Performance Analysis on Extended-Rang Ensemble Prediction over Middle and Lower Reaches of Yangtze River in the East Asian Rainy Season of 2011

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Background

In the summer of 2011, severe drought and flood transitions occurred in the middle and lower reaches of the Yangtze River. After the start of the rainy season, several consecutive rainstorms brought severe flooding to the area. In recent years, ensemble prediction has been widely used in medium and long range forecasting business. Although many studies use statistical methods to assess the overall performance of ensemble predictions. However, research on ensemble forecasting in weather processes and weather systems is still very rare. In order to understand the forecasting performance of ensemble prediction for specific seasons and specific regions from the perspective of weather science, and to improve forecasters' ability to understand and control ensemble forecast products. We conduct a preliminary assessment of ensemble forecast performance from the perspective of a forecaster.

Data&Methods

Forecast System: ECMWF, 50members + control, integrated to 15 days **Resolution:** Daily (0-15d), 1.0° × 1.0° (Pressure layer)
Data: forecast: 500hPa, 200hPa and 850hPa wind, 500hPa and 200hPa height, and 850hPa specific humidity (May 24, 2011 - June 2, 2011, 12Z) Observation: Reanalyzed data
Methods: Weather case study (Heavy rain on June 3-7, June 9-11, June 13-15 and June 17-19, 2011) **Test object**: Evolution of atmospheric circulation and major weather systems

Results

Forecast performance of ensemble prediction for circulation transformation

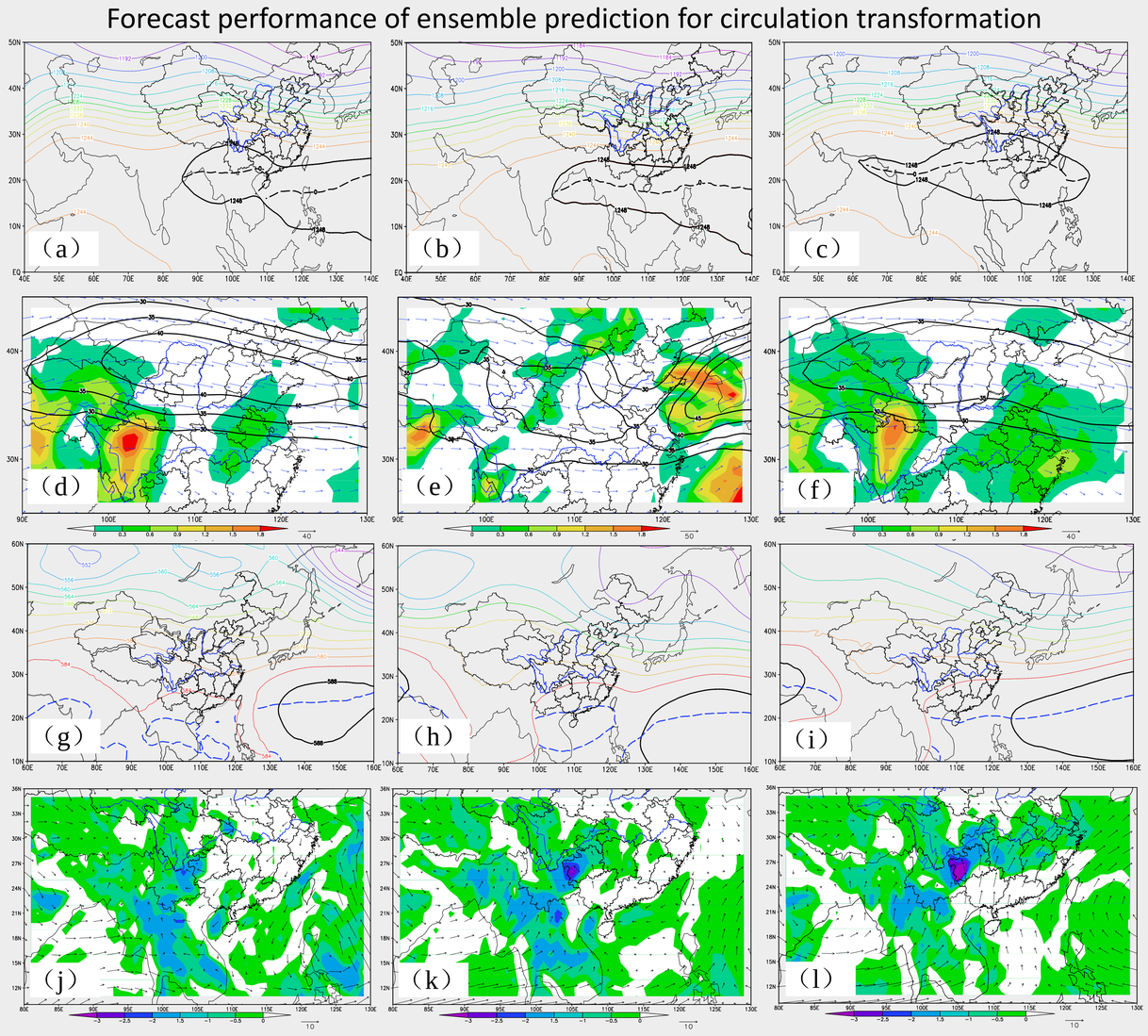

Fig1. Ensemble average fields of 24 May during transform period of circulation, a, b, c: height of 200hPa (unit: dagpm) (dash line: ridge line); d, e, f: wind and divergence of 200hPa (unit: $10^{-5}s^{-1}$) (shaded: divergence area); g, h, i: height of 500hPa (unit: dagpm) (dash line: ridge line); j, k, l: wind and divergence of 850hPa (unit: $10^{-5}s^{-1}$) (shaded: convergence area); a, d, g, j: 24-28 May; b, e, h, k: 29 May-2 June; c, f, g, l: 3-7 June

Stability of ensemble prediction during the occurrence of heavy rainfall

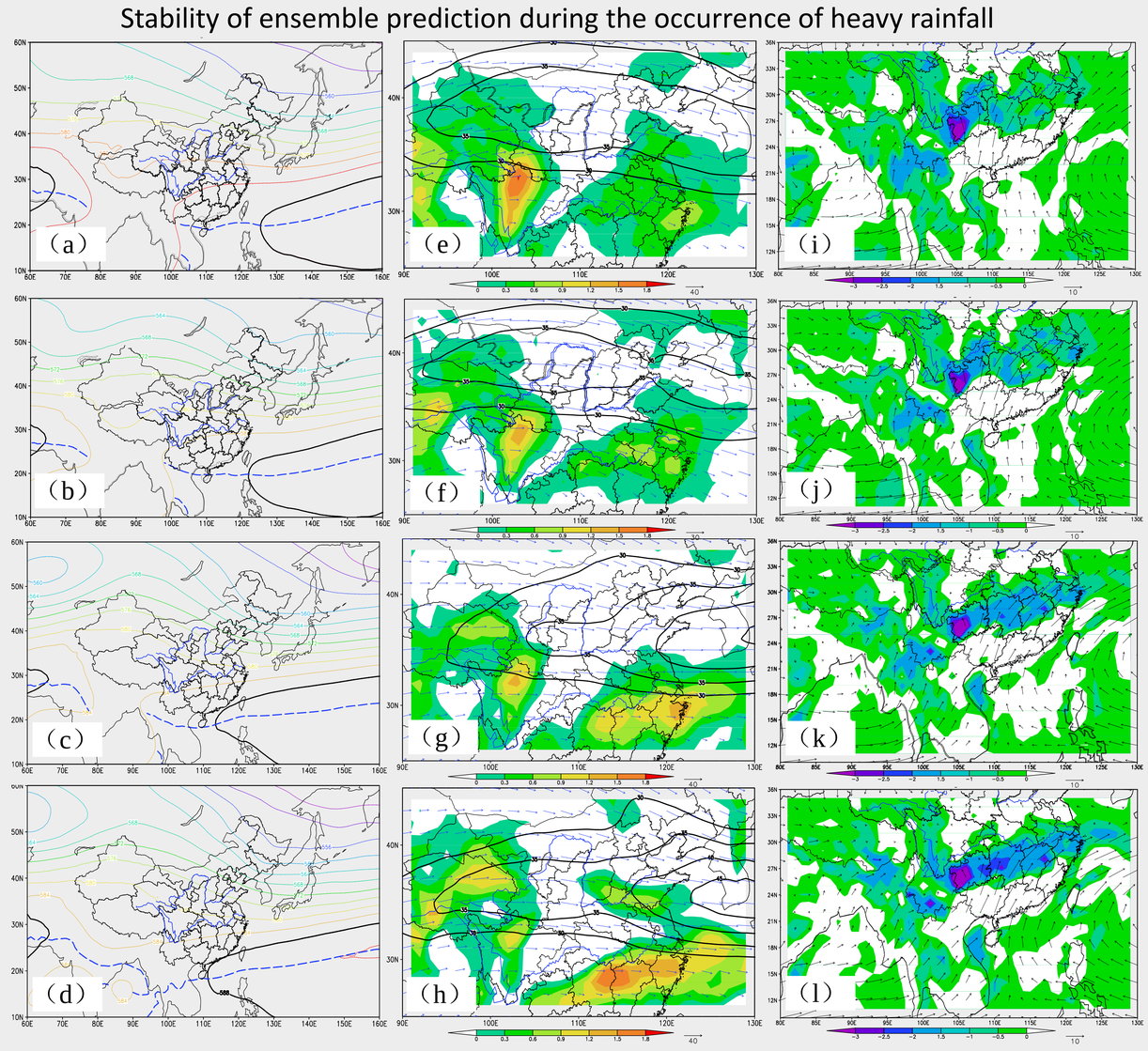

Fig.2 Average height of 500hPa (a, b, c, d) (unit: dagpm) (dash line: ridge line), wind and divergence of 200hPa (e, f, g, h) (unit: $10^{-5}s^{-1}$) (shaded: divergence area), wind and vapor flux divergence of 850hPa (i, j, k, l) (unit: $10^{-5}s^{-1}$) (shaded: convergence area) during 3-7June in different initial forecast
a, e, i: 24May; b, f, j: 26 May; c, g, k: 29 May; d, h, l: 2 June

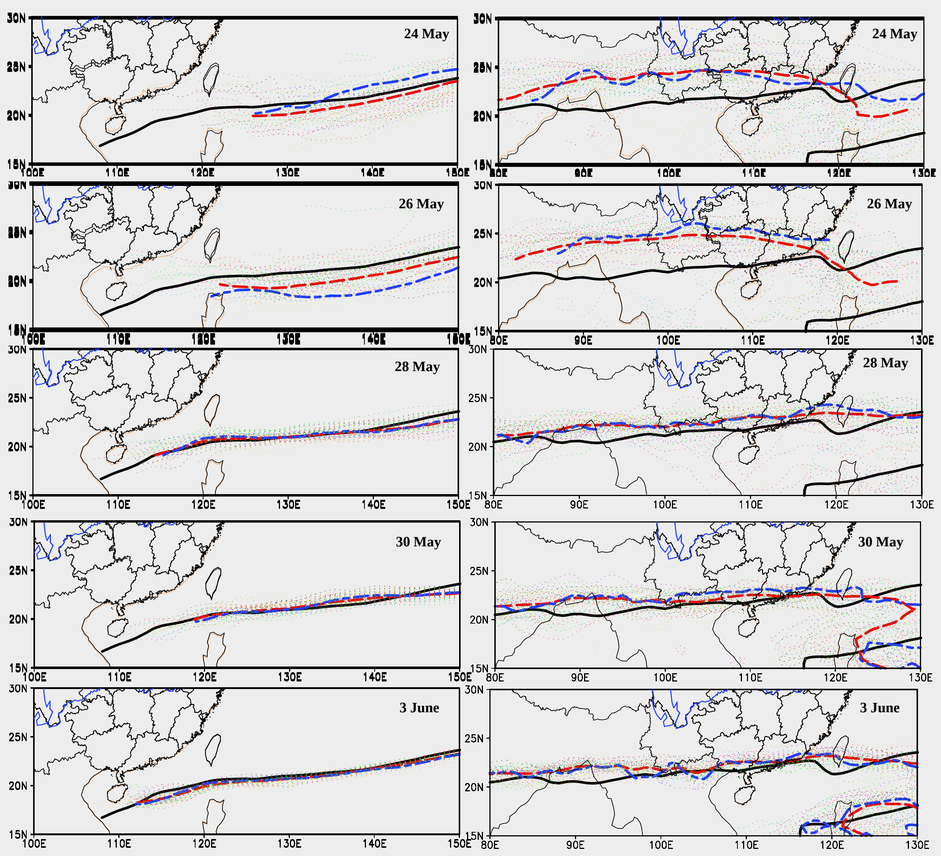

Fig.3 Average ridge line of subtropical High (left) and south Asia High (right) during the first heavy rain process in different initial forecast (solid: conversation; long dash: ensemble average; long and short dash: control; dotted: members)

Forecasting performance of ensemble forecast members on weather systems

Table: The Number of ensemble forecast members with 500hPa Subtropical High (SH) and 200hPa South Asian High (SAH) deviating less than 1 latitude during the four rainfall periods (Process 1: 3-7 June; Process 2: 9-11 June; Process 3: 13-15 June; Process 4: 17-19 June)

Process 1	24 May	25 May	26 May	27 May	29 May	30 May	1 June	2 June
SN	7	11	9	12	28	22	26	25
SAN	3	4	7	6	9	14	15	15

Process 2	27 May	29 May	30 May	1 June	2 June	3 June	5 June	7 June
SN	12	11	12	13	12	14	20	26
SAN	10	11	10	9	14	17	12	20

Process 3	1 June	2 June	3 June	4 June	5 June	6 June	7 June	9 June
SN	10	8	6	13	8	18	9	15
SAN	8	6	6	16	19	17	10	17

Process 4	4 June	5 June	6 June	7 June	9 June	10 June	11 June	12 June
SN	12	17	13	14	15	8	12	11
SAN	9	9	10	14	18	21	20	22

Summary

The performances of ensemble forecasting about large-scale circulation and heavy rain processes in the mid-lower reaches of the Yangtze River during drought and flood transition period in 2011 are examined. The results show that ensemble average forecasting has a good performance on the adjustments of large-scale circulation in the whole troposphere in extended-range period. During different forecasting period, ensemble average forecasting display stability of forecasting on mainly affecting systems during the heavy rain processes. With the shorting of the forecasting period, the dispersion of various ensemble members decrease gradually on mainly weather systems. The forecasting of individual ensemble members including ensemble average and control member has not obvious regularity in the different forecasting period.