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Augmenting Bifrost code capabilities with Dispatch framework

For over a decade, the Bifrost code has established itself as a capable tool for simulating stellar atmospheres. Many scientific projects benefitted from Bifrost's detailed numerical models of the chromosphere and corona in the quiet Sun. Although it is a very optimized code, its time integration method, which uses global time stepping, makes it prohibitively expensive to run an experiment with very large FOV and boundaries set deep in the convective zone and high corona at the same time. Both conditions are necessary to model an active Sun with the details Bifrost is famous for.

To address this bottleneck, we embedded Bifrost in the Dispatch, a hybrid MPI/OpenMP high-performance simulation framework that uses local time steps for each small sub-domain and its parallelism depends only on nearest-neighbor MPI communications, which gives theoretically unlimited scaling.

This work compares legacy Bifrost simulations and newer models run with Dispatch/Bifrost. We will also expand on performance differences and the challenges we encounter during porting Bifrost to the Dispatch framework.

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