

RESPONSE TO EDITOR:

We corrected the following parts in the manuscript based on editor's comments.

Comments 1

line 144: "prevents to set the ...than the grid interval" -> "prevents setting a localization length smaller than the grid interval"

Response 1:

We corrected it as your comment.

Changes in manuscript:

The larger interval of the analysis grid reduces the computational cost but makes the resolution of analysis increments coarser and prevents to set the localization length smaller than the grid interval. (L143-145)

Comments 2

The NICAS method also uses compactly supported functions to improve the parallelization, which is not different from the MGBF. It is worthy to mention this or at least not to differentiate MGBF from NICAS on this point.

Response 2:

We corrected the explanation not to regard the compact-support filter as difference of MGBF from NICAS.

Changes in manuscript:

The idea to apply the compact-support filter with the coarse resolution is the same as the Normalized Interpolated Convolution from an Adaptive Subgrid (NICAS) adopted in the Model for Prediction Across Scales-Atmosphere with the Joint Effort for Data assimilation Integration (JEDI-MPAS, Liu et al. 2022). The NICAS applies a localization matrix on the unstructured coarse filter grid and interpolates it to the analysis grid directly. On the other hand, the MGBF-based localization applies a filter on the structured coarse filter grid and interpolates it from the coarsest filter grid g_T to the analysis grid g_0 step by step. One advantage of the MGBF-based localization is high parallelization efficiency with the step-by-step interpolation. (L323-329)