SWAN – The Operational System for Nowcasting and Very-short Range Forecast in CMA

National Meteorological Center (NMC)
China Meteorological Administration (CMA)

Mao Dongyan, Zheng Yuanyuan, Zhou Kanghui
Feng Yerong, Yang Bo, Han Feng, Xue Feng, et al

国家气象中心
NATIONAL METEOROLOGICAL CENTER

OUTLINE

- **INTRODUCTION**
- **MAIN FUNCTIONS in SWAN**

INTRODUCTION

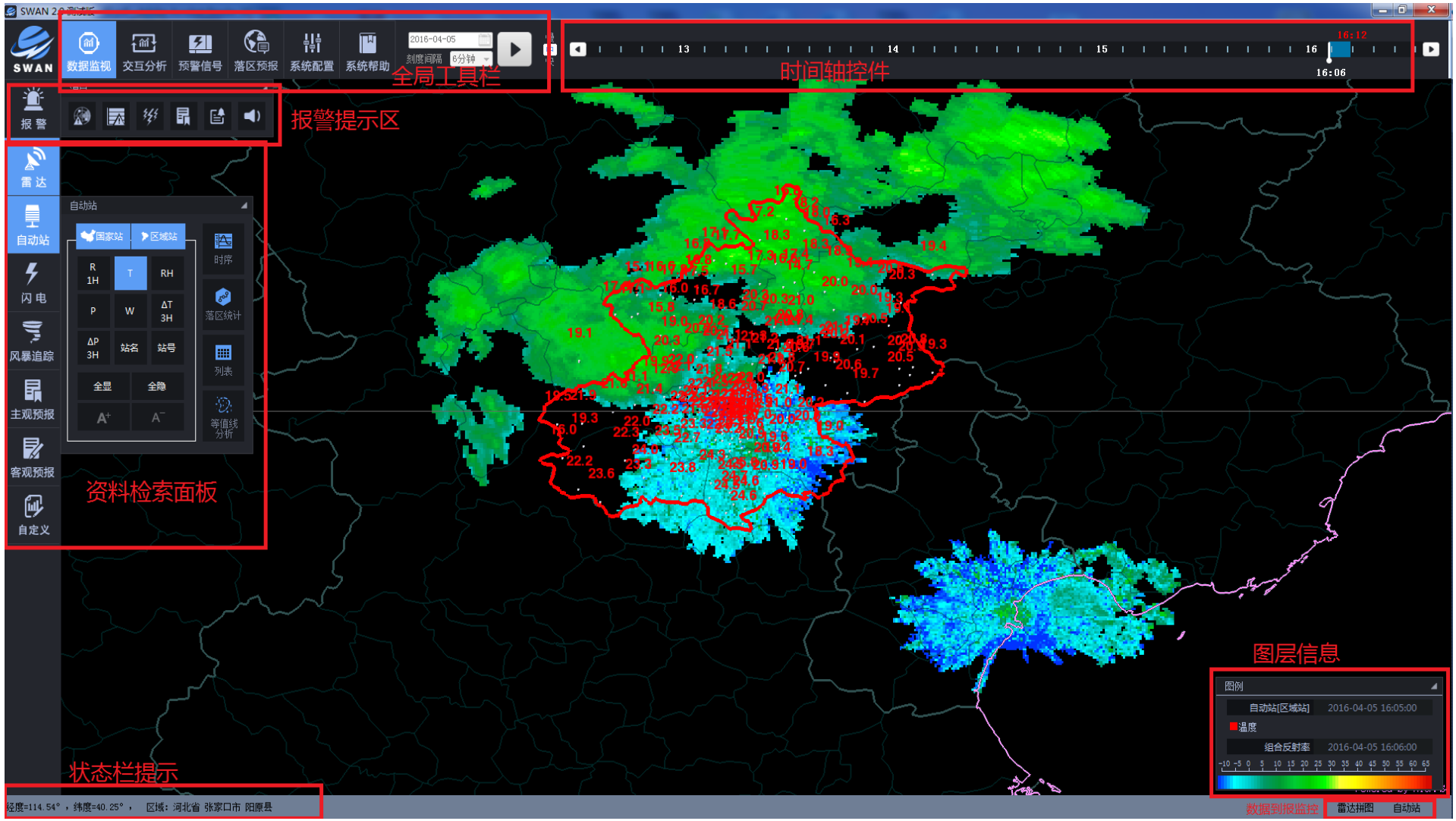
- **SWAN** — Severe Weather Automatic Nowcasting System
- SWAN was developed by the cooperation among NMC, Guangdong Meteorological Bureau, Wuhan Storm Office and other local meteorological departments and research institutions.
- SWAN was first proposed in 2008, and updated to V2.0 in June 2016.

国家气象中心
NATIONAL METEOROLOGICAL CENTER

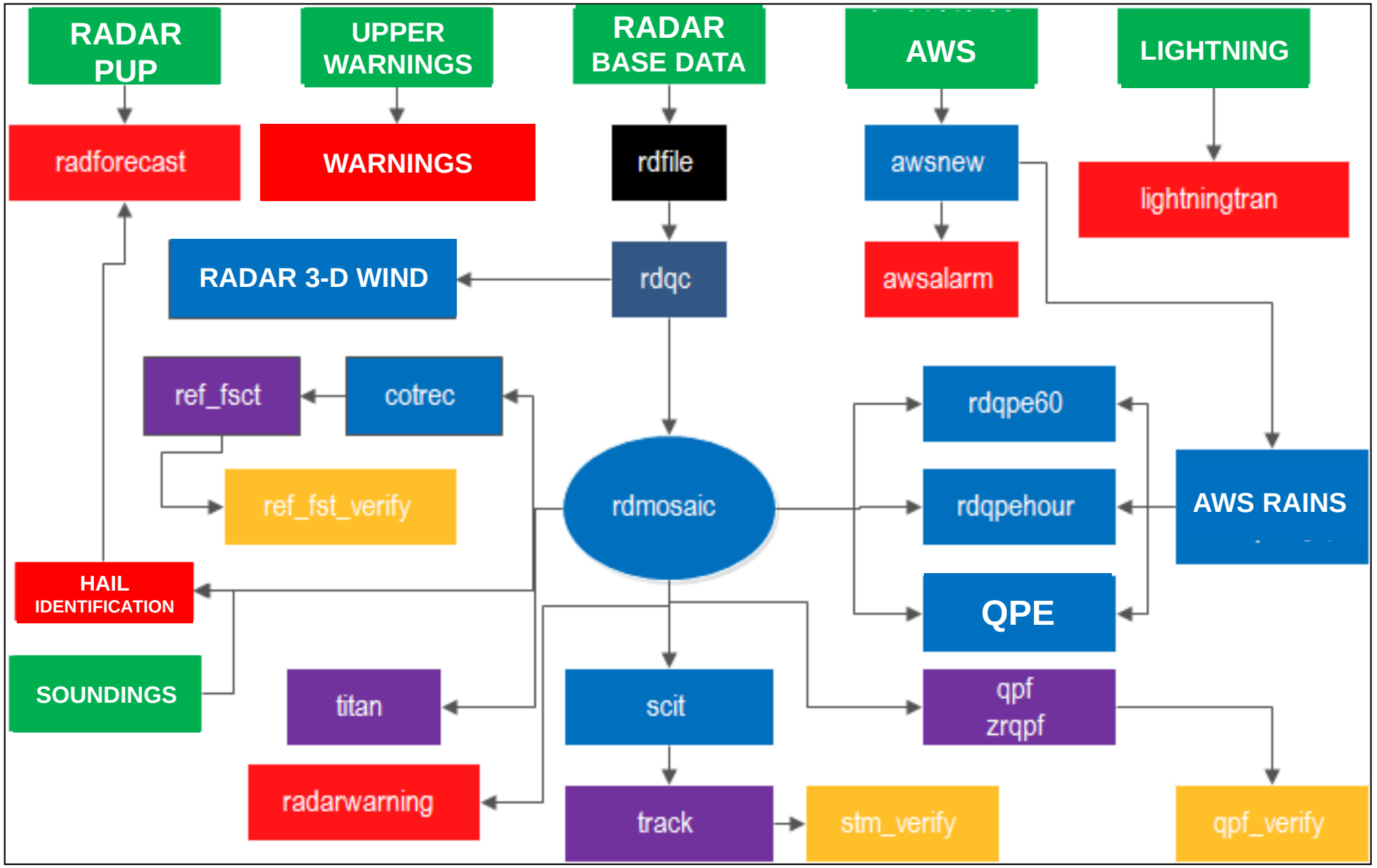
SWAN-Severe Weather Auto-Nowcasting

- Version 0(2009): preliminary finished the framework construction and basic algorithms development
- Version 1.0(2010): improved the algorithms, embeded the client to Micaps 3.1
- Version 1.5(2012): developed the Flash floods integrated platform of geological disasters, upgraded the client to Micaps 3.2
- Version 2.0 (2016): integrated new algorithms, updated the client to Micaps4.0

SWAN interface



SWAN DATA FLOW



DATA SOURCE WARNINGS MONITORING FORCAST

MAIN FUNCTIONS in SWAN

- Working model
- Monitoring and auto-alarm
- Nowcasting and very-short range forecast
- Warning issuance

Working model

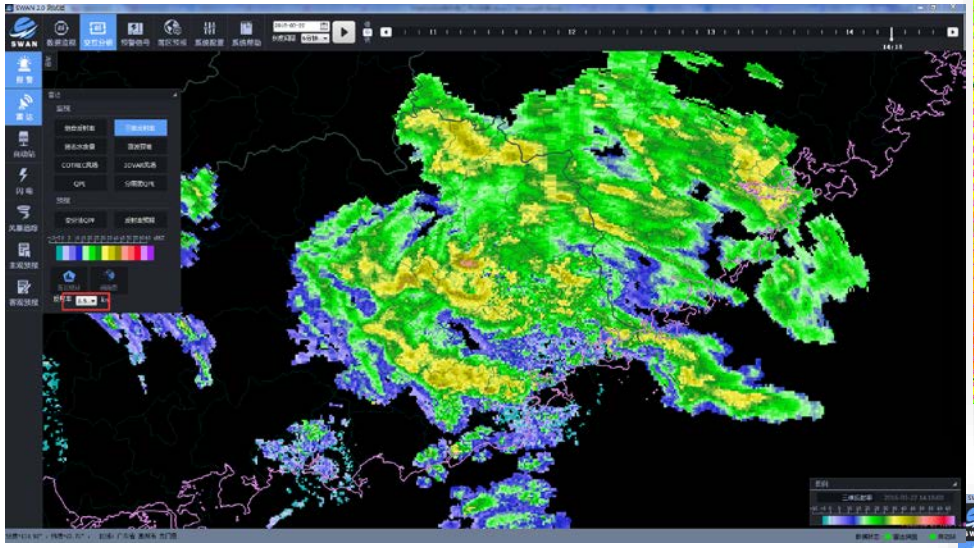
- 2 models: real-time model and analyzing model

- **Real-time model**: updated automatically without any operating
- **Analyzing model**: forecasters can operate by using the time-axis and analyzing

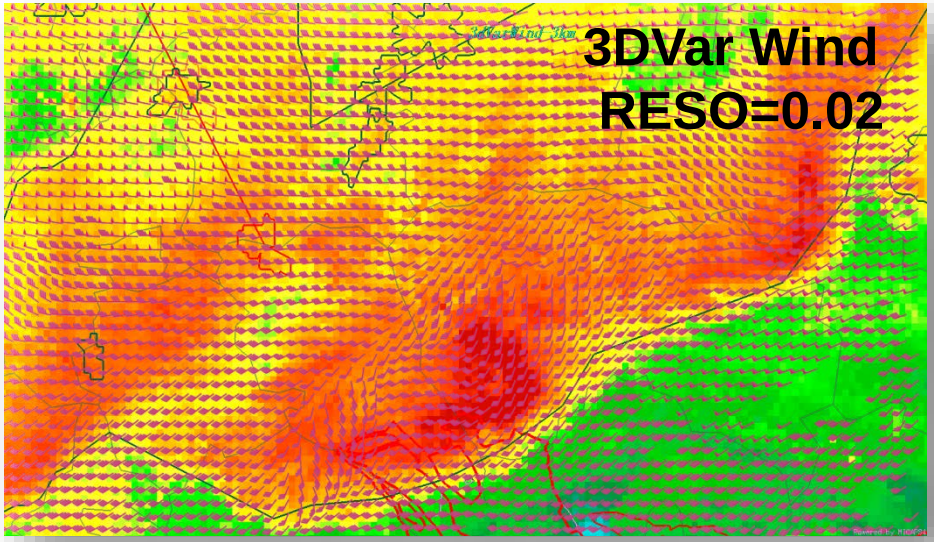
Monitoring and auto-alarm

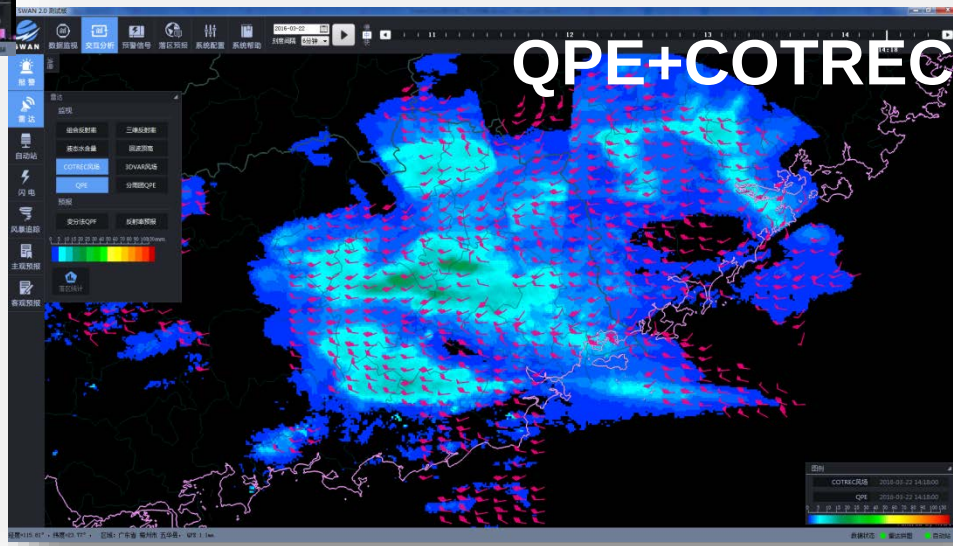
Products	Frequency	Basic data/technique
Radar 3-D mosic	6min	Radar base data by QC
Com. Reflectivity	6min	Radar base data by QC
3-DVAR wind	6min	Radar base data by QC
ET	6min	Radar 3-D mosic
VIL	6min	Radar 3-D mosic
1-h QPE	6min	Radar 3-D mosic
QPE for heavy rain	1hour	Radar 3-D mosic
Cotrec wind	6min	Radar 3-D mosic
AWS	5/10 min	AWS observation
Lightning	Real time	Lightning observation
AWS warning	5/10 min	AWS observation
PUP warning	Real time	PUP products
Hail warning	6min	Radar 3-D mosic

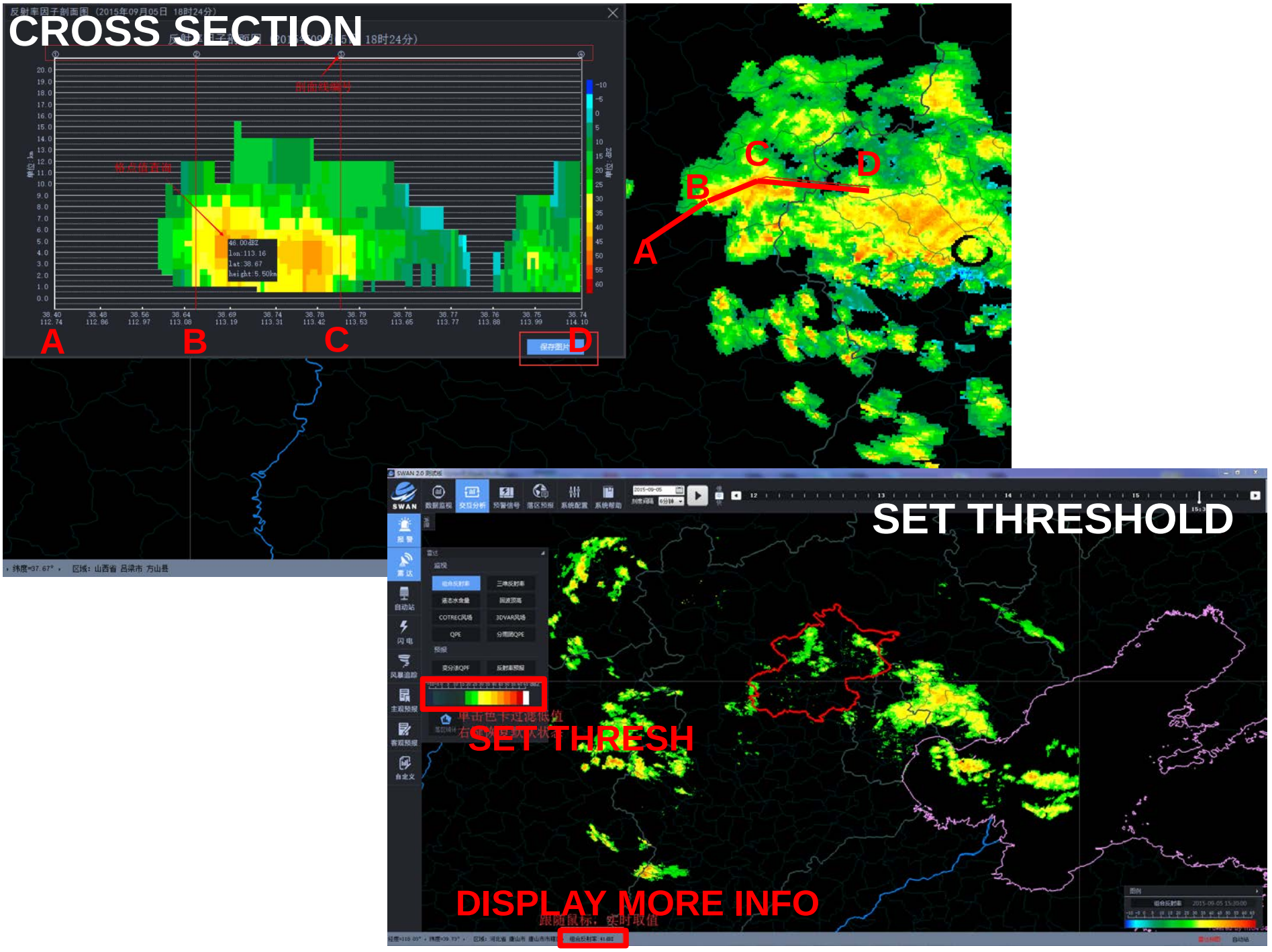
Radar Monitoring



3-D Ref Mosic





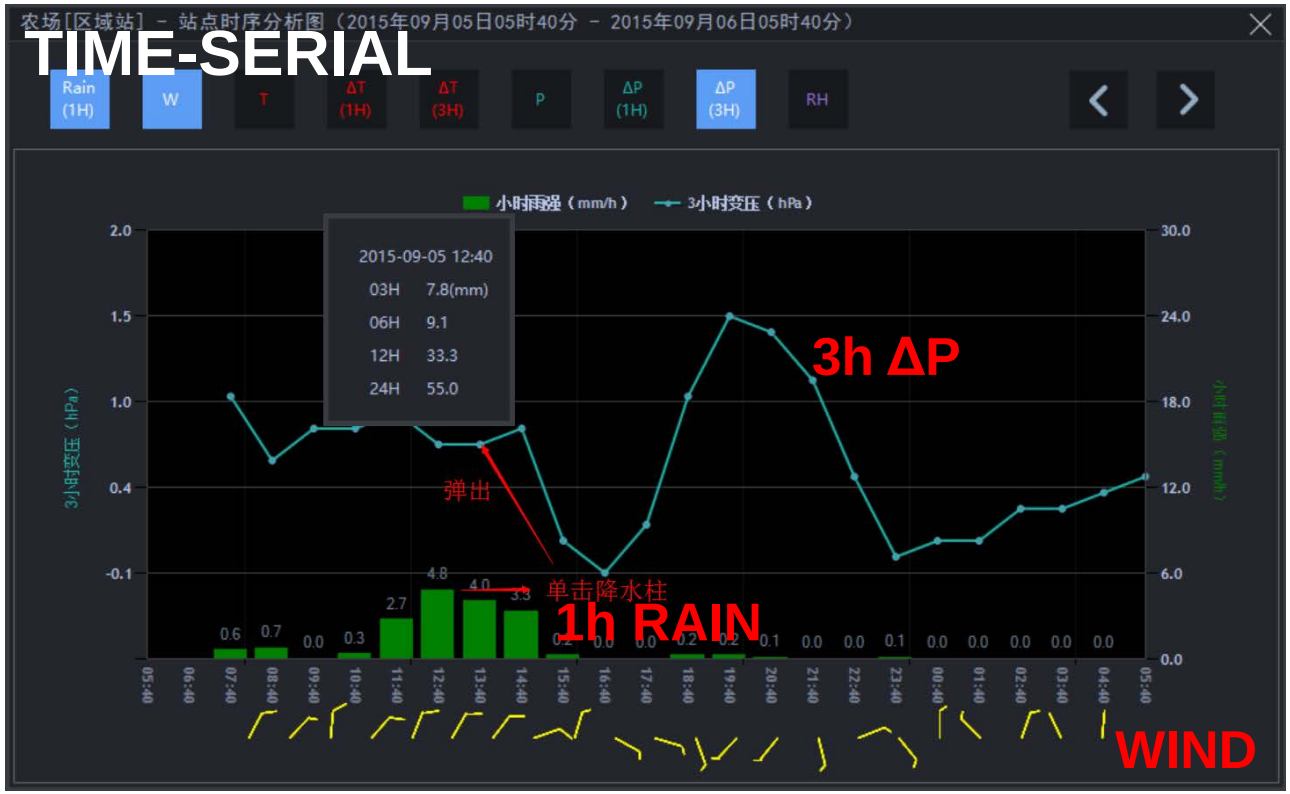

CROSS SECTION
A
B
C
D
SET THRESHOLD
SET THRESH
DISPLAY MORE INFO

AWS Monitoring

RAIN :
Different period from 10min to 24h

RH、WIND :
different threshold

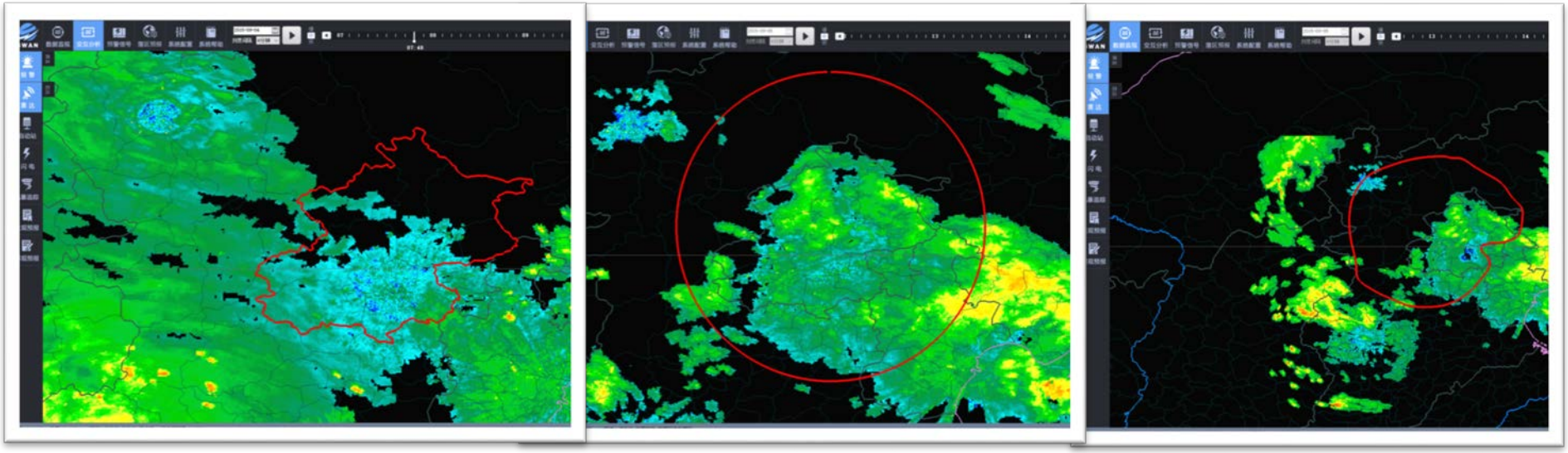
Variation of T and P:
different period



STATISTIC of a specified area

Auto-Alarm Based on Radar and AWS

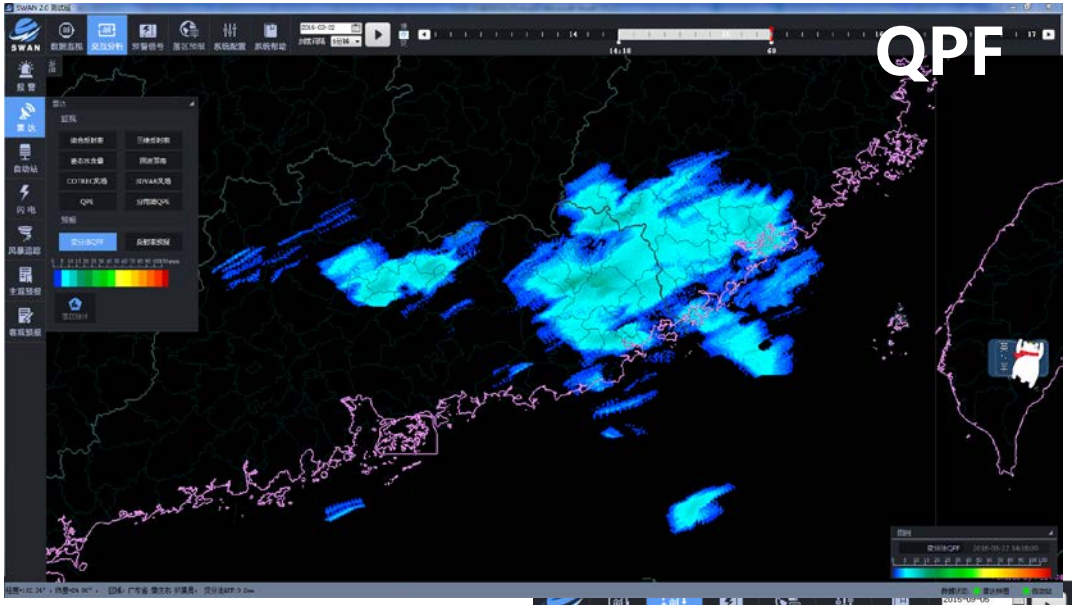
- Alarm Regions:
  - Administrative region
  - Circle (radius defined by user)
  - user-defined
- Alarm Form:
  - Flash
  - Sound

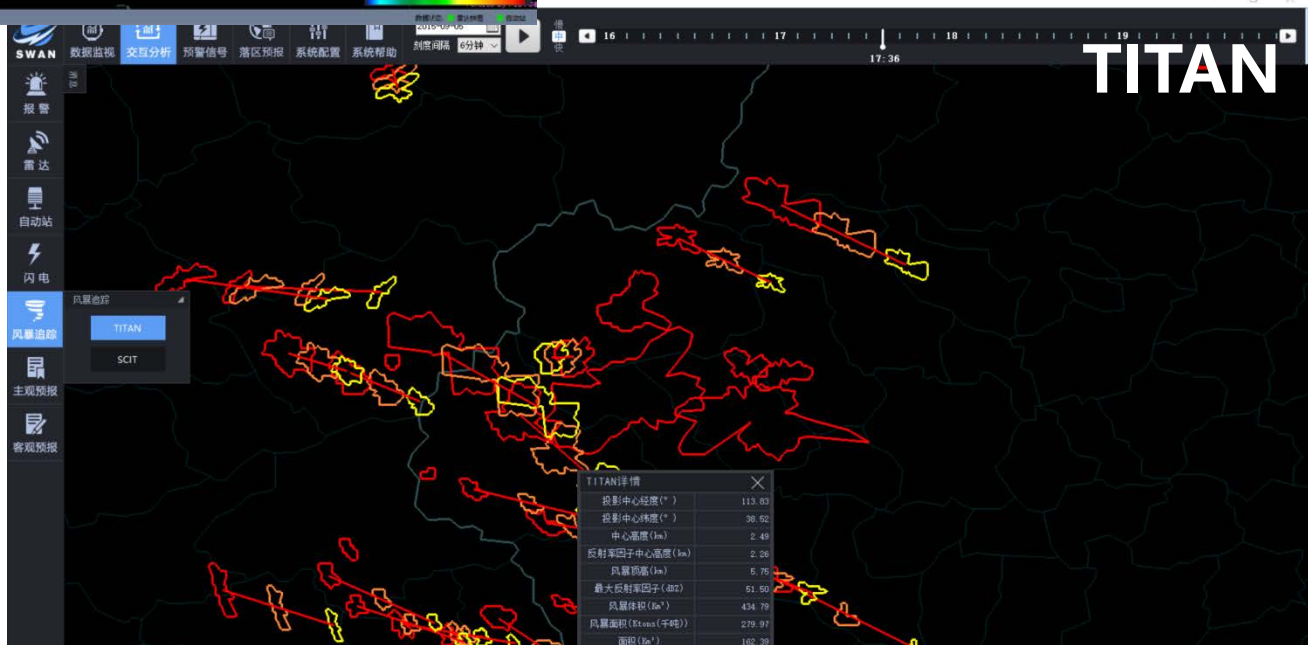


ALARM INTERFACE

Nowcasting and very-short range forecast

Products	Frequency	Basic data/technique
Radar Ref. Fcst	6min	Cotrec wind
QPF	6min	Cotrec wind
SCIT	6min	Radar 3-D mosic
TITAN	6min	Radar 3-D mosic



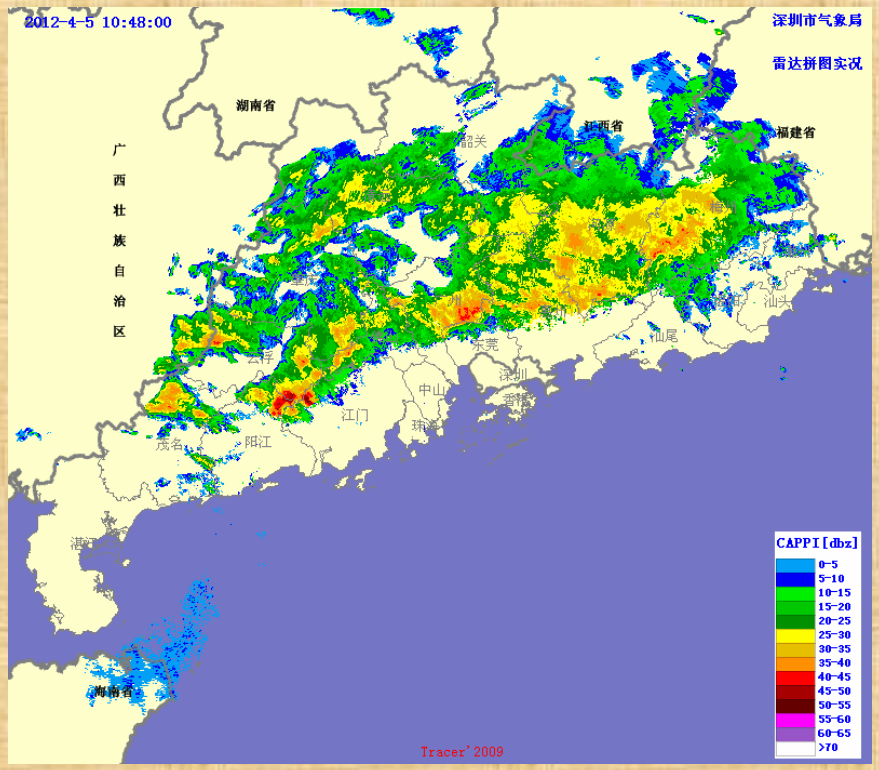


TITAN : Thunderstorm Identification, Tracking, Analysis and Nowcasting

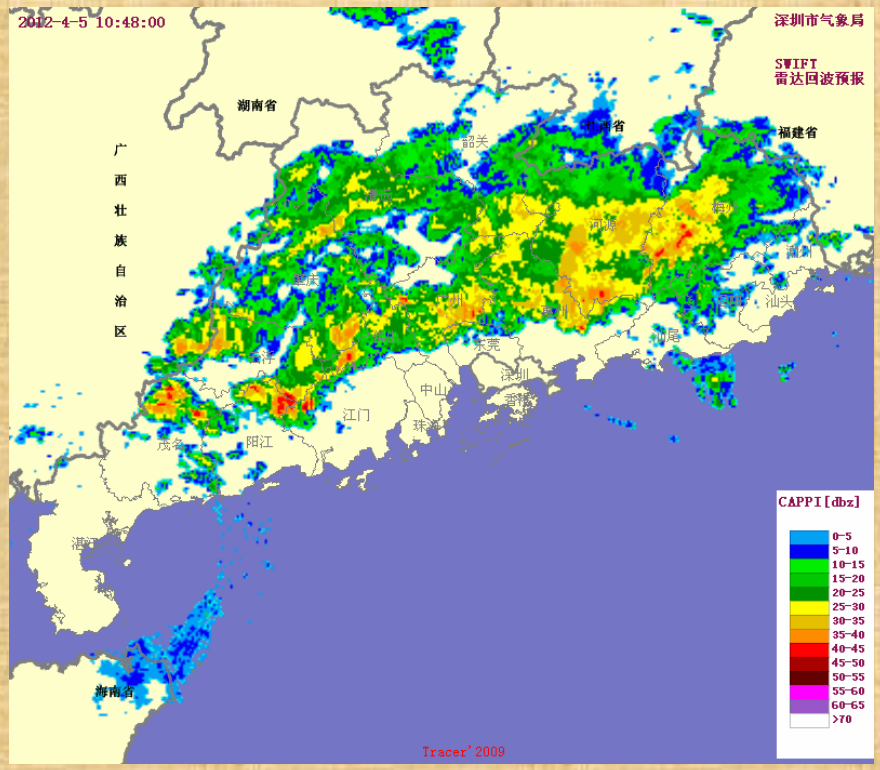
CTREC : Current implementation of Tracking Radar Echoes by Correlation

Radar Echo Nowcasting

Radar OBS
11:42 5 Apr,2014



1h Radar Ref Nowcasting



OBJECTIVE FORECAST

Ingredients-Based Methodology

—Charles Doswell (1996)

$$P = \overline{EqwD}$$

P: total rainfall
E: rainfall efficiency
D: duration
W: ascending velocity
q: mixing ratio for ascending air

Charles Doswell

The **Ingredients-Based Methodology (IM)**

provides a framework for a systematic assessment of the fundamental physical ingredients that influence the *duration, intensity, and type* of a given weather phenomenon. (Wetzel and Martin 2001)

Physical Parameters

Unstability

SI (Showalter Index)

LI (Lifting Index) /BLI (Best Lifting Index)

T850-T500 (Temperature difference between 850hPa and 500hPa)

CAPE (Convective Available Potential Energy)

DCAPE (Downdraft CAPE)

K (K Index)

……

Water Vapour

RH (Relative Humidity)

PWAT (Precipitable Water)

Td (Dew point Temperature)

……

Convergence

DIV (Divergence)

CON(Convergence)

……

Vertical Wind Shear

Shr0-6 (0-6km shear)

Shr0-3 (0-3km shear)

Others

T (Temperature)

H0 (Height of 0 ℃)

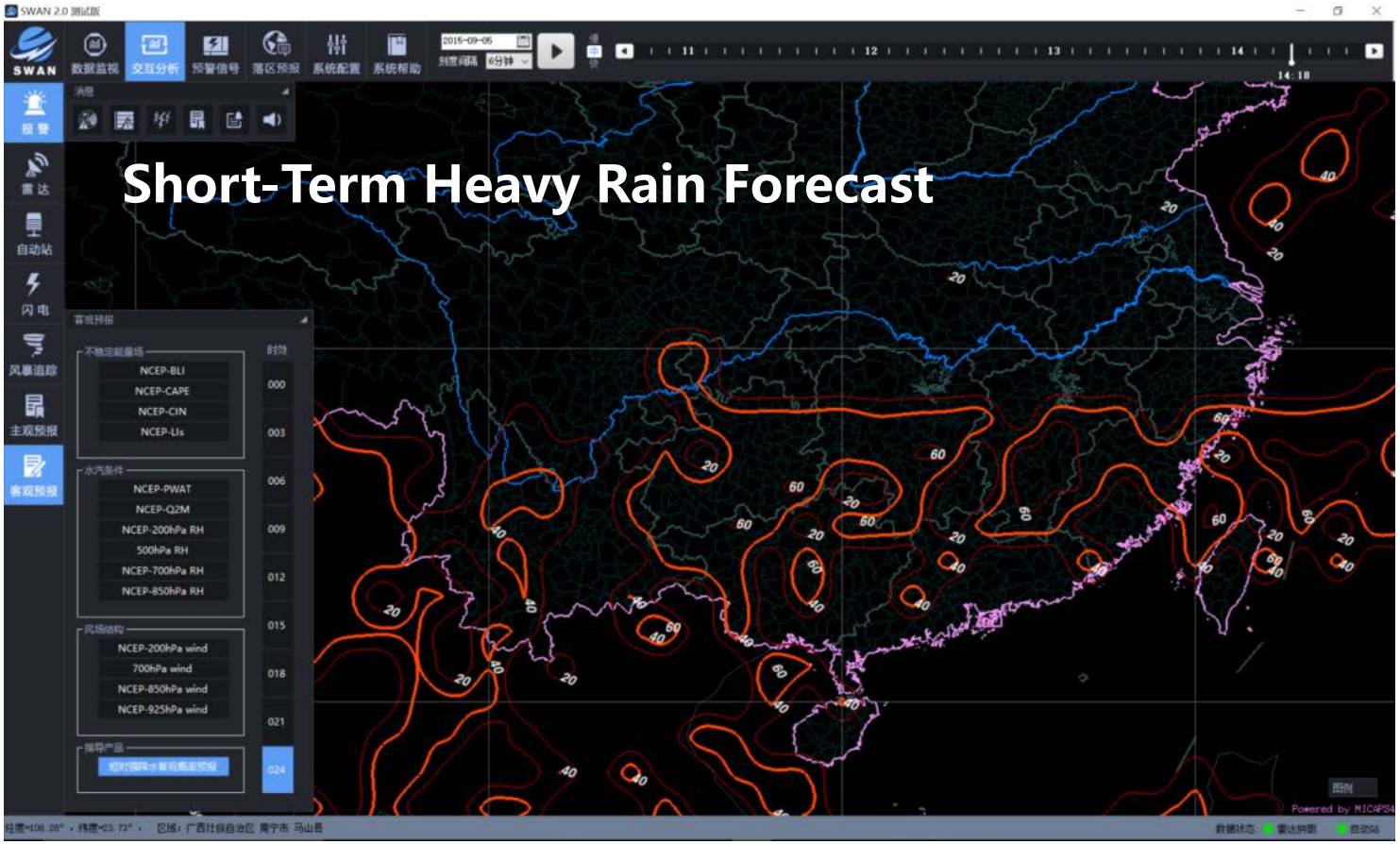
H20 (Height of -20 ℃)

WI (Windex)

TT (Total Totals)

SWEAT (Severe WEAther Threat)

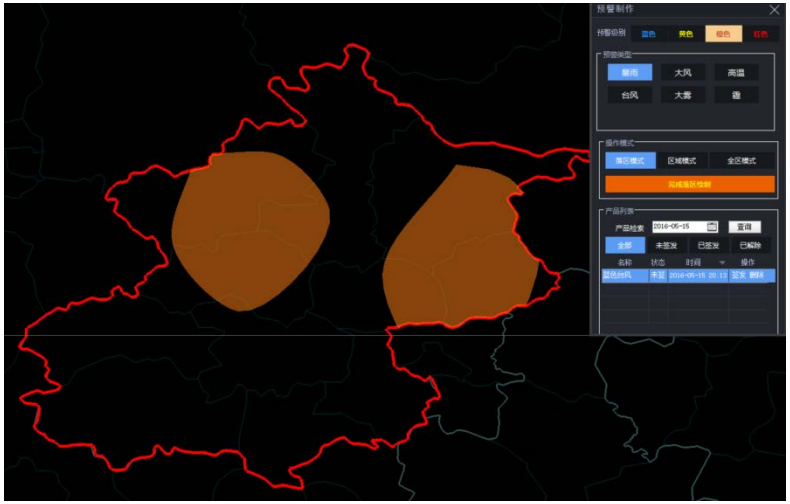
……



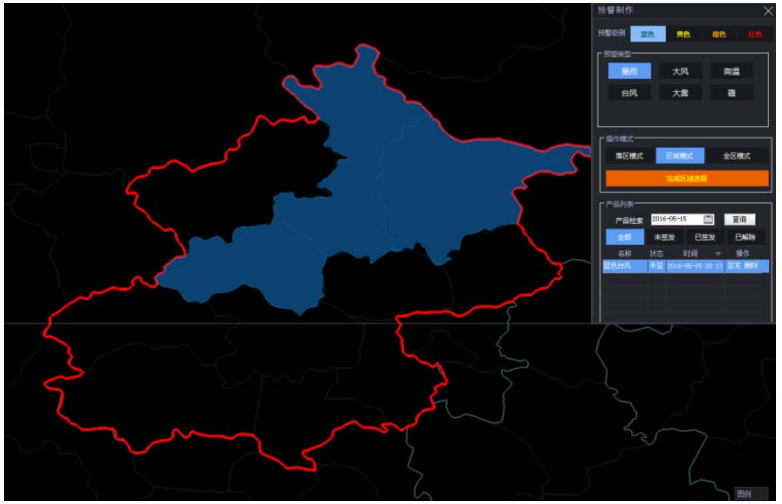
- **Short-Term Heavy Rain: PWAT, T850-T500, BLI, RH, Low-level DIV…**

Warning issue

- 3 ways of warning producing:
  - Draw warning areas
  - Select administrative regions
  - All the area
- Warning issued by one button.



Draw warning areas



Select different areas

THANKS FOR YOUR ATTENTION!

国家气象中心
NATIONAL METEOROLOGICAL CENTER