Analysis of Quantitative Precipitation Estimation（QPE） Based on Merging Multiple Source Of Observation data

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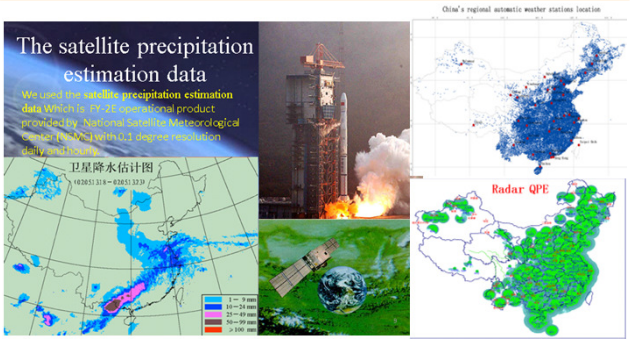
Abstract

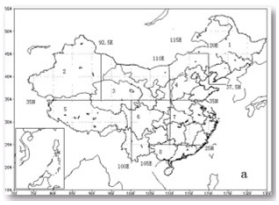
High resolution rainfall distribution map can be derived from satellite observation, radar can describe the vertical rainfall and rain gauges data can give us accurate rainfall measurements at a fixed location .Combined them together, the merging of satellite precipitation estimates and radar precipitation estimates and rain gauge measurement is to “calibrate” precipitation estimation so that a more accurate rainfall field can be drawn. In our study. the satellite precipitation estimation data we used to fusing is from the National Satellite Meteorological Center(NSMC) which resolution is 0.1 degree. The radar data is from the CMA Meteorological Observation Centre which resolution is 0.01 degree. The rain gauge data is from the National Meteorological Information Center (NMIC). Based on the hourly and daily rain gauge precipitation observations of over 30000 rain gauges and the remote precipitation estimation products, a real-time merging system to get the QPE product is established. At last we have done a series of evaluate and verify job to test the accuracy of the QPE products.

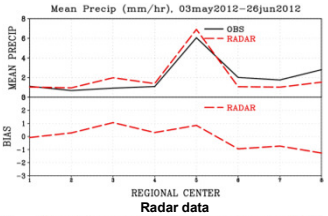
Key words: distributed hydrology model routing model meso-scale meteorological model streamflow

Data description



Evaluation of multi data





Radar data

Satallite data

The evaluation result of the multi data show that the Radar data is available in the regions of 1,3,4,6,7,8.The satellite data Shows that the RMSE is between -5~5mm per day.

“Fusing” technique description

In this study, we use the “joint probability density function” and “intellective objective analysis scheme” provided by Lu naimeng(2004) to fuse the multi data.

$$p(t/g_1g_2g_3) = \frac{p(tg_1g_2g_3)}{p(g_1g_2g_3)} = \frac{p(t)p(g_1g_2g_3/t)}{p(g_1g_2g_3)} = \frac{p(t)p(g_1/t)p(g_2/t)p(g_3/t)}{p(g_1g_2g_3)}$$

$$QPE = \sum_{k=1}^{n} x^k Q^n$$

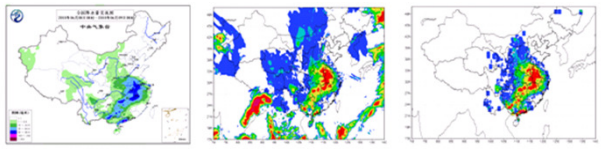
$$R_i^a = R_i^g + \sum_{k=1}^{N} P_k (R_k^o - R_k^g)$$

$$P_k = (W_{rk} / \sum_{j=1}^{N} W_{rj}) \cdot \prod_{j=1}^{N} W_{\theta j}$$

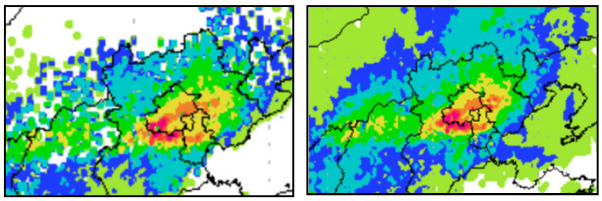
$$W_{\theta j} = \begin{cases} 1 - \cos\theta_j & \theta_j < \pi/2 \quad , r_j < r_k \quad , j \neq k \\ 1 & else \end{cases}$$

$$W_{rj} = \begin{cases} 1 & r_j \le 0.33\,D \\ 1 + (r_j / D - 0.33)^{-3} & r_j > 0.33\,D \end{cases}$$

Evaluation of fusing multi data



A case of quantitative precipitation estimation(QPE) in the 6th, Jun,2010(a. Observational precipitation in the rain gauges(from (NMIC);b.The satellite precipitation estimates product (from NSMC);c. The quantitative precipitation estimation(QPE) product by fusing the satellite precipitation estimates and the rain gauges precipitation.(unit:mm)



A case of quantitative precipitation estimation(QPE) in the 21st, July,2012(a. Observational precipitation in the rain gauges(from (NMIC);b.The merging QPE with multi data.(unit:mm)

Conclusions

In this study, we find that the test results show that the optimal result was given with an adjusting radius of 0.6-0.8 based on the “fusing” technique. The evaluation results show that the performance of QPE product based on the fusing technique is well improved than the satellite precipitation estimates product or radar data themselves as the the case study results explained it also.

As well known, there are obvious bias on multi data as satellite precipitation estimate and radar remote data, etc. But the results of satellite precipitation estimate can be widely used because the resolution of both spatial and temporal is good enough for the use of precipitation estimation as well as radar data. So, better results could be expected when the multi data fusing together.