

Development of a storm-scale particle filter for investigating predictability of convection initiation and development

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A particle filter (PF) with the JMA meso-scale nonhydrostatic model (NHM-PF) has been developed since 2017. The aim is to study predictability of convection initiation and development under weak forcing conditions. In general, convections without strong forcings (e.g., cold fronts, tropical cyclones, mountains) seem to be initiated randomly. Therefore, it is difficult to detect exact factors for the initiations. Moreover, PDFs of these predictability are thought to be non-Gaussian, which has made it difficult to predict and even investigate such phenomena, so far. While, it is able to deal with the non-Gaussianity when PF is applied to these researches. The NHM-PF employs a sampling importance resampling (SIR) filter with advanced observations such as GNSS integrated water vapor, dual polarimetric radars and conventional observations developed for NHM-4DVAR (Kawabata et al. 2014). These rich observations are important to constrain the initiations in the model, but these may be cause of filter collapse. A short assimilation period and introduction of model error should mitigate this collapse.

The idea of this study is to investigate non-Gaussianities in environmental fields (winds, temperature, water vapor) before the initiations as well as interior cumulonimbus (cloud microphysics) after the initiations. Detailed descriptions on this study and the NHM-PF will be presented.

Keywords: Data assimilation, particle filter, cumulonimbus