Large error correction in storms at convective scales by "grafting" look-alike modelled storms from other ensemble backgrounds

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Abstract

Traditional assimilation approaches assume the existence of a linear relationship between field errors, a condition typically found where errors are small. This, however, makes it difficult to correct large errors that grow highly non-linearly, such as in storms at convective scales. Here a method we call "grafting" is proposed. In areas where observation errors are high, the ensemble members are searched for a storm that looks like the observations (such as radar reflectivity). Upon a successful match, that near-twin storm, with its adjacent environment is transplanted in other members with high observation errors, hence the name grafting. The hypothesis is that a storm that looks similar to the observed storm is likely to have similar dynamics. The hope is that large errors are reduced at the location of the storm. The grafting method shares some similarity with bogus DA that has been historically used to improve larger-scale hurricane forecasts. We experimented with grafting in an identical-twin setup using WRF at convective scales. Early results show that the storm placed in a member with this method lasts longer and evolves more closely to the real storm than one where the analysis is generated via EnKF. This method is only applied in the region (i.e., storm) where the errors are large, while in the rest of the domain the observations are assimilated with EnKF. The proposed method is complimentary to other traditional assimilation methods and benefits from the use of information from the available members. Current and future work includes minimizing model shock after grafting and generating perturbations for the grafted storm to increase ensemble spread.

Keywords: radar DA, convective scales, grafting, enkf

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