The Interpretation of ECMWF NWP Products for Flood and Draught Forecasting in the Middle and Lower Reaches of Yangtse River in China

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Outline

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3. Design of prediction scheme
4. Diagnostic analysis
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Introduction

---Why we do it?

The middle and lower reaches of Yangtze river in China suffers from the flood disaster frequently (for example,flood in1954, 1991, and 1998 etc. and drought in 1965 and 1988).

The flood or drought in the large area is difficult problem in the domain of middle-range weather forecast.

the ECMWF 7-day NWP products possess high quality.

The main object of this work is how to utilize the ECMWF 7-day NWP products fully to study and develop the prediction model for the flood and drought of the middle and lower reaches of Yangtze river.

Data

- Data:

Element and level: 500hPa geopotential height---H;
850hPa temperature---T

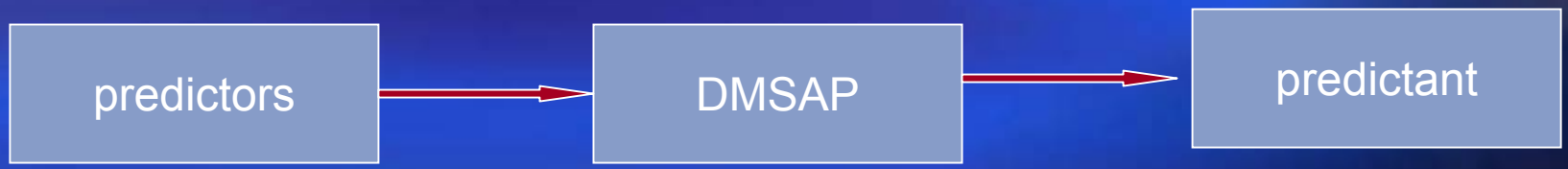
Time: initial time 12:00(UTC)
June 1 to July 31
00h(1986～ 1997)
00 ～ 168h(1998 ～ 2002)

Resolution: 5*5

Design of prediction scheme

- **Scheme:**

  Double-level multi-factor synthetic analogue prediction method(DMSAP)

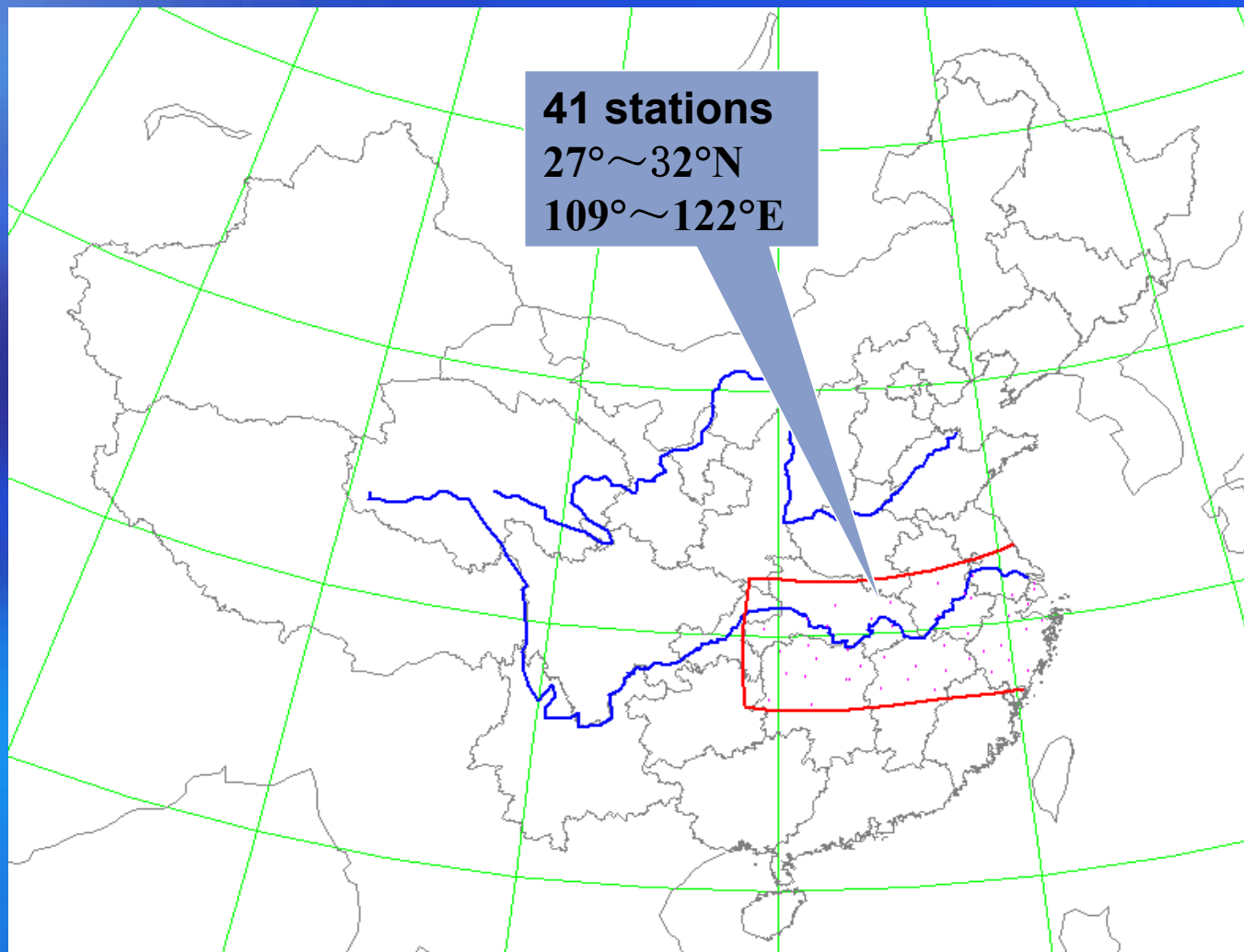


Predictior

1. 500hPa geopotential heights H
2. 850hPa temperature T
3. Area index of the subtropical high at 500hPa
4. Geostrophic momentum transport at 500hPa
5. Temperature longitudinal gradient at 850hPa

----the pentad mean value every 5 days

Predictand: the class of flood and drought during the period of coming 10 day every 5 days



Criterion of the flood and drought classification in the middle and lower reaches of Yangtse river

Class	ΔR <0	$\Delta R \leqslant$ -50%	ΔR =-100%	R≥100mm	R≥200mm	Assessment
	PCT（%）			NUM		
1	≥0.80	≥0.40	≥0.11	≤4	≤1	Terrible drought
	≥0.80					
	≥0.65	≥0.35		≤4	≤1	
2	0.80>P≥0.55			≤10	≤2	Drought
3	0.80>P≥0.55			≤13	≤4	Little drought
	0.55>P≥0.45			≤13	≤2	
	0.55>P≥0.45			≤10	≤3	
4	others			11-14	2-6	Little flood
5	<0.55			≥15	≥3	Flood
	<0.55			≥18	≥2	
6	<0.55			≥18	≥7	Sever flood
	<0.55			≥15	≥10	

PCT: percentage of stations that meet the condition

NUM: number of station that meet the conditon

- **Techniques:**

(1)The **analogue** index formula is

$$I_{ij} = r_{ij}(1 - \frac{E_{ij}}{n\sigma})$$

where E_{ij} is the Euclidean distance.

$\sigma = \frac{1}{2}(\sigma_i + \sigma_j)$, where σ_i and σ_j are the mean square error of the prediction field and the historical field respectively. n is the negative real value to control the E_{ij}. n in this paper is defined as 15. r_{ij} is the correlation coefficient. This correlation index possesses the capacities to represent the similar degree in the aspects of not only the number but also the pattern.

(2)Diagnostic volume

$$u_g = -\frac{g}{fa}\frac{\partial H}{\partial \varphi}$$

Zonal geostrophic wind

$$V_g = -\frac{g}{fa\cos\varphi}\frac{\partial H}{\partial \lambda}$$

longitudinal geostrophic wind

$$u_g v_g$$

Geostophic momentum transport

Represent the dynamic status

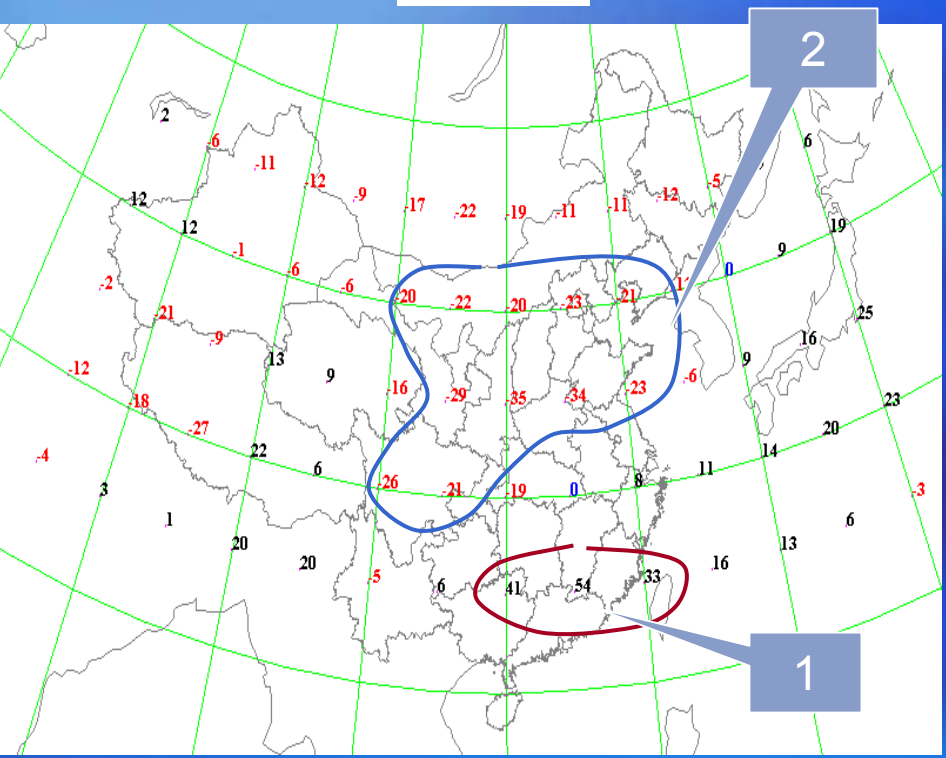
$$\nabla_y T$$

Temperature longitudinal gradient

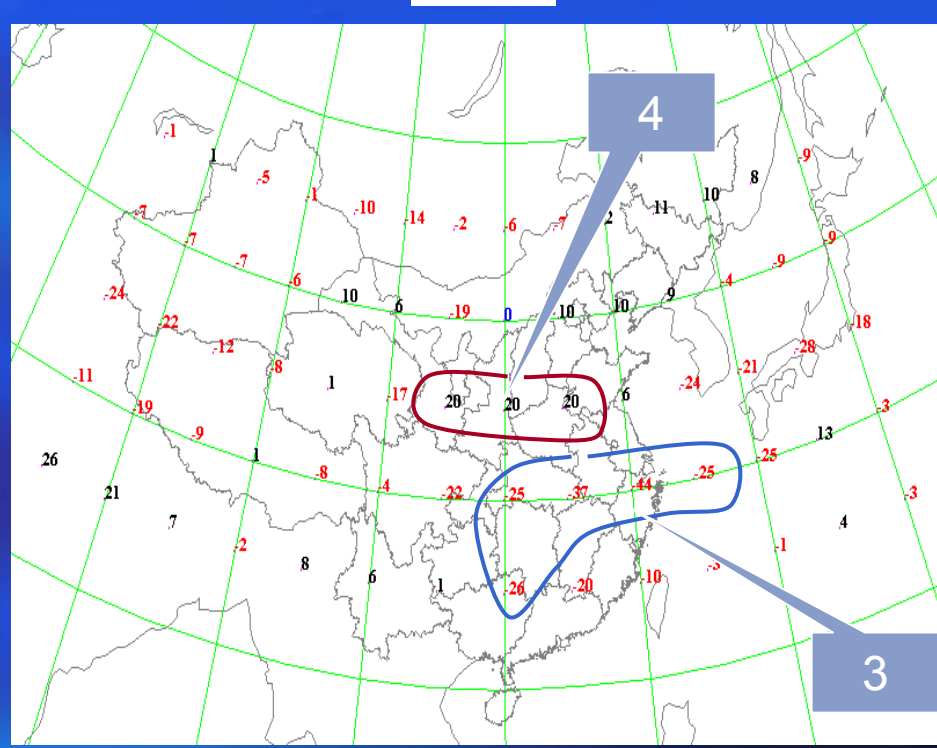
Indicate the thermodynamic condition

Diagnostic analysis

$u_g v_g$



$\nabla_y T$



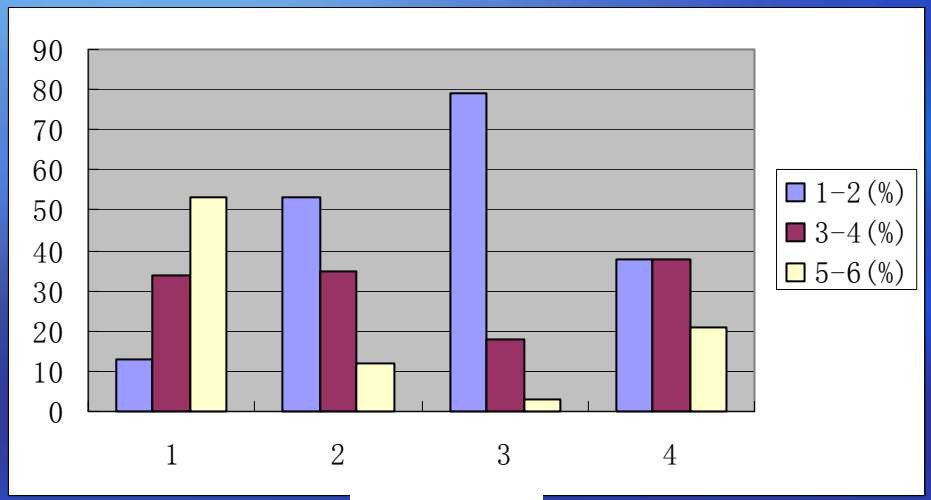
the correlation coefficient distribution between the diagnostic volume and the class of flood and drought(25°～45°N ,75°～140°E)

(have pass t test, at 0.05 significance level)

Criterion of the diagnostic volume classification

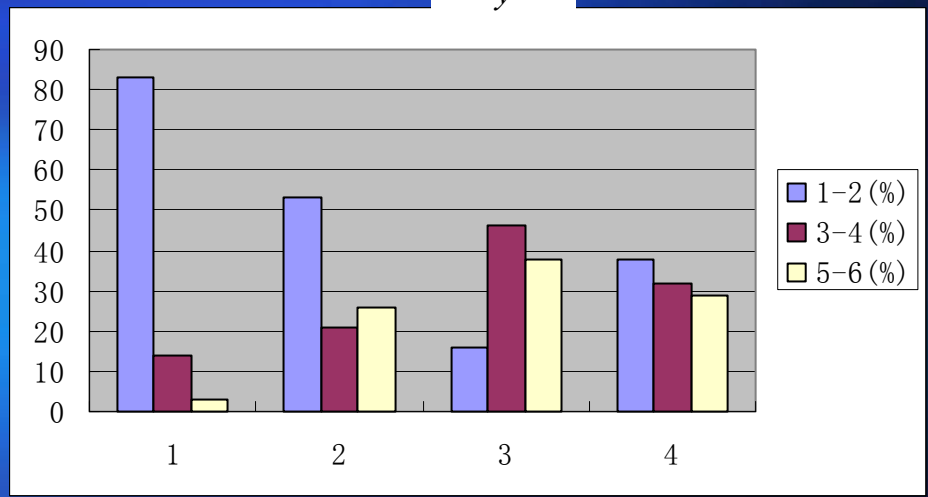
Grade	$u_g v_g$ (key region 1)	$u_g v_g$ (key region 2)	$\nabla_y T$ (key region 3)	$\nabla_y T$ (key region 4)
1	>5	<-5	⩾4	
2	>5	⩾-5	$4 > \nabla_y T > 0$	
3	⩽5	⩾-5	⩽0	⩾5
4	⩽5	<-5	⩽0	

Statistic of the corresponding flood and drought to various grades of diagnostic volume

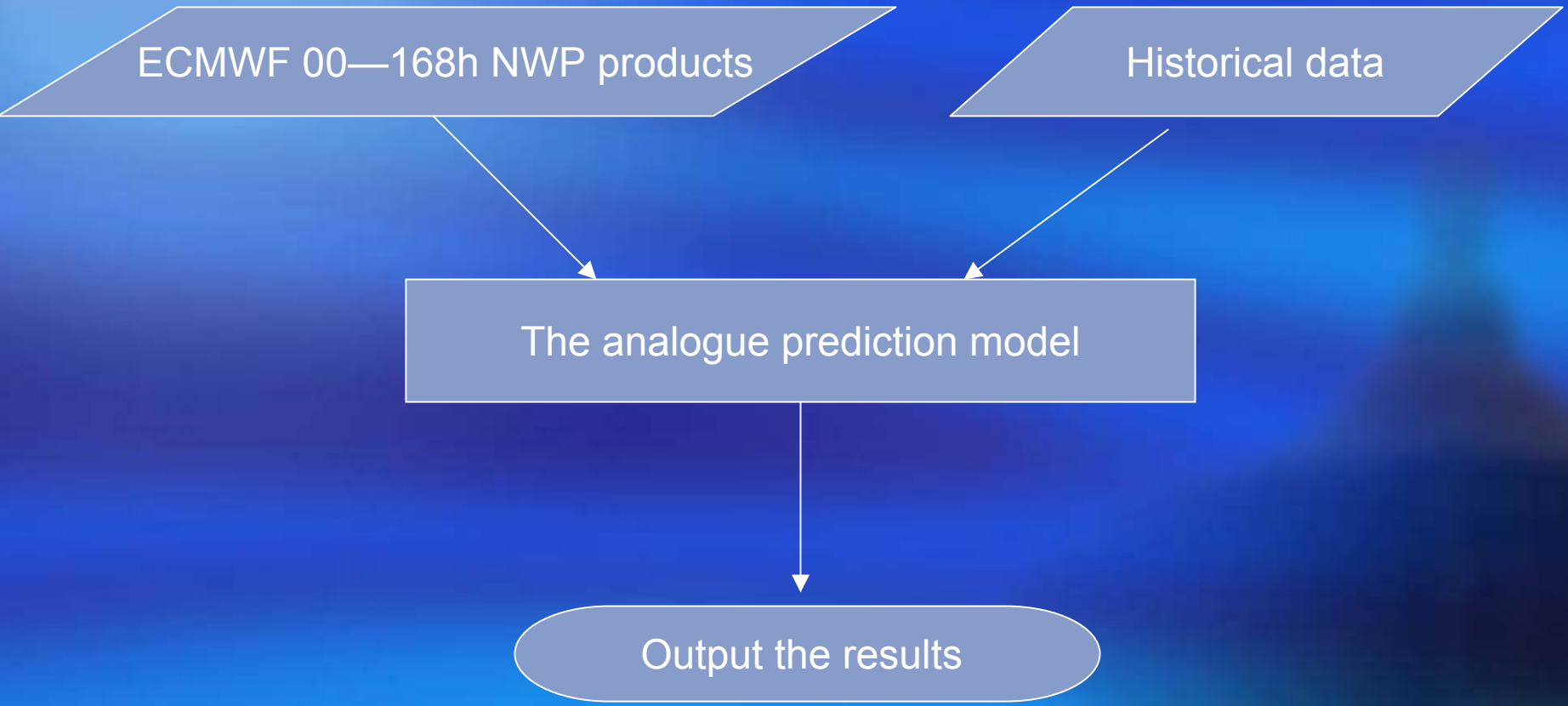


$u_g v_g$

$\nabla_y T$



Prediction model framework



Prediction system flow chart

Double-level multi-factor synthetic analogue prediction model framework

Score of the analogue prediction model

S=1-(Co-Cp)*0.2

Co: observation

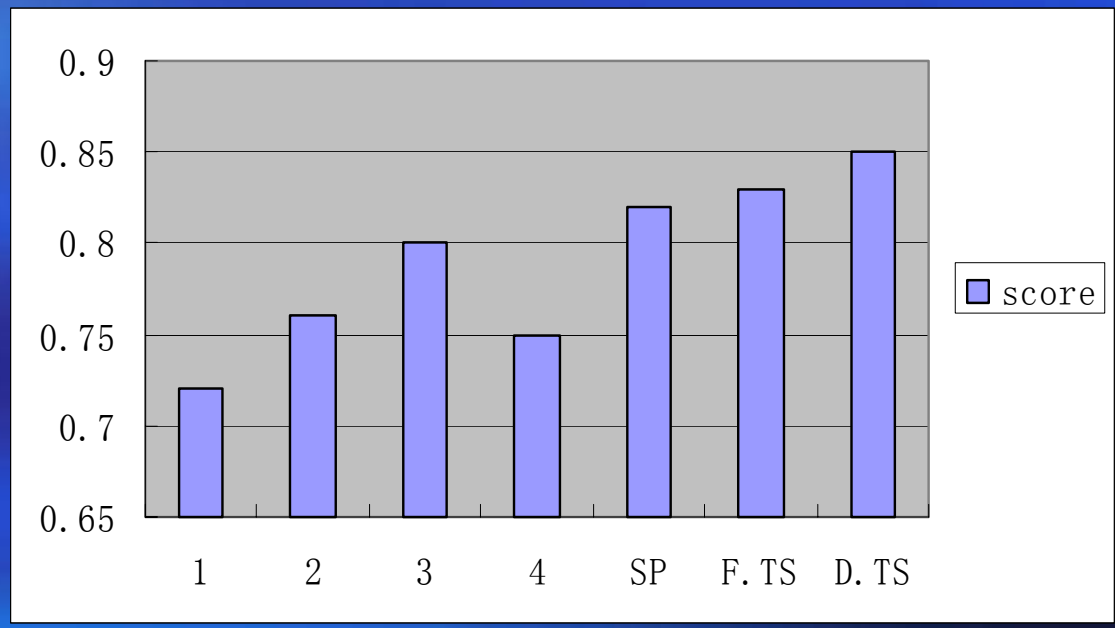
Cp: prediction

1: 500hPa height

2: Area index

3: $u_g v_g$

4: $\nabla_y T$



SP: synthetic prediction

F.TS: TS for the flood prediction

D.TS: TS for the drought prediction

Conclusion

1. Good performance
2. Contribution of diagnostic volume
3. Comparison with single level or single factor prediction
4. Improvement


Thank you for your attention!
welcome to China!