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Statistical bias correction and downscaling methods

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Numerical models currently used to generate global weather forecasts typically have lead time dependent errors due to systematic model errors (ie., model drift), and also lack the spatial resolution for high impact weather forecasting. Statistical correction methods designed to mitigate these problems often do not distinguish between lead-time dependent systematic model biases, and the lack of resolution that is not model dependent. In this presentation, a two-step approach is presented where first biases in coarse resolution model forecasts are corrected, and then the bias-corrected forecasts are downscaled to a finer grid. In this study, the relationship found between course and fine resolution analysis fields is being used for downscaling coarse resolution forecasts. In particular, the systematic difference observed between the coarse and fine resolution analysis fields is evaluated, and added as a "downscaling vector" to coarse resolution bias corrected forecasts. A potential advantage of the two-step approach is that the use of hind-casts (ie, a sample of analysis - forecast pairs) in this approach is limited to the bias correction step as downscaling is applied on forecasts that are already bias corrected. The need for a large sample of hind-casts is therefore reduced as downscaling uses only a sample of high vs. coarse resolution analysis pairs. The proposed statistical bias correction and downscaling methods will be demonstrated on the North American Ensemble Forecast System (NAEFS), where 1x1 latitude/longitude coarse resolution weather forecasts are downscaled to a 5x5 km fine resolution grid.