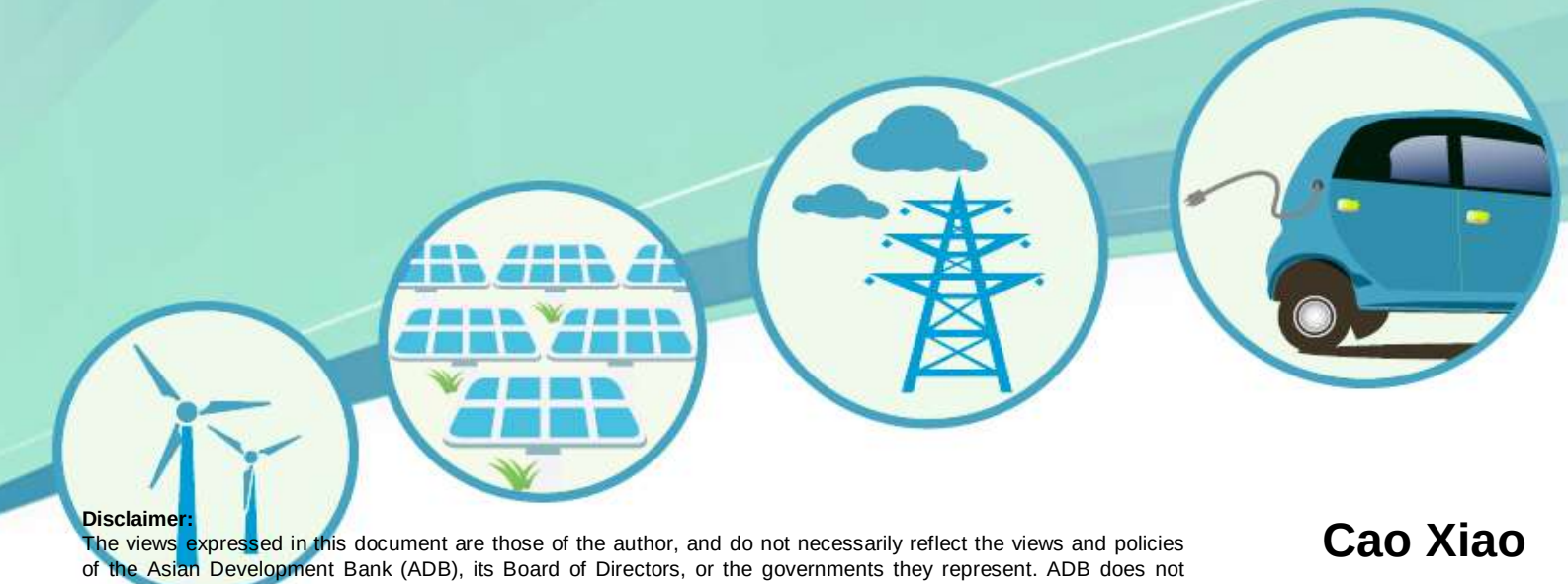
# Wind Power Forecasting





**Cao Xiao**

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# Content

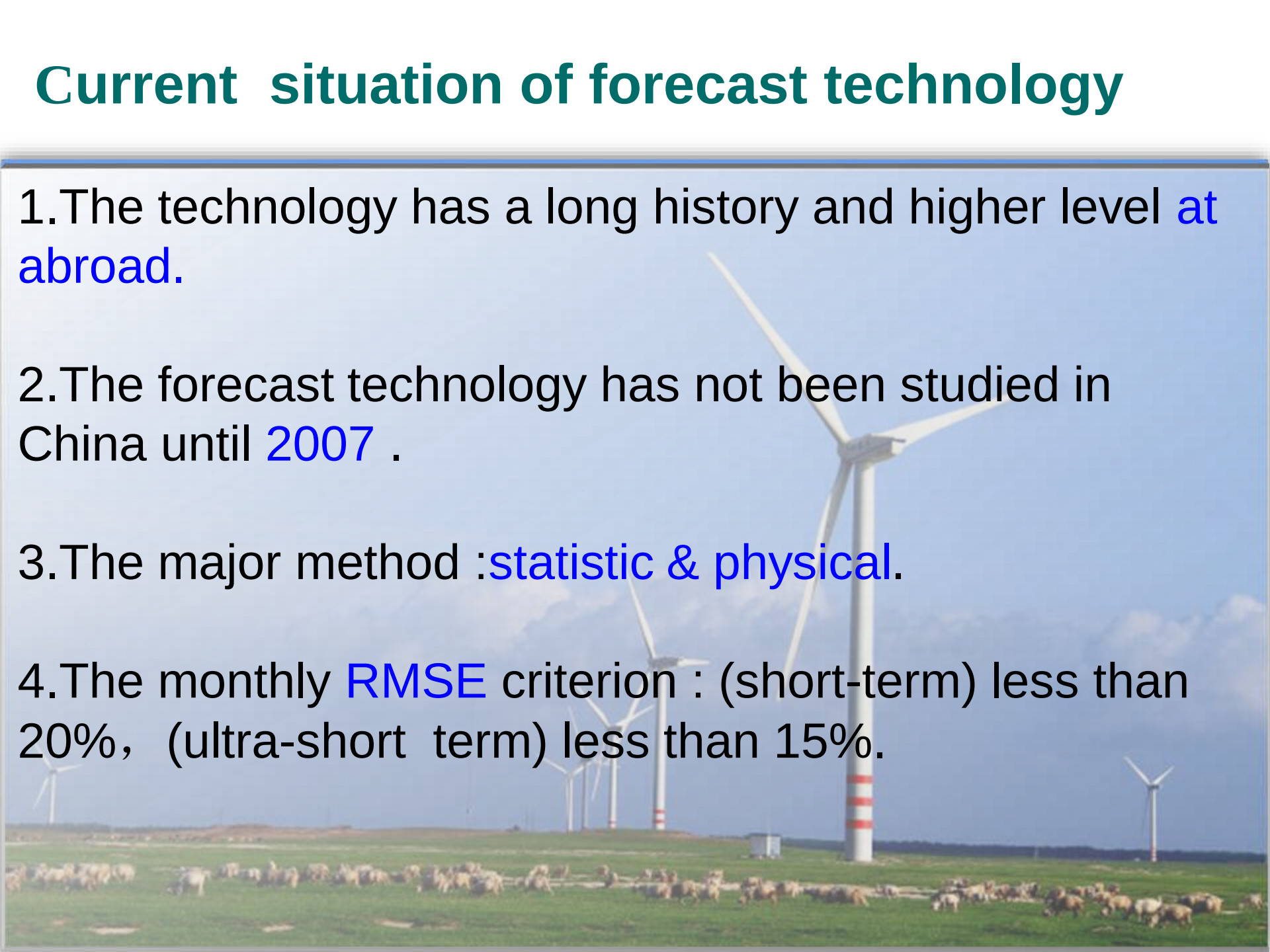
# Current situation of forecast technology

1.The technology has a long history and higher level at abroad.

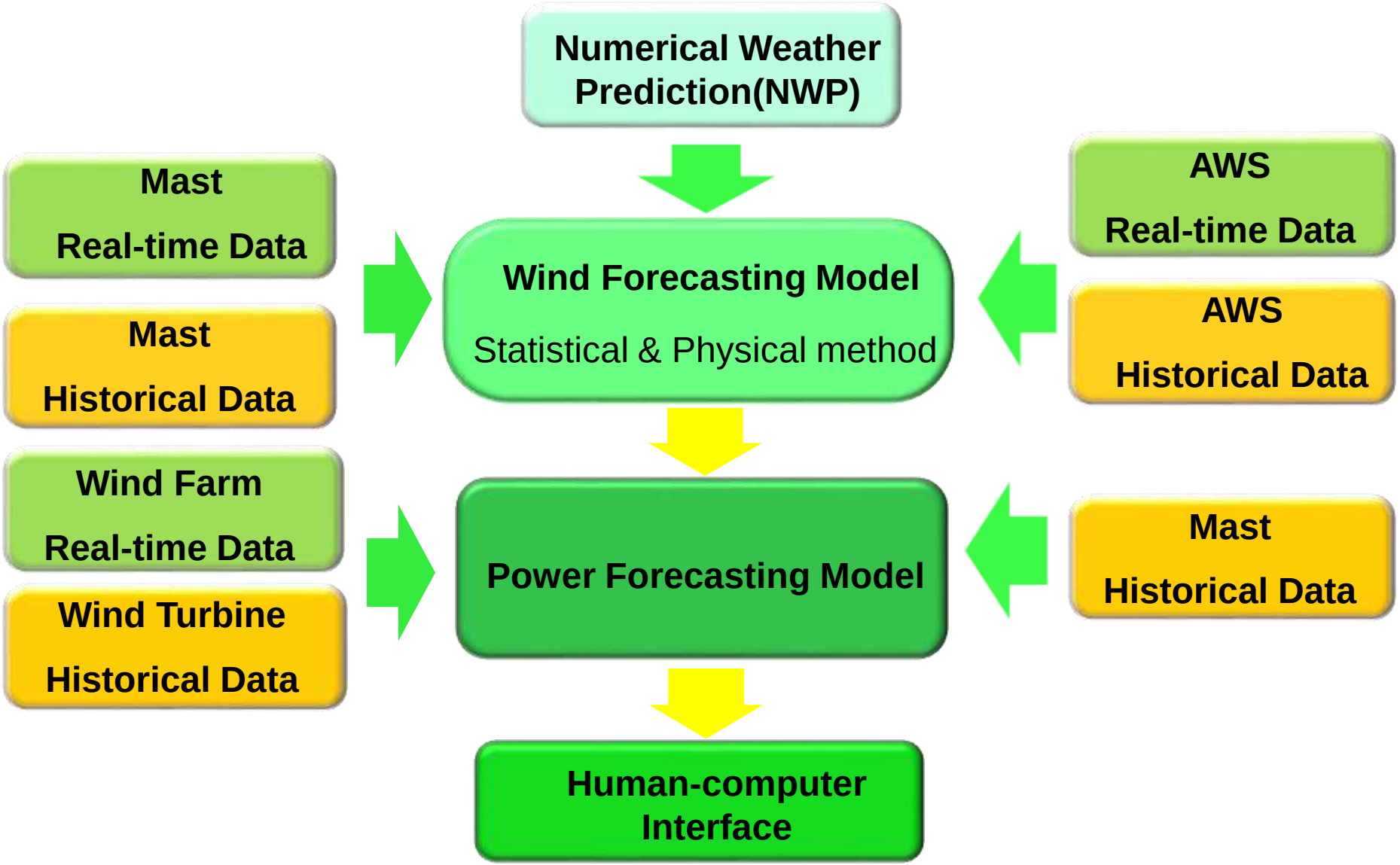
2.The forecast technology has not been studied in China until 2007 .

3.The major method :statistic & physical.

4.The monthly RMSE criterion : (short-term) less than 20%，(ultra-short term) less than 15%.



# Forecast principle of wind power



# Forecast principle of wind power

**Statistic Method:**

**building the relativity between weather element and power output.**

1 .The different mathematical models could be adopted.

2. The large amount of historical data is needed to conduct training.

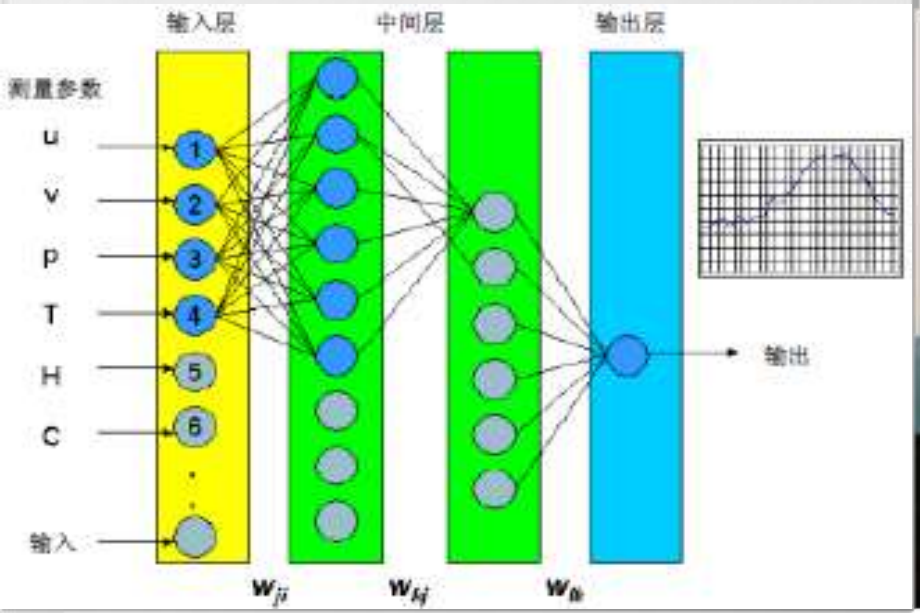
3. The regular retraining for the model is needed.

**Physical Method:**

**calculate wind speed and direction at the hub height.**

1.NWP, WT/WasP and so on could be adopted to calculate the wind speed and direction in the surface layer.

2.Boundary conditions are needed.

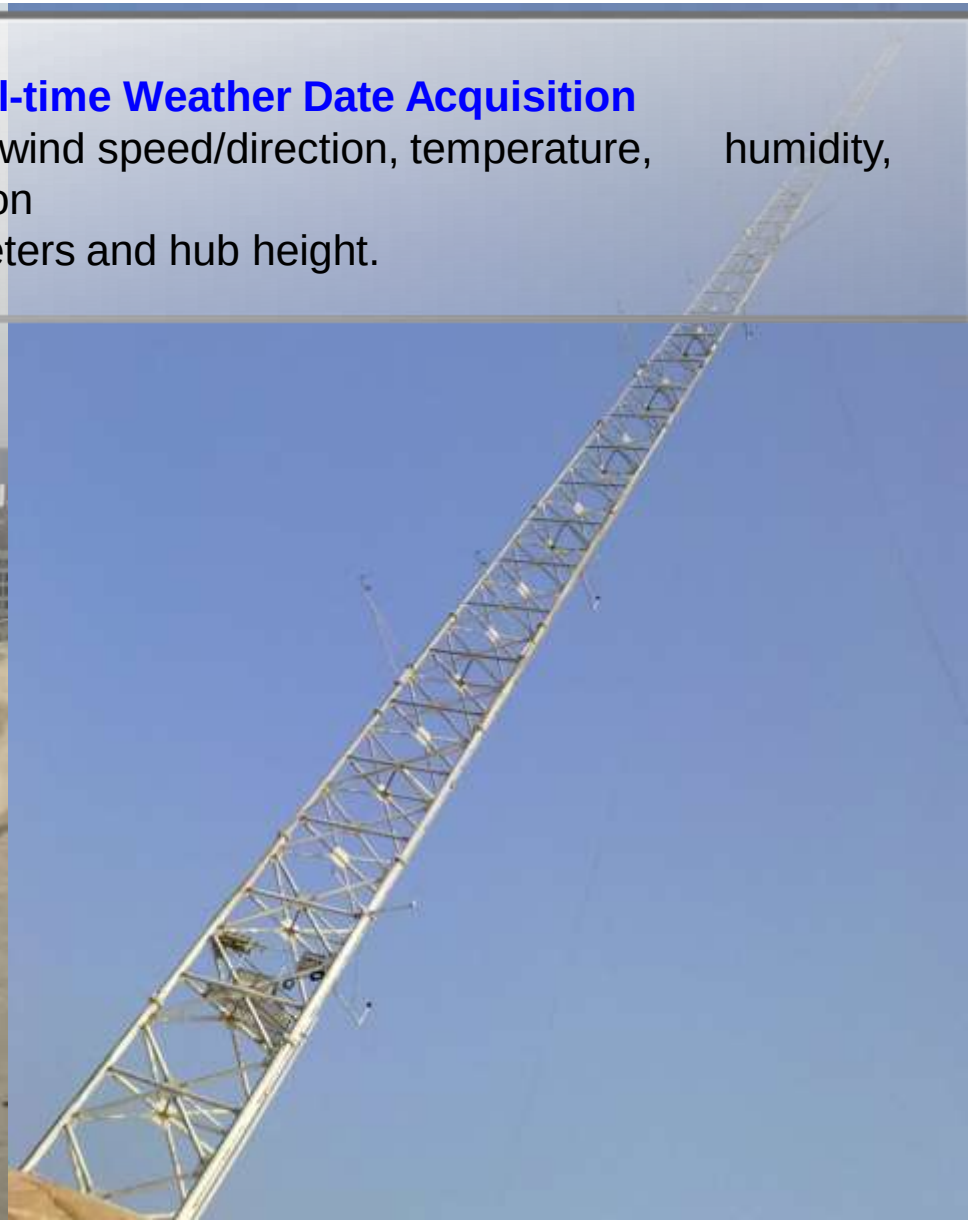



# Key technology of forecast

**Technology of Real-time Weather Date Acquisition**

**Weather element :** wind speed/direction, temperature, humidity, air pressure, radiation

**Height :**10/30/70meters and hub height.



# Key technology of forecast

**Numerical Weather Prediction:**

1. Regard GFS (global forecasting system) as the background field.
2. Based on ADAS (ARPS Data Analysis System).
3. Combine large amount of locally actual measurement data.
4. Debug Mesoscale model WRF.
5. Adopt application technology

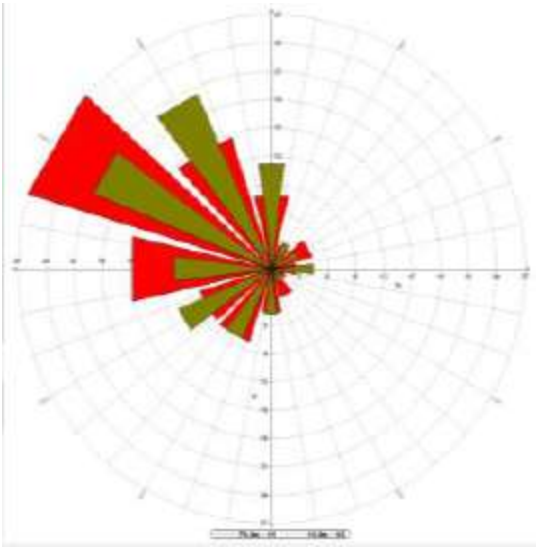
➢ output 0-72 hours' forecast value of wind speed and direction.

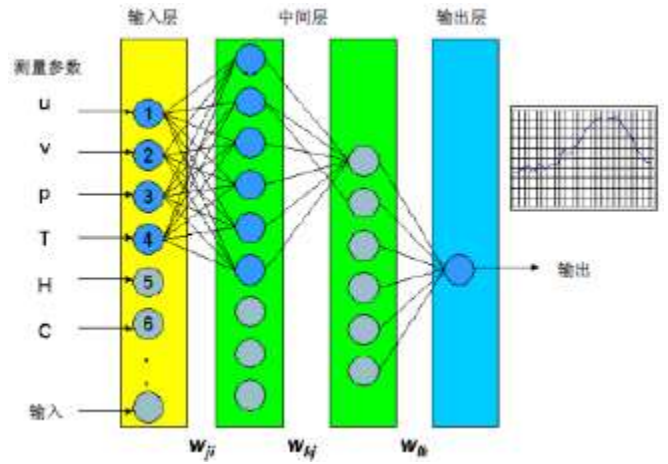
# Key technology of forecast

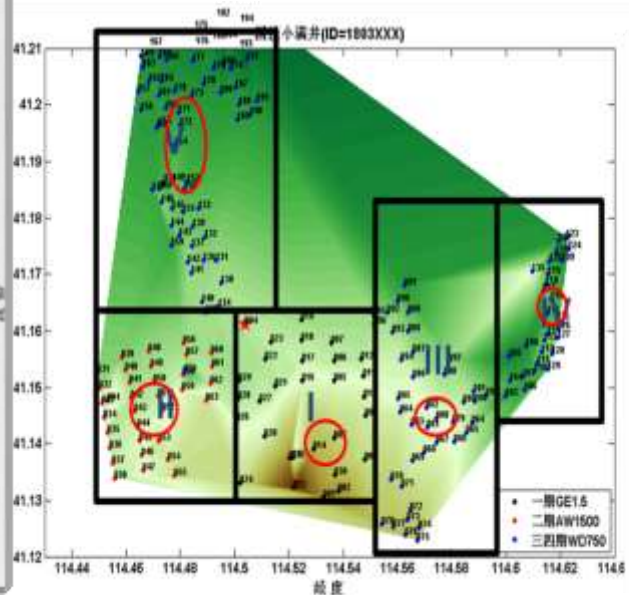
**Technology of Forecast Modeling ：**

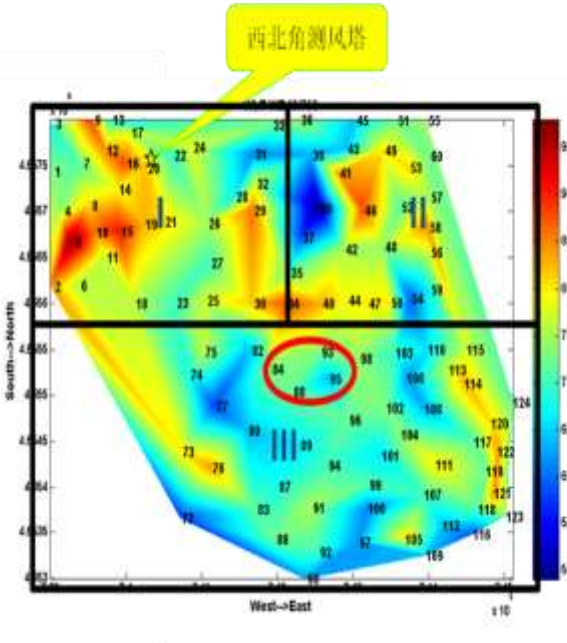
1.Establish **weather forecast model** by the combination of statistic and physical methods.

2.Establish **power forecast models** in accordance with the conditions ( geography and climate features , type and distribution of wind turbine and so on).





# Development of forecast technology

**1、The Diversity of Wind Power Forecast Result at Home and Abroad:**

**(1) Distribution of wind power stations**

◆ Large scale of collective distribution in China.

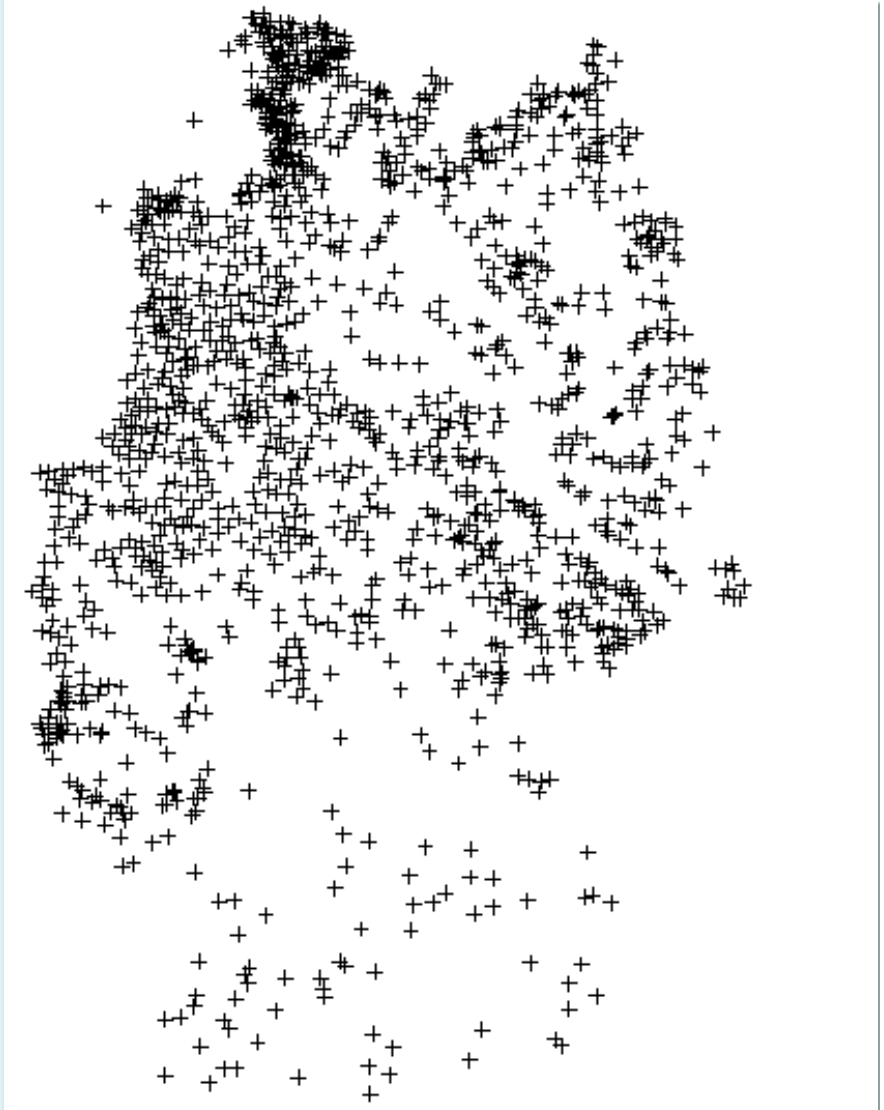
◆More expansive and equal in Europe

**(2)NWP level**

◆The weather stations are dense distribution in the Europe .

◆ The geographic location Europe lies are beneficial to NWP.

◆Many commercialized weather service companies in Europe.

*Distribution of wind turbines in Germany*

## *Cooperation with ADB*

**Demand of China**

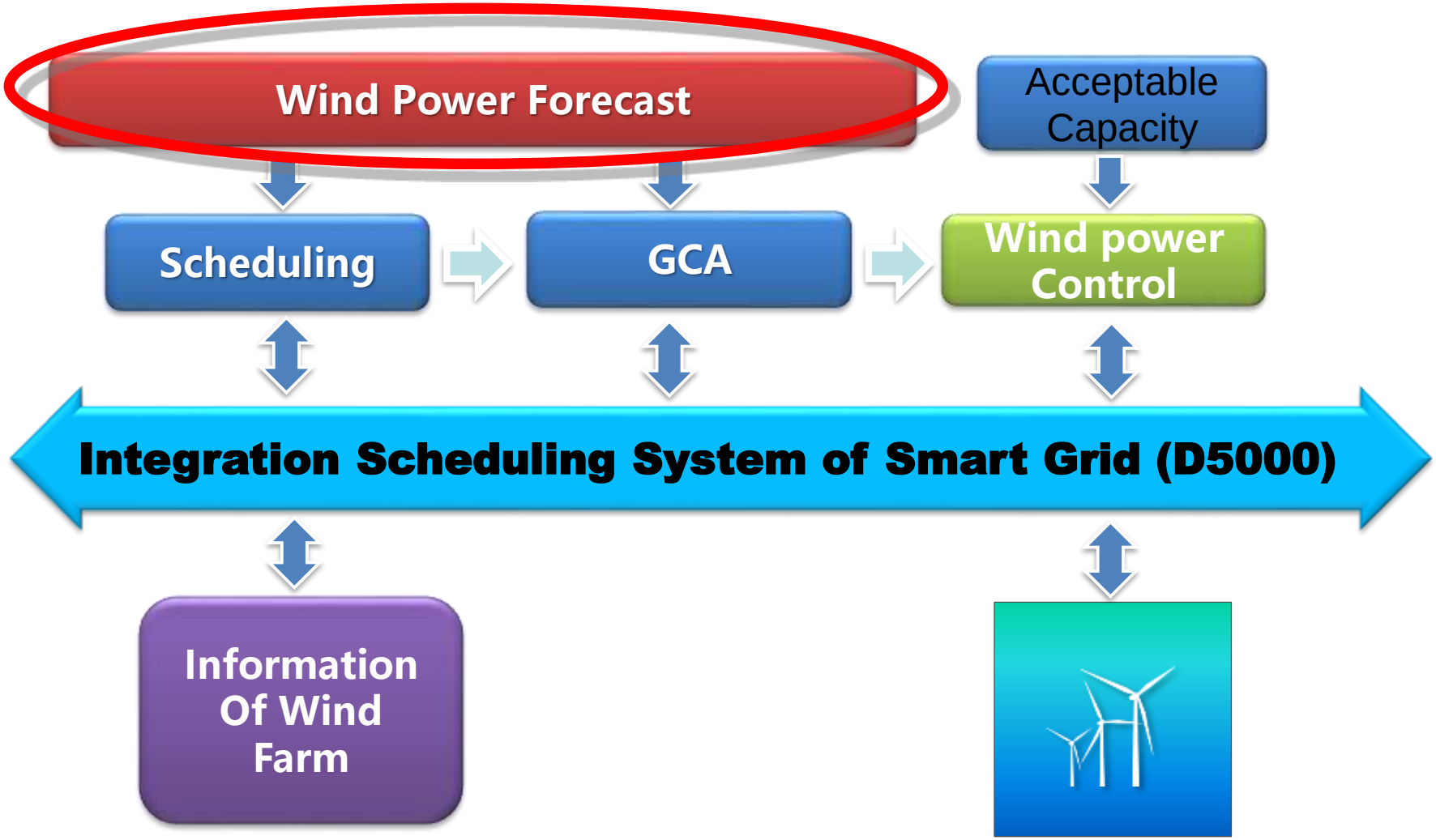
**Mission of ADB**

**Smart Grid & Reduce $CO_2$ emission**

**Eliminating Poverty & Environment Sustaining**

**TA7721-PRC: Developing Smart Grid for Efficient Utilization of Renewable Energy**

# *Smart Grid Demonstration Project*



# Wind Power Forecast Result

*Forecast the Weather Trend*

**Date: 2011.04-2011.05**

**RMSE=12.72%** **MAE=9.77%**

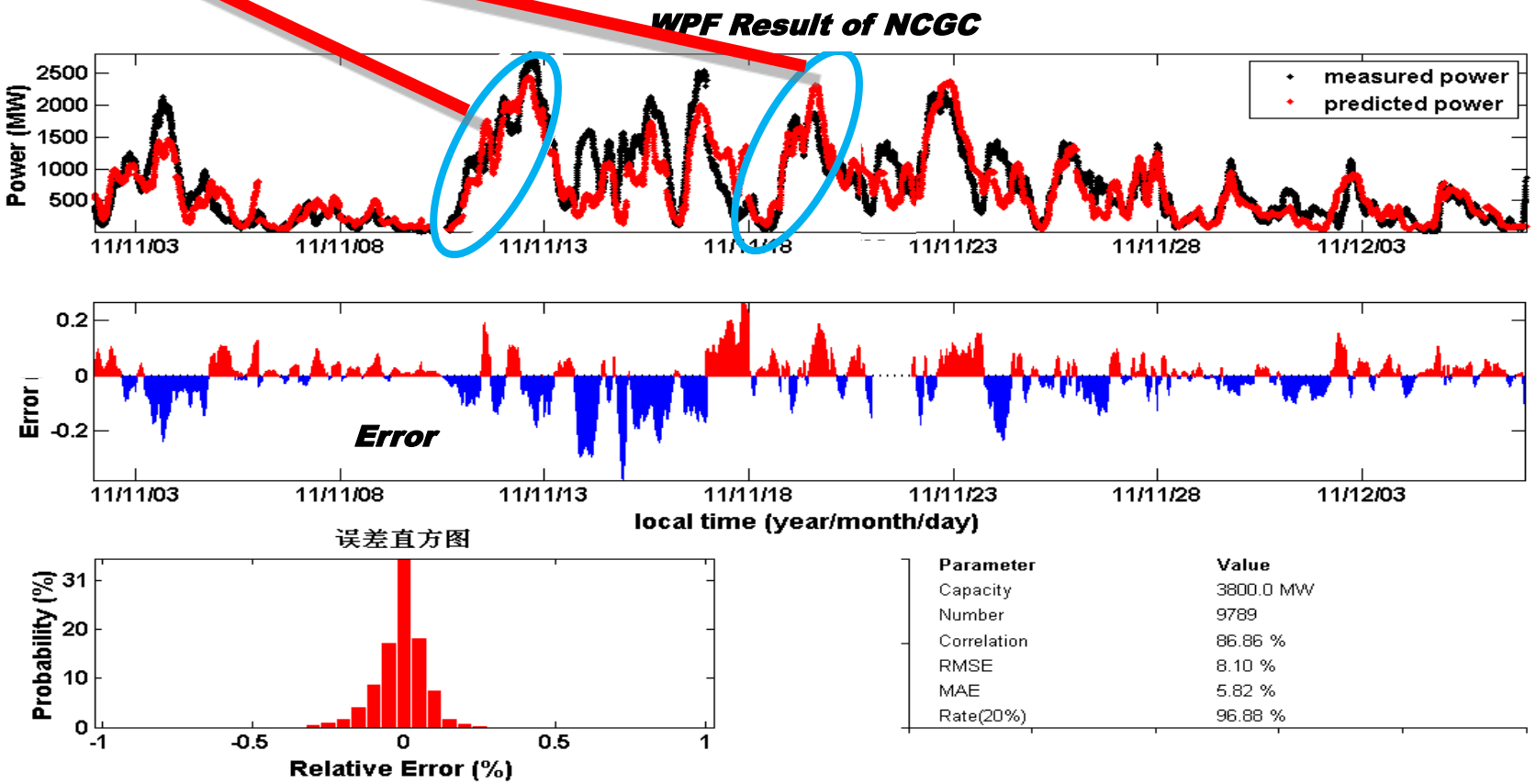
**Corr=74.71%** **Rate=87.44%**

**Date: 2011.11-2011.12**

**RMSE=8.1%** **MAE=5.82%**

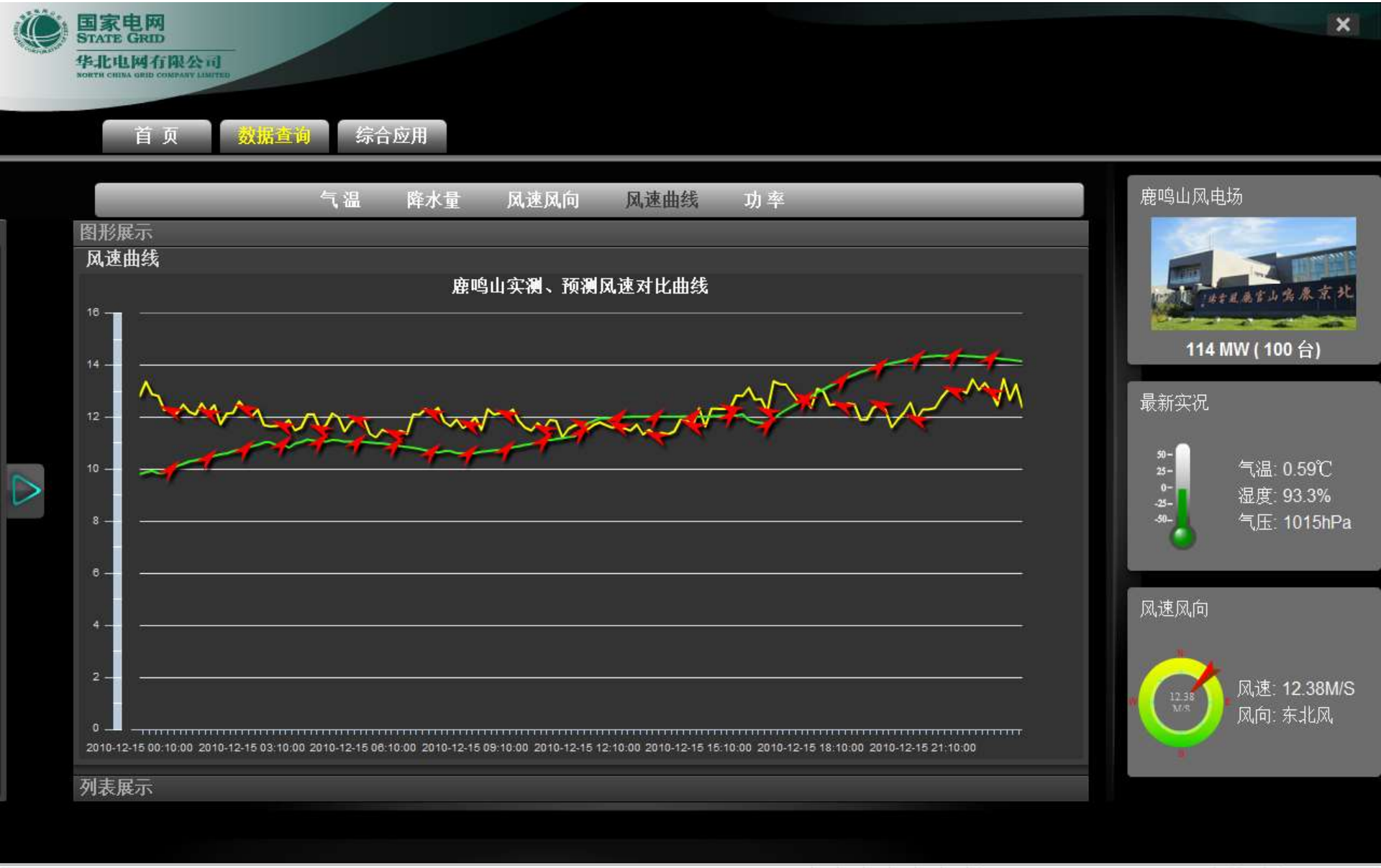
**Corr=86.86%** **Rate=96.88%**

***Significant improve !***




| Parameter | Value |
|---|---|
| Capacity | 3800.0 MW |
| Number | 9789 |
| Correlation | 86.86 % |
| RMSE | 8.10 % |
| MAE | 5.82 % |
| Rate(20%) | 96.88 % |

# Case : Wind Forecasting



# Case : Wind Power Forecasting

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Thank you!