A method of Blending and Assimilation of Lightning and Radar based on 4dvar in extreme rain on 7.21, 2012

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ABSTRACT:

Based on 4dvar, a new technique of assimilation and blending has been developed to improve the analysis and forecasting skill of cloud and meso scale, namely, a method of Blending and Assimilation of Lightning and Radar was used to adjust the ice phase microphysics parameterization in a variational Doppler Radar analysis system consisting of a three-dimensional cloud model (VDRAS). Ice crystals (such as graupel and snow), which has good relation with the lightning activity are adjusted by 4dvar technique from VDRAS (variational Doppler Radar analysis system). In fact, however, if adjusting ice crystals only by the lightning activity, the result shows that the outflows from cool pool produced by storms will cut off the inflow of storms more quickly, which will produce the precipitation weaker than the act from the QPE blending from the radar and AWS. So we firstly select the empirical formulas between total lightning and ice phase and between ice phase and reflectivity of radar by several numerical simulations in Beijing area, then construct the blending empirical formula between ice phase, reflectivity of radar and ice phase, according to the height, temperature of the storms and the distance between the storms and lightning activity to adjust the ice phase based on 4dvar. In simulation of extreme rain 7.21 case, the result shows that strong motion plays significant roles in raising southerly warm and moist airflow for keeping durative echo training and promoting the MCS development. And compared the ice crystals adjusted by 4dvar with lightning date and radar and without lightning date, it is found that 2 parameter of microphysical is more easily convergence and less computer cost based on 4dvar. And it is also found that the assimilation to adjust the ice crystals is more able to reveal the vertical motion structure of the extreme rain and the position and strength of storms has also been improved. And compared the assimilation of lightning or not, it is clearly found that in the mature stage of extreme rain, the vertical structure is more reasonable than without from the analysis field and the amount of extreme is more than without from 3h of forecast. And the position and strength of convection are also improved than without lightning.