The Effective Use of Anchor Observations in VarBC in the Presence of Model Bias

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Abstract

Satellite data have a significant impact on forecast skill, but the data must be bias corrected prior to use. At many operational centres, the bias correction is performed using Variational Bias Correction (VarBC), however, VarBC relies on unbiased observations that are not bias corrected (anchor observations) in order to constrain any model bias that is present within the system. As the number of satellite observations increases, the proportion of unbiased observations to biased observations decreases, so it is important to use these anchor observations effectively. In order to understand how anchor observations impact the bias correction, we derive analytical expressions to show the sensitivity of the bias correction to the anchor observations. We find that the ability of the anchor observations to correct the observation bias is dependent on the information shared between the biased observations and the unbiased observations via the background error covariance matrix. We show that it is necessary for the anchor observations to observe the regions of significant model bias, in order to reduce the effect of model bias on the estimate of the observation bias. We demonstrate these results in a series of idealised numerical experiments to show the implications on the current network of anchor observations in the use of VarBC for operational NWP.

Keywords: VarBC, anchor observations, model bias

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