Evaluation of hydrostatic option in UFS for community-based seasonal modeling

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The community-friendly Unified Forecast System (UFS) framework has recently introduced the option to run the FV3 atmospheric dynamic core in hydrostatic mode, as an alternative to the existing nonhydrostatic mode. To date, tests of hydrostatic UFS for seasonal prediction have been limited to the planned operational configuration of NOAA's upcoming Seasonal Forecast System (SFS) – primarily, at a horizontal resolution of ~0.5º ("C192"). However, for the purposes of modeling at seasonal timescales, UFS users may wish to conduct tests a coarser resolution of ~1º ("C96"). This work presents the first head-to-head comparison between nonhydrostatic and hydrostatic for seasonal-length (9-month-long) integrations of UFS at C96 resolution. These integrations cover a long time period, with initializations from 1991 through 2022 (32 years) capturing various states of the climate system (e.g., phases of ENSO and the QBO). Generally consistent with the results at C192, there is no benefit to using the nonhydrostatic option at such coarse resolutions (in terms of model biases, SST evolution, and global energy budget – amongst other things). These results hold regardless of initialization season and for all lead times. Therefore, it is safe to recommend the hydrostatic option (which has, among other benefits, the ability to run with a longer timestep and thus save the computational expense) for UFS community users who wish to conduct seasonal modeling at C96.