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Application Study on Assimilation of Surface Observation Data

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There are more than 2000 surface observation stations in China, while many Automatic Weather Stations (AWS) have been established in recent years to enhance the observation system comprehensively and more new AWS are to be set up. Surface observation data has high temporal and spatial resolution and the observed elements (surface pressure, temperature, wind components, and relative humidity) are variables in numerical models. Since these data are influenced by topography and geomorphy, there exists different elevation between surface observation station measurement and numerical model surface, very little work has been done to assimilate these data into numerical model compared with other observation data (radiosonde data, satellite or radar data). In 2002, Guo Yongyun et al developed an observation operator and its corresponding adjoint to assimilate AWS surface observations, based on the similarity theory. In their work they assume all the observed sites are located at the model surface, regardless of the actual difference in elevation between the surface observation station measurement and the model surface. In order to make clear whether the actual difference elevation between observation station measurement with numerical model surface should be put into consideration during directly assimilating surface observation data in regions of complex terrain, their approach is used in our experiments, while in our study, a terrain error of representativeness is add into observation error in surface observation data assimilation to solve the influence of different elevation between observation site and model surface. Some sensitivity experiments are performed with surface observation data and radiosonde data, using MM5_3DVAR system. Results show that 3DVAR assimilation of surface observation data can impact mesoscale model analysis and forecast. 3DVAR assimilation of every surface observed element can influence 24hour numerical rainfall forecast and the effects of every surface observed element assimilation are different. The surface temperature assimilation brings maximum contribution to rainfall forecast. The difference in elevation between observation sites and numerical model surface should be put into consideration during assimilating surface observation data. Better results will be obtained when surface observation data is assimilated into numerical model with terrain error of representativeness added into observation error.

Keywords: Assimilation, terrain error of representativeness, surface observation data