Performance-portability progress for an ultra-high resolution non-hydrostatic atmosphere model in E3SM

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The Simple Cloud Resolving E3SM Atmosphere Model (SCREAM) project is developing an ultra-high non-hydrostatic atmosphere model, with a target horizontal resolution
of about 3km, and 128 vertical levels. It has roughly 7 billion grid points.

In order for SCREAM to be used to make climate predictions, a throughput ofthe order of Simulated Years Per wall clock Day (SYPD) is required. Given the large size of the problem, a crucial goal for the project isto have an implementation that runs efficiently on each of the target machines used for production runs, which span several architectures, with more to come in the near future. For this task, SCREAM has opted for a C++ implementation, using the Kokkos programming model for on-node parallelism.

In this presentation, we will show some of our efforts toward this goal. We will present our successful port of the new non-hydrostatic dycore to C++/Kokkos, which was able to achieve 0.97 SYPD on GPU when running on the full Summit supercomputer, while still being highly performant on other architectures. Additionally, we will present some infrastructure tools that we are developing for writing Kokkos-enabled HPC C++ in the E3SM ecosystem.