



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

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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.

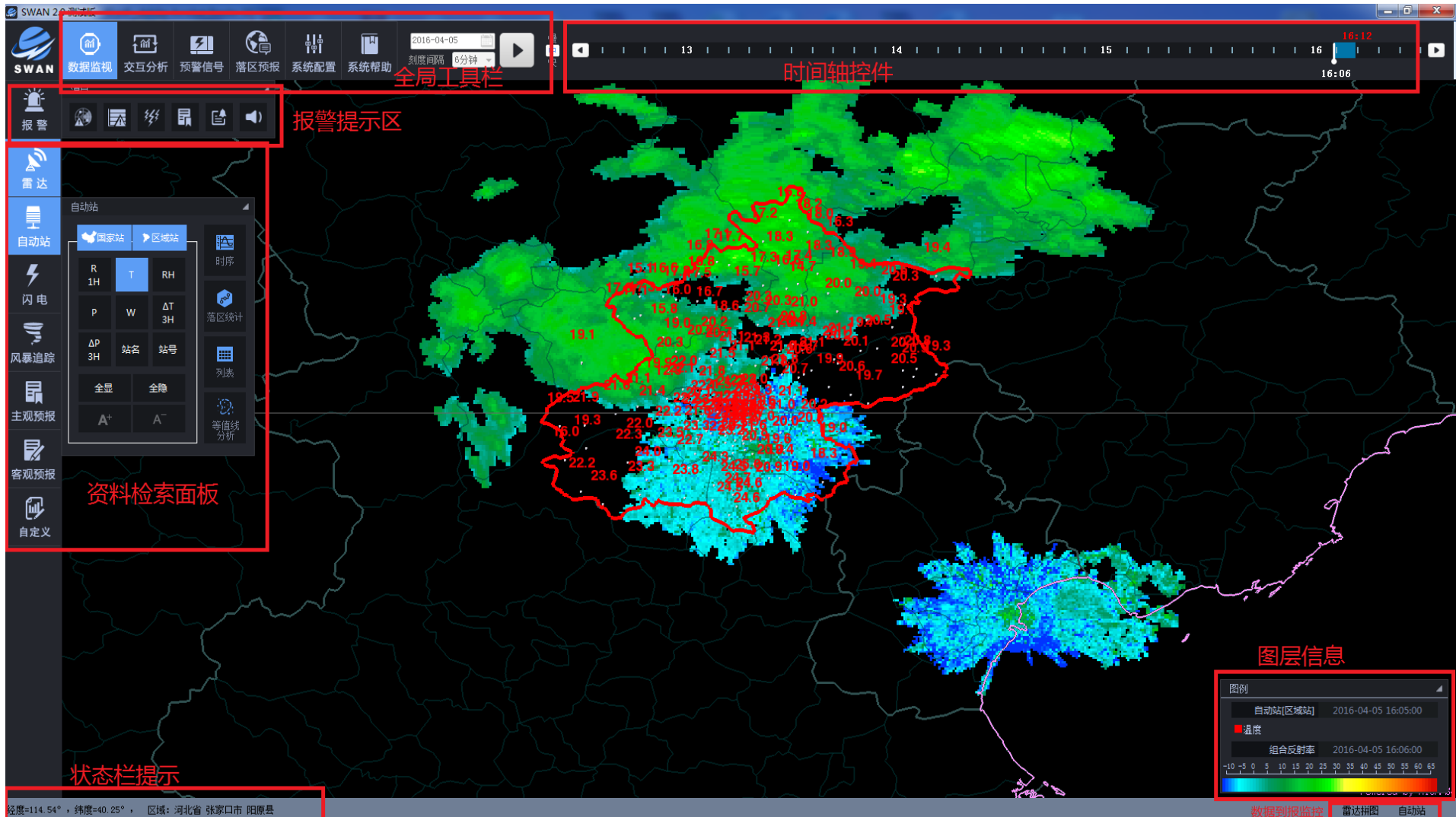


SWAN-Severe Weather Auto-Nowcasting

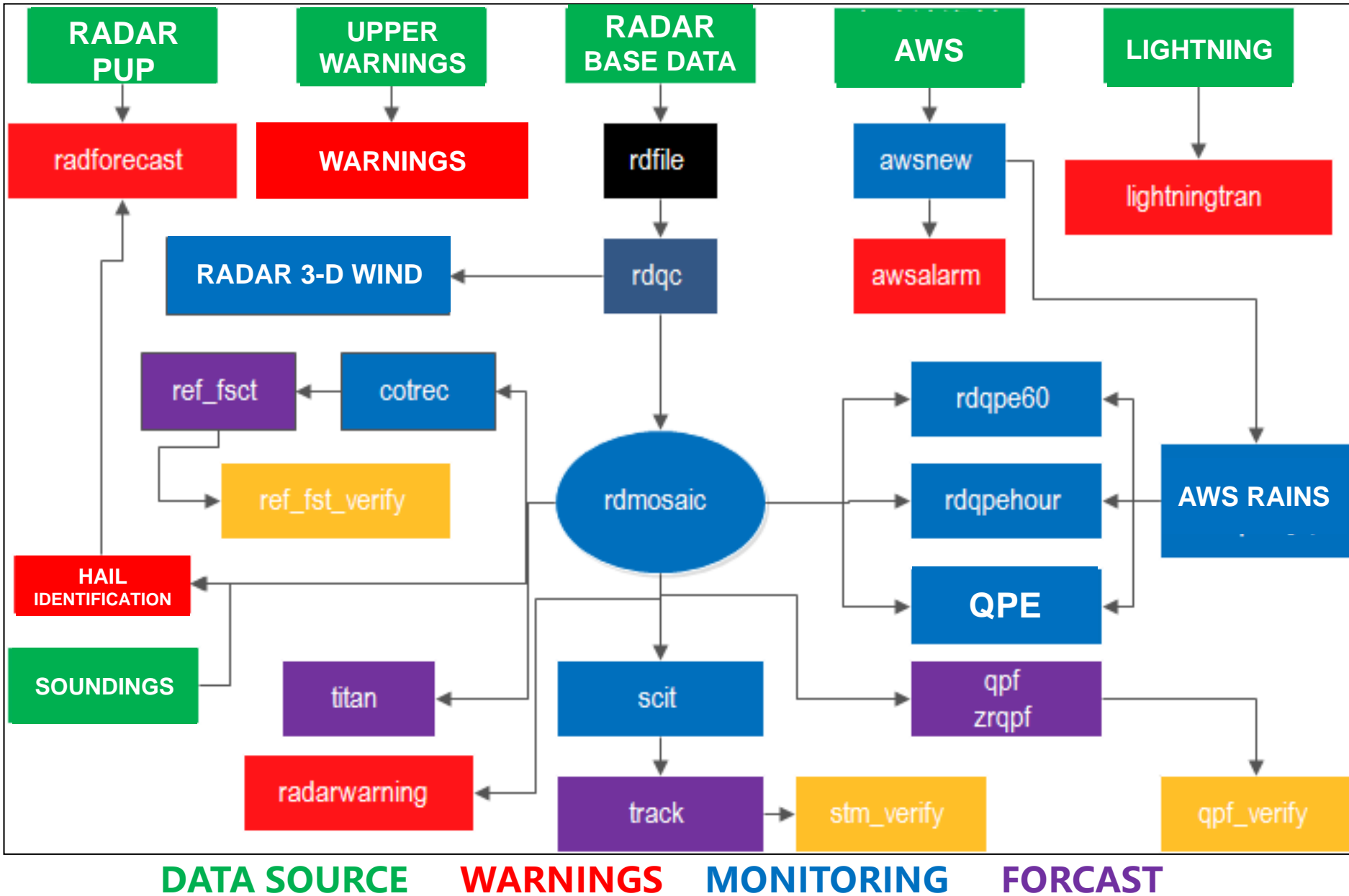
- Version 0(2009): preliminary finished the framework construction and basic algorithms development
- Version 1.0(2010): improved the algorithms, embedded the client to Micaps 3.1
- Version 1.5(2012): developed the Flash floods integrated platform of geological disasters, upgraded the client to Micaps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



SWAN interface



SWAN DATA FLOW



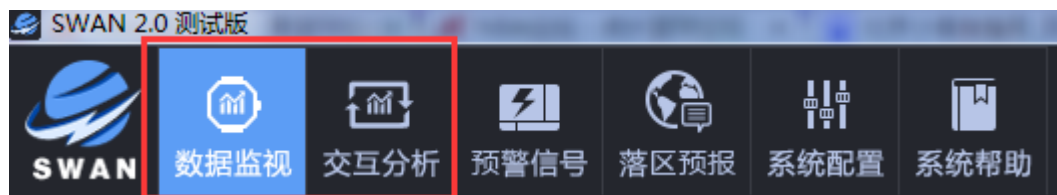
MAIN FUNCTIONS in SWAN

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



Working model

- 2 models: real-time model and analyzing model

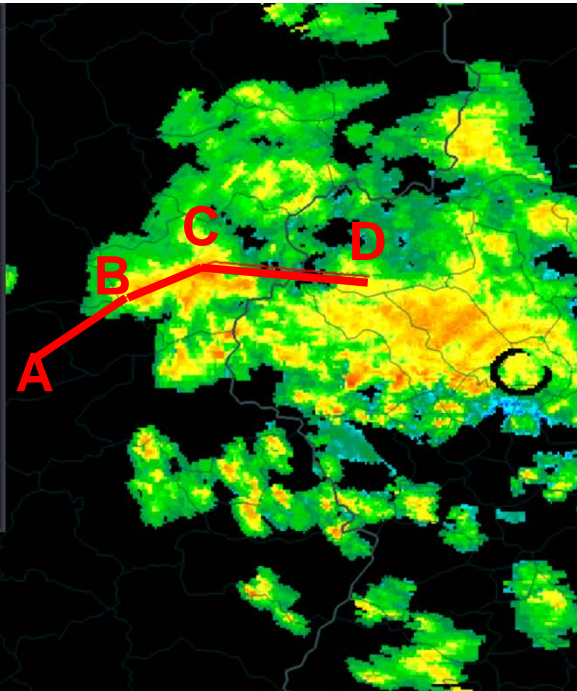
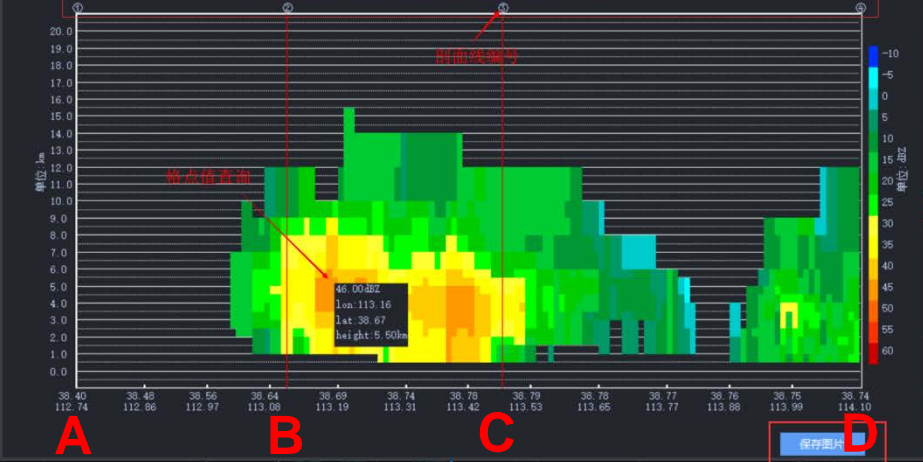


- **Real-time model**: updated automatically without any operating
- **Analyzing model**: forecasters can operate by using the time-axis and analyzing

Monitoring and auto-alarm

Products	Frequency	Basic data/technique
Radar 3-D mosaic	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 mosaic
VIL	6min	Radar 3-D mosaic
1-h QPE	6min	Radar 3-D mosaic
QPE for heavy rain	1hour	Radar 3-D mosaic
Cotrec wind	6min	Radar 3-D mosaic
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 mosaic

CROSS SECTION



SET THRESHOLD

SWAN 2.0 软件界面

报警

数据监控

交互分析

报警信号

落区预报

系统配置

系统帮助

2015-09-05

SET THRESH

DISPLAY MORE INFO

跟随机标, 实时取值

AWS Monitoring



RAIN :
Different period
from 10min to 24h



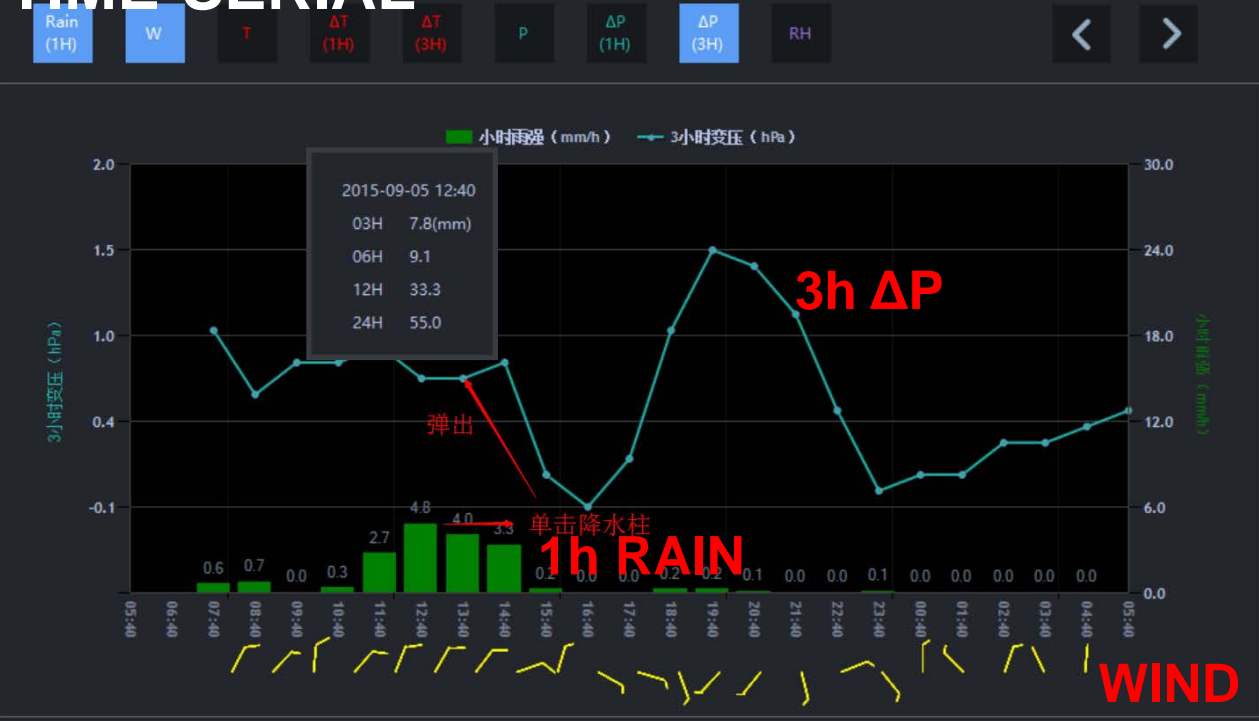
RH、WIND :
different threshold



Variation of T and P:
different period

TIME-SERIAL

农场[区域站] - 站点时序分析图 (2015年09月05日05时40分 - 2015年09月06日05时40分)



STATISTIC of a specified area

落区统计

最近1小时

量级(mm)	站数	排行榜
0.1-10.0	4	怀柔镇 (0.1mm)
10.1-20.0	0	不老屯 (0.1mm)
20.1-30.0	0	冯家峪 (0.1mm)
>=30.1	0	

有降水 4 无降水 25

最近3小时

量级(mm)	站数	排行榜
0.1-10.0	9	宝山 (0.3mm)
10.1-25.0	0	渤海 (0.2mm)
25.1-50.0	0	城南公园 (0.2mm)
>=50.1	0	

有降水 9 无降水 20

最近6小时

量级(mm)	站数	排行榜
0.1-10.0	10	宝山 (0.3mm)
10.1-25.0	0	渤海 (0.2mm)
25.1-50.0	0	城南公园 (0.2mm)
>=50.1	0	

有降水 10 无降水 19

最近12小时

量级(mm)	站数	排行榜
0.1-10.0	24	溪翁庄 (2.8mm)
10.1-25.0	0	黑龙潭 (1.7mm)
25.1-50.0	0	穆家峪 (1.7mm)
50.1-100.0	0	
>=100.1	0	

有降水 24 无降水 5

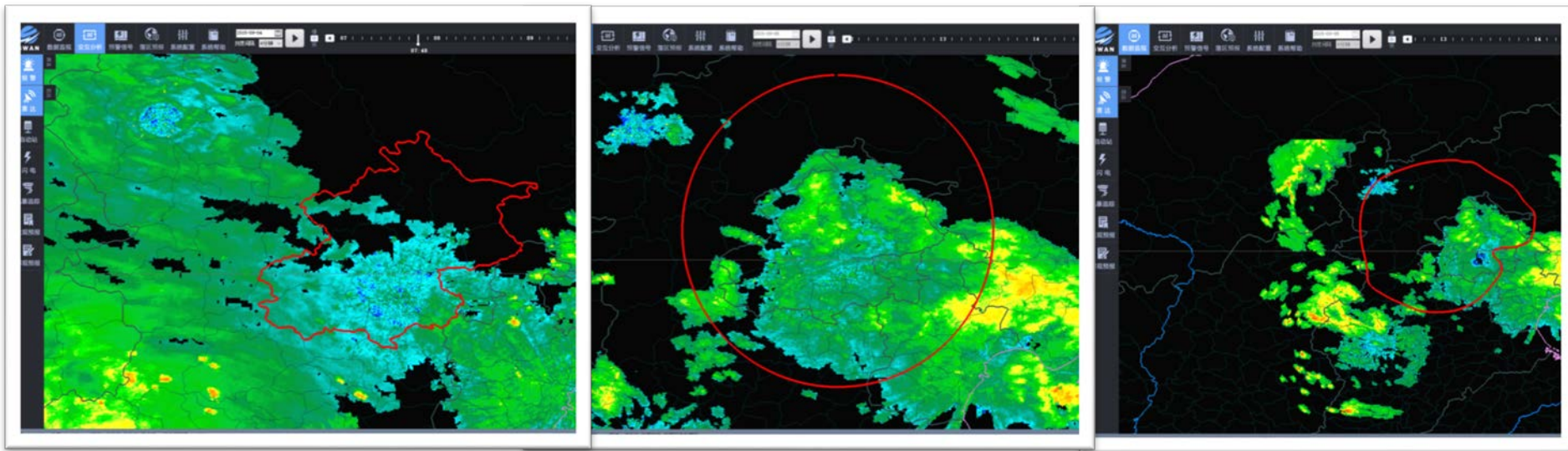
最近24小时

量级(mm)	站数	排行榜
0.1-10.0	11	渤海 (17.5mm)
10.1-25.0	18	桥梓 (15.5mm)
25.1-50.0	0	黑龙潭 (15.4mm)
50.1-100.0	0	
>=100.1	0	

有降水 29 无降水 0

Auto-Alarm Based on Radar and AWS

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



ALARM INTERFACE

The screenshot displays the SWAN 2.0 Alarm Interface. The main view is a map of Beijing with a red outline of the city. Several alarm icons are scattered across the map. A white arrow points from the '报警' (Alarm) button in the top-left navigation bar to the map. Another white arrow points from a specific alarm icon on the map to the '报警详情' (Alarm Details) window. A third white arrow points from the '报警' button to a notification area showing '4' and '9+' icons, with the text 'Not read alarm' below it. A fourth white arrow points from the '报警' button to a table titled '报警信息' (Alarm Information) on the right side of the screen. The table lists various alarms with columns for product name, occurrence time, alarm type, station number, and description. The '报警详情' window shows details for a specific alarm: occurrence time 2015-09-06 00:03:31, alarm type '强阵雨' (Strong Squall Rain), station number 651253, and description '降水量: 11.1毫米, 时长: 1.0小时' (Precipitation: 11.1mm, Duration: 1.0h).

Alarm list

产品名称	发生时间	报警类型	站号	报警描述
20150905113731暴雨报警	2015-09-05 11:37:31	暴雨	651820	降水量: 60.2毫米, 时长: 3.0小时
20150905113731暴雨报警	2015-09-05 11:37:31	暴雨	651354	降水量: 60.6毫米, 时长: 6.0小时
20150905113731暴雨报警	2015-09-05 11:37:31	暴雨	651032	降水量: 62.3毫米, 时长: 6.0小时
20150905113731暴雨报警	2015-09-05 11:37:31	强阵雨	651410	降水量: 20.2毫米, 时长: 1.0小时
20150905113731暴雨报警	2015-09-05 11:37:31	强阵雨	651253	降水量: 11.1毫米, 时长: 1.0小时
20150905113731暴雨报警	2015-09-05 11:37:31	强阵雨	651354	降水量: 11.3毫米, 时长: 1.0小时
20150905113631	2015-09-05 11:30:00	3小时负压	651007	负压: -2.1, 类型: 3小时负压
20150905113631	2015-09-05 11:30:00	3小时负压	651017	负压: -2.1, 类型: 3小时负压
20150905113631	2015-09-05 11:30:00	3小时负压	651018	负压: -2.1, 类型: 3小时负压
20150905113631	2015-09-05 11:30:00	3小时负压	651034	负压: -2.2, 类型: 3小时负压
20150905113631	2015-09-05 11:30:00	3小时负压	651050	负压: -2.1, 类型: 3小时负压
20150905113631	2015-09-05 11:30:00	3小时负压	651054	负压: -2.1, 类型: 3小时负压
20150905113631	2015-09-05 11:30:00	3小时负压	651409	负压: -2.1, 类型: 3小时负压
20150905113631	2015-09-05 11:30:00	3小时负压	651451	负压: -2.3, 类型: 3小时负压
20150905113631	2015-09-05 11:30:00	3小时负压	651453	负压: -2.5, 类型: 3小时负压
20150905113631	2015-09-05 11:30:00	3小时负压	651455	负压: -2.5, 类型: 3小时负压

Not read alarm

Alarm icon

Alarm info

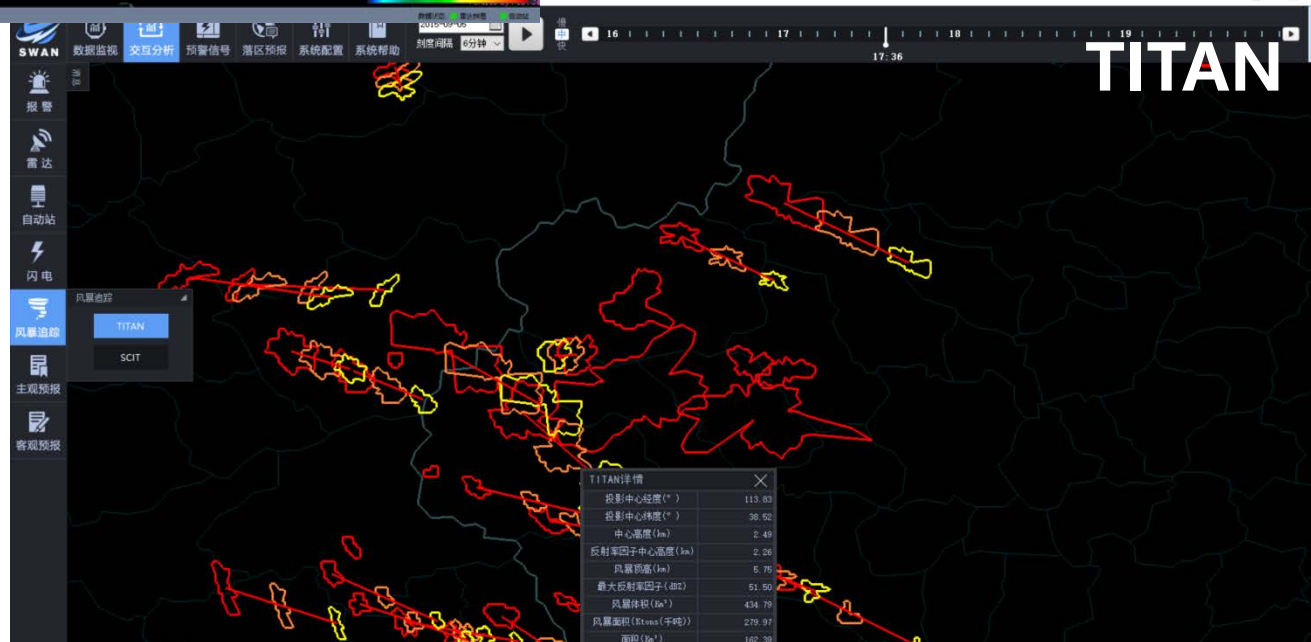
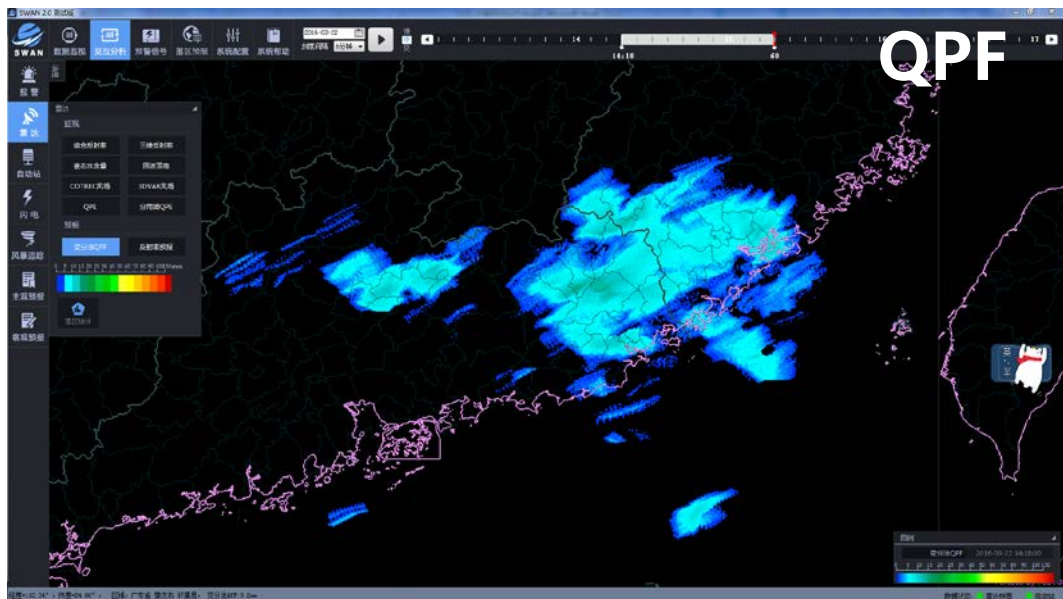
报警详情

发生时间	2015-09-06 00:03:31
报警类型	强阵雨
站号	651253
报警描述	降水量: 11.1毫米, 时长: 1.0小时

经纬度: 116.00°, 纬度: 39.89°, 区域: 北京市 北京市 门头沟区

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 mosaic
TITAN	6min	Radar 3-D mosaic



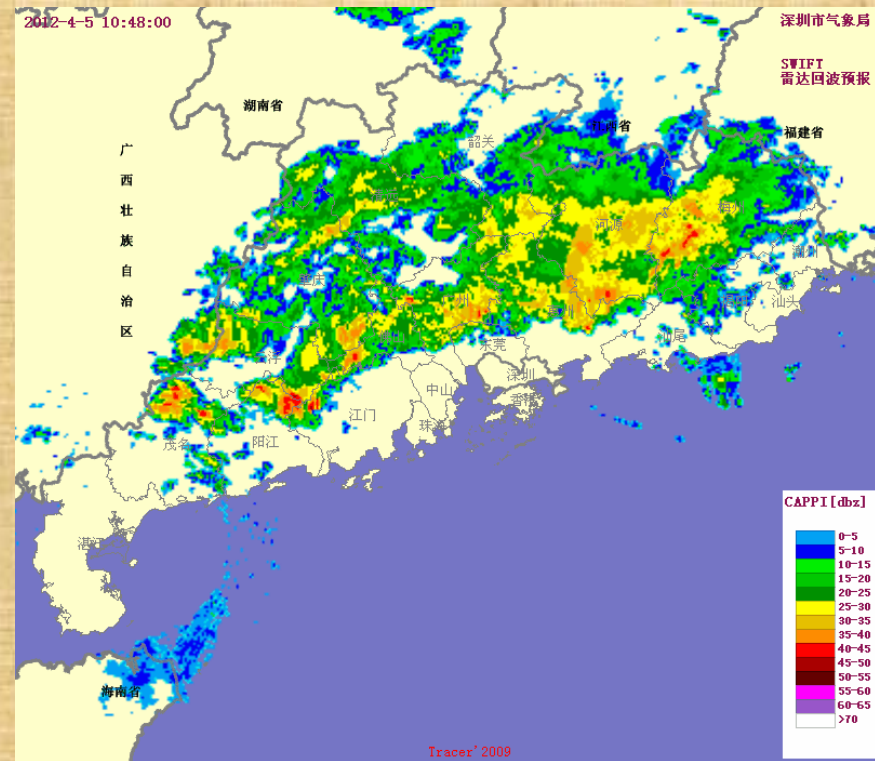
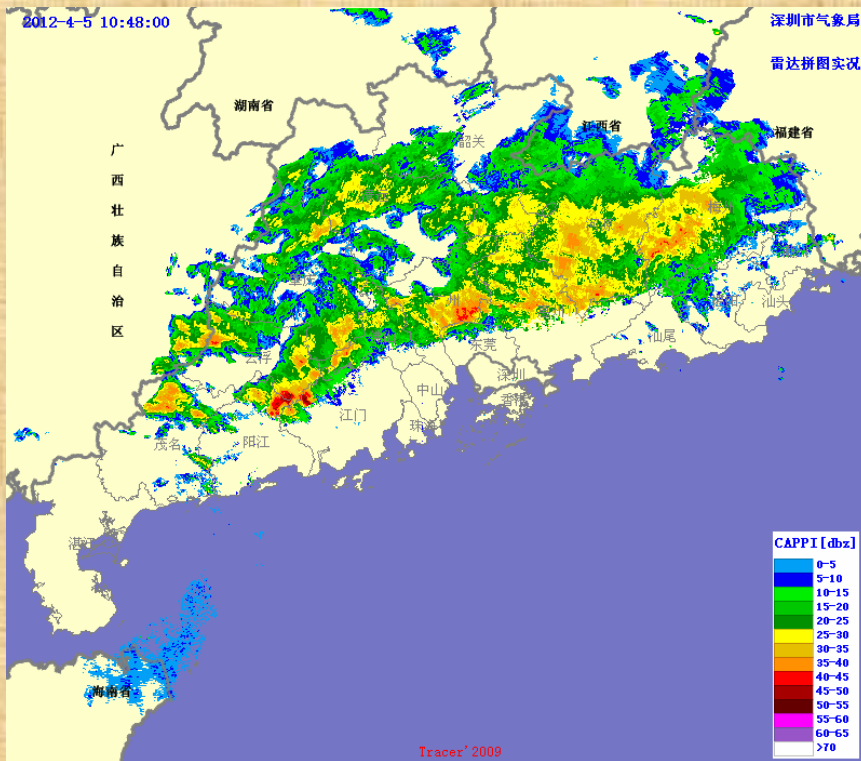
TITAN : **T**hunderstorm **I**dentification, **T**racking, **A**nalysis and **N**owcasting

CTREC : **C**urrent implementation of **T**racking **R**adar **E**choes by **C**orrelation

Radar Echo Nowcasting

Radar OBS
11:42 5 Apr, 2014

1h Radar Ref Nowcasting



Ingredients-Based Methodology

— Charles Doswell (1996)

$$P = E \overline{qW} D$$

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 °C)

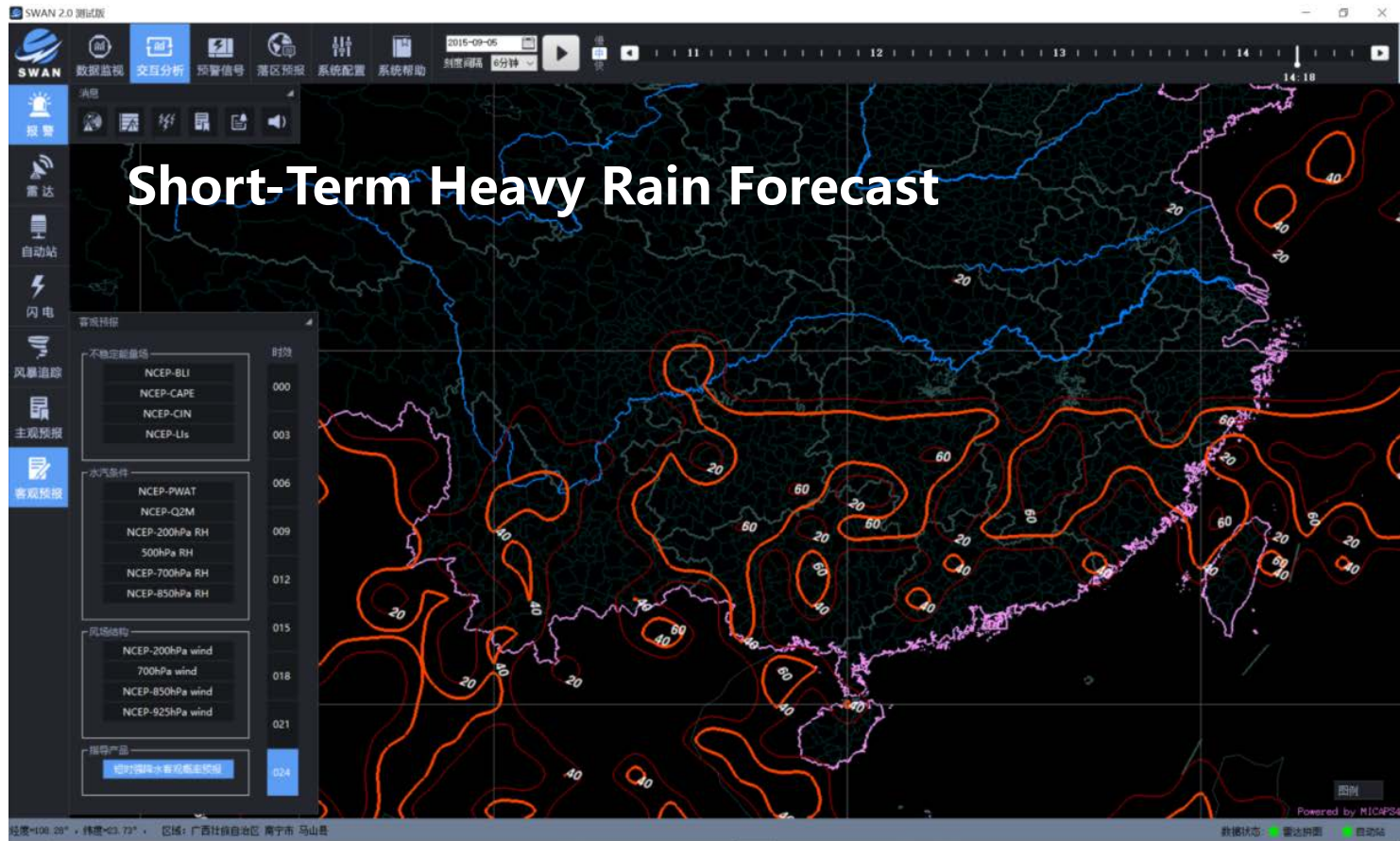
H20 (Height of -20 °C)

WI (Windex)

TT (Total Totals)

SWEAT (Severe WEATHER Threat)

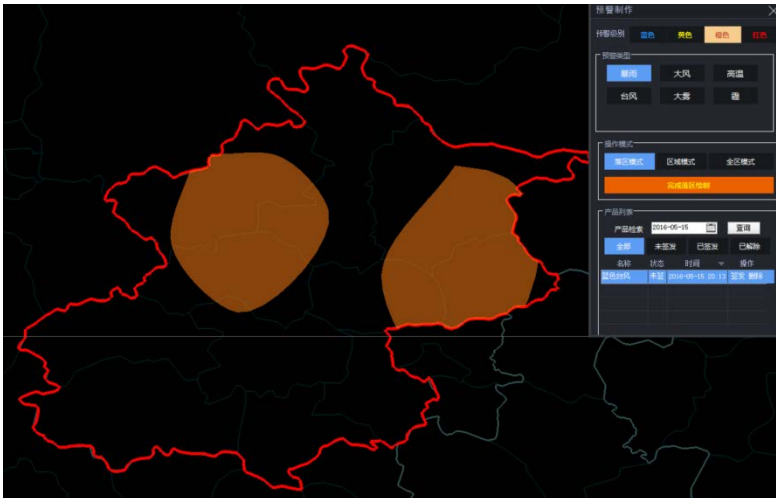
.....



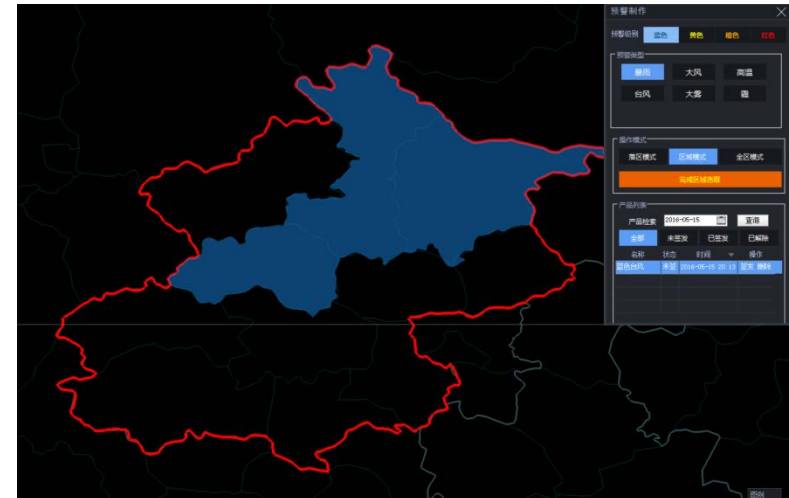
- Short-Term Heavy Rain: **PWAT**, **T850-T500**, **BLI**, **RH**, **Low-level DIV**...

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!

