The Predictability of Rainbelt Position Of rainfall event for the period from 30 June to 4 July in 2016

Jie Ma[1] , Kevin Bowley[2] and Fuqing Zhang[2]

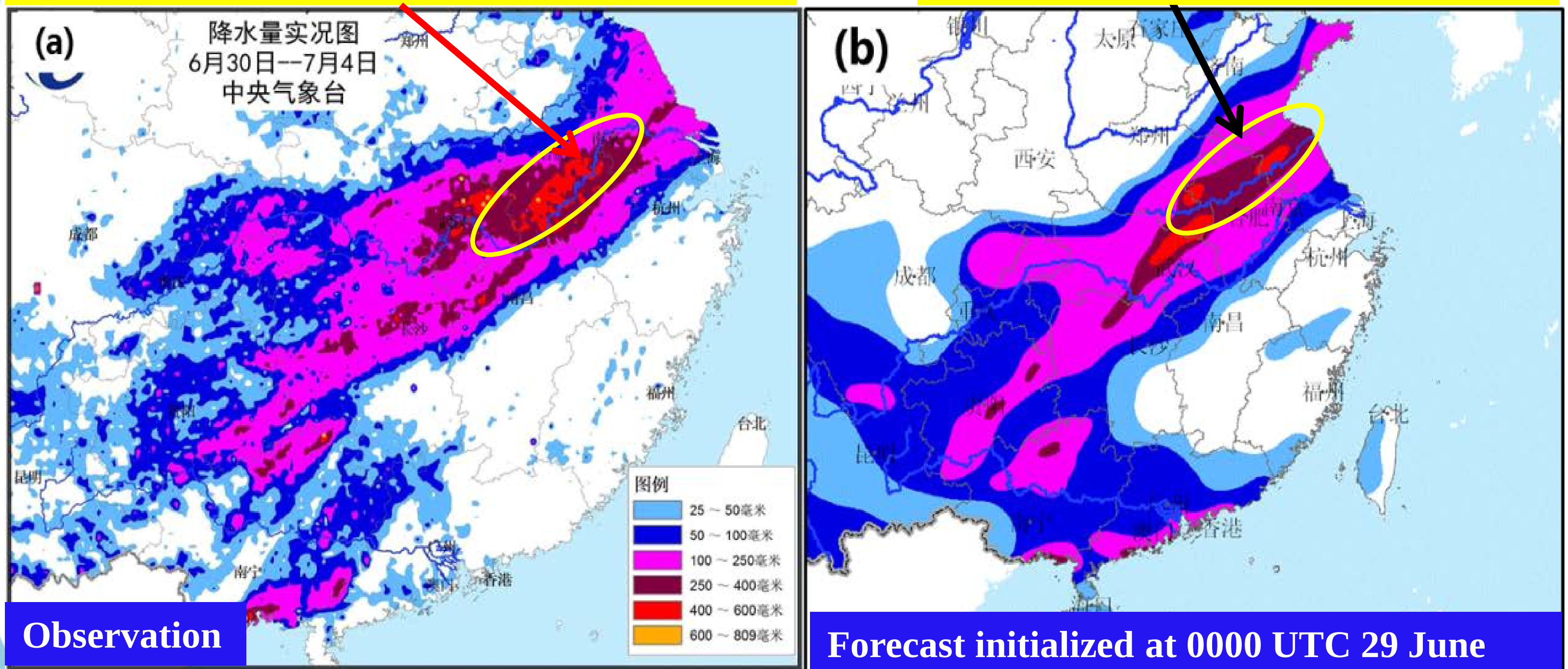
1. National Meteorological Center, China Meteorological Administration, Beijing, China
2. Department of Meteorology and Atmospheric Science, and Center for Advanced Data Assimilation and Predictability Techniques

国家气象中心
NATIONAL METEOROLOGICAL CENTER

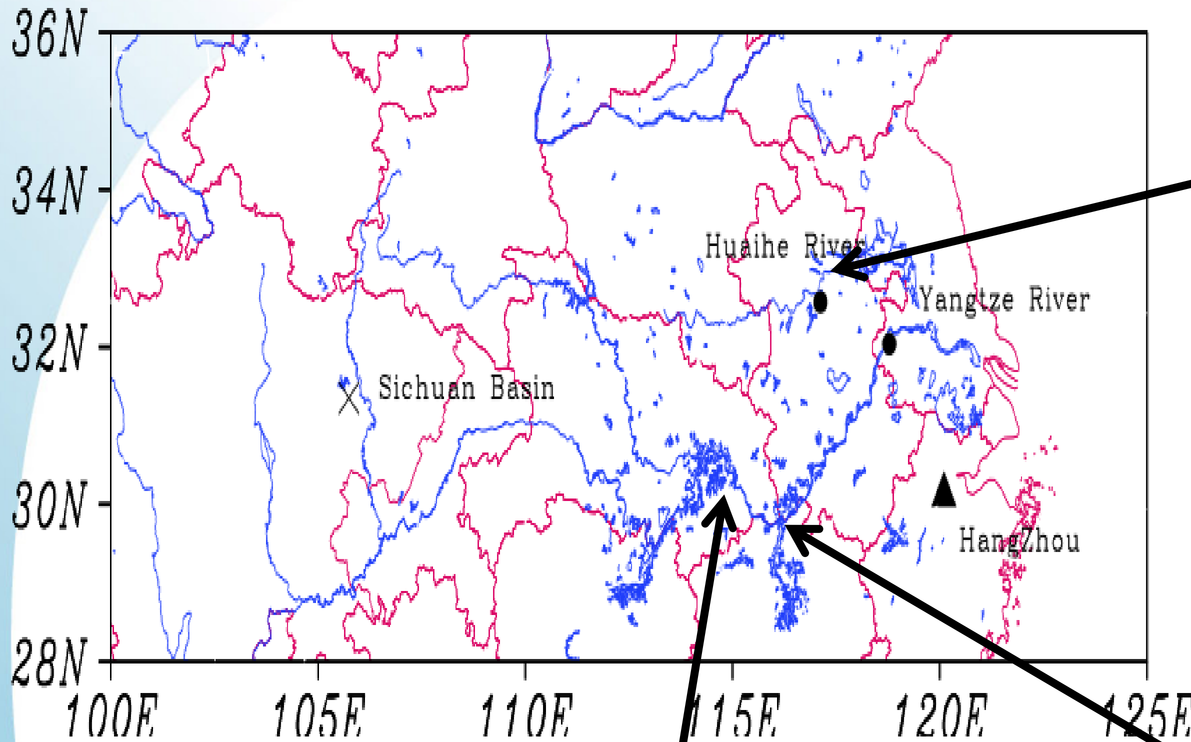
Background of the extreme rainfall event from 30 June to 4 July 2016

30~31°N:Yangtze River

33°N:Huaihe River



(a) Observation of rainfall event in the period from 30 June to 4 July 2016. (b) the ECMWF deterministic forecasts at 12 UTC 29 June 2016.



33N:Huaihe River

31N:
Yangtze River

Content

1. Evolution of the event
2. Performance of prediction model
3. Diagnosis of forecast error
4. The spatial–temporal forecast error
5. Conclusion and discussion

国家气象中心
NATIONAL METEOROLOGICAL CENTER

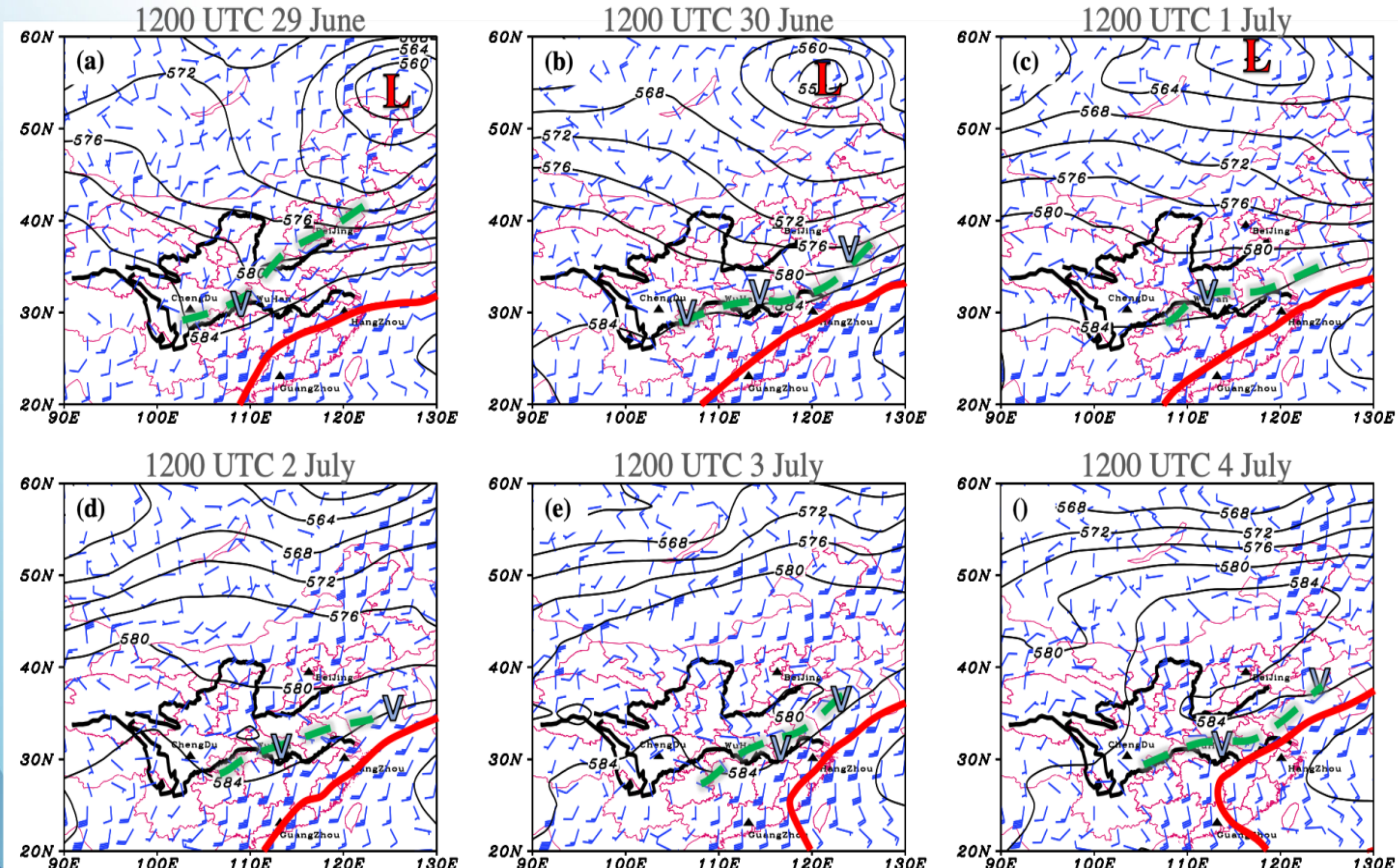
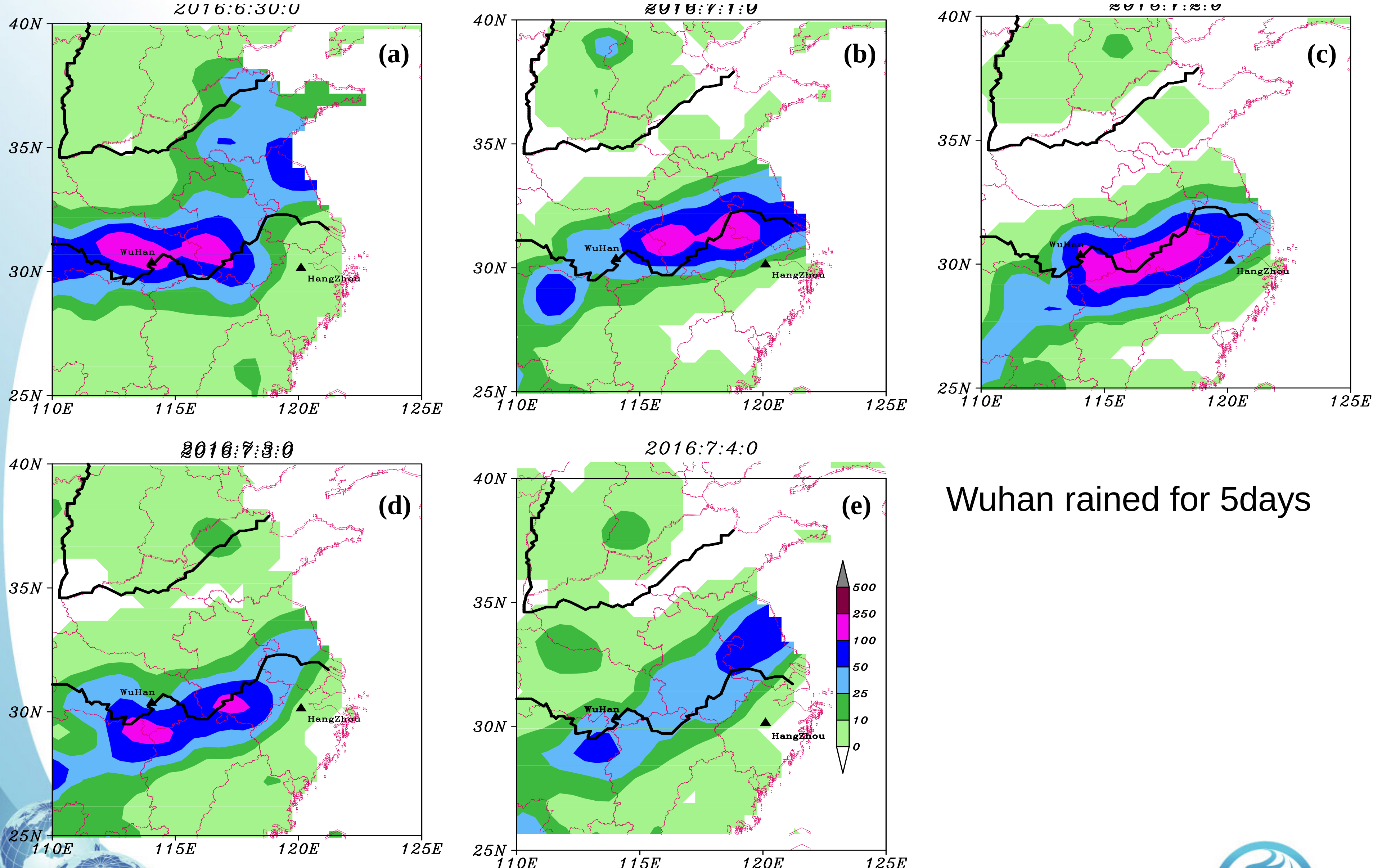


Fig . Spatial distribution of the 500-hPa ECMWF analyses of geopotential height (10gpm; solid black contour) and the corresponding wind field at 850 hPa. Analyses are valid at (a) 1200 UTC 29 Jun, (b) 1200 UTC 30 Jun, (c) 1200 UTC 1st Jul, (d) 1200 UTC 2nd Jul, (e) 1200 UTC 3th Jul



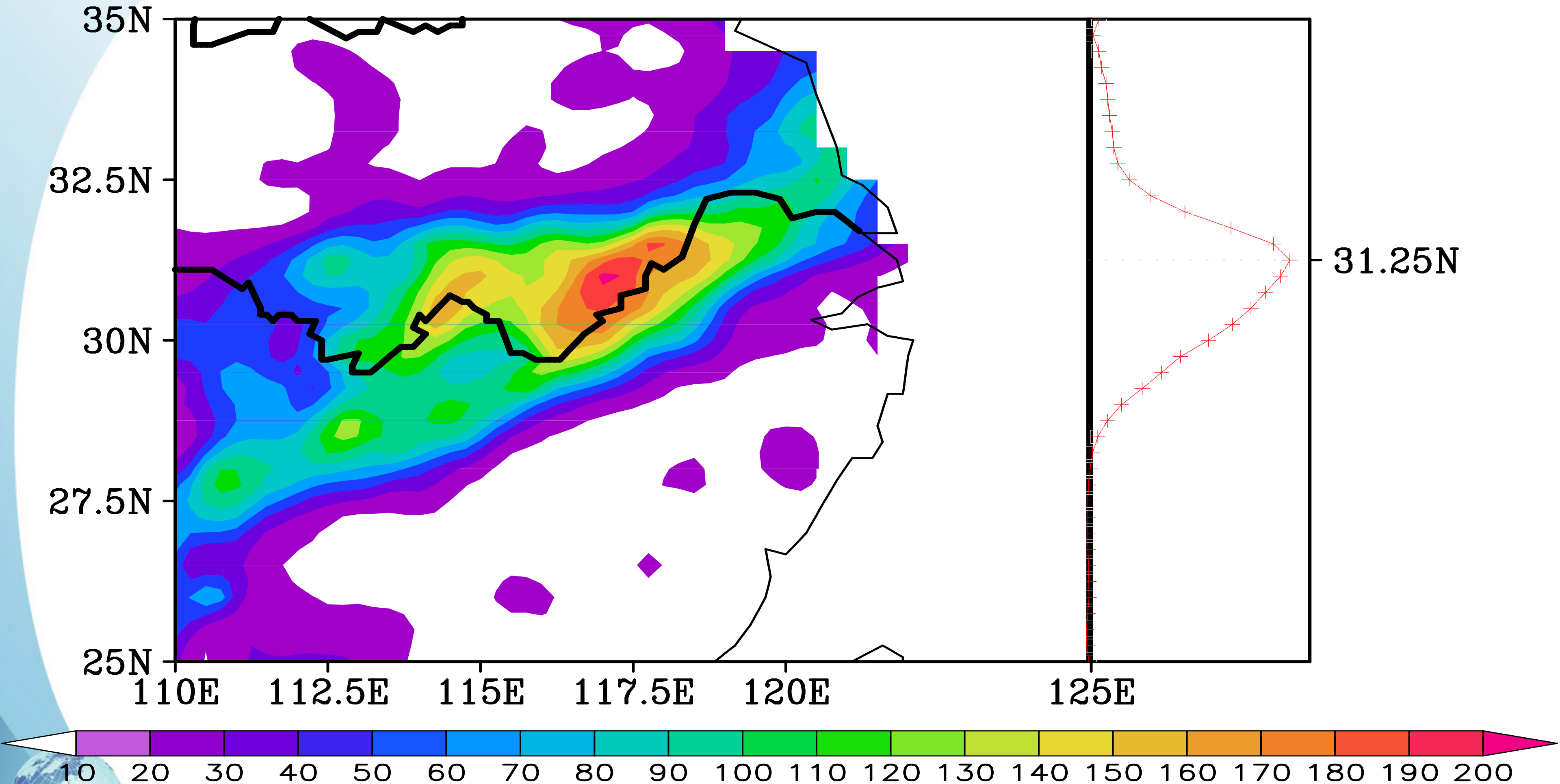
Wuhan rained for 5days

Fig . Spatial distribution of 24 h accumulated precipitation in eastern China. (a) 0800 UTC 30 Jun- 0800 UTC 1st Jul, (b) 0800 UTC 1st-0800 UTC 2nd Jul, (c) 0800 UTC 2nd -0800 UTC 3th Jul, (d) 0800 UTC 3th-0800 UTC 3th Jul, (d) 0800 UTC 4th-0800 UTC 5th Jul.

Content

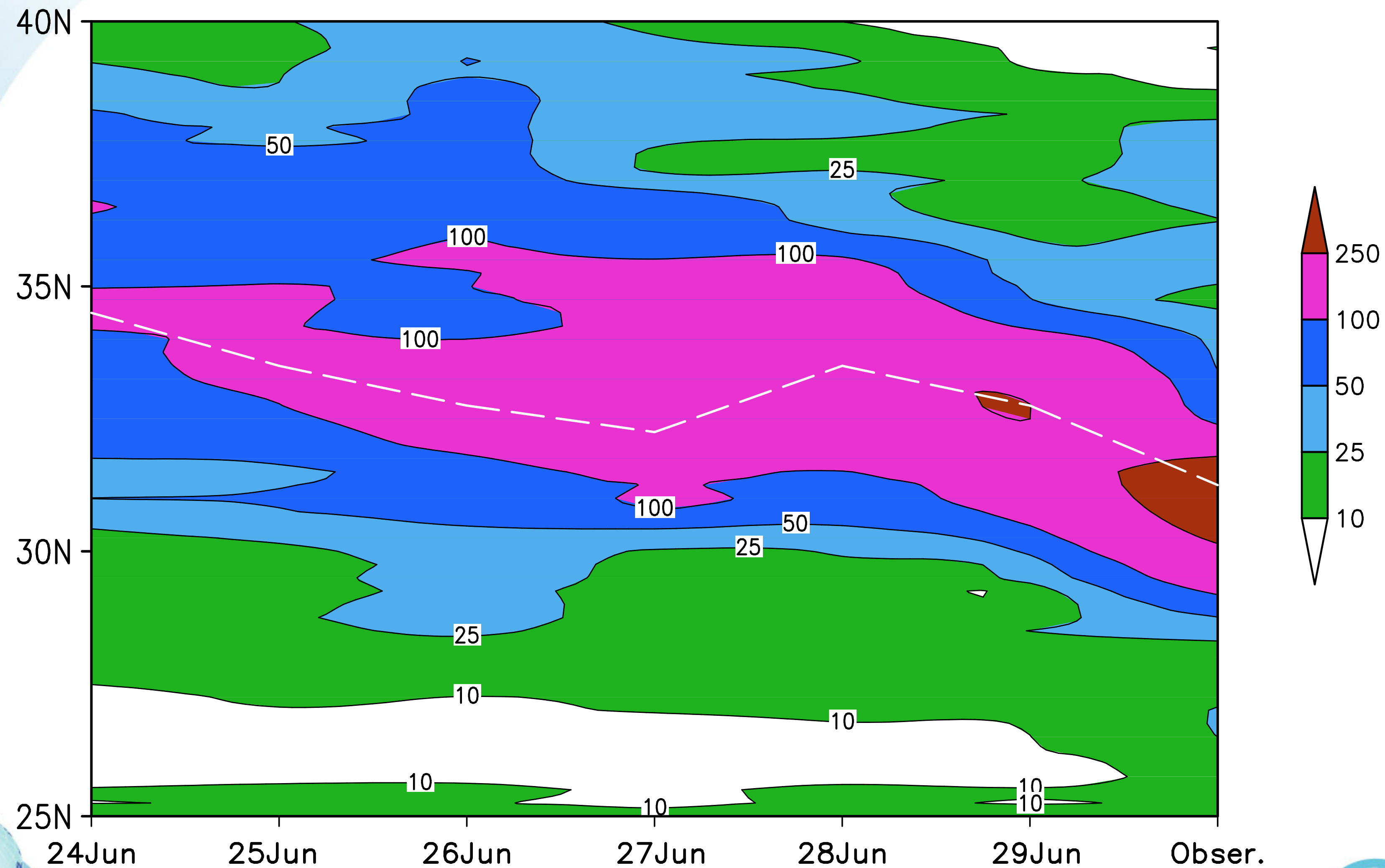
国家气象中心
NATIONAL METEOROLOGICAL CENTER

Methodology and Data



Here we defined the position of zonal-mean precipitation maximum in the middle-lower Yangtze River reaches from 110E to 120E as **the location of Rainbelt** for the period from 30 Jun to 4 July 2016.

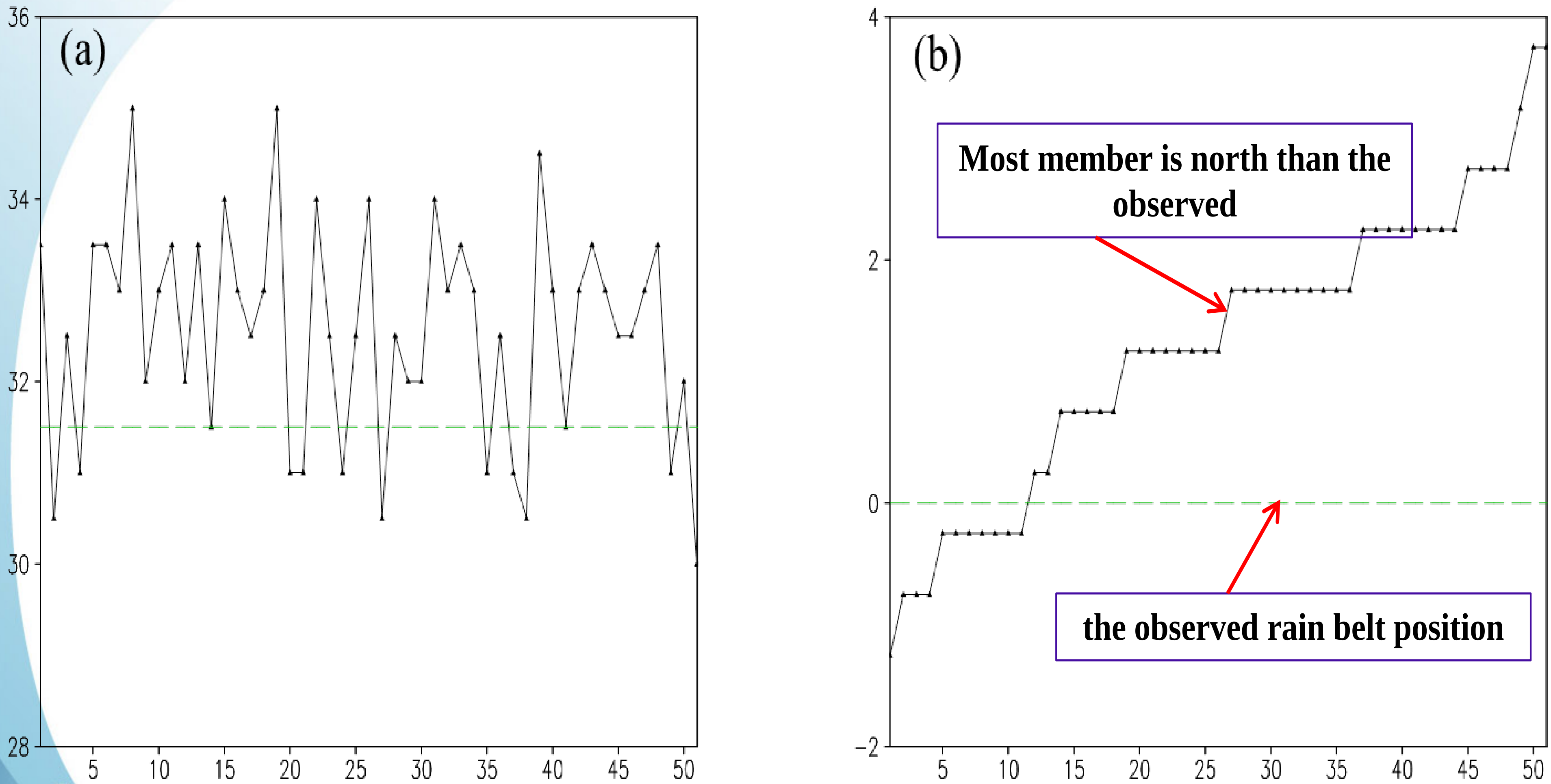
ECMWF deterministic forecasts



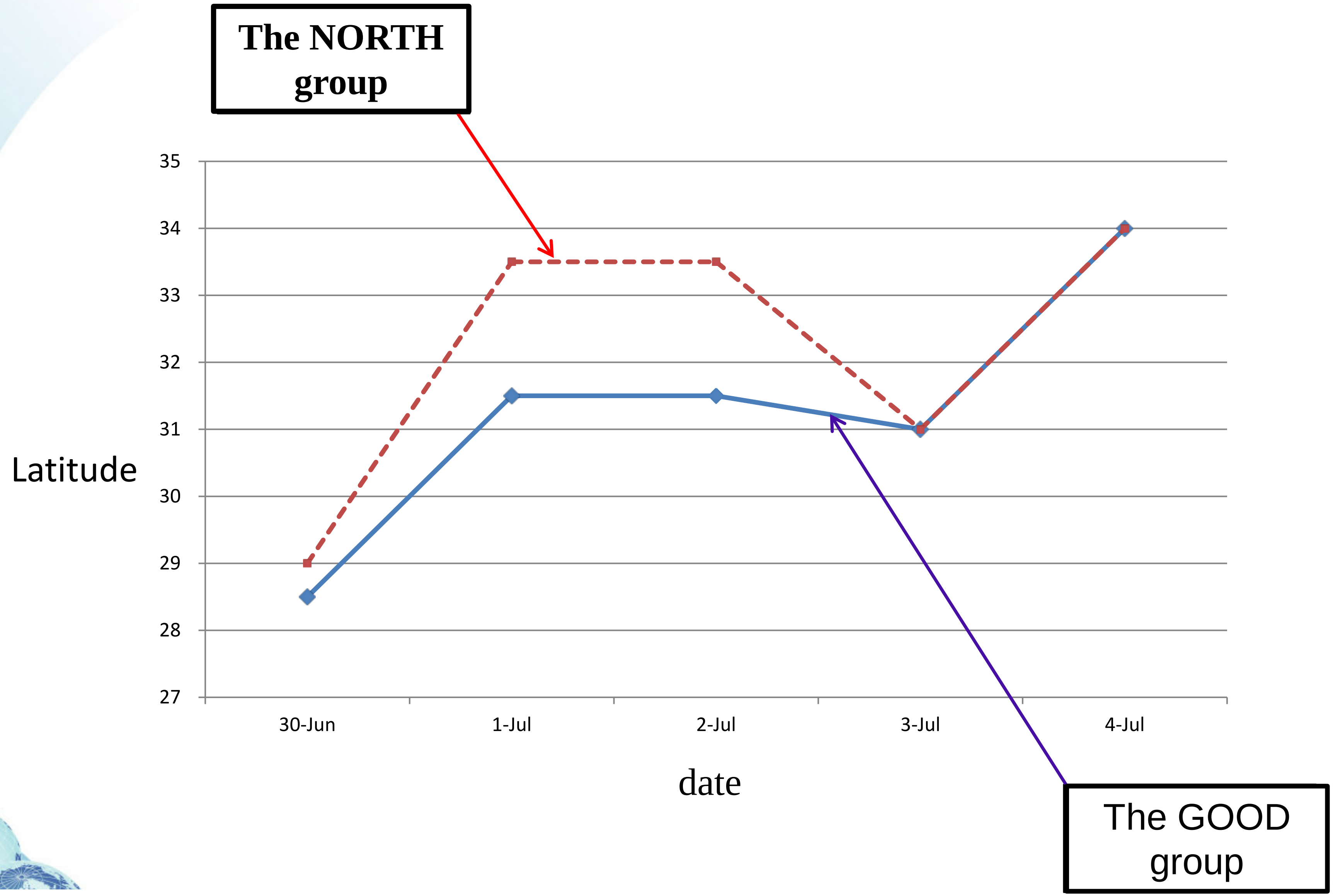
The forecast rain belt position based the zonal-mean precipitation **initialized at** 1200 UTC 24, 25,26,27,28,29 June and the observation

国家气象中心
NATIONAL METEOROLOGICAL CENTER

ECMWF ENS forecasts



(a) Calculated the forecast rain belt position index of the rainfall event, based on ECMWF 51-member initialized 1200 29 June. (b) same as (a), but for standardized anomalies and ordering series, here the mean value is the observed rain belt position.



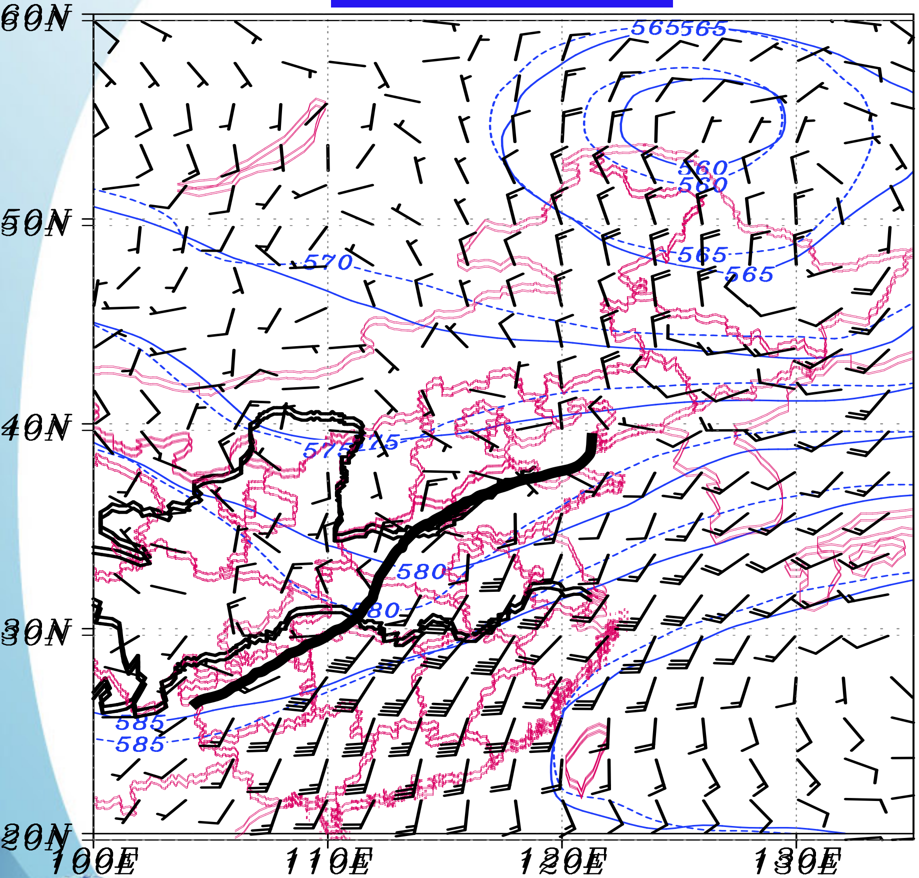
The daily variability of the north and accurate subset which are choose from 51 ECMWF forecast members in the period from 30 Jun to 4 July 2016.

Content

国家气象中心
NATIONAL METEOROLOGICAL CENTER

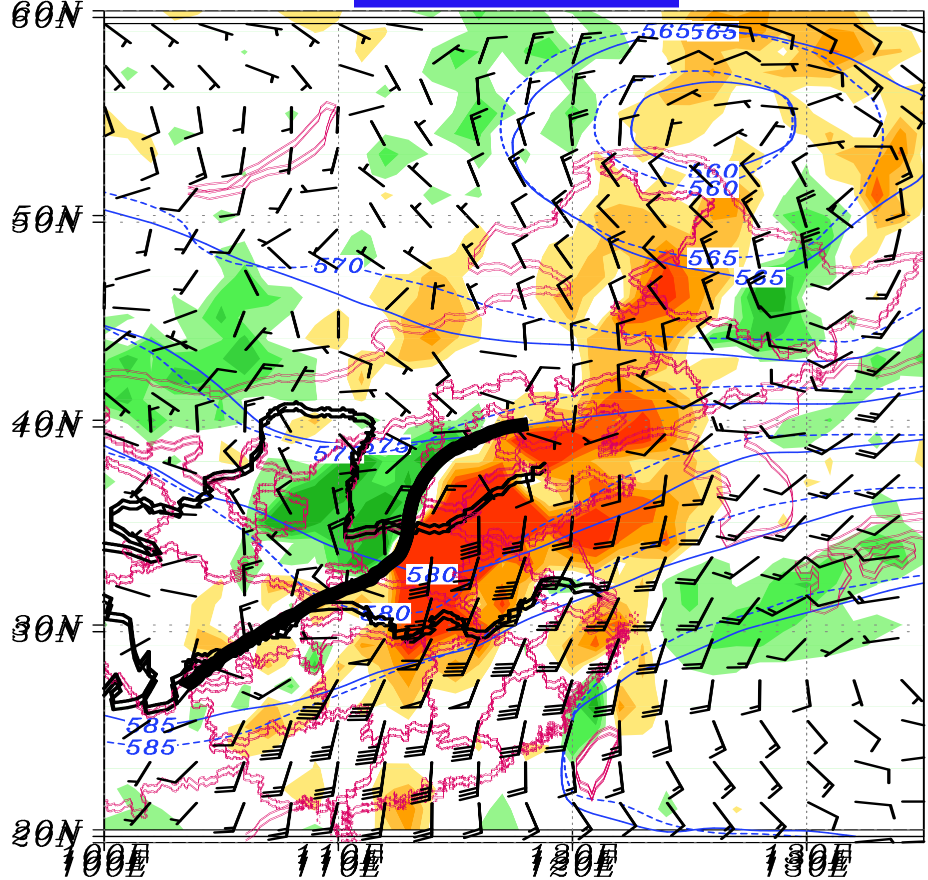
Initialized at 2000 28 June

GOOD



The 850hPa wind (barb) and 500hPa height(dashed contour) of north members; the accurate 500hPa height(solid line)

NORTH



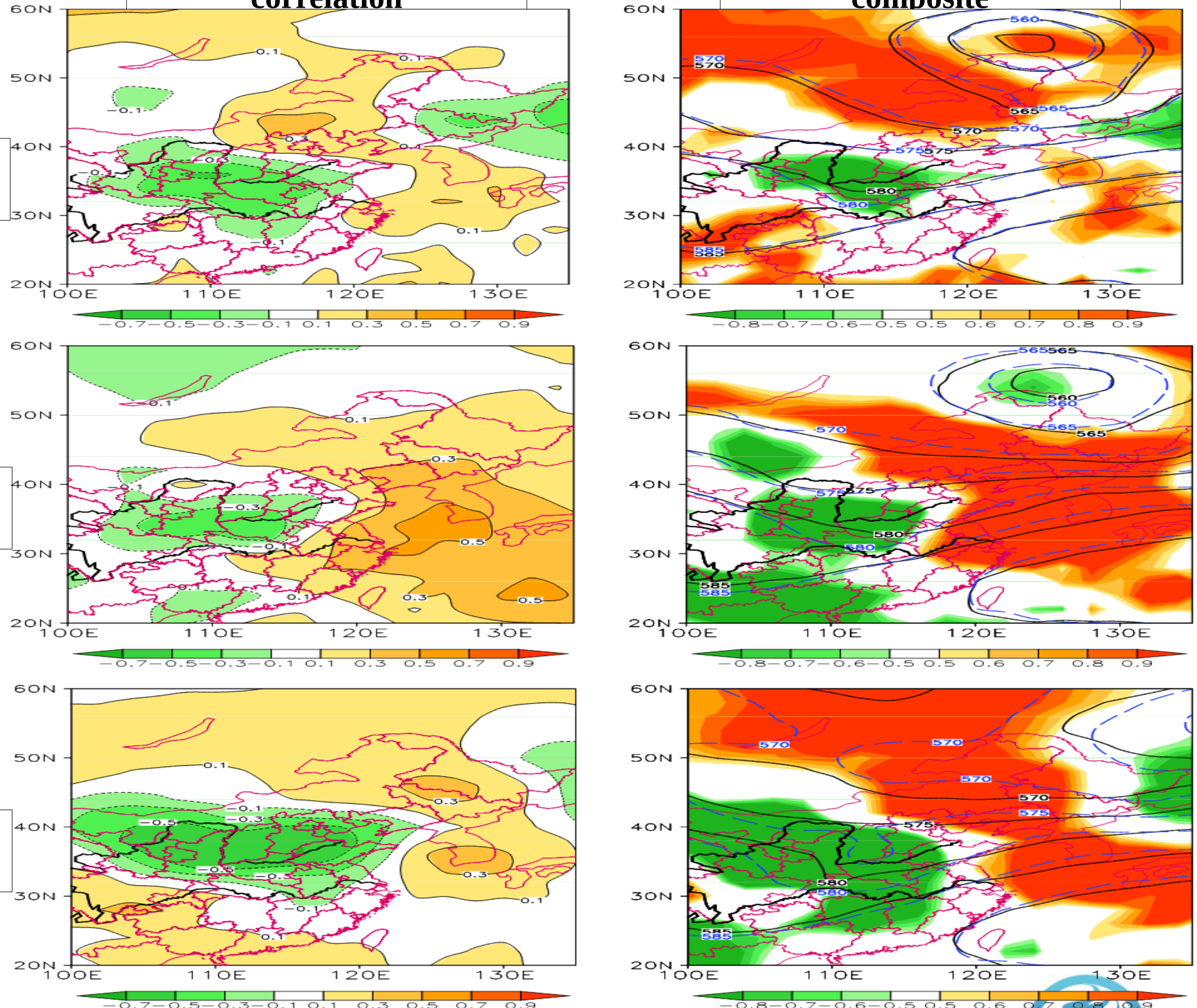
The same with left figure, and there is also the difference of meridional wind in 850hPa between the north and accurate members.

correlation | **composite**

Initialized at 1200 UTC 29 Jun

Initialized at 1200 UTC 28 Jun

Initialized at 1200 UTC 27 Jun

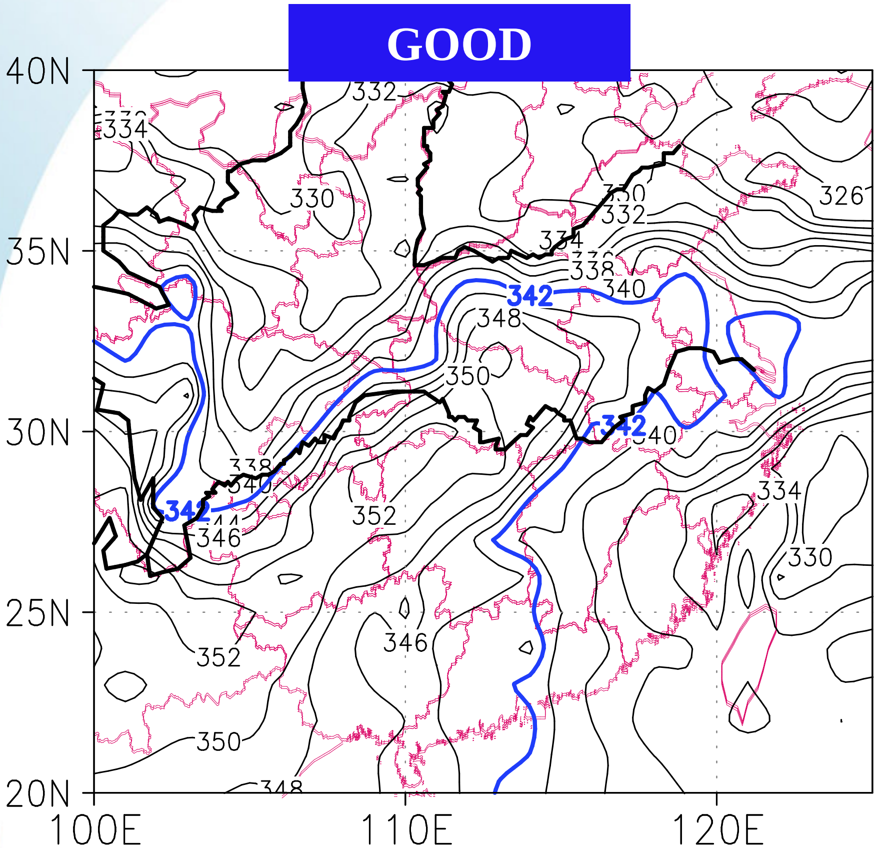


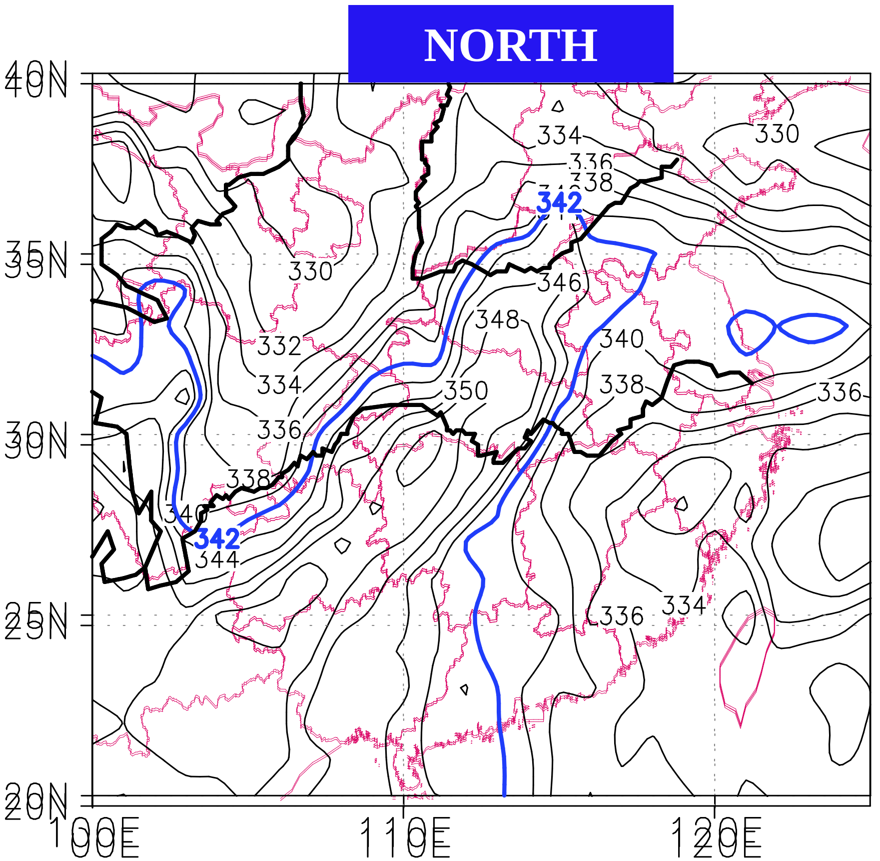
The correlation between the position of rain belt and 500 hPa geopotential height

The standard difference (shaded) between the north (the dashed blue contour) and accurate (the solid black contour) members of the 500 hPa geopotential height

How it impact the variability of rainbelt position?

700hPa
pseudoequivalent potential temperature

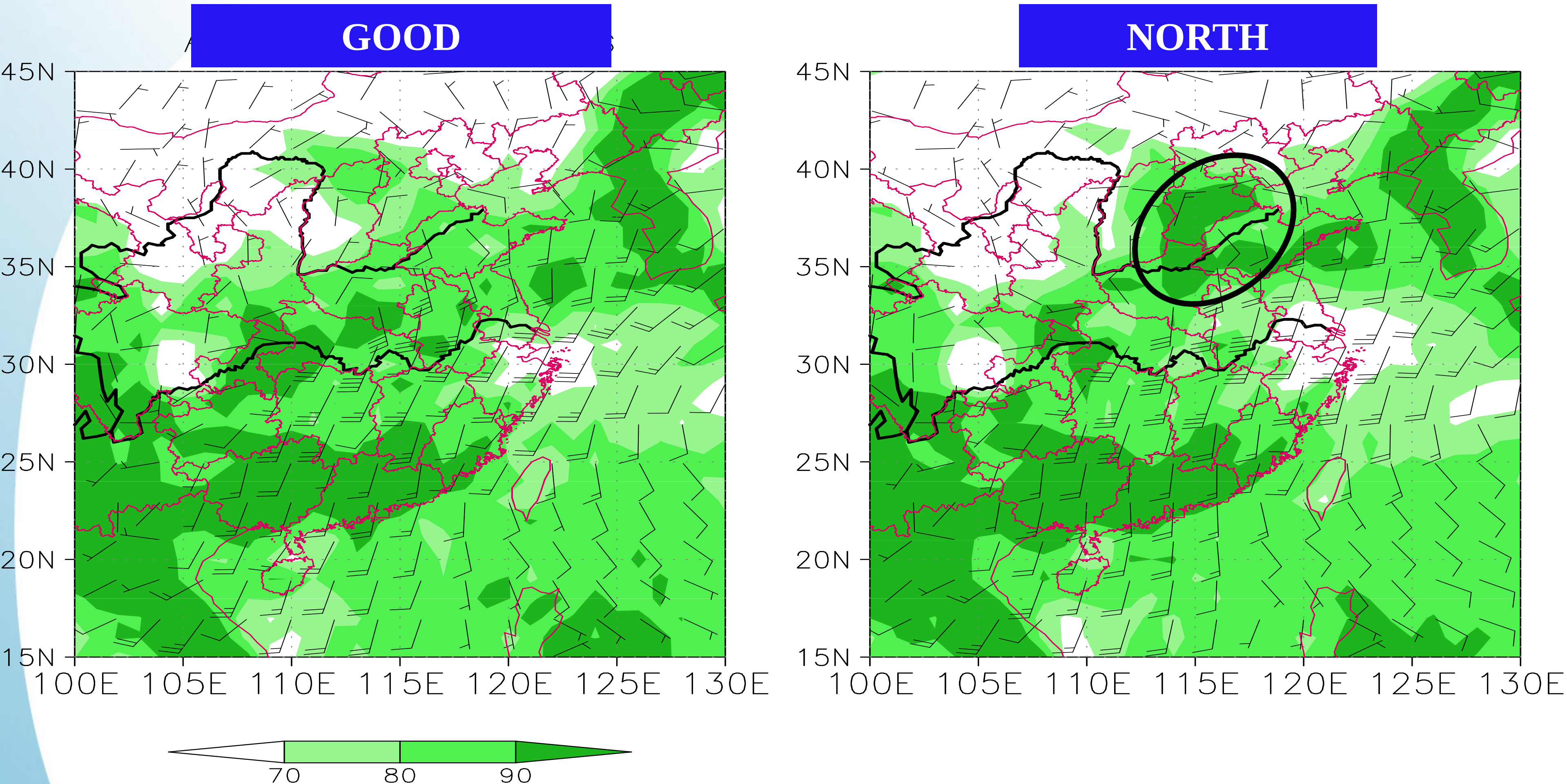




Here we regard the region with robust gradient as meiyu front. When the westerly trough is stronger and extend further south, the slope of front is greater.

国家气象中心
NATIONAL METEOROLOGICAL CENTER

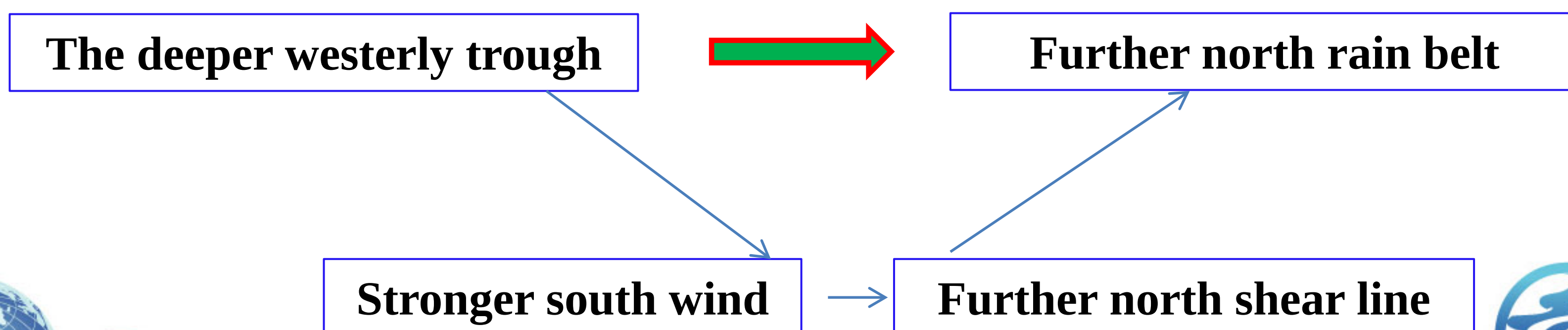
700hPa Relative Humid



Meanwhile, the north subset transport the moisture further north. The same result was showed in the difference between the north subset and the accurate subset.

Differences in the strength of the upper level trough between the most and least accurate ENS members are shown to influence a variety of lower-tropospheric processes, including but not limited to:

1) An enhanced lower tropospheric vortex along the wind shear line;
2) An enhanced southerly low-level jet that increases moisture flux convergence along the front;
3) Poleward displacements of the eastern flank of the Meiyu front as indicated through both the location of maximum 850 hPa horizontal wind shear and the location of the maximum 700 hPa equivalent potential temperature gradient.



国家气象中心
NATIONAL METEOROLOGICAL CENTER

The spatial–temporal forecast error

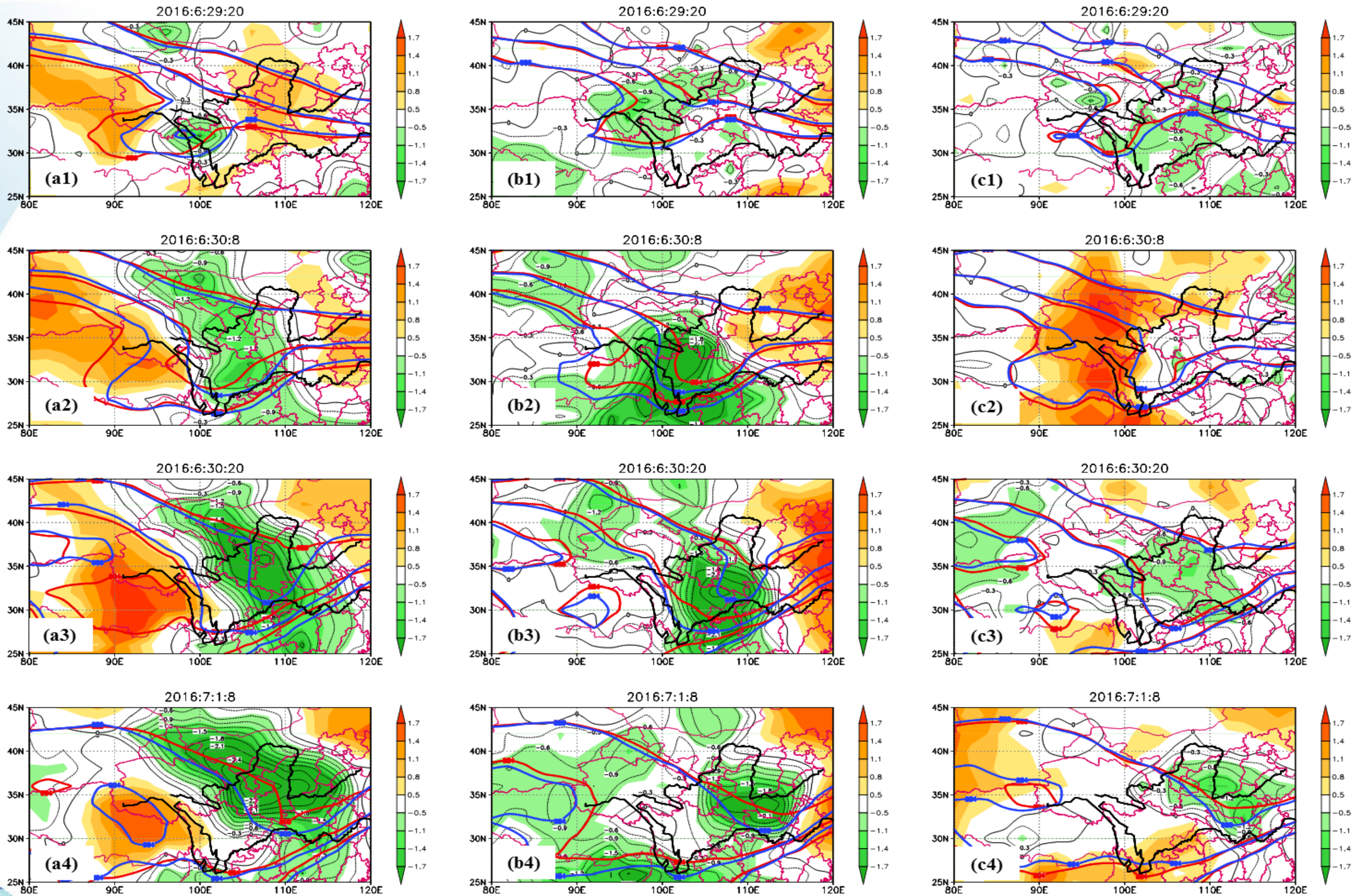
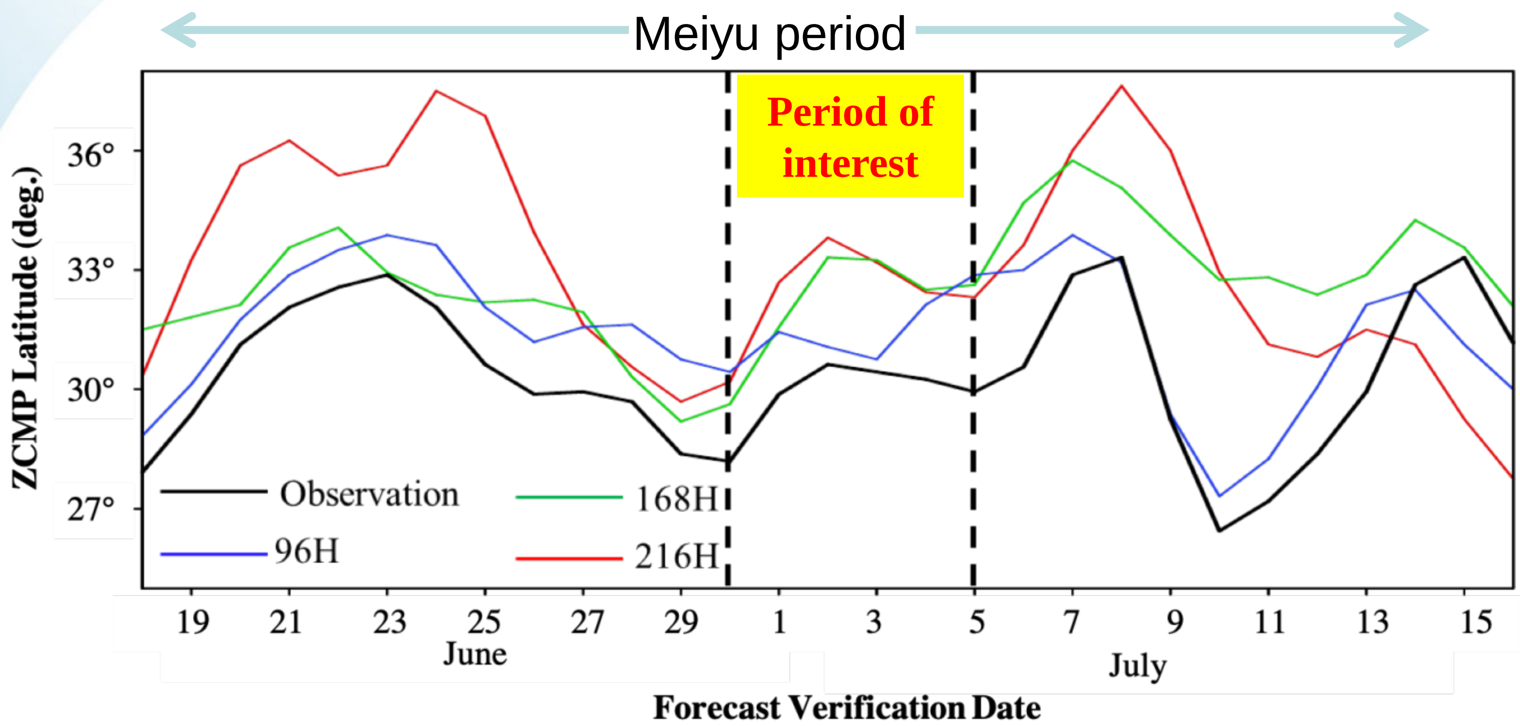


Fig . The temporal evolution of 500 hPa geopotential height and its standard difference between the two subsets in every 12 hours. figures a1-a4 are initialized at 2000 UTC 27 Jun. analyses are valid at (a1) 2000 UTC 29 Jun, (a2) 0800 UTC 30 Jun, (a3) 2000 UTC 30 Jun, (a4) 0800 UTC 1st Jul. the figures b1-b4 are same with figures a1-4, but the initialized at 2000 UTC 27 Jun. figures c1-c4 are initialized at 2000 UTC 29 Jun. The solid red (blue) contour corresponds to the accurate (north) subsets.

Conclusion:

The 500hPa westerly trough acts the dominant role on causing the rainbelt position with northward bias. When the intensity prediction is stronger, it will extend more southward, then induce the stronger 850hPa southerly, informing the stronger cyclone and northward shear line at 850-hPa level. Finally the rainbelt would locate northward and precipitation would be stronger.

discussion:



The observed ZMCP (station data, black line) and 96-h, 168-h, and 216-h deterministic ECMWF forecasted ZMCP of the Meiyu rain band (blue, green, and red lines, respectively) for the Meiyu precipitation season from 18 June to 16 July 2016. The thick dashed black line represents the starting (0000 UTC 30 June 2016) and ending point (0000 UTC 5 July 2016) of the period of interest for the study.

国家气象中心
NATIONAL METEOROLOGICAL CENTER

Thanks