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Assessment and Comparison of Subseasonal Bias and Forecast Skill in the Unified Forecast System (UFS) Benchmarks 3 and 5

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A series of reforecasts have been generated with prototype versions of the coupled Unified Forecast System (UFS) to evaluate progress in the model development. The forecast skill and biases of the UFS Prototypes 3 and 5 reforecast sets—called Benchmark 3 and Benchmark 5, respectively—are analyzed and compared with the NCEP Climate Forecast System version 2 (CFSv2) reforecasts from the Subseasonal Prediction Experiment (SubX). The evaluation focuses on surface variables typically provided in the subseasonal outlooks at weekly-averaged timescales, namely 2-meter air temperature, precipitation rate, and sea surface temperature. Additional assessment of the structure of the systematic error in total diabatic heating over three broad layers of the atmosphere (850-650 hPa, 650-450 hPa and 450-50 hPa) has been performed as a function of season and forecast lead. In terms of forecast skill, all models still experience a skill drop-off of varying degree by week 3. In general, however, the UFS prototypes considerably reduce the marked diminution of variability with lead time displayed in their predecessor, CFSv2. Moreover, the prototypes have reduced systematic error compared to CFSv2, particularly for 2-meter temperature and precipitation. A systematic overestimate of diabatic cooling is noted in the upper atmosphere (diabatic heating too negative compare to ERA-5 estimates) during boreal winter.