

# Techniques of Severe Convective Weather Comprehensive Monitoring

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**China**

**6 Aug 2012**

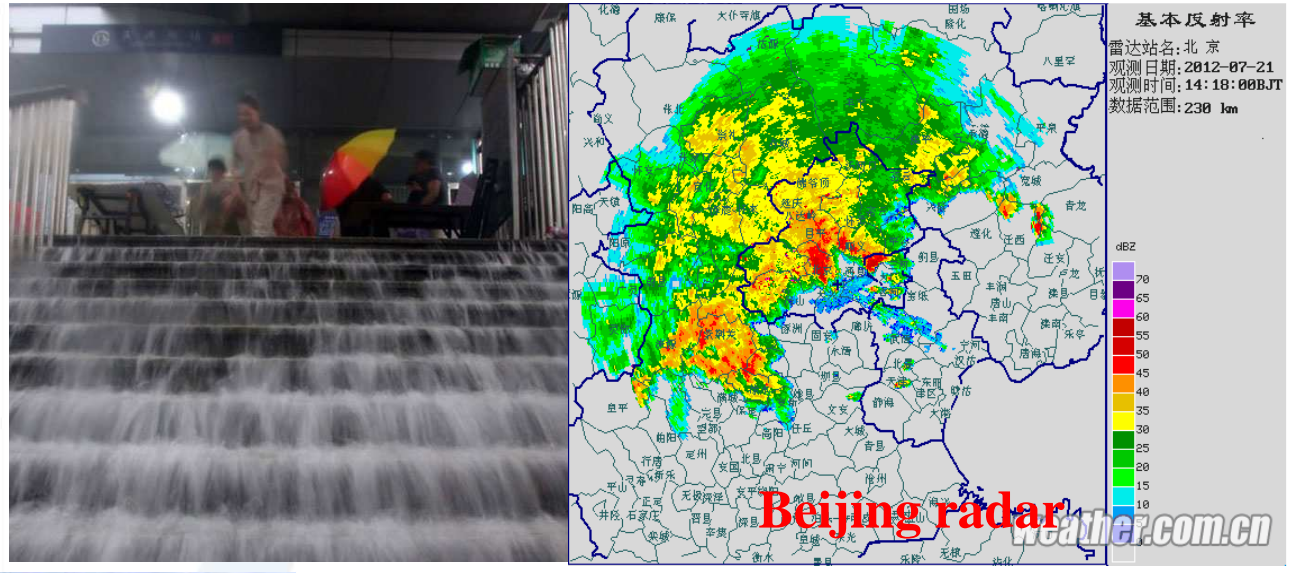
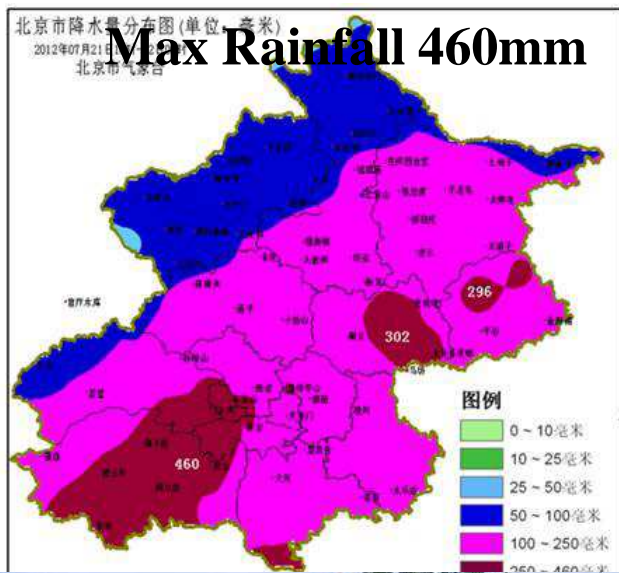


# Some Severe Convective Cases in China



**Severe Convective Weather, 3 June 2009, Henan Prov**

**High Winds, Yongcheng, Henan Prov**



# Extreme Heavy Rain, 21 July 2012, Beijing

# 78 deaths in Beijing

# Outline

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- Objectives
- Data
- Monitoring Products
- **Techniques**
- **Future work**
- **Summary**



# 1 Objectives

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- Basis of Forecasting
- Get Convective Weather State Rapidly
  - Current State
  - Convective Weather Process
  - Dataset of Convective Weather Cases
  - Study the Climatological Distribution
- Verify Convective Weather Forecast
  - **Qualitative** Verification
  - **Quantitative** Verification ( TS score, etc)



## 2 Data Sources

- Conventional surface observations
- Severe Weather Reports ( WS reports )
- Automatic Weather Station Data
- Cloud-ground Lightning Data
- IR and WV TBB from Geostationary Satellite (Fengyun-2)
- Radar reflectivity mosaic data



# 3 Monitoring Products

- Cumuli
- Thunderstorms
- Cloud-ground lightning
- Hail
- Tornadoes
- High winds
- Thunderstorm high winds
- Short-term heavy rain
- Radar reflectivity
- Convective storms (based on radar data)
- Deep convective clouds
- Mesoscale convective systems (MCS, based on the IR satellite data)



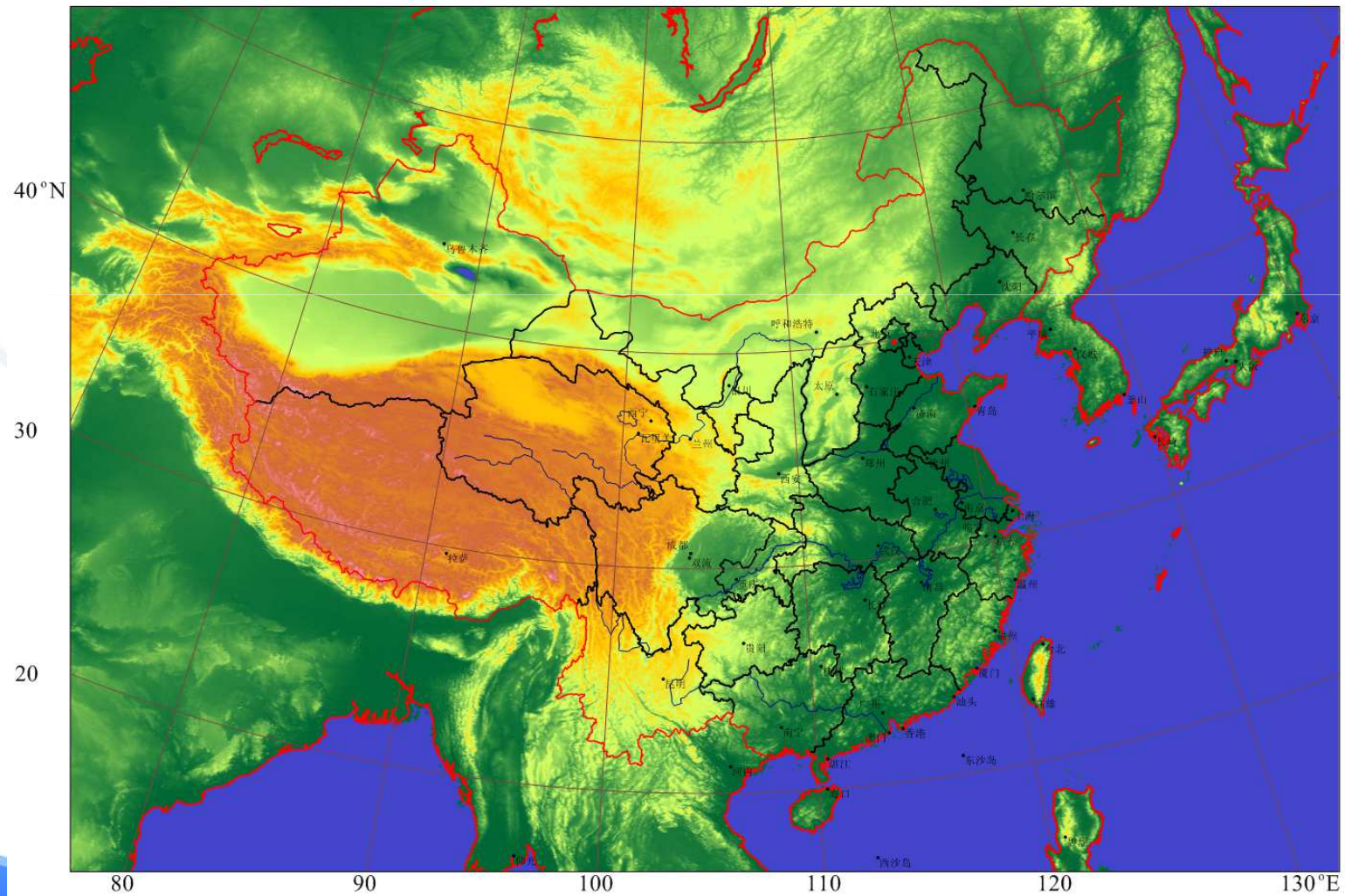
- Different convective weather distribution during recent 1, 3, 6, 12, or 24 hours
- Real-time Update
- Monthly, decade, and pentad distribution can also be gotten





# Monitoring Region

-China and surrounding areas

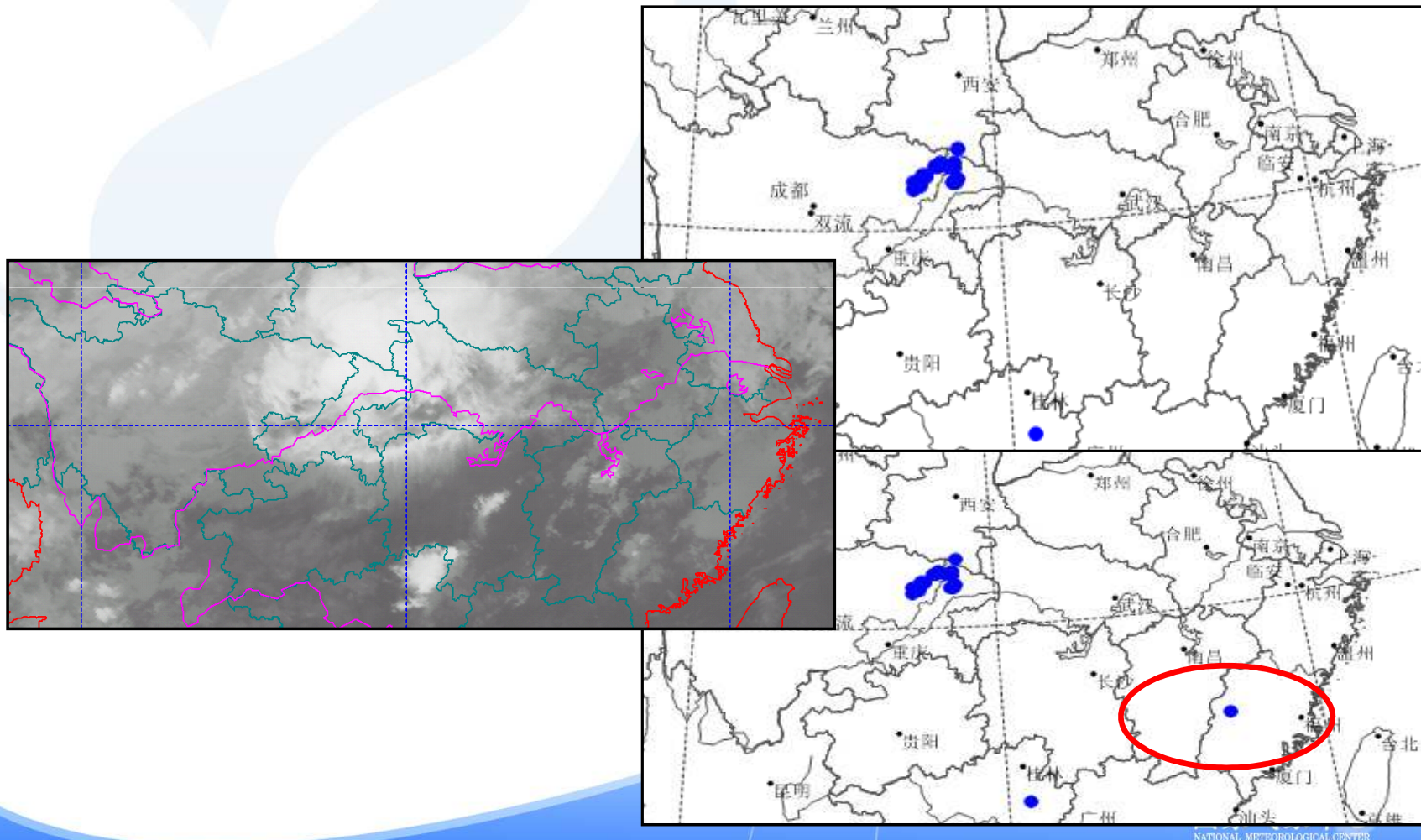


# 4 Techniques

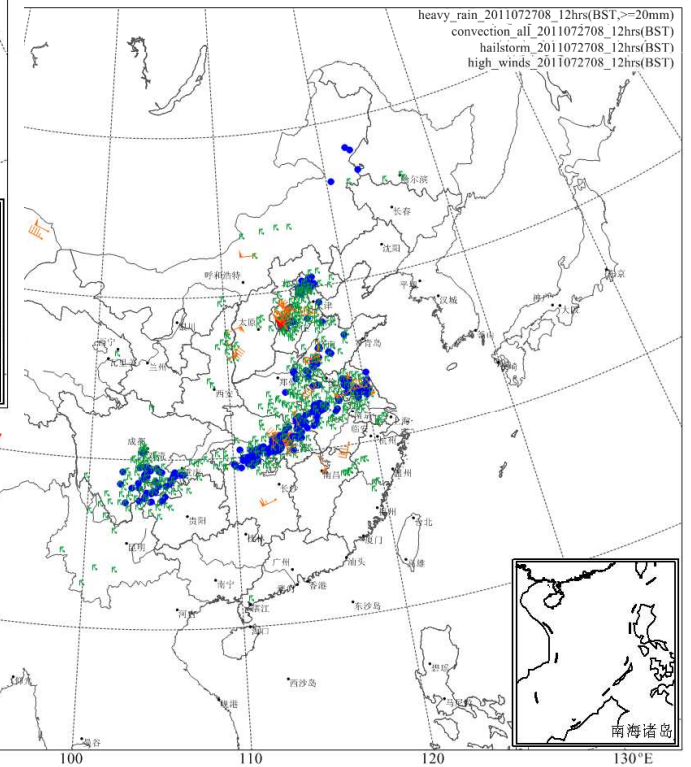
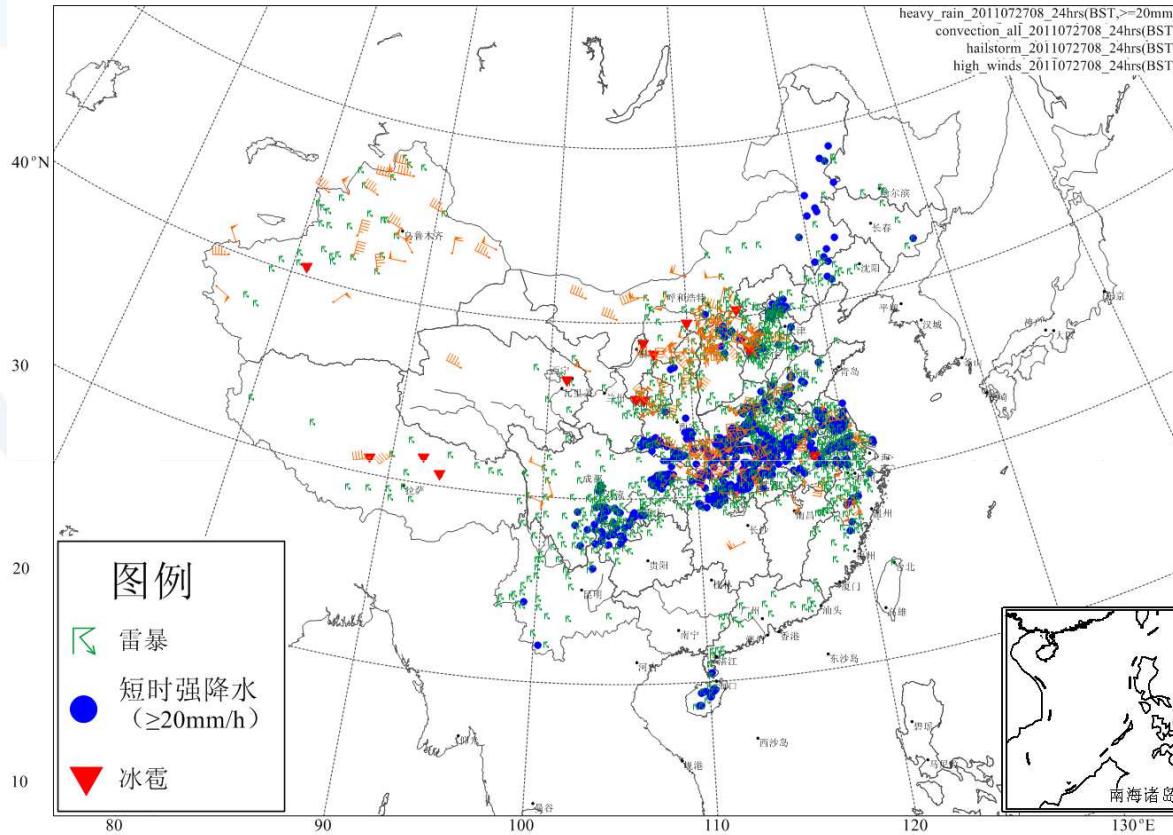
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- **Quality control of automatic weather station data**
- **Extracting information and statistical technique**
- **Lightning density monitoring**
  
- **CTREC (Cartesian Tracking Radar Echoes by Correlation)**
- **TITAN (Thunderstorm Identification, Tracking, Analysis, and Nowcasting)**
  
- **Identification of deep convective clouds**
- **Identification and tracking of MCS**

# 4.1 Quality Control of AWS data



# 4.2 Extracting Convection Information

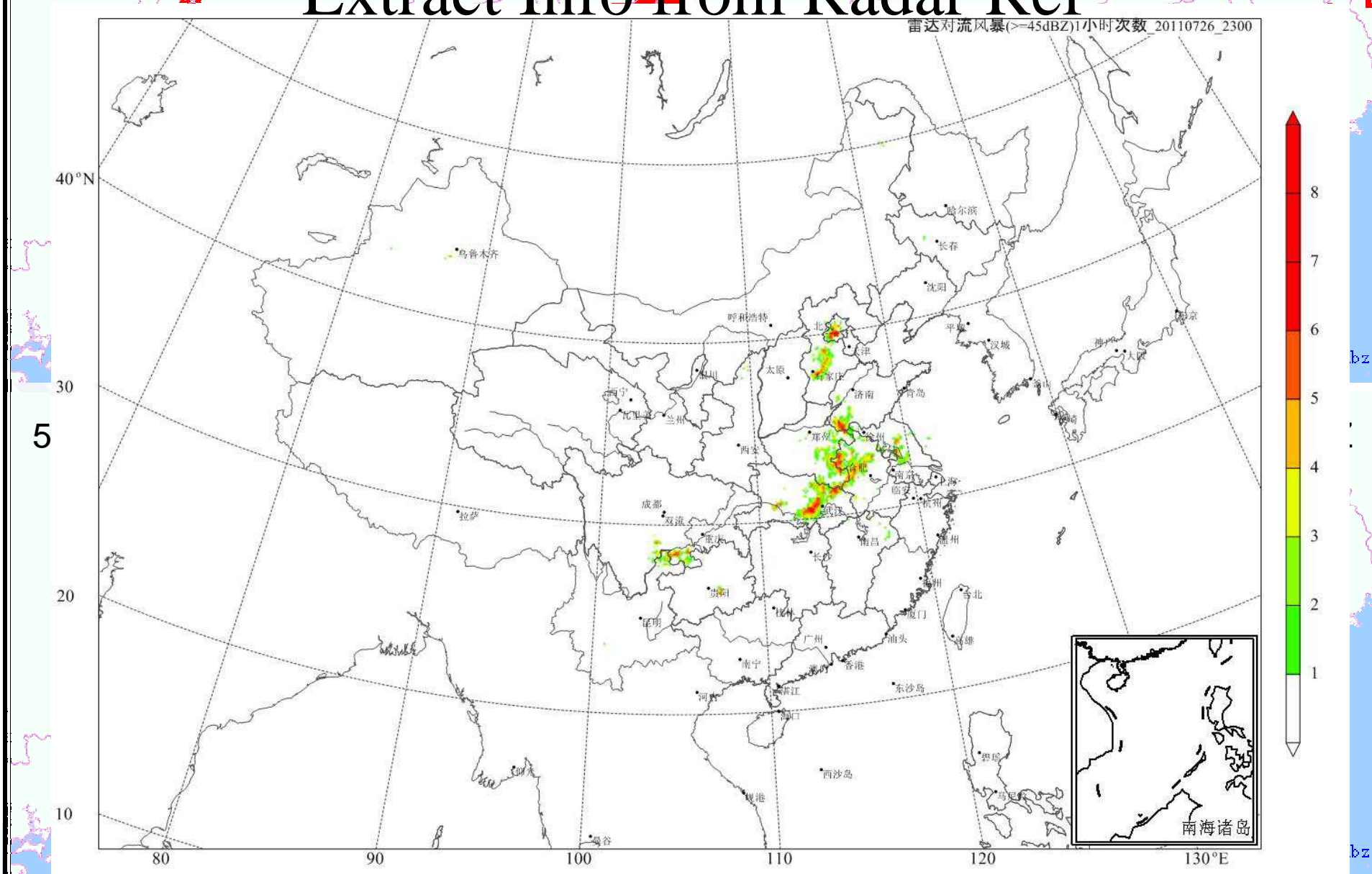


30dBZ

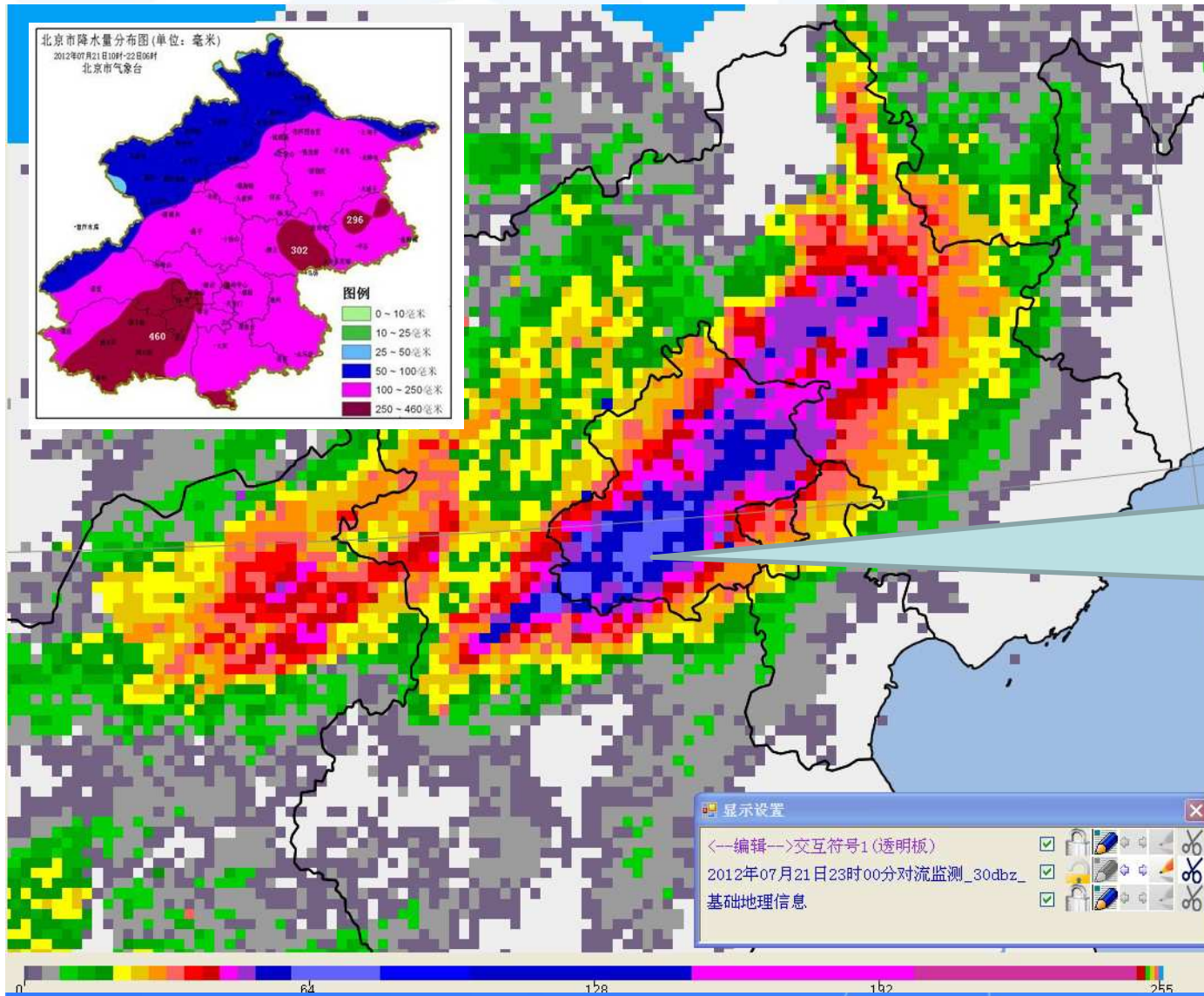
45dBZ

# Extract Info from Radar Ref

雷达对流风暴(>=45dBZ)1小时次数 20110726\_2300



# 30dBZ during 12 Hours, 21 July 2012



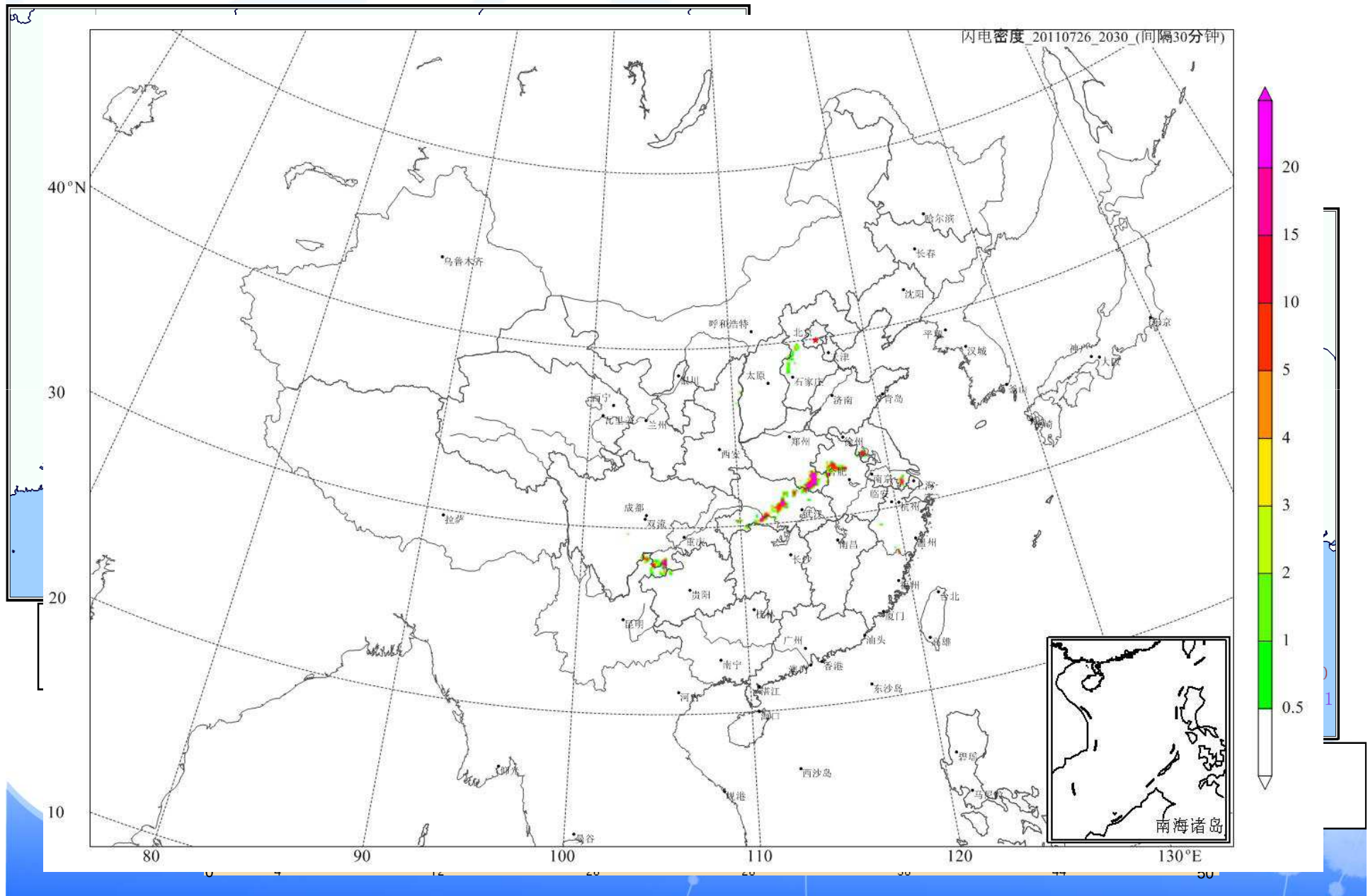
Last for  
more than  
10 hours

## 4.3 CG Lightning density monitoring

- Total CG lightning density in different periods
- Positive CG lightning density
- Negative CG lightning density

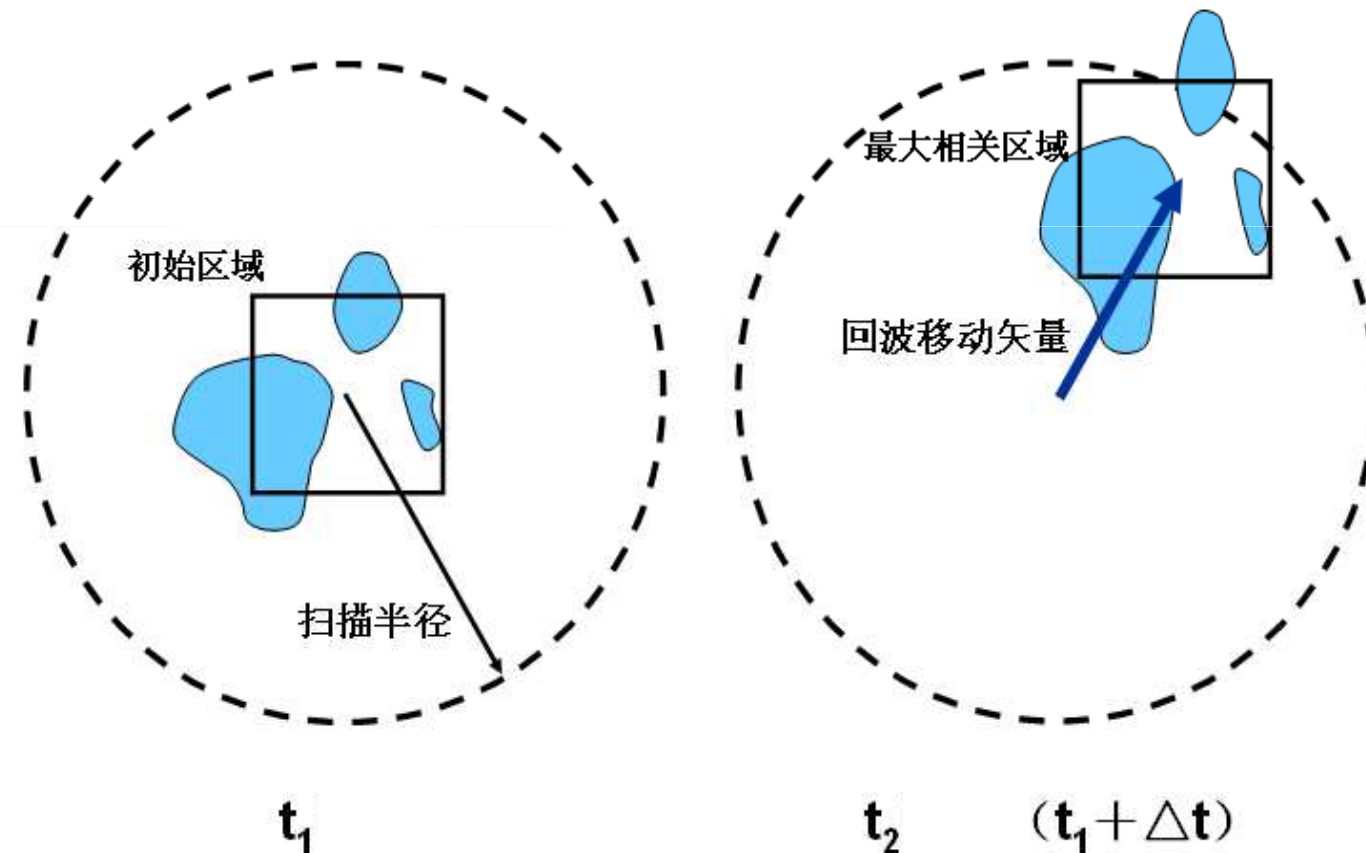


# CG lightning density on 17 Apr 2011

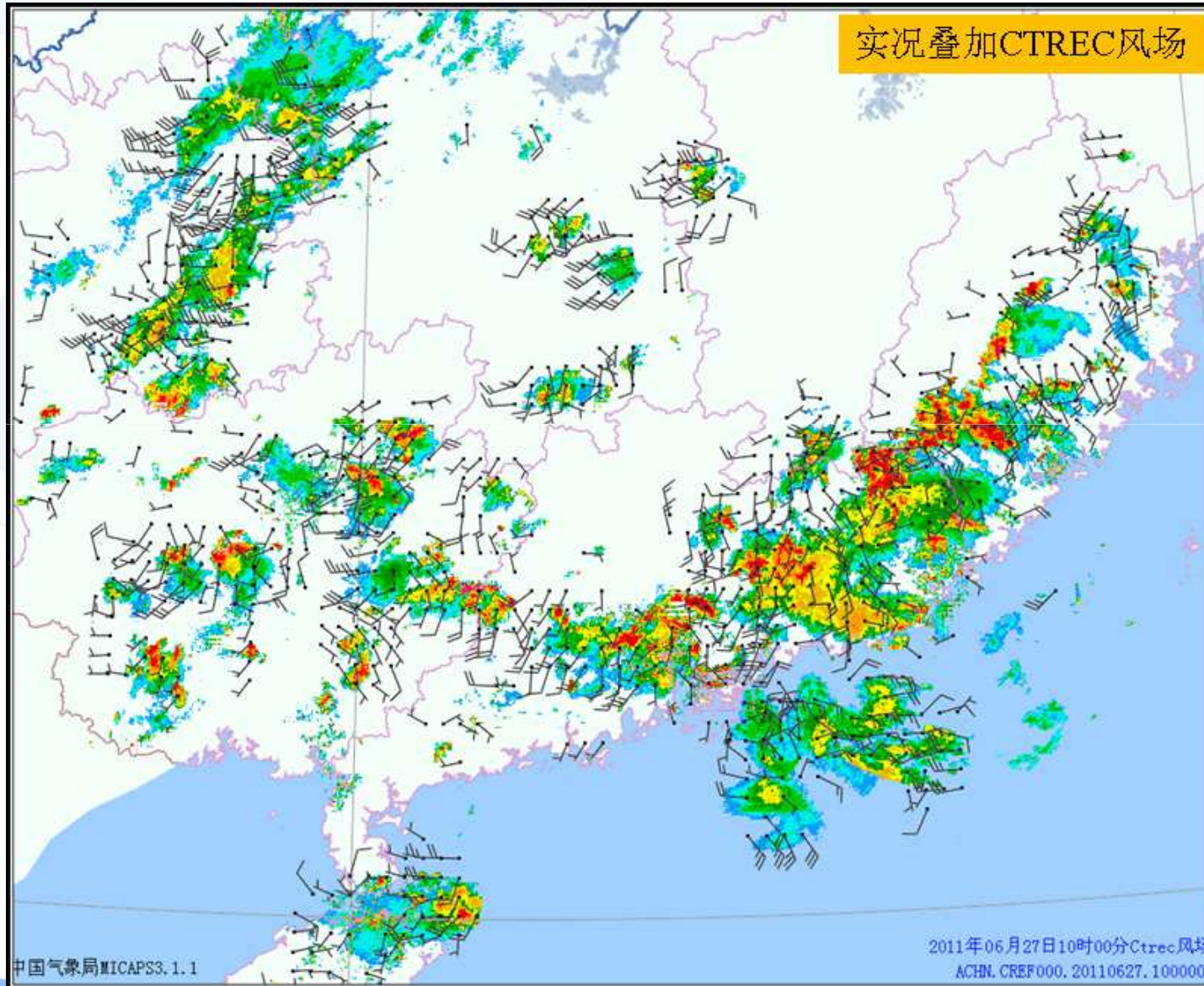




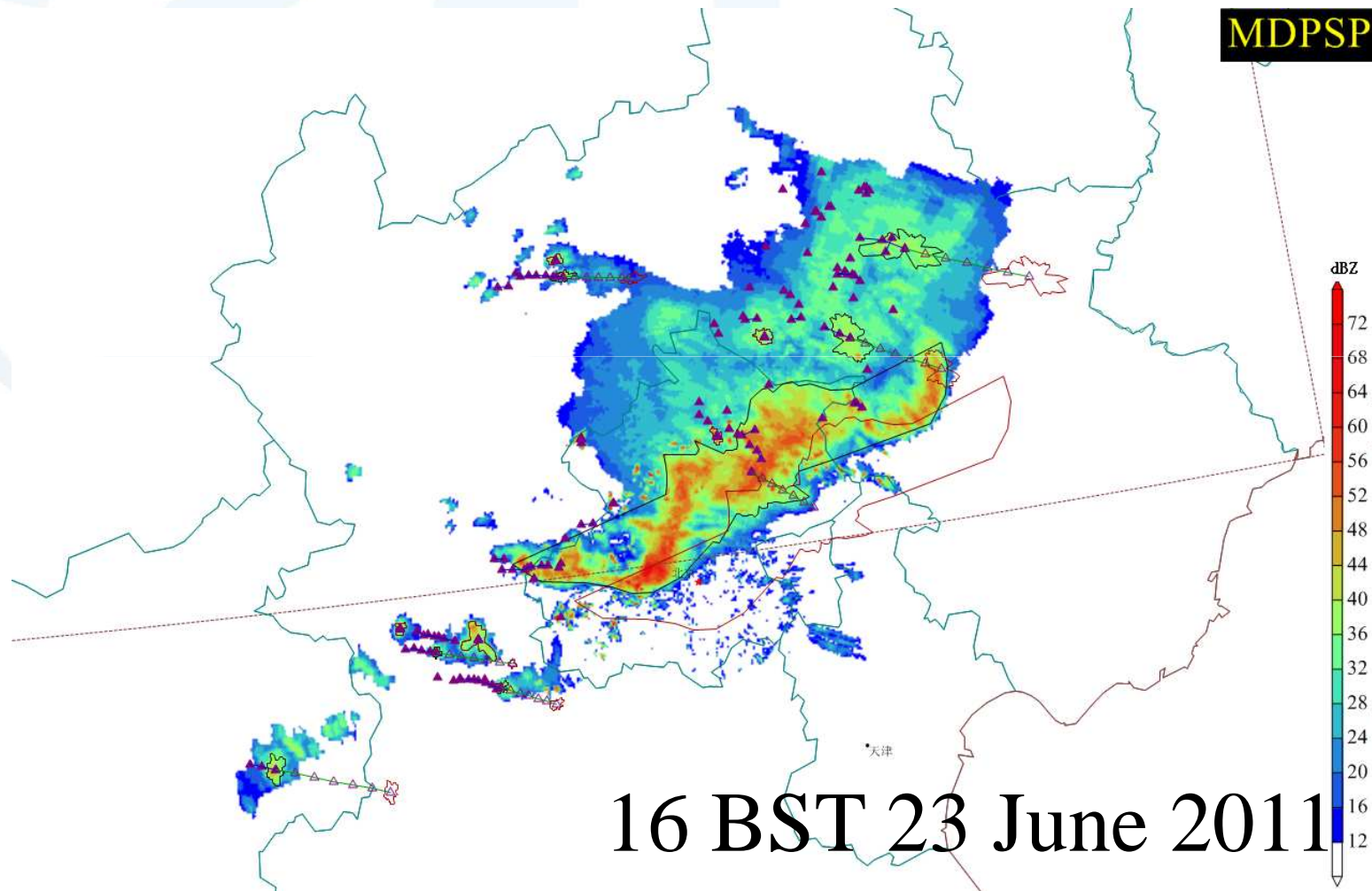
# 4.4 CTREC (Cartesian Tracking Radar Echoes by Correlation)



# 18BST 27 June 2011



## 4.5 TITAN (Thunderstorm Identification, Tracking, Analysis, and Nowcasting, from NCAR)



# 4.6 Identification of deep convective clouds

Criterion:

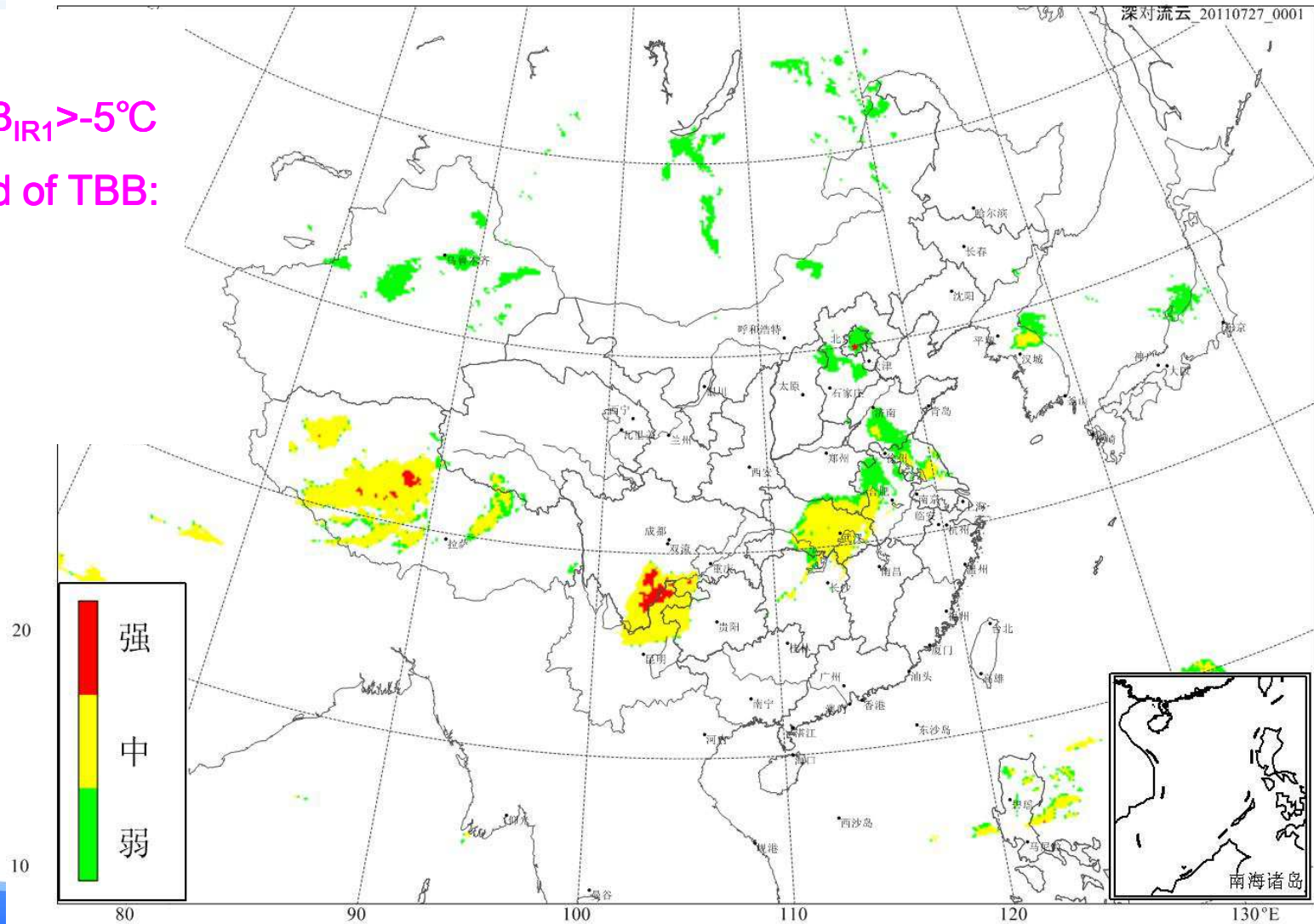
$$TBB_{WV} - TBB_{IR1} > -5^{\circ}\text{C}$$

3 Threshold of TBB:

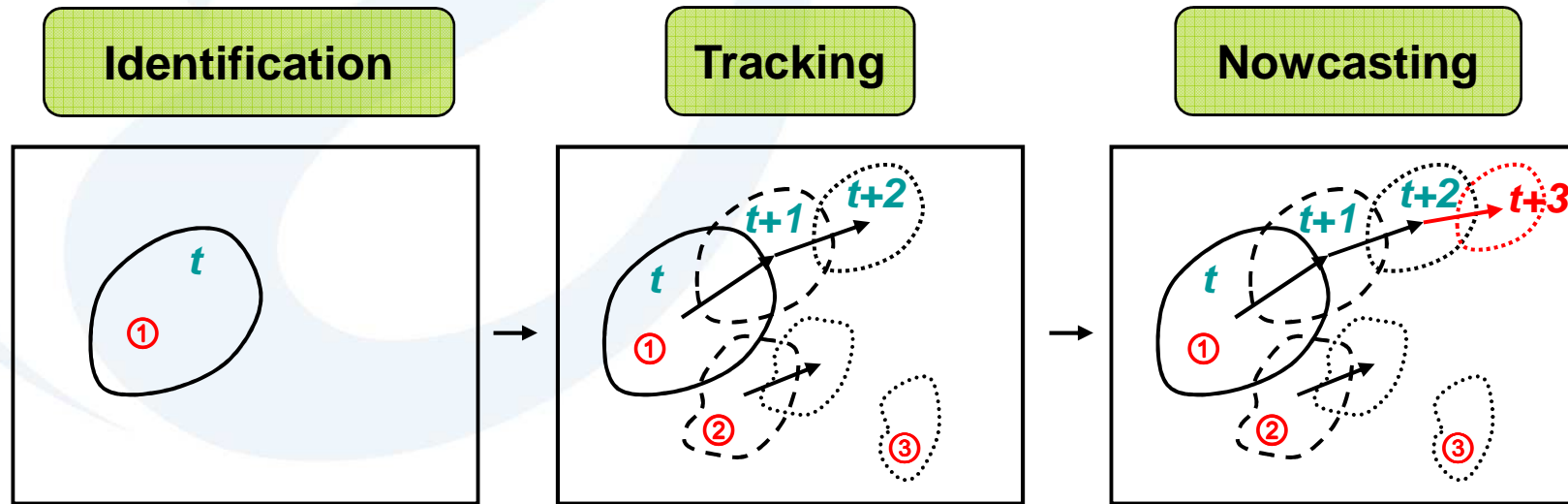
$-32^{\circ}\text{C}$

$-52^{\circ}\text{C}$

$-72^{\circ}\text{C}$



# 4.7 Identification and tracking of MCS



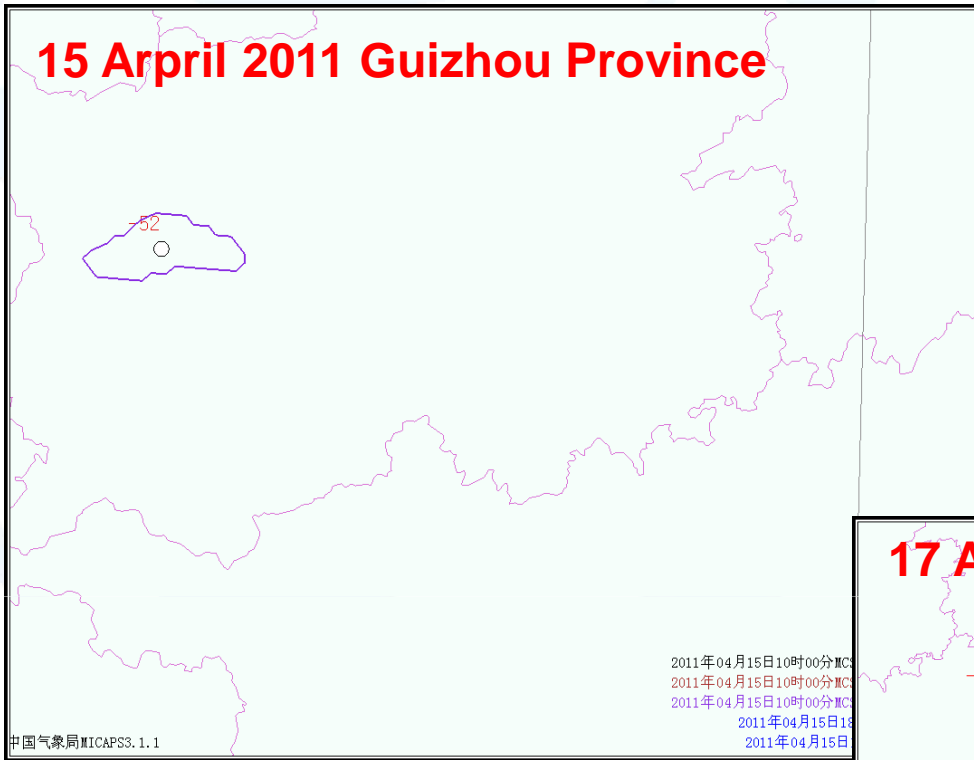
**-32°C TBB MCS**

**-52°C TBB MCS**

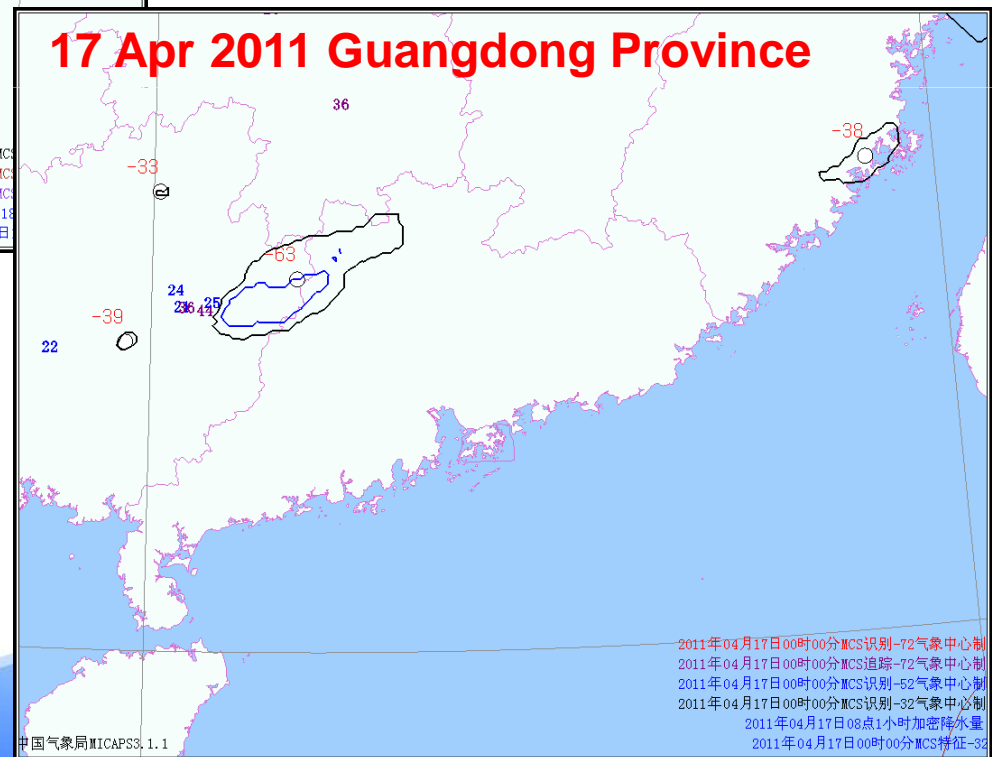
**Min TBB**

**1-hr Rainfal**

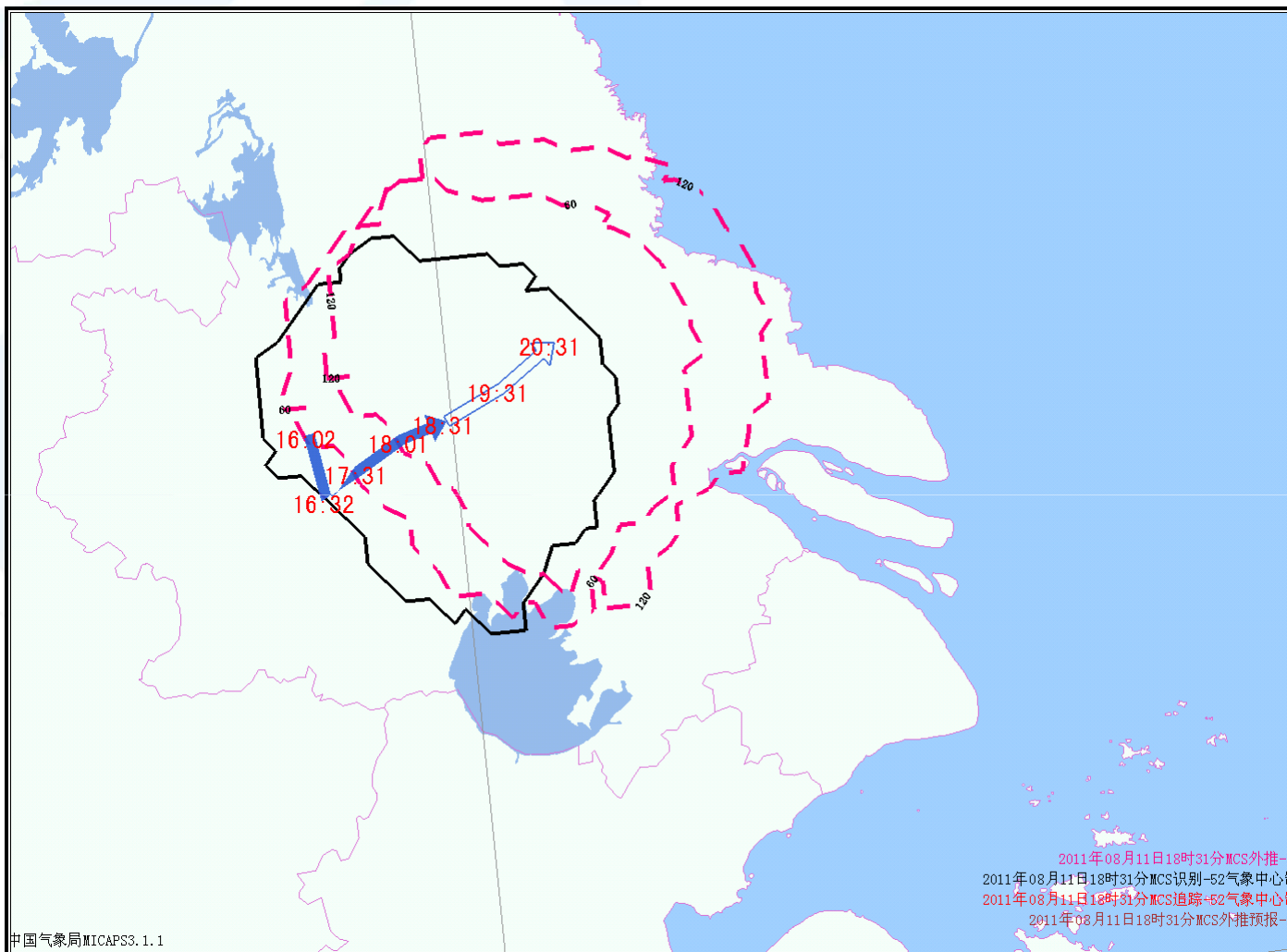
**15 April 2011 Guizhou Province**



**17 Apr 2011 Guangdong Province**



# MCS Nowcasting 12 Aug 2011



# 5 Future Work

- ❑ AWS data QC need to be further improved
- ❑ Enhance MCS tracking method
- ❑ Further can monitor the favorable conditions for convective weather (such as dewpoint at surface, convergence line)





# 6 Summary

- An operational system of convective weather monitoring has been built at NMC of CMA
- The techniques are based on the multi-source data (conventional, AWS, lightning, radar, satellite).
- The monitoring products have played important roles in the convective weather forecasting and nowcasting operations at NMC of CMA



Thanks !



国家气象中心  
NATIONAL METEOROLOGICAL CENTER