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Forecast bias correction through model integration: a dynamical wholesale approach

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Unlike the retail-like statistical post-processing methods, an innovative wholesale-like dynamical approach is proposed to correct forecast bias during model integration. By subtracting a bias tendency from the model total tendency, it is intended to debias all variables at once to better couple with downstream applications. Three experiments were tested using an ensemble prediction system since the method is intended for an ensemble model. The verification was carried out over China for a period of 10 days (1-10 July 2015).
The verification of 500-hPa temperature indicates that all three experiments significantly improved the raw ensemble forecasts with reduced bias error, a more accurate ensemble mean, a better spread-skill relationship, and more reliable and sharper probabilities. The performance is comparable to the current operational statistical method. When the verification was expanded to include more variables, a summary scoreboard shows that the three experiments also had a general positive impact on both upper air and surface variables, especially the height and temperature fields. Precipitation forecasts remained relatively unchanged. There were only a few categories that were degraded. The comparison between the three experiments yielded a mixed result: the most sophisticated approach performed the best for 500-hPa temperature, while the simplest approach worked the best when verifying a mixture of variables. This suggests that more studies are needed to understand the method. In particular, two key issues are how to accurately describe the bias tendency and how to add internally coherent bias tendencies to multiple variables. Given its advantages, this approach represents a future method of correcting biases in a numerical model.