CCSM with the HOMME Cubed-Sphere Atmospheric Dynamical Core

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We present recent results from the CCSM with the HOMME atmospheric dynamical core. HOMME is an experimental option included with CCSM version 4 and CESM version 1. HOMME makes it possible for the CCSM to scale to O(350K) tasks on modern petascale machines. We present preliminary results from global 1/8 degree resolution time-slice simulations. These simulations use the CCSM configured with active atmosphere, land and sea ice models with prescribed ice extent and ocean conditions. In addition, we present benchmark results from two petascale platforms, ORNL's Cray XT5 and ANL's IBM BG/P system, including parallel I/O performance, out to O(100,000) cores. HOMME uses a 4th-order-accurate quadrilateral-based finite-element method on the cubed-sphere grid coupled with the Simmons & Burridge (1981) vertical discretization. It locally conserves mass to machine precision, moist energy to better than 0.02 W/m2. Local conservation is obtained through the use of a compatible/mimetic numerical discretization. For tracer advection CAM-HOMME uses the Lagrange+remap approach (SJ Lin, MWR, 2004), a monotone piecewise cubic reconstruction in the vertical (Zerroukat et. al, QJRMS 2005), coupled with a sign-preserving or quasi-monotone horizontal advection scheme in the horizontal. (Taylor, St.Cyr, Fourner, ICCS 2009).