM atmospheric model, and shown to produce a factor of 2.24 speedup for the model's standard configuration with 40 tracers. The scheme serves as an algorithmic prototype, and we introduce plans for development of the scheme into a full 3D non-hydrostatic dynamical core.

REFERENCES

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