

Forecast Error Analysis of a Persistent Heavy Rainfall Event

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Abstract

A heavy rainfall case is verified over Yangtze river in China from June 22nd to 27th, 2017. The precipitation belt is forecasted north-shift by ECMWF ensemble model. By using observation data, ECMWF products and NCEP GFS data, cumulative rainfall forecast for the process and cause of the forecast error is analyzed. The results reveal that low-level Jet is stronger from ECMWF products at 850hPa than from NCEP model, therefore the wind shear which results in heavy rainfall from ECMWF model is obviously located more north than the observed one. The circulation error at 500hPa is slighter compared with low-level wind.

Background

- A persistent heavy rainfall event occurred in Yantze river in China from 22June to 28June in 2017. In the earlier stage of this case, the precipitation is stronger, after 25 June, the rain belt moves south and decrease.
- The circulation at 500hPa shows that a trough from middle latitude meets the subtropical high just in Yangtze river. And a low level jet locates to the north of subtropical high.

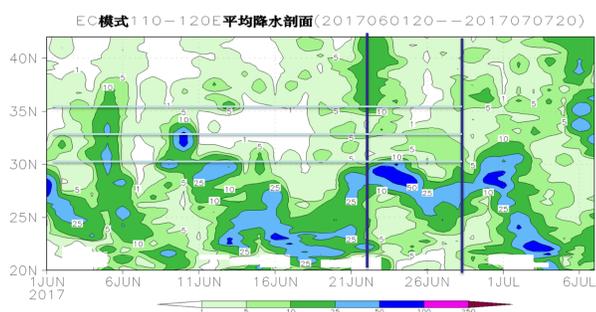


Fig.1 The latitude-time section of precipitation(along 110-120E)

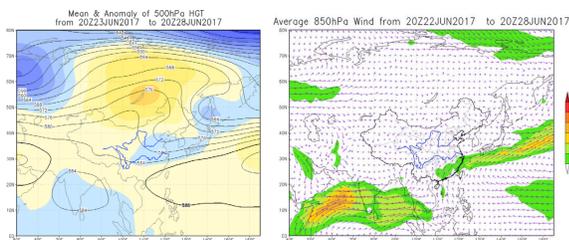


Fig.2 geopotential height at 500hPa(left) and wind at 850hPa(right) from Jun 22nd to 28th

forecast

- The daily precipitation belt forecasted by ECMWF HDet is obviously more north than the observation especially in short-term forecast.

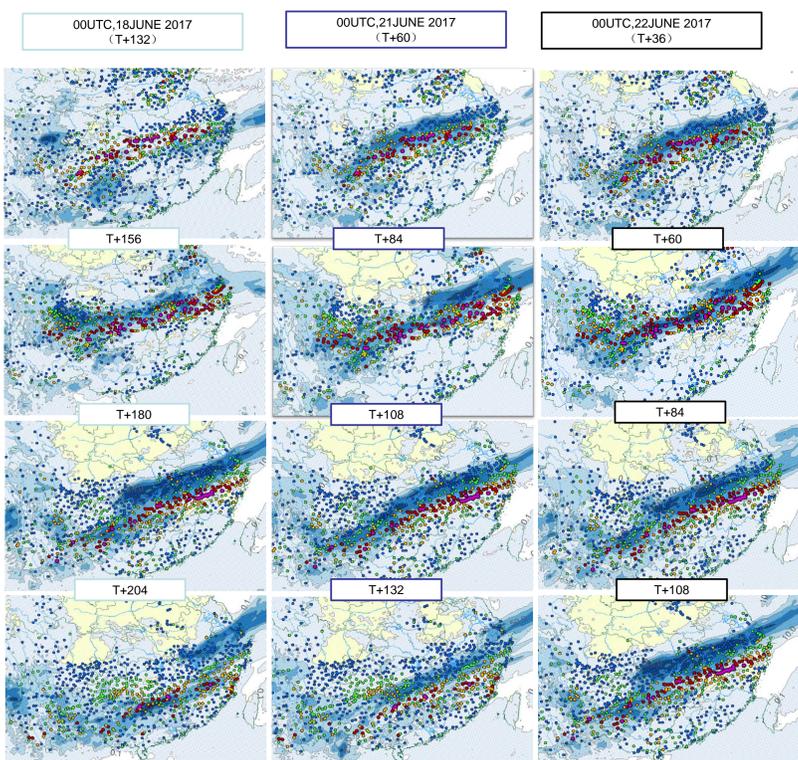


Fig.3 ECMWF HDet daily precipitation initiated at 00UTC, June 21st; 00UTC, 22nd and 00UTC, 23rd (shaded: forecast, dot: observation)

- The rain belt of ensemble mean from NCEP EPS is more south than ECMWF EPS, but south than the observation.

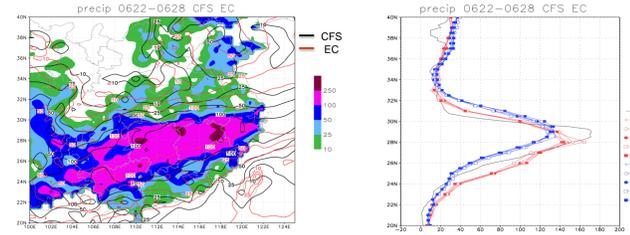


Fig.4 ECMWF ensemble mean accumulative precipitation initiated at 00UTC, 22nd (shaded: observation, black line: NCEP; red line: ECMWF, left); precipitation meridional mean (along 110-122.5E) initiated at different time from CFS(red line), ECMWF(blue line) and observation (black line)

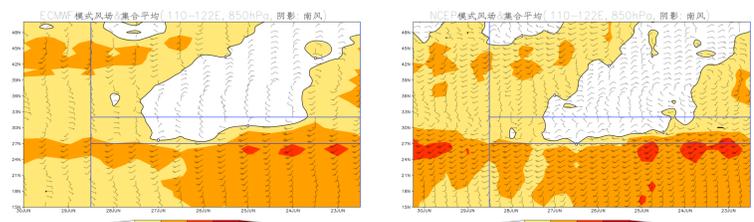


Fig.5 latitude-time section of wind at 850hPa along longitude (110-122E, shaded: Meridional wind speed(v>0))

The south-westly wind from ECMWF model is stronger than NCEP, and the zero line of meridional wind is more north, so low-level shear is north from ECMWF model than NCEP.

Discussion

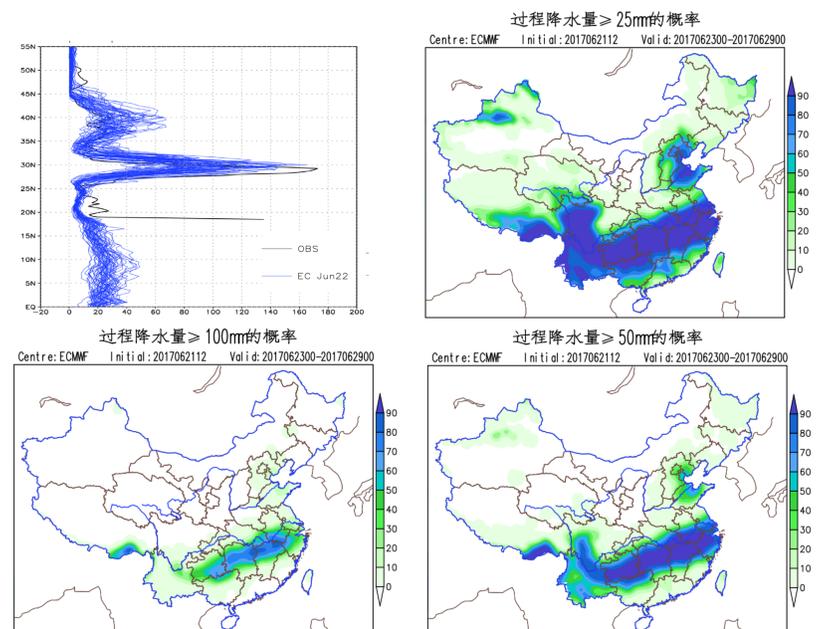


Fig.6. Accumulative precipitation forecast by ECMWF ensemble members initiated at 00UTC, 22JUNE (upper left, black line: observation); probability forecast of different magnitude of precipitation initiated at 12UTC, 21JUNE (upper right: >25mm, lower left: >100mm; lower right: >50mm)

Only several ensemble members could forecast the correct location of the rain belt, but quantity of precipitation is less. And the area of the high probability of heavy precipitation is also north. The forecasters are hardly to adjust the forecast by the EPS products. However, the error of circulation forecast at 500hPa is smaller. The divergence from upper level may help.

Conclusions

- The area of accumulative precipitation from ECMWF HDet and EPS is obviously north.
- The rain belt in earlier period of the case from ECMWF model is obviously northward, but later adjusting southward.
- The wind field of NCEP and ECMWF model are compared, the low-level wind field of ECMWF is northerly. The position of cold air is basically consistent with the actual situation.
- A few members of the ECMWF ensemble forecast have the same position as the observation, but the products of ENS (eg. probability matching, percentile, etc.) can not give the information about that the rain belt should be south.