Grant DE-SC0001658 **Title:** Toward a Non-Hydrostatic HOMME

Final Report

In the following paragraphs we review some of our key accomplishments:

CSLAM integration into HOMME: The finite-volume based CSLAM algorithm is designed for a uniform-resolution equiangular central projection on the cubed-sphere for the control volumes (cells). However, the HOMME model uses spectral elements that contain highly irregular cells within. Thus, to implement CSLAM in the HOMME framework presents two major challenges: (1) extend CSLAM to general quadrilateral meshes and (2) widen the halo regions in HOMME to incorporate monotonicity constraints. Since the HOMME communication package gathers only the points on the surface of its nearest-neighbor elements, widening the halo region is a significant data structure change in HOMME that required substantial software engineering support. Recently this work was completed.

NH Research Efforts: A new two-dimensional explicit DG compressible Euler model has been developed; this work benefited from prior research on flux-based characteristic semi-Lagrangain methods (Norman et al. JCP 2011). Our goal is to develop a moderate order (3rd or 4th) DG model with non-oscillatory property, because lower-order spatial discretization is amenable to explicit Runge-Kutta time integration. A new limiter based on a Hermite-WENO (weighted essentially non-oscillatory) approach has been recently developed that requires only a 3x3 stencil for 3rd-order DG.