Multicore Performance for a Nonhydrostatic Atmospheric Dynamical Core with Adaptive Mesh Refinement

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We present progress with our adaptive, conservative finite volume approach for moist non-hydrostatic global atmospheric dynamics. We use horizontal, vertical, and time-adaptive mesh refinement, to allocate computational effort only where greater accuracy is needed for dynamic features, like tropical cyclones, that occur below hydrostatic scales. With horizontal, vertical, and time-adaptive mesh refinement, computational effort is allocated only where greater accuracy is needed. However, this adaptivity requires significant extra investment in software and performance for HPC and multicore architectures, including memory optimization, load balancing, vectorization, and batching of various kernels. We demonstrate that, at the cost of some software complexity, the accuracy of solutions can be greatly improved, but with 10-100x fewer grid points and greatly reduced computational expense.