Selex Systems Integration GmbH

Company Presentation

Dr. Monika Pfeifer
Manager Marketing&Sales

SELEX
Systems Integration

Leader in Weather Radar Technology and Meteorological Systems

Key Figures

- Turnover: ~ 30 Mio. €
- **>** 90% export
- Employees: ~ 155 staff, mainly engineers, meteorologists and skilled technicians
- Over 250 radars installed in 60 countries on all continents

Facilities

- R&D in Hardware & Software
- Own Labs and Test Ranges
- Own Production and Training Facilities

Quality

- 24 hr permanent operation
- Unattended operation
- ISO 9001 certified since 1996

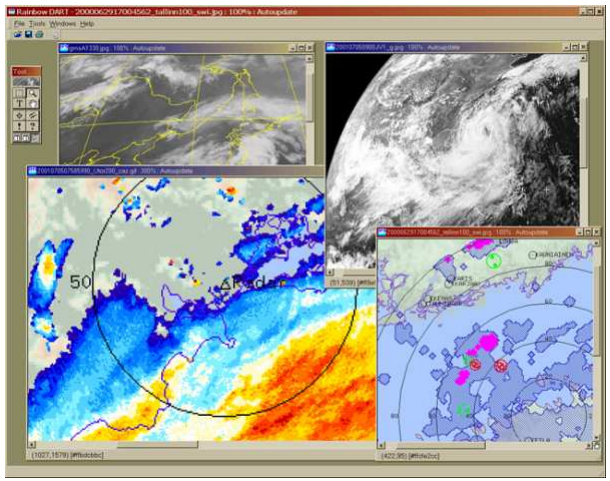
Leader in Weather Radar Technology and Meteorological Systems

Mission

- Technological Leadership in Weather Radar and Integrated Meteorological Systems

Products

- Doppler Weather Radar Systems in C-, S- and X-Band
- Wind Shear Detection Systems
- Meteorological display and analysis software
- Integrated Meteorological Systems (Radar Networks, Sensor Fusion)



Company History

1961 — **Gematronik** founded

Service & Support
Provide service and support for ATS radars produced by Raytheon and Alenia

1984

METEOR 200
Internal design and sale of 1st Generation Doppler radar systems

1992 — Gematronik joins **Alenia / Finmeccanica** Group

1993

METEOR 360
2nd Generation of Doppler weather radar systems introduced to the market. Over 100 systems delivered

1998

METEOR 500 / 1500
3rd Generation of Doppler weather radar systems introduced to the market. Includes magetron and klystron transmitters.

2001 — Gematronik acquired by **AMS** Ltd. Becomes part of **ATMAS Division**

2005

METEOR 50DX
New generation of dual polarized mobile weather radar systems using X-Band

Gematronik is fully acquired by **Finmeccanica Group** and renamed **SELEX Sistemi Integrati**

2006

METEOR 600 / 1600
4th Generation of Doppler weather radar systems introduced to the market. Includes magnetron and klystron transmitters.

2009 — **Meteorological Centre of Excellence** within Finmeccanica Group

50 years 1961 - 2011

Service Provider → **Hardware Provider** → **Turnkey Systems** → **Integrated Solutions**

METEOR SYSTEM - Highlights

System

Full Inhouse Design:

- Design rights & capabilities on key components & technologies
- Perfect integration and optimisation
- Full support expertise on component-, interface- and system- level

Hardware

- Antenna with rapid-scan pedestals & drives
- Transmitter with solid-state modulators (~ 130 systems up to now)
- Graceful degradation (M635C only)
- More than 100 digital receivers installed, ultra-low noise, wide dynamic range

Software

SDR - Software-designed architecture:

- A network-centric design makes all sub-systems transparent to the outside world
- Maintenance and software upgrades from all remote locations

METEOR SYSTEM - Highlights II

Speed

Highest Data Acquisition Rates:

- High-speed scanning antennas
- Solid-state modulator enable optimum pulse width/repetition rates
- Maximum performance of digital receiver and data processing

Norms

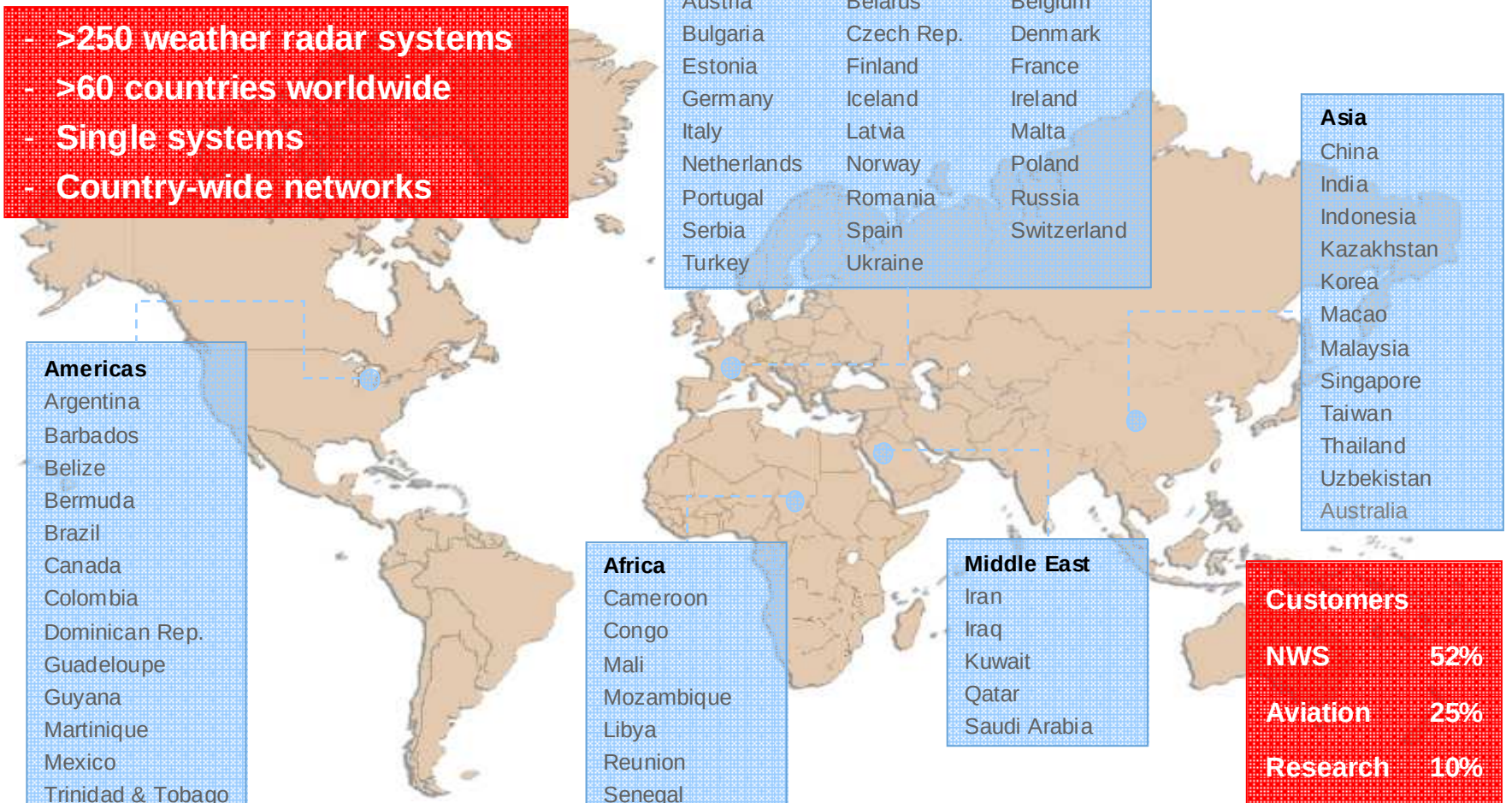
- Compliance to latest EU Directives:
- Improved mechanical safety: Risk analysis and safety system acc. ISO 12100 ensures max. human safety during maintenance.
- Production complies to latest Environmental EU Directives, i.e. 2002/95/EC (RoHS)
- Only MAK certified radar available

Quality

- QM-System acc. to ISO 9001 in place since 1996 as first weather radar manufacturer
- High-skilled technicians and engineers

Worldwide Customer Base

- >250 weather radar systems
- >60 countries worldwide
- Single systems
- Country-wide networks



Europe

Austria	Belarus	Belgium
Bulgaria	Czech Rep.	Denmark
Estonia	Finland	France
Germany	Iceland	Ireland
Italy	Latvia	Malta
Netherlands	Norway	Poland
Portugal	Romania	Russia
Serbia	Spain	Switzerland
Turkey	Ukraine	

Asia
China
India
Indonesia
Kazakhstan
Korea
Macao
Malaysia
Singapore
Taiwan
Thailand
Uzbekistan
Australia

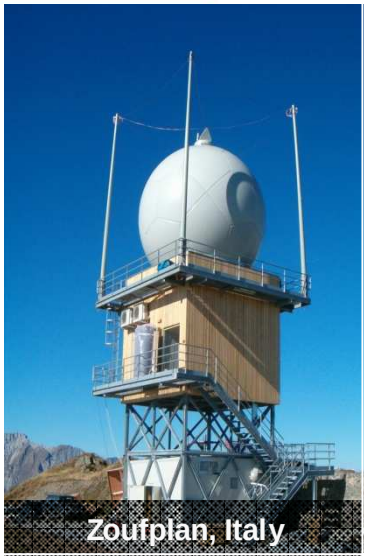
Americas
Argentina
Barbados
Belize
Bermuda
Brazil
Canada
Colombia
Dominican Rep.
Guadeloupe
Guyana
Martinique
Mexico
Trinidad & Tobago
USA
Venezuela

Africa
Cameroon
Congo
Mali
Mozambique
Libya
Reunion
Senegal
South Africa
Togo
Tunisia

Middle East
Iran
Iraq
Kuwait
Qatar
Saudi Arabia

Customers	
NWS	52%
Aviation	25%
Research	10%
Military	9%
Misc	4%

Some Weather Radar Installations Worldwide


Zoufplan, Italy


Ken Ting, Taiwan


Adelaide, Australia


Surabaya, Indonesia


Barbados


Røst, Norway


Momuy, France


Vishaka-Pattinam, India


Beijing, China


St. Petersburg, Russia

METEOR 50DX

Mobile Version

Stationary Version

METEOR 50DX

A Mobile, Short Range Radar for Professional Applications

Product

- Full Doppler Weather Radar in X-band
- Magnetron Transmitter (55 kW)
- Antenna sizes: 1,2 / 1,8 / 2,4m
- Dual Polarization as standard feature
- Full Support of Rainbow and Ravis Software Packages

Benefits

- Ultra compact Design
- Suitable for Mobile Applications
- Minimized Installation Efforts
- Operational w/o radome up to 155 Km/h
- Capability for radar network integration
- Dual Polarization leads to improved precipitation measurement results

Applications

- Gap-Filler in Radar Networks
- Hydrological Applications
- Research Applications

Trailer Solution enables 360° Scans without Lifting Unit

- The mobile solution is based on a trailer, which fulfills EU directives for street hangers (weight, height, width)
- The application Software can be accessed locally (via Laptop/LAN) and remotely (UMTS/Edge or WiFi)
- A Generator allows for independent operation of up to 24 Hours

METEOR – Polarimetric Operation

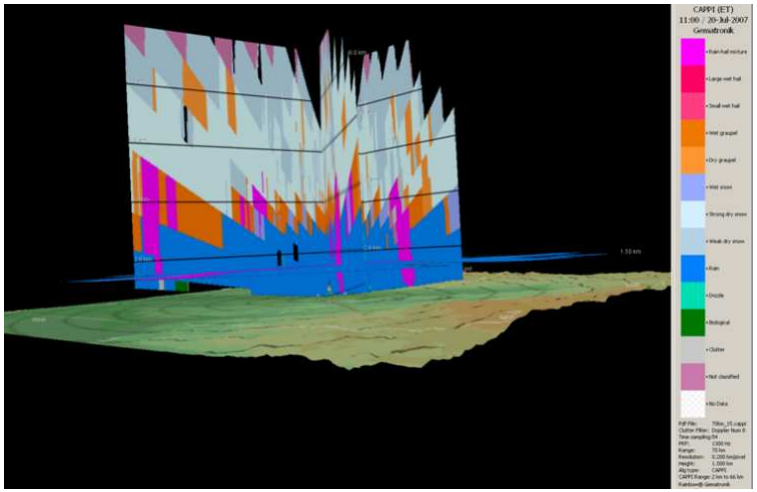
Advantage: enhance data quality, algorithms developed in cooperation with CSU

Technology

- Dual Channel Dual Polarization Configuration (DCDP)
- "Simultaneous-Transmit-And-Receive (STAR)"
- Proven design: >50 DP systems under contract

Data Sets

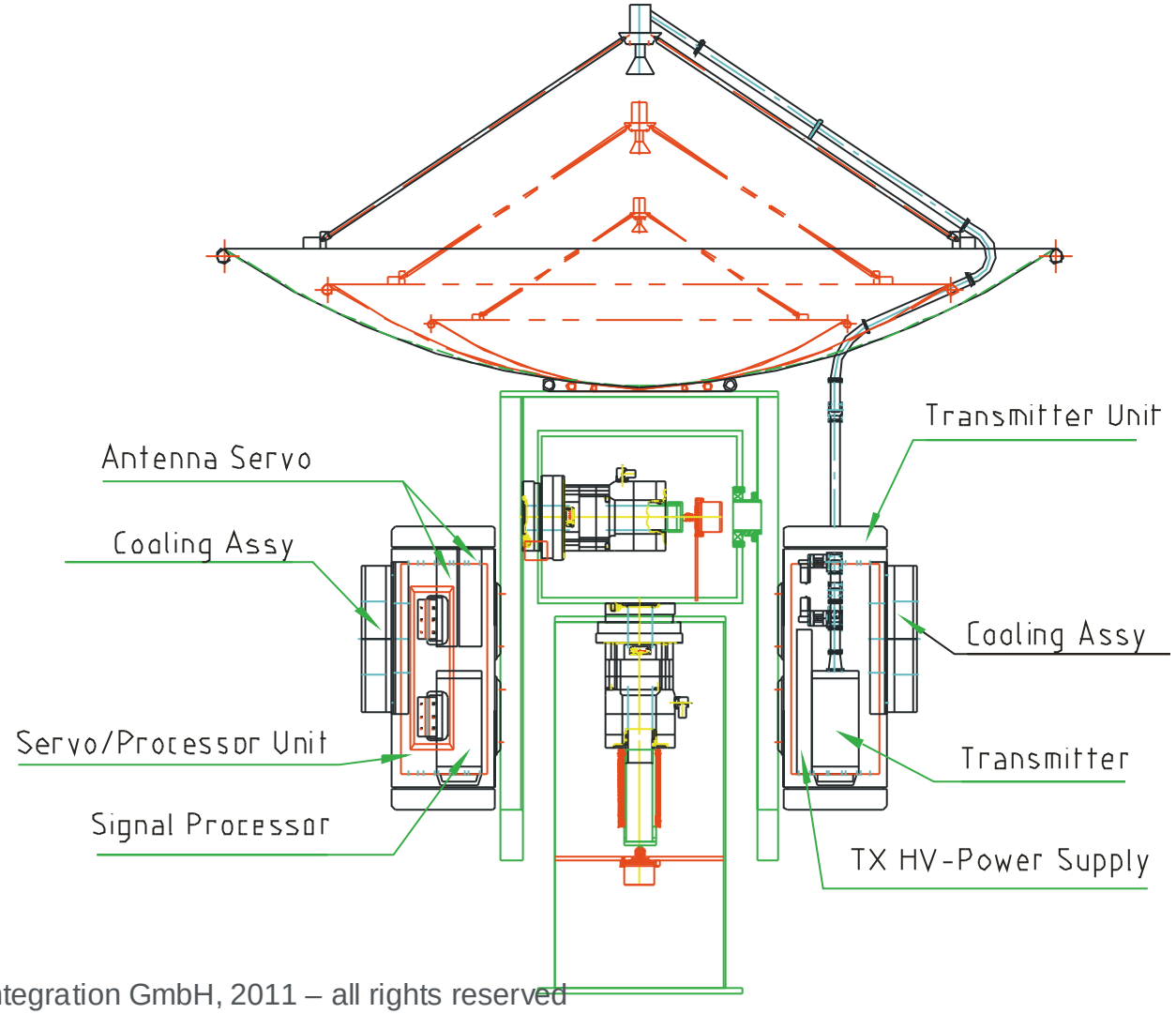
- ZDR (Differential Reflectivity)
- PhiDP (Differential Phase Shift)
- KDP (Specific Differential Phase Shift)
- RhoHV (Pol. Correlation Coefficient)
- LDR (Linear Depolarisation Ratio)



Benefits

- Better clutter elimination
- Improved precipitation estimates
- Better correction of rainfall attenuation
- Classification of hydrometeors

Full “Radar-over-Elevation”, no Rotary Joints



METEOR 50DX

Key Performance Parameters

Operating Frequency Range	**9.36 – 9.38 GHz or 9.30 – 9.35 GHz**
Peak Power (at Magnetron Output)	**75 KW**
Beam Width (1.8m standard , 2.4m)	**1.3º, 1.0º**
Antenna Gain	**42.5, 44.5 dB**
Pulse Modes	**4**
Pulse Width (PW), configurable	**0,33 – 2.0 µs or 0,83 – 3.3 µs**
Range Resolution @ Short Pulse	**50 - 500 m**
Pulse Repetition Frequency (PRF)	**250 – 2500 Hz**
Operational Range	**100 km**
Maximum Unambiguous Velocity @ 5:4	**+/- 80 m/s**
MDS @ Long Pulse	**-113 dBm**
Sensitivity (dBZ) @ LP& 100km	**~ -11 dBZ**
Sensitivity (mm/hr) @ LP, 100km	**~ 0.002 mm/h**

METEOR 50DX

Environmental Conditions

Specification	Value	Unit
Temperature range with radome	- 25 to + 45	°C
Temperature range without radome	- 10 to + 35	°C
Relative humidity maximum (non-condensing)	10 to 95	%
Permissible operational wind load Without radome	155	km/h
Permissible operational wind load with radome	200 In gusts	km/h
Precipitation rate	60	mm/h
Weather	Fog, rain, hail, thunderstorm	
Atmosphere	Saline, corrosive	
Installation height	Sea level to 3 km	

METEOR 50DX Projects

System	Qty	Country	Customer
METEOR50DX	1	Iceland	National Meteorological Service
METEOR50DX	3	France	Meteo France
METEOR50DX mobile	1	France	Meteo France (Nice Airport)
METEOR50DX mobile	1	UK	University of Leeds
METEOR50DX mobile	1	Japan	Jamstec
METEOR50DX	1	Russia	Hydrometeorological University of St. Petersburg
METEOR 50DX mobile	1	Brazil	INPE, Instituto Nacional de Pesquisas Espaciais
METEOR 50DX	2	Germany	DWD
METEOR 50DX mobile	1	Germany	KIT
METEOR 50DX mobile	1	Swiss	Arma Swiss
METEOR50DX mobile	1	Libya	Libyan National Meteorological Center
METEOR 50DX mobile	2	South Africa	Weather Service
METEOR 50DX	1	Colombia	Civil Aviation Authority
METEOR 50DX mobile	4	Italy	DPC
METEOR 50DX mobile	1	Italy	ARPA Piemonte
METEOR 50DX	1	China	Hongkong Observatory
TOTAL	23	SYSTEMS	

Projects and Impressions

South Africa

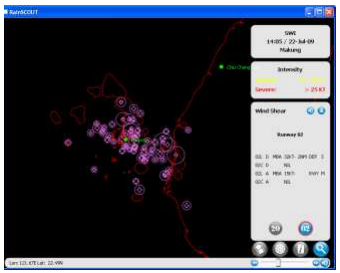
- Modernization of SAWS Weather Radar Network
  - Current radars >15 years old
    - C-Band
- Contract includes:
  - 10 S-Band systems
  - 2 X-Band mobile systems
  - Dual Polarization
  - Rainbow state-of-the-art processing software
  - Centralized control and monitoring of entire network

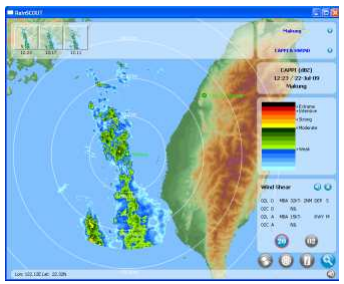
S-Band installation in Bethlehem

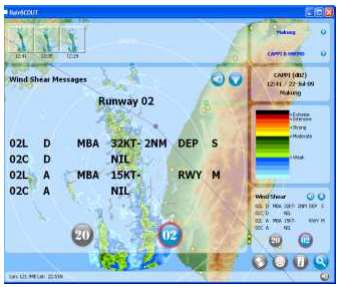
Key Successes 2009 - Frankfurt/Munich Airport

Project

- Low Level Wind Shear Alert System to enhance aviation safety at:
- Frankfurt Airport
- Munich Airport
- Integration of X-Band Radar (M50DX) and LIDAR
- Duration: 2009 – 2012
- Cooperation with Lockheed Martin



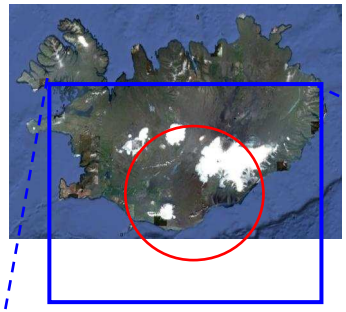




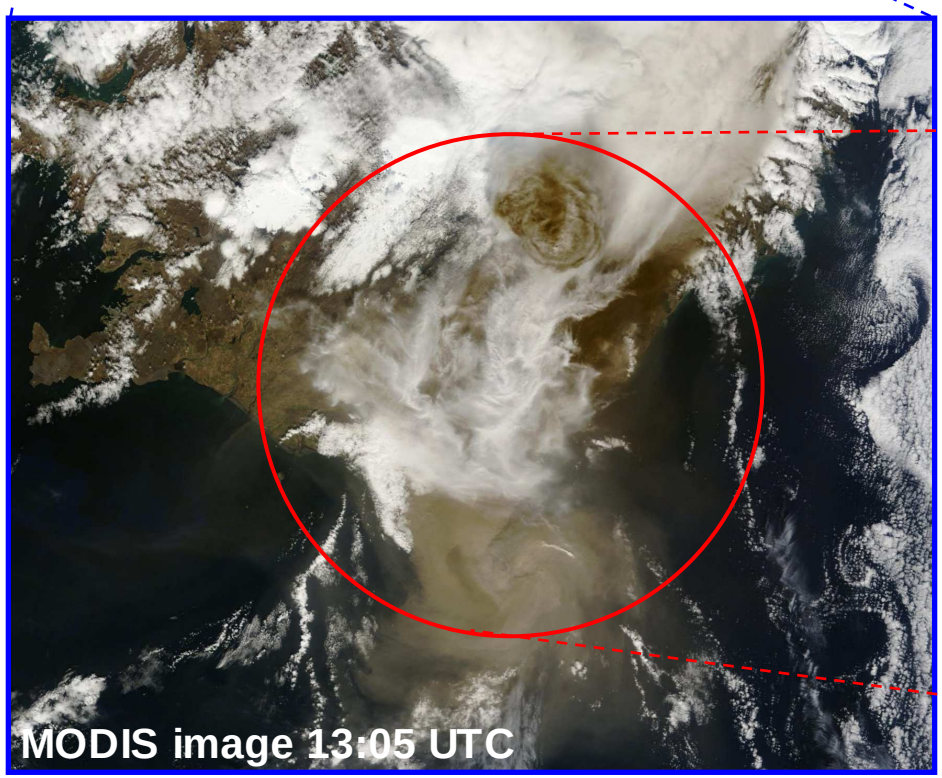
METEOR 50DX

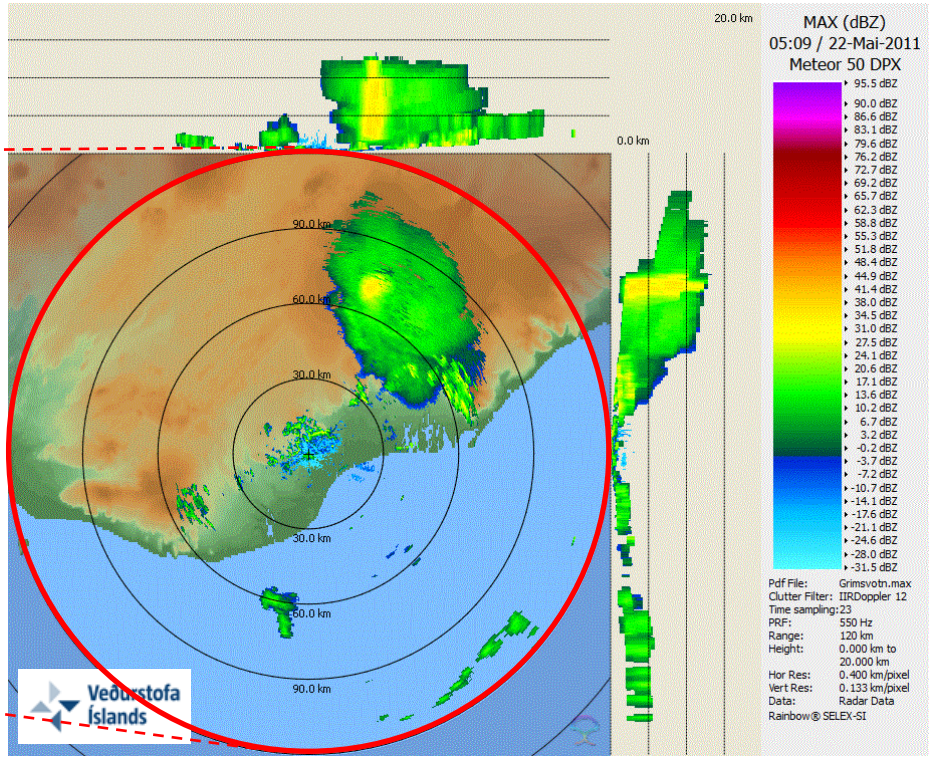
- Location: Colombia, Antonio Narino Airport
- Type: Fixed Installation
- Altitude: 1834m

X-band data of Grimsvotn eruption



Grimsvotn eruption on 22-May 2011: Ash data (mostly)





METEOR 50DX

- Location: France, Sait-Andre-Les-Alpes
- Type: Fixed Installation
- Altitude: 1775m

METEOR 50DX

- The Mission: Measure the cloud physical process of the main precipitation systems in Brasil
- The Schedule: 2010 to 2013
- 50DX Locations: Different climate regimes all over Brazil

Belem

Fortaleza

„The mobile 50DX has meanwhile traveled about 3500km. I would like to say that the 50DX is very robust and the collected data are very good. This dataset will be a reference for climate studies in Brazil and I hope in 10 years people will still be using this dataset. We are very happy with the 50DX and it was ‚certified' to work in Brazilian conditions. The weather in Belem was extremely hot and wet and the radar never stopped."

Luiz Augusto Toledo Machado INPE/CPTEC; General Coordinator of the CHUVA Campaign

METEOR 50DX

On the road in France

On the road in Libya

Off the road in Iceland

On the road in Brazil

METEOR 50DX

Vulcanic Ash Tracking in Sicily

Measurement Campaign Arpa Piemonte, Italy

Vulcanic Ash Tracking in Island

50DX welcome ceremony South Africa

METEOR 50DX

On the road in Poland

Special Site Inspection Nice Airport

Measurement Campaign Nice Airport

Fuel for the generator, South Africa

METEOR 50DX Summary

METEOR 50DX

- Medium range high-power X-Band Weather Radar System
- Doppler, Dual Polarization
- Detection of rainfall, radial wind
- Classification of rainfall intensity, type, wind, turbulence
- Compact, robust, Mobile, easy to install

Benefits

- Extremely sensitive
- High resolution
- Rapid update rate
- Precise Measurements, Tracking, Warnings & Nowcasting

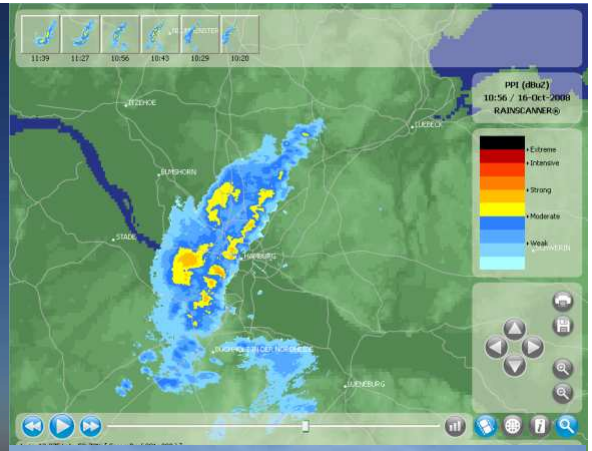
Applications

- Gapfiller in country-wide meteorological networks
- Research and temporary research campaigns
- Sensor for hydrological systems (flood/river/urban area monitoring, water reservoirs, drainage systems)
- Sensor for aviation met systems in the terminal area (hazardous weather, wind shear, gusts)

Support

- Warranty (24 months)
- Training and operational support
- Tailored service contracts

RAINSCANNER®



Marine Radar becomes Weather Radar

Marine Radar

- COTS mass produced
- Withstand hostile environments
- Easy maintenance
- Spare part availability
- Low cost

Transformed

- Enhanced **sensitivity**
- Enhanced **resolution**
- Increased **range**
- 3 parabolic antenna systems
- Control Processor & Receiver
- RainView®
- RainView® Analyzer

MARINE RADAR

WEATHER RADAR

X-Band Weather Radar System

Sensitivity

- Range: 50 – 100 km
- Rainfall detection
- Rainfall intensity classification
  - Light rain 35-40 KM
  - Moderate rain 60-70 KM
  - Heavy rain 70-100 KM

Benefits

- Highly sensitive
- Street level rainfall data
- Real time accuracy
- Mobility & Ease of Use

Applications

- Local Media
- Outdoor Events
- Military
- Civil Protection
- Research

Outdoor Events – Méteo France

System

- RS60 and RS90
- RS90 developed in cooperation with MF for F1
- Mobile operations & high sensitivity

Events

- FIA Formula 1 (all races)
- International Roland Garros Tennis Open
- 24 hr Le Mans
- Ski World Cup in Val d'Isère

Military - Eurocorps

System

- NATO High Readiness Force
- RS60
- Mobile operations
- International deployment

RAINSCANNER demonstration project

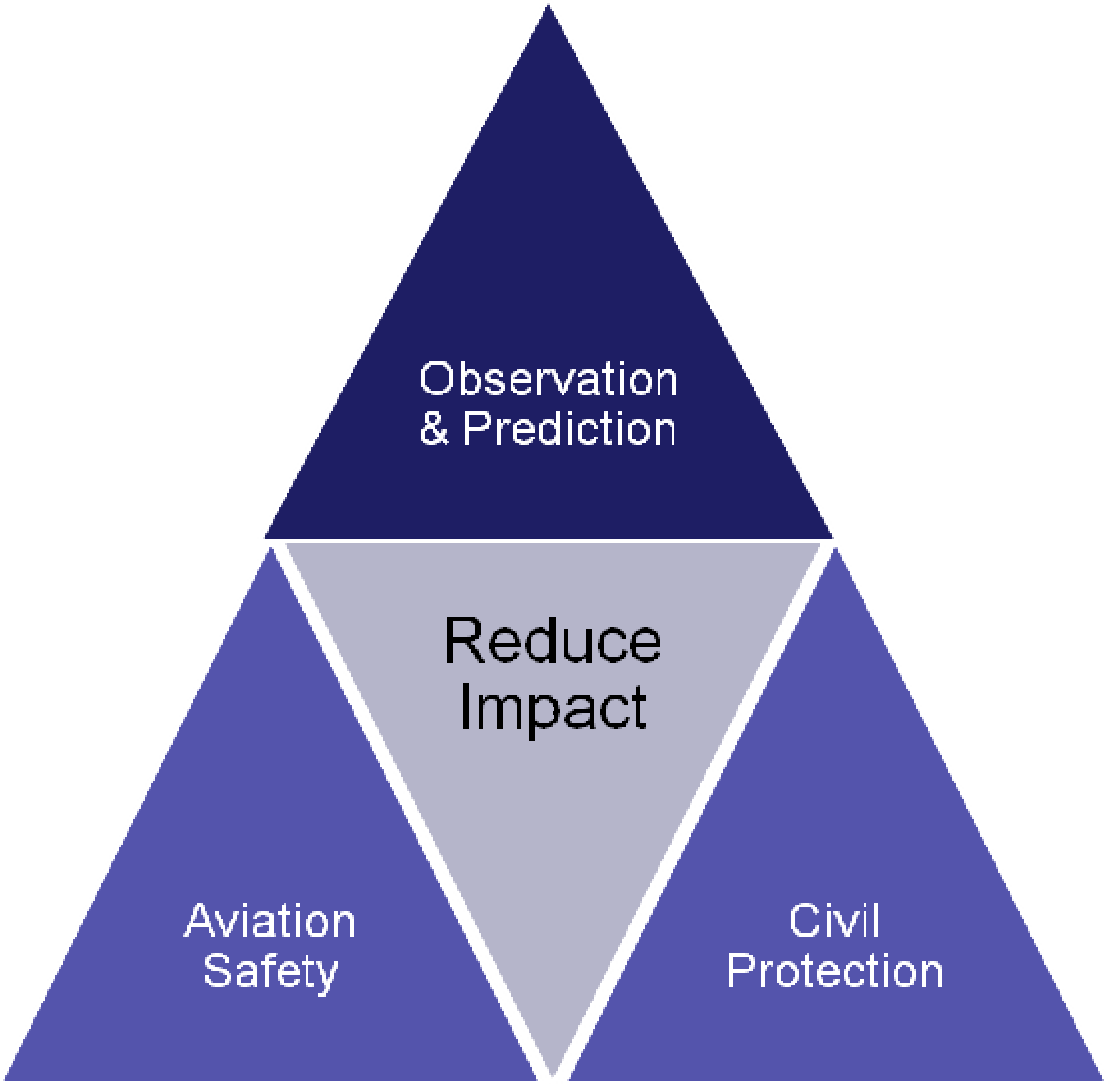
- Research Project in collaboration with Prof. Sempere Torres (CRAHI, Barcelona)
- 6 months experiment of the RainScanner in Barcelona in summer/autumn 2011
- Demonstration of added value of high-resolution radar data for the storm water management in Barcelona
- Funding: Selex and public Catalan Agencies

CRAHI UPC

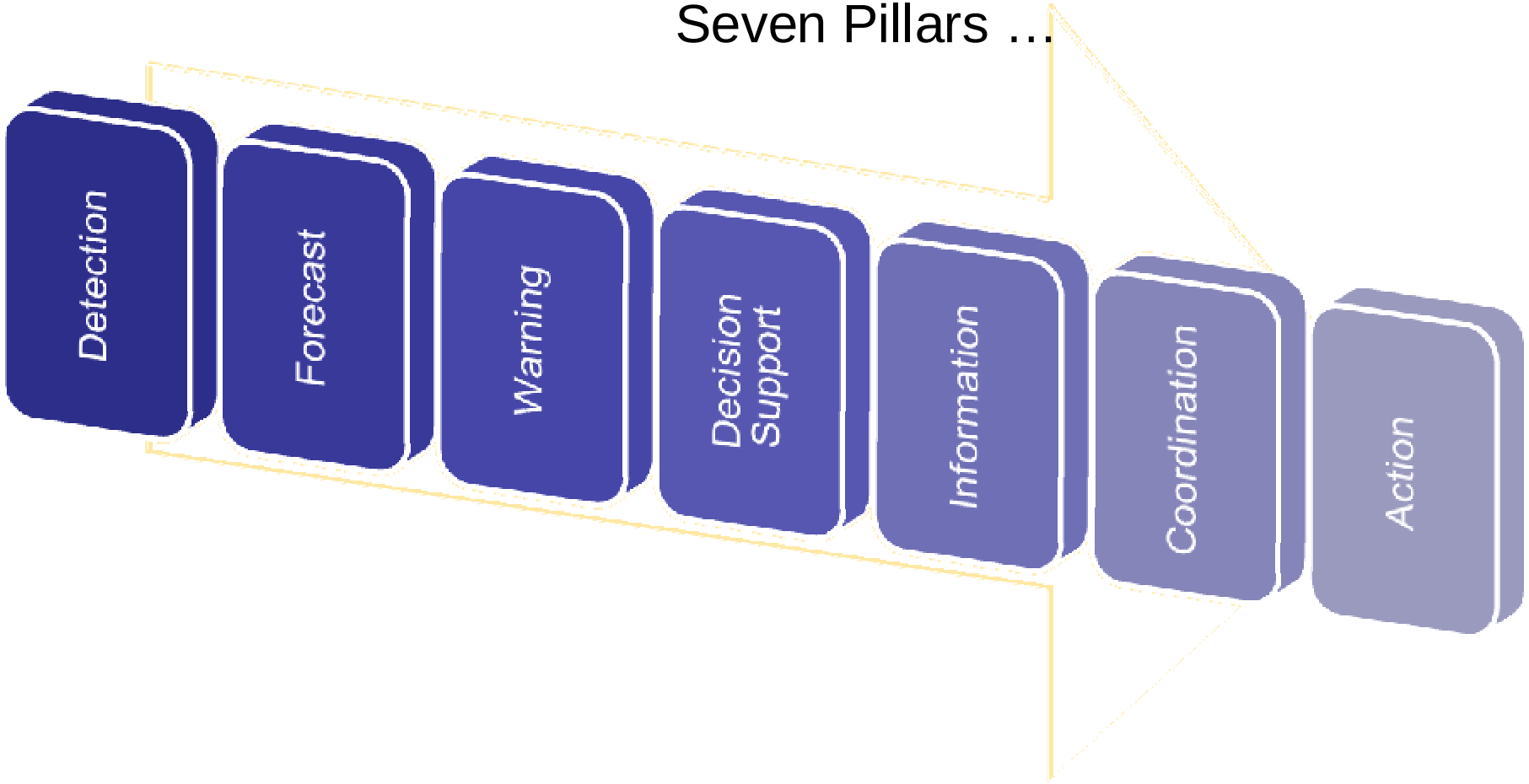
Centre de Recerca Aplicada en Hidrometeorologia

UNIVERSITAT POLITÈCNICA DE CATALUNYA

Applications



Flash Flood Guidance Systems. Seven Pillars …



Meteorological Software Rainbow 5

Rainbow 5 Highlights

Operational

- Rainbow 5 completely reprogrammed using stable and platform independent architecture: Windows, Linux, Unix etc…
- Tried & Tested: over 50 installations worldwide
- KNMI evaluation winner (2005): compared with Iris and Muran

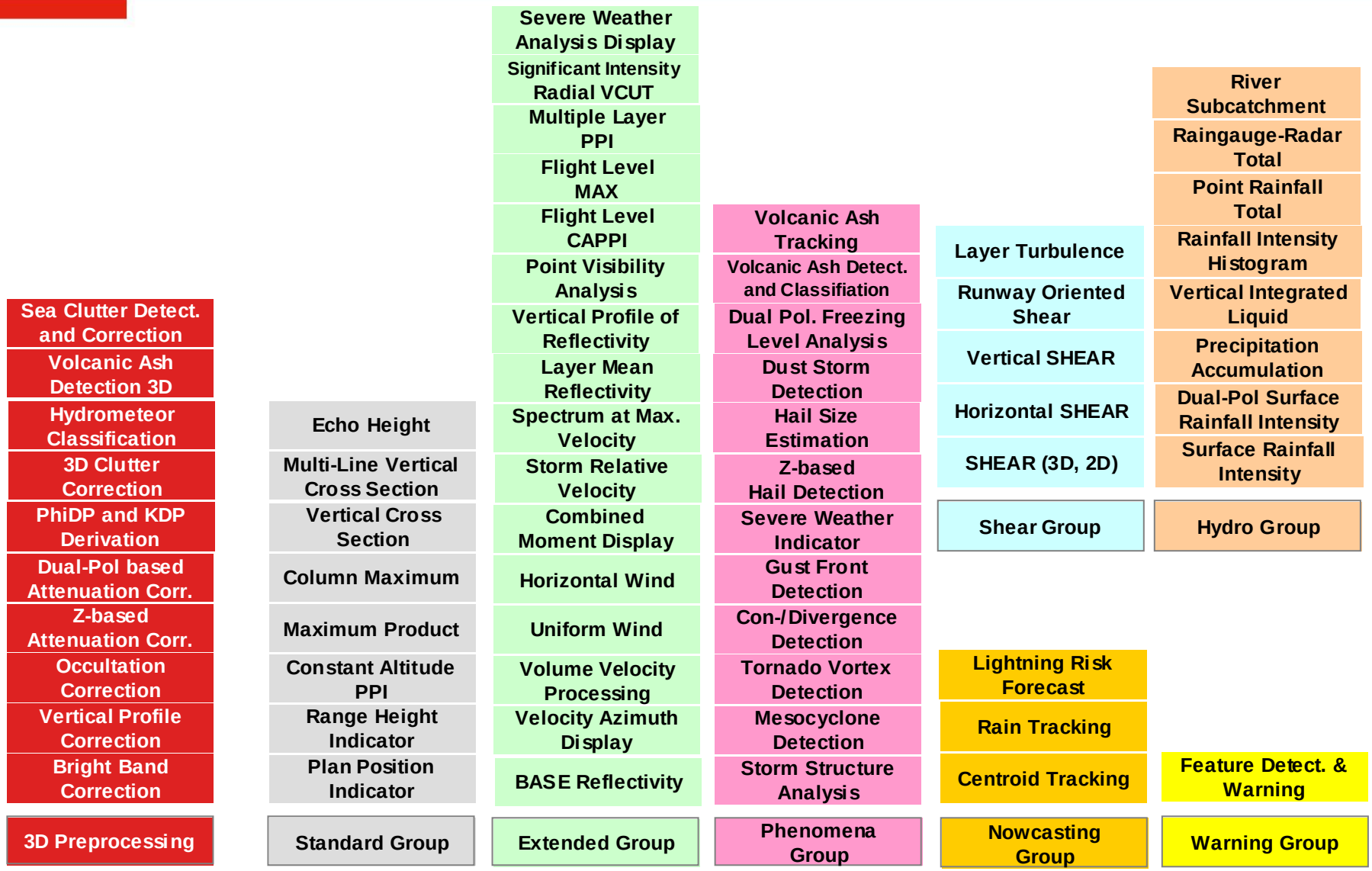
Features

- Multi Document Interface (MDI): unlimited screens
- Complete radar management and control: local & remote
- Flexible scan definition

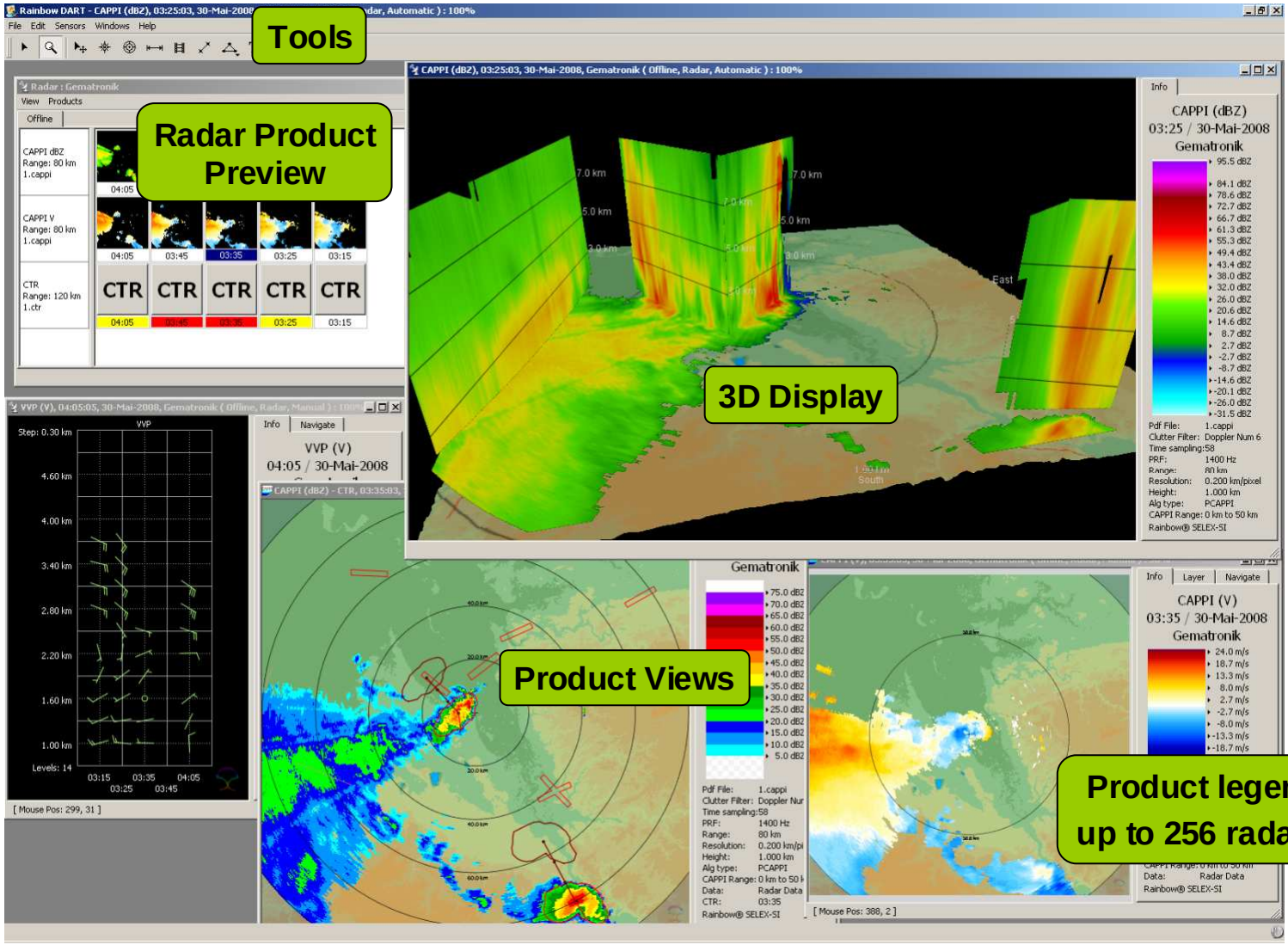
Products

- Over 50 meteorological products
- Unique algorithms: Dust Storm Detection (DSD)
- NEXRAD / TDWR style products: SWI
- Sophisticate aviation products: ASTERIX CAT 008
- Industry best nowcasting products: TITAN interface, STEPS interface
- Multiple sensor integration: AWOS, Lightning, LLWAS, LIDAR, Sounding

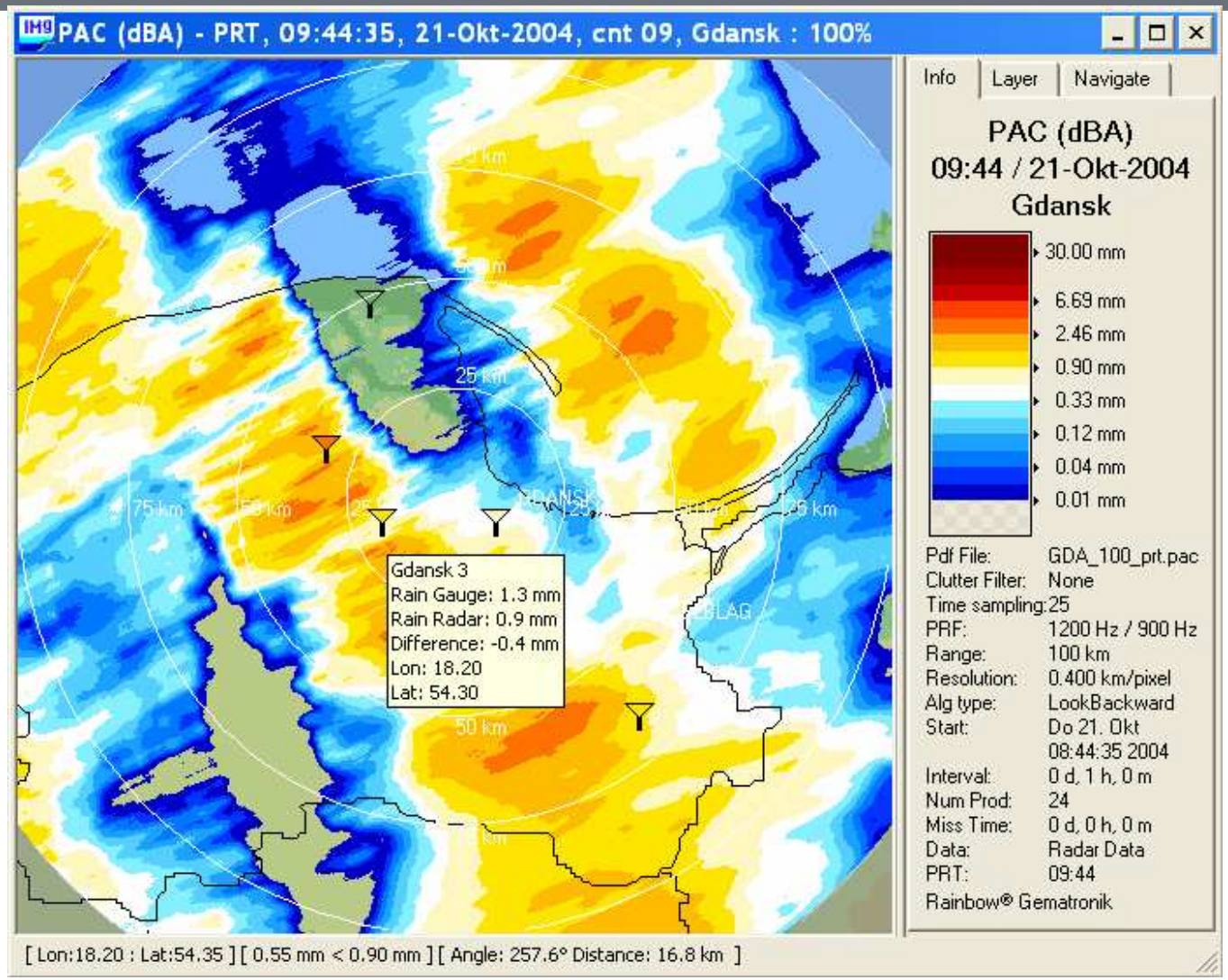
Rainbow® 5 – Product Overview



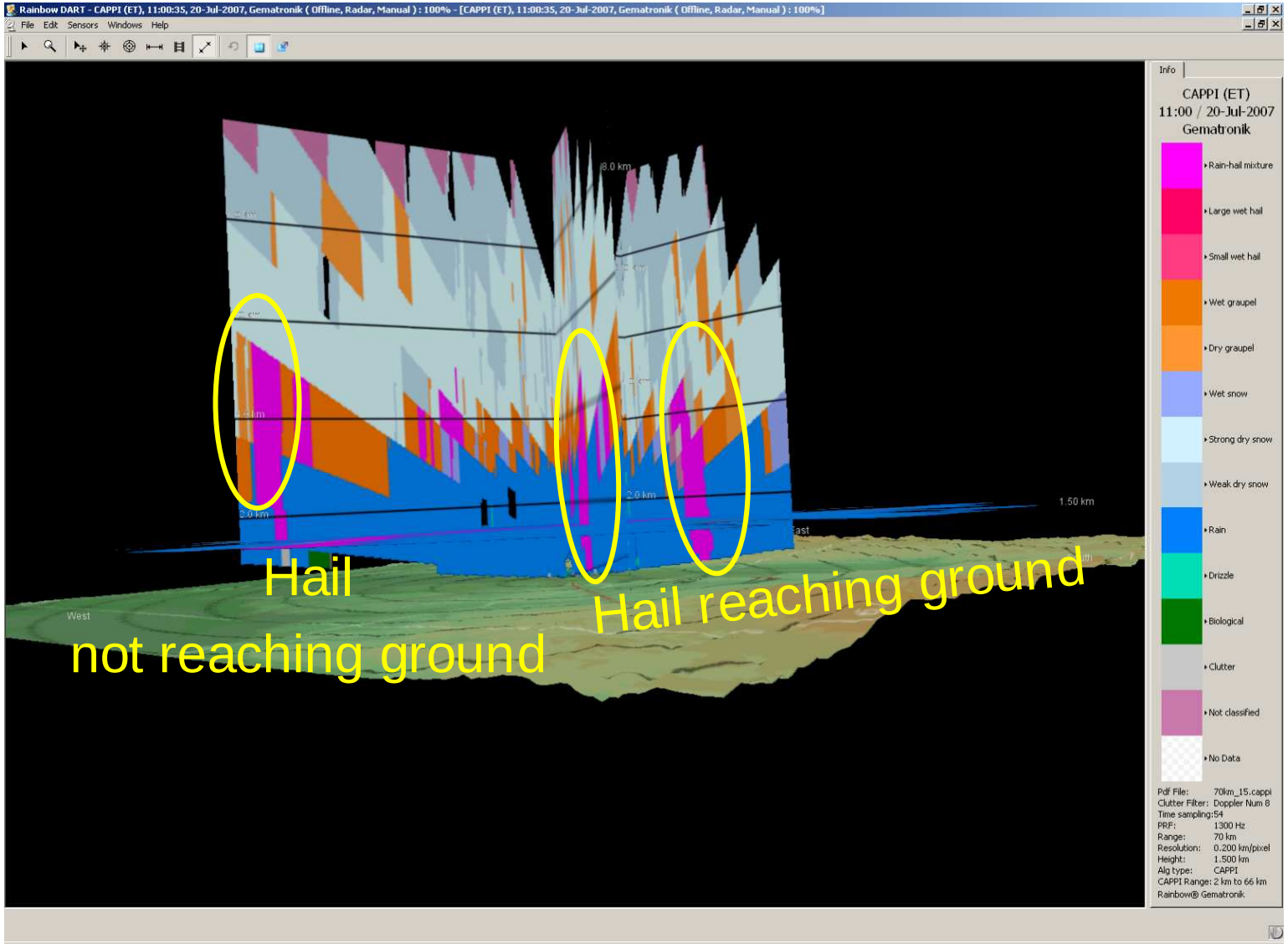
Rainbow® 5 Display: RainDART



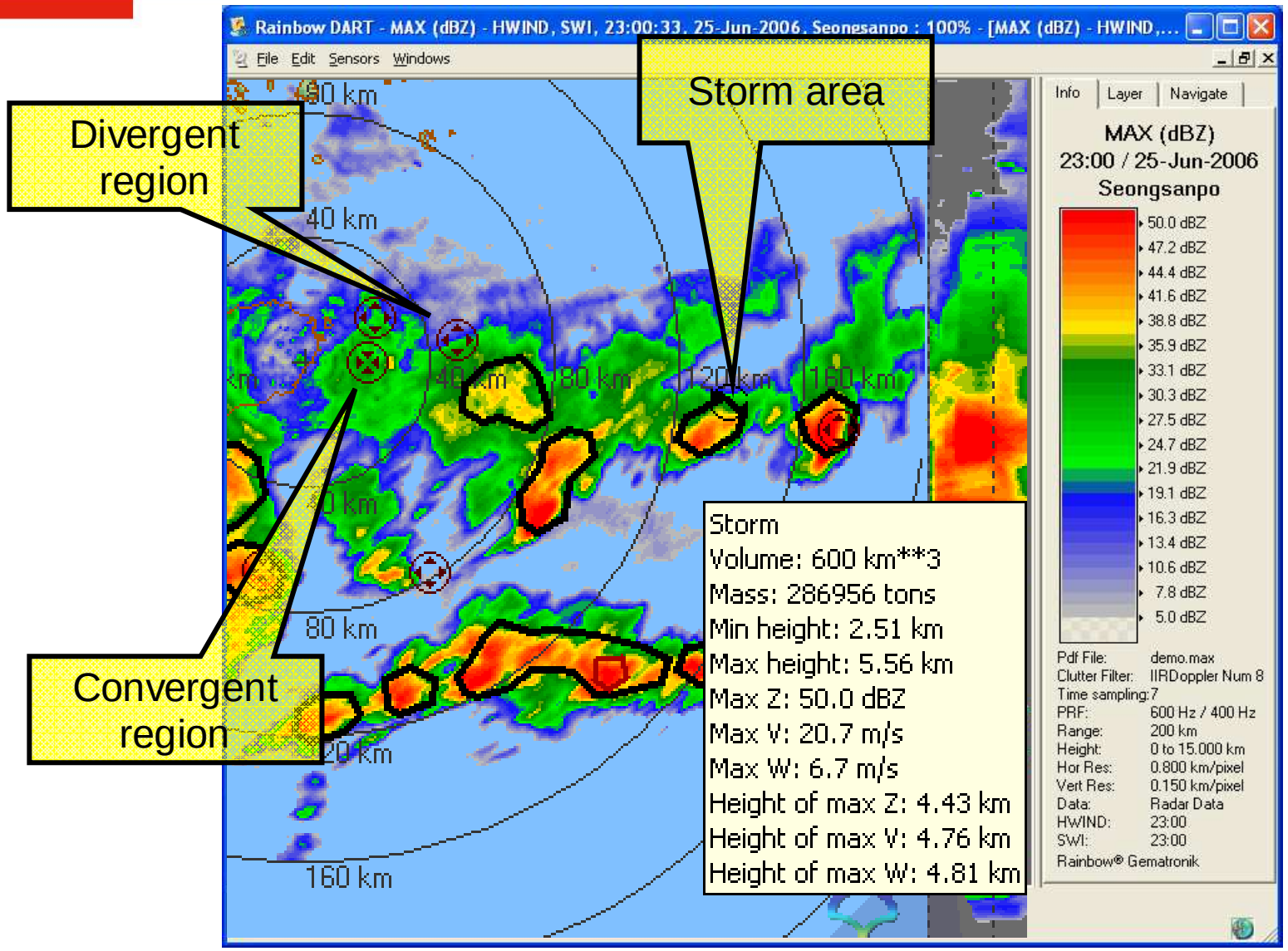
Rain Gauge – Radar Adjustment and Overlay



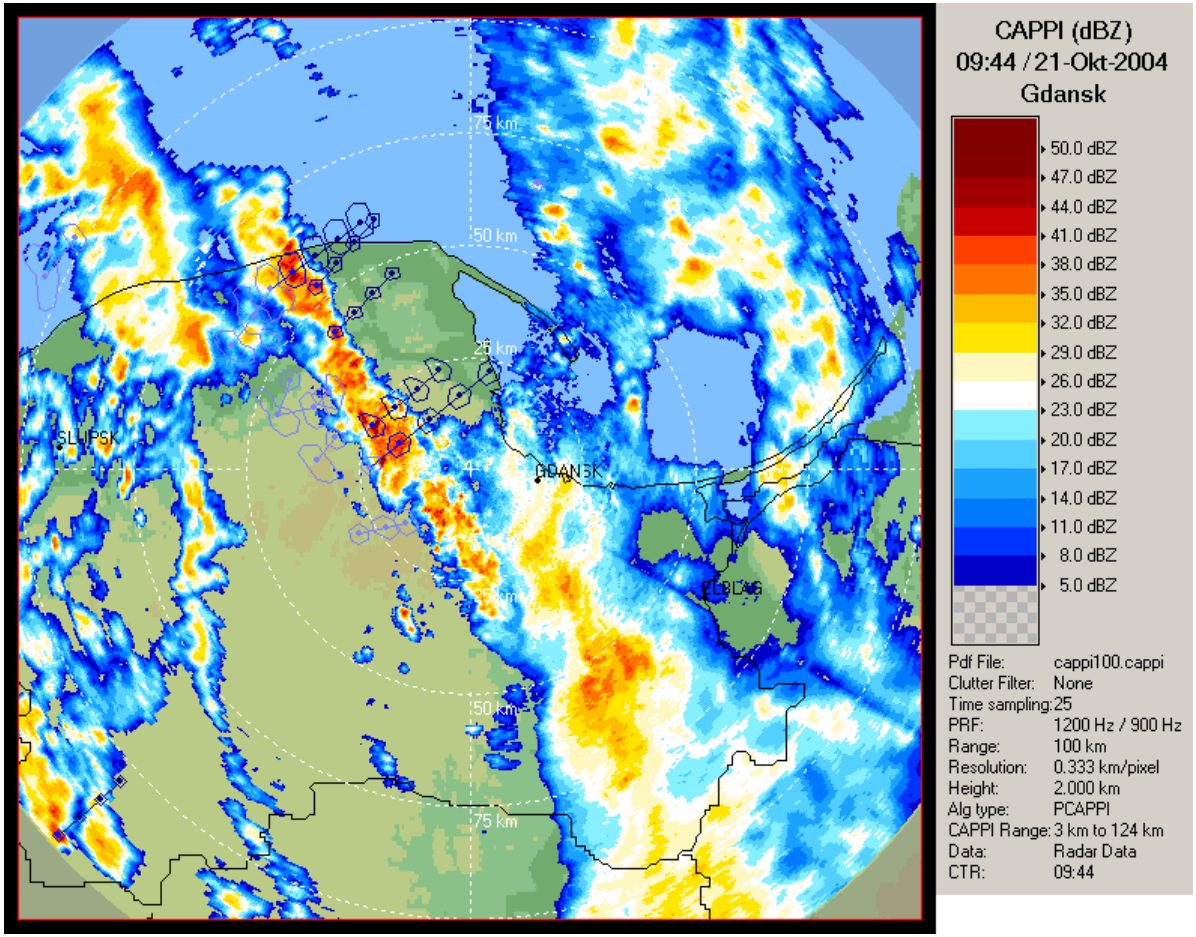
Echo Classification 3D Display



Severe Weather Indicator



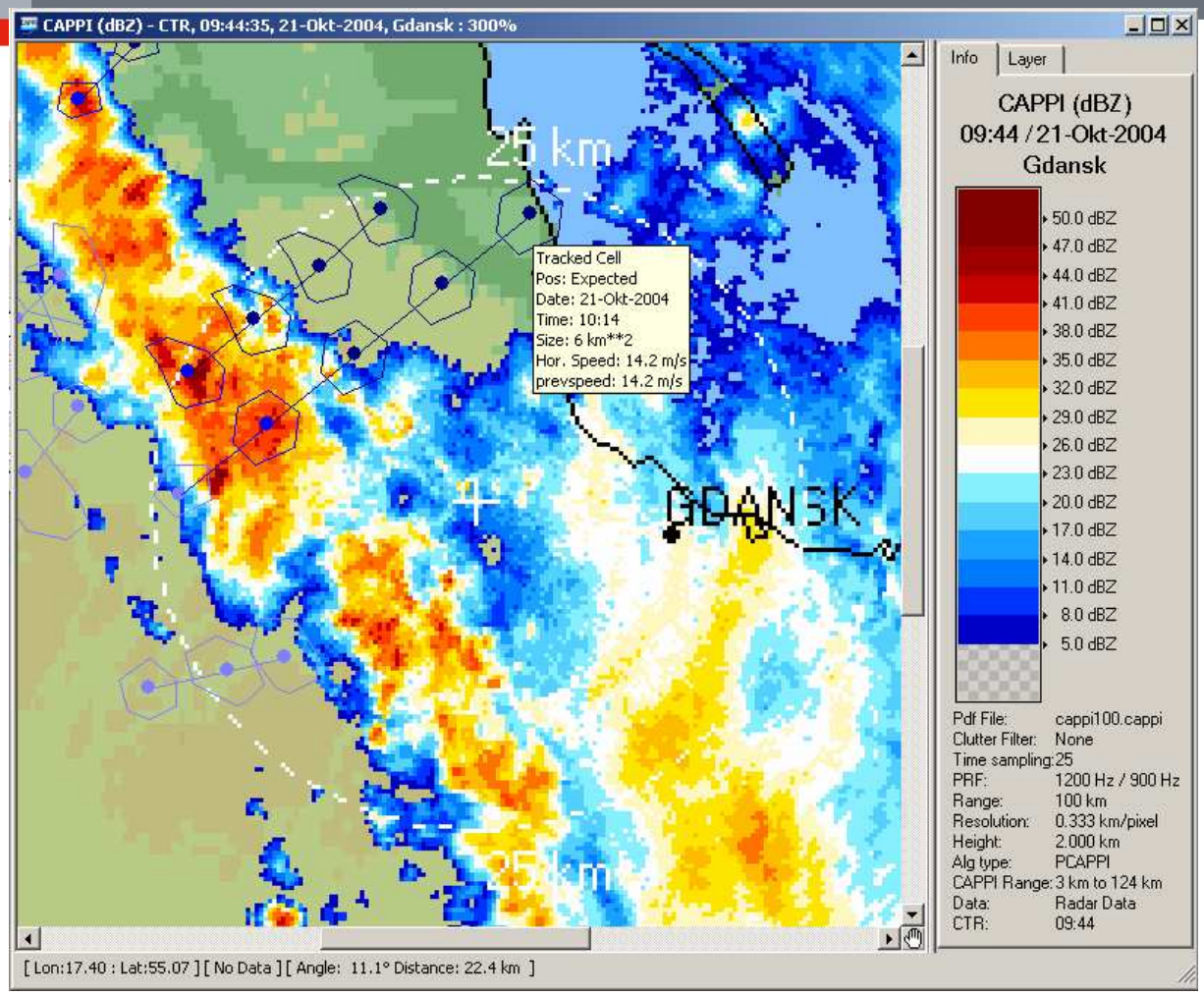
CTR - Cell Centroid Tracking



CTR analysis reflectivity data to identify and track storm cells. With every new antenna scan the display of the identified cells is updated. The display contains:

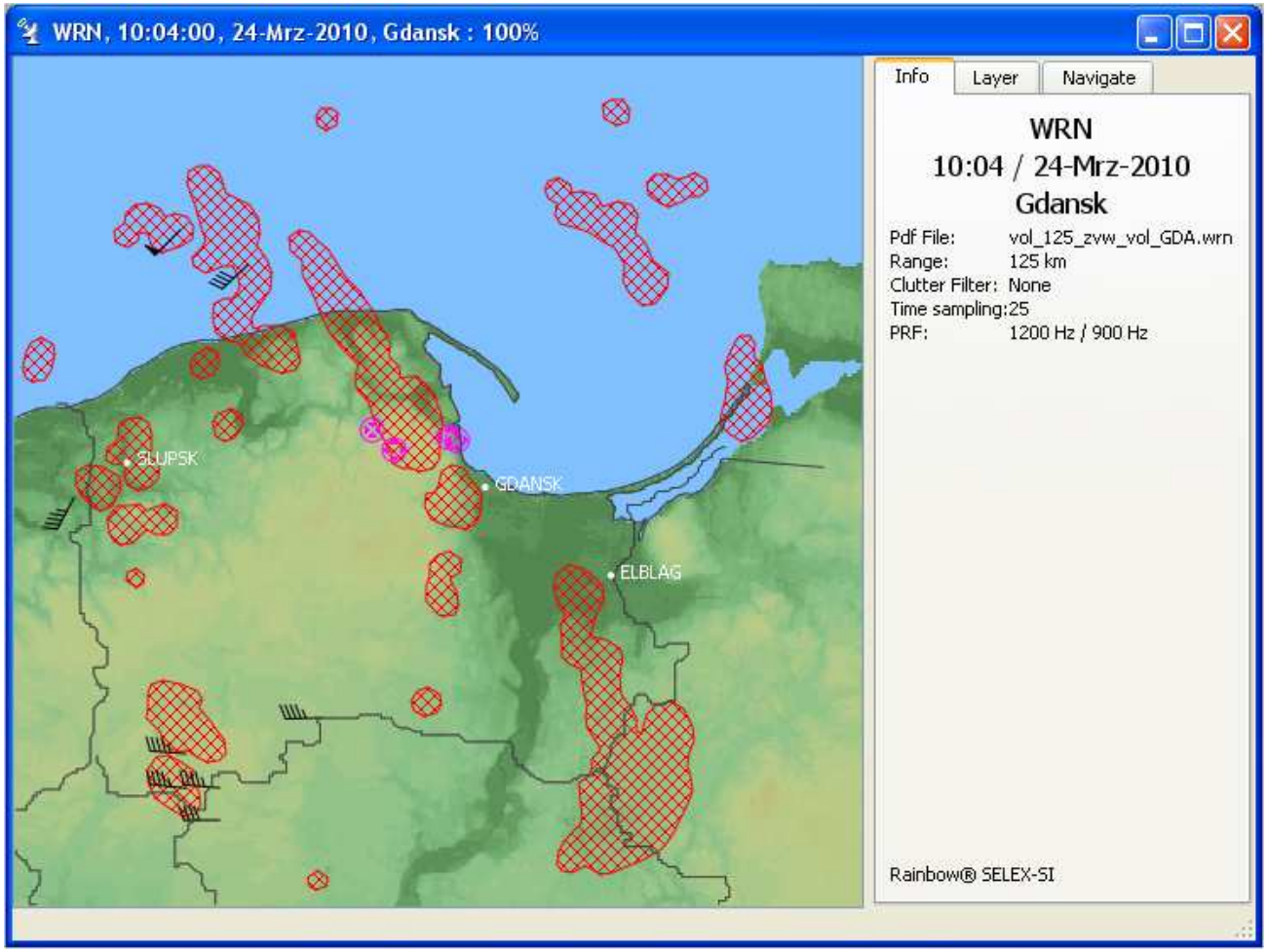
- current cells
- trace image with cells of the previous scans
- forecast images

CTR - Cell Centroid Tracking



Zoomed CTR image with information about the forecasted cell.

FD&WARN – Feature Detection and Warning



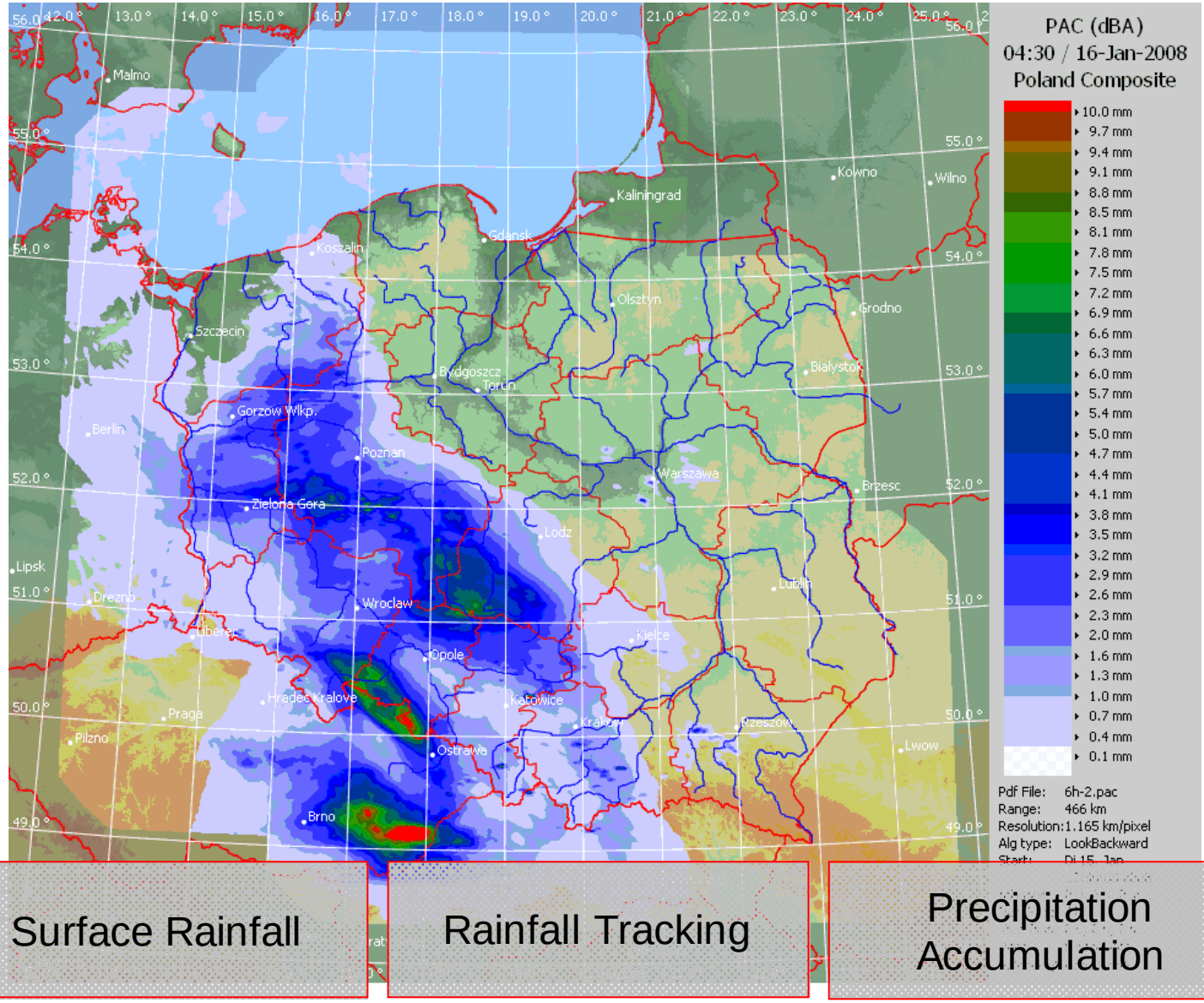
Radar Gdansk (Poland)

FD&WARN can be applied to almost all product types. Different warning scenarios with individual warning parameter settings are possible.

A separate warning product shows all single warning regions merged into one image, e.g. here:

- dBZ (red shaded)
- HWIND (barbs)
- Con/Divergence (pink symbols)

8 Radar Precipitation Mosaic with Cross Correlation and Nowcasting



Surface Rainfall

Rainfall Tracking

Precipitation Accumulation

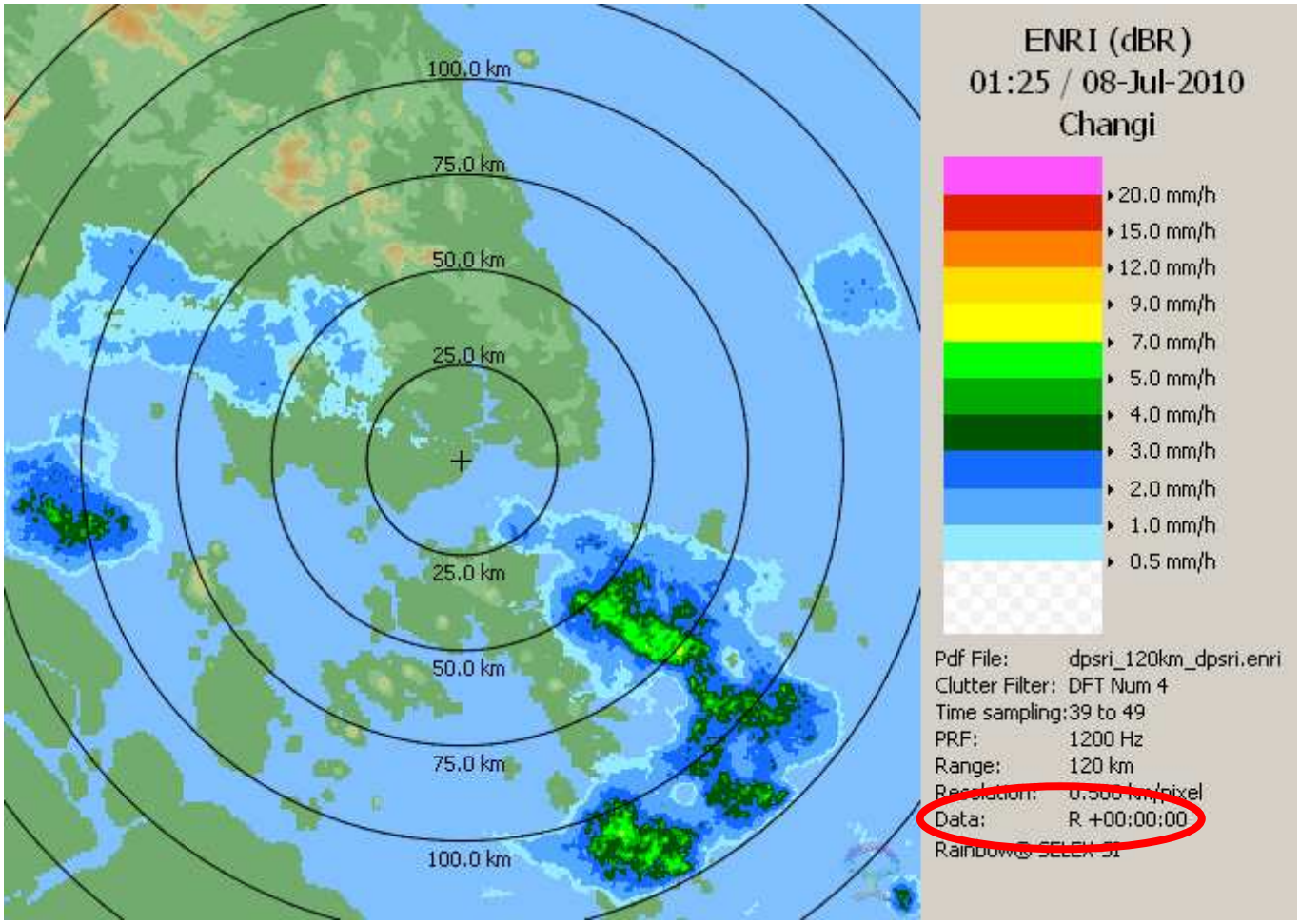
STEPS – RainENCAST

RainENCAST (**E**nsemble **N**ow**cast**ing)

- **S**TEPS – **S**hort **T**erm **E**nsemble **P**rediction **S**ystem (Bowler et al., 2004, 2006)
- Jointly developed by UK Met Office and Australian Bureau of Meteorology
- is the **fully licensed** implementation of the STEPS algorithm (without NWP blending) into Rainbow® 5.
- produces an ensemble of precipitation forecasts by means of tracking. For the particular ensemble member forecasts, the following data variations are performed in order to obtain a random distribution of the data forecasts:
  - Variation of the input data (simulation of an observation error)
  - Variation of the tracking vectors (simulation of an inaccuracy of the tracking method)
  - Variation of the rain data with each forecast step, in order to simulate an unknown development of precipitation (initiation, intensification and decay)

STEPS – RainENCAST

Ensemble **N**owcasting **R**ainfall **I**ntensities:
Average rain data of the ensemble members for each forecast time step



STEPS – RainENCAST

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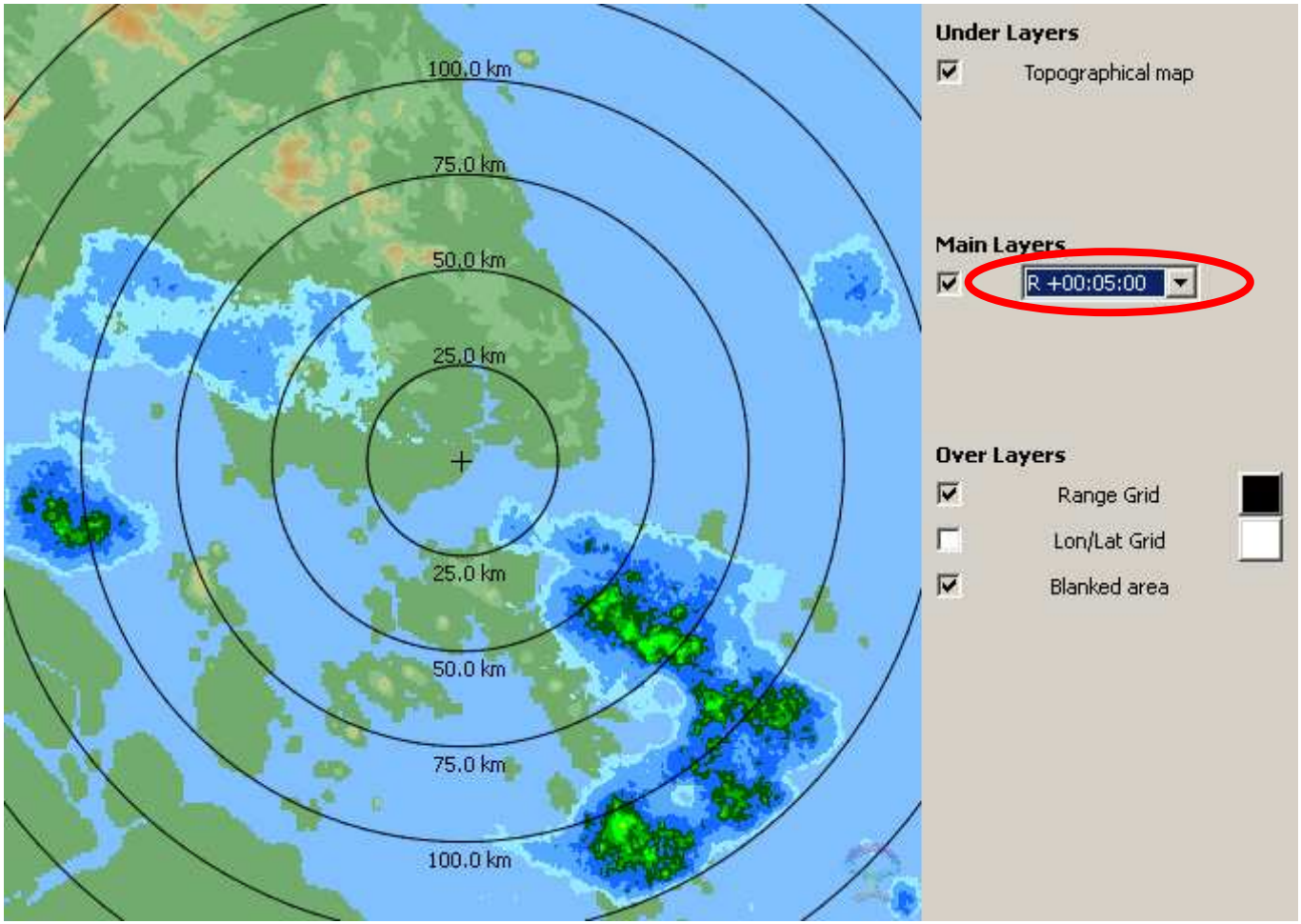

STEPS – RainENCAST

Ensemble **N**owcasting **R**ainfall **I**ntensities:
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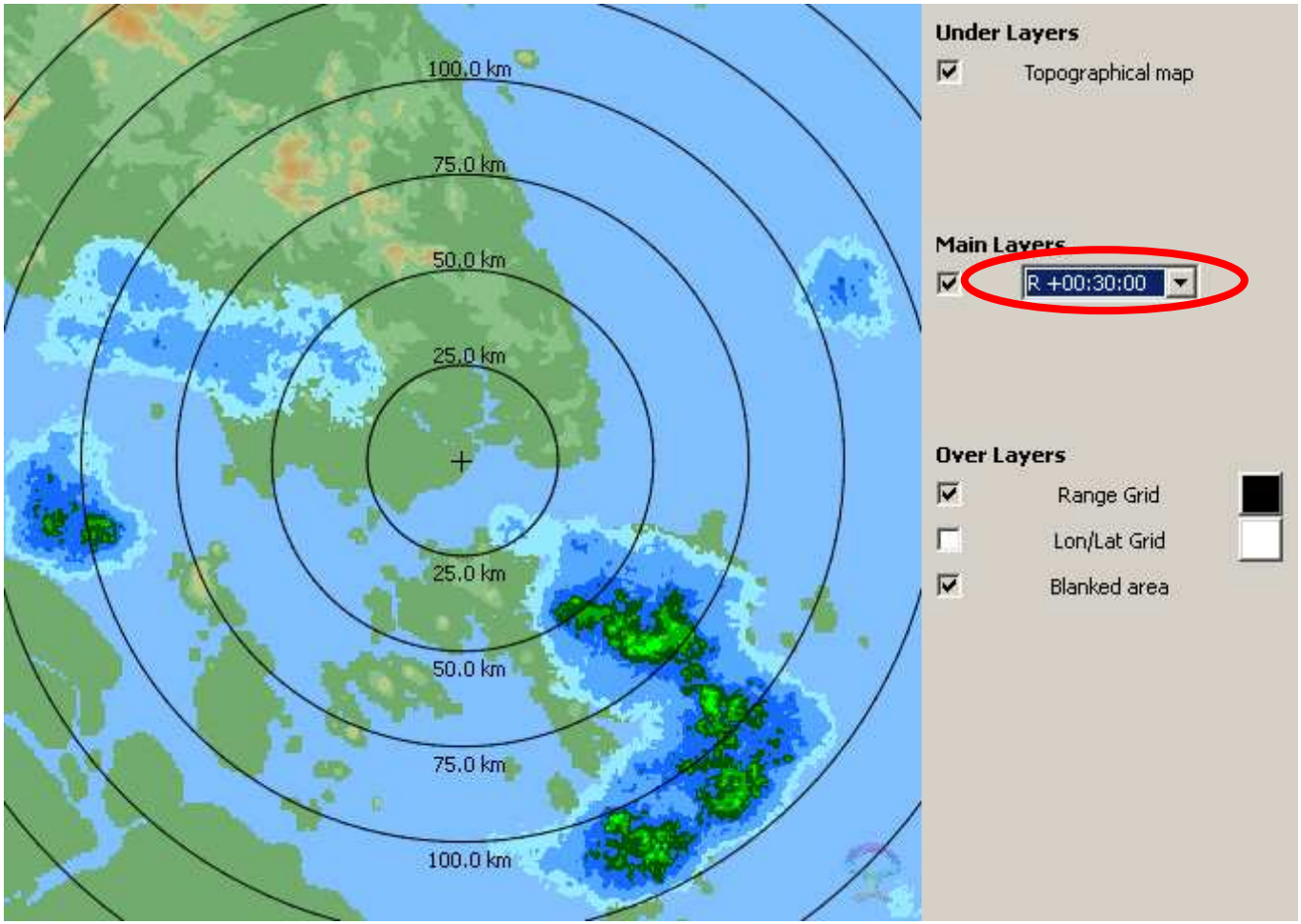
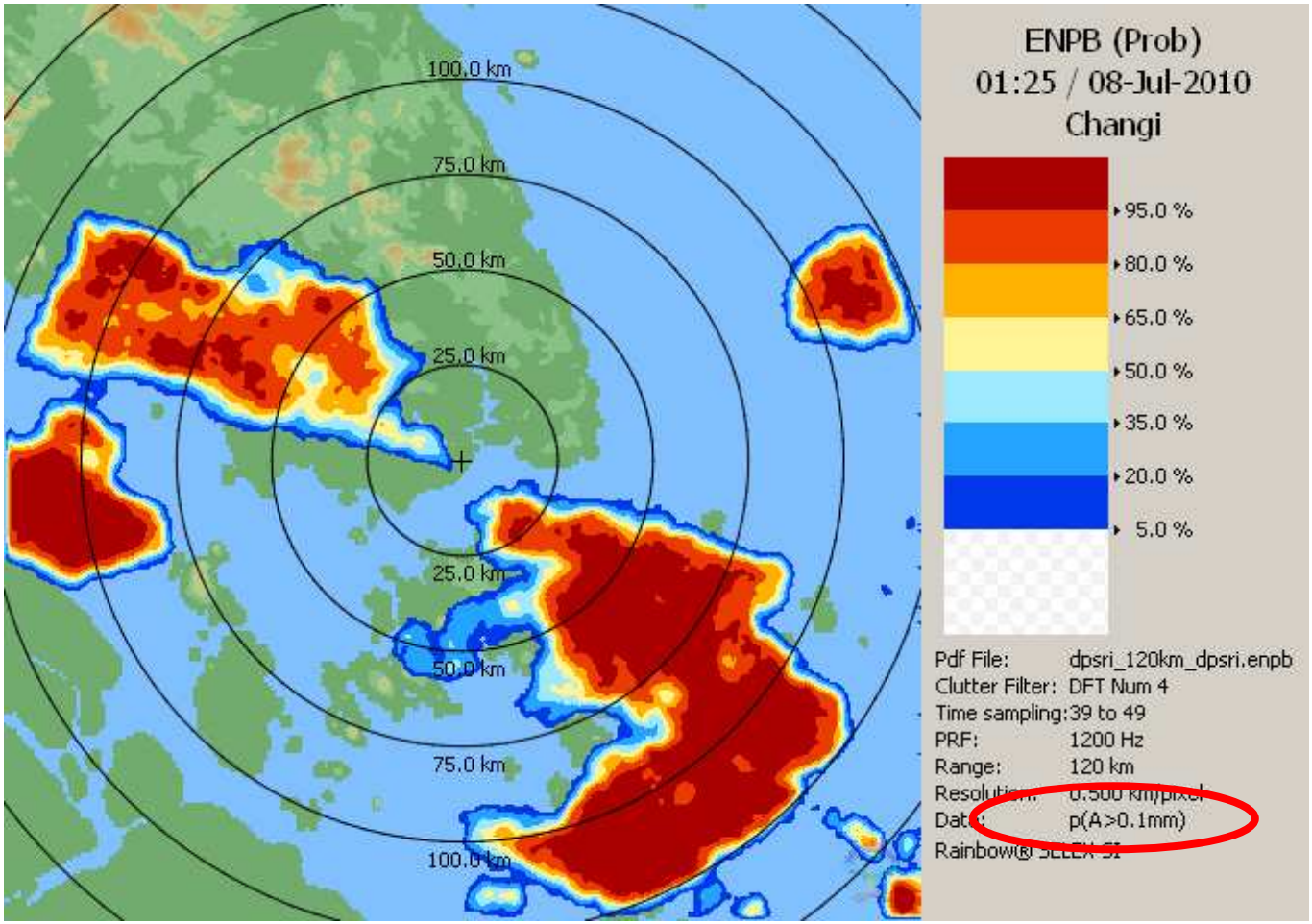


STEPS – RainENCAST

ENPB: Ensemble **N**owcasting **P**ro**b**abilities: 2D distribution of probability to exceed a particular rain threshold (for the forecast period specified).



rain threshold

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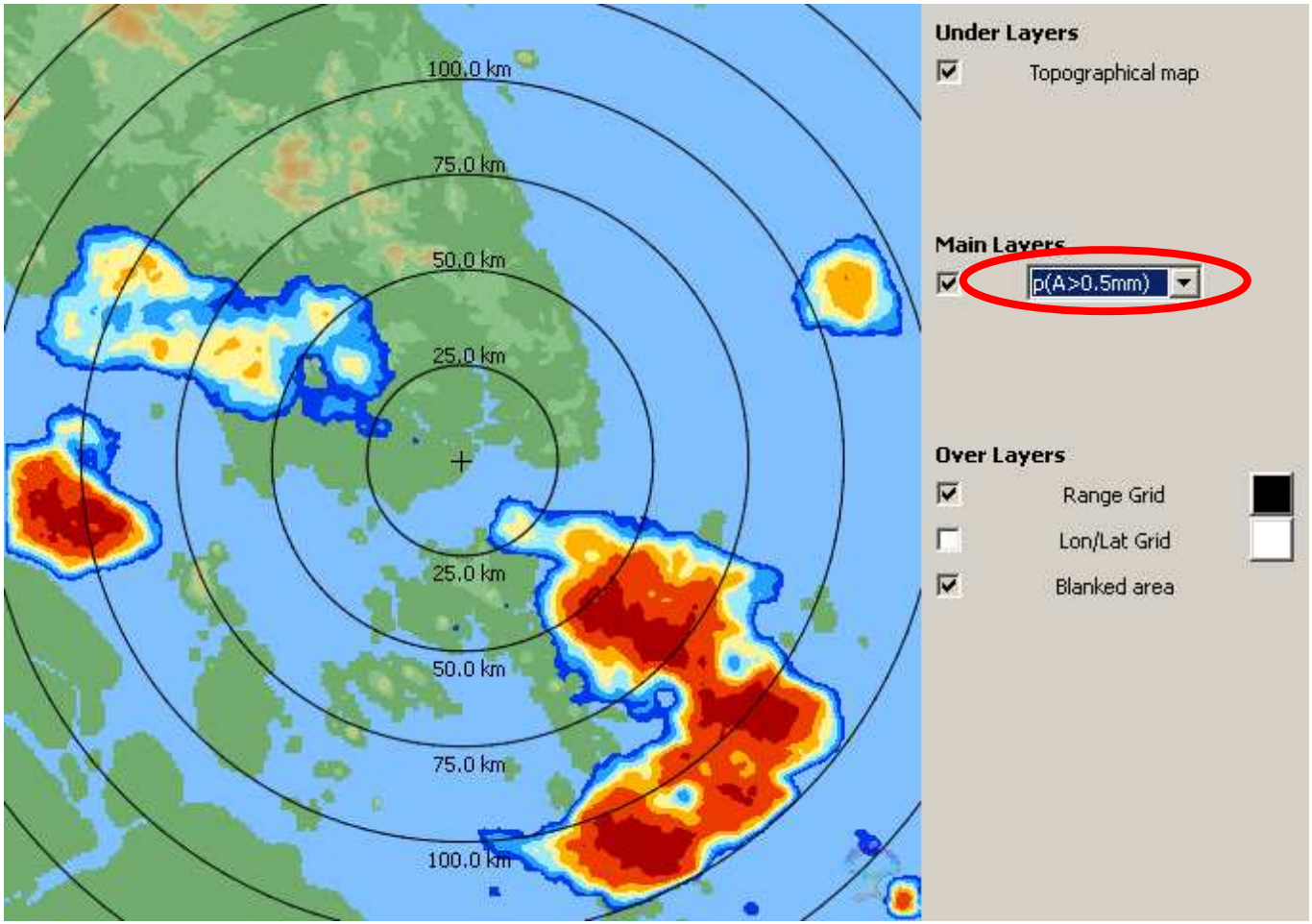

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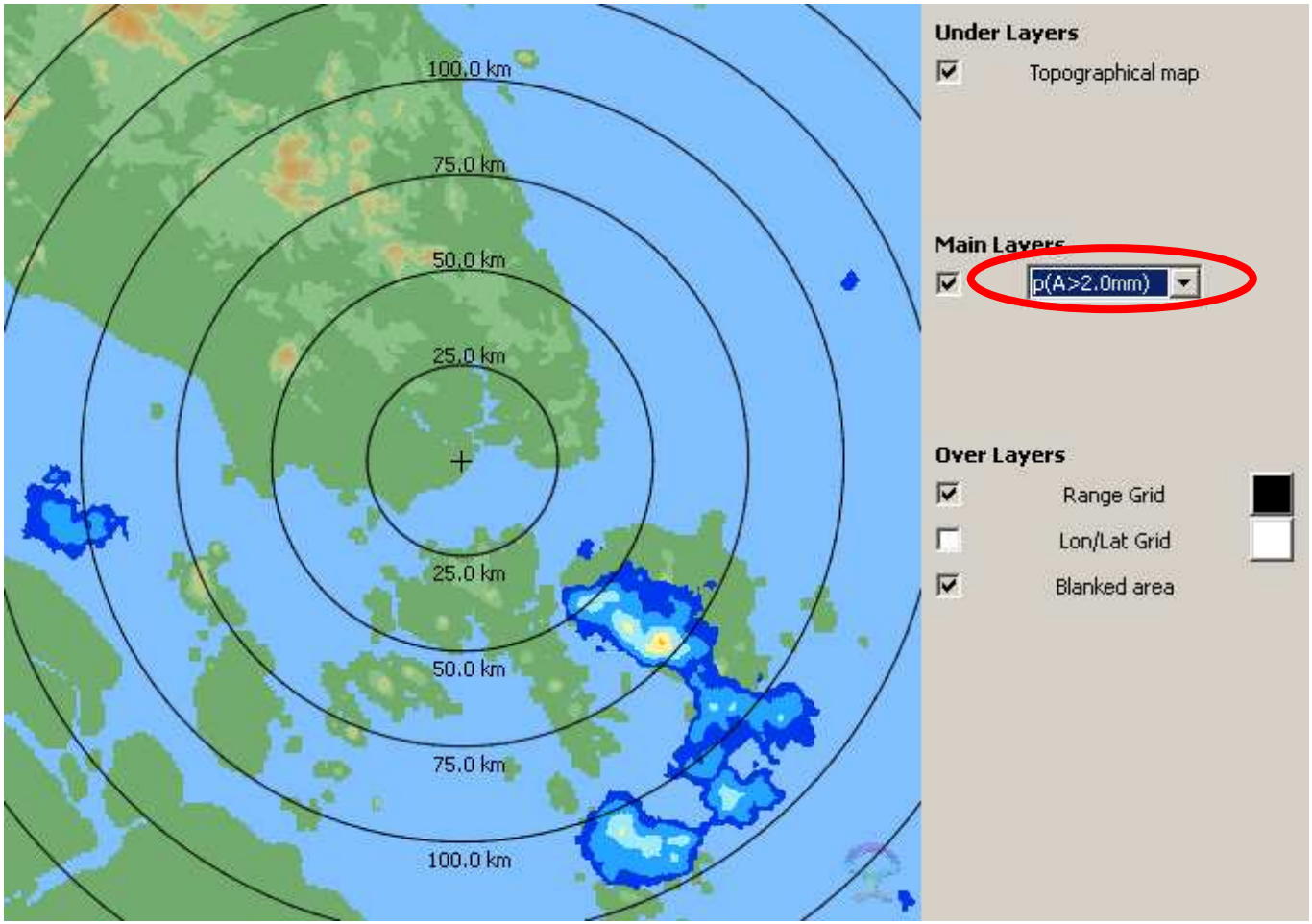

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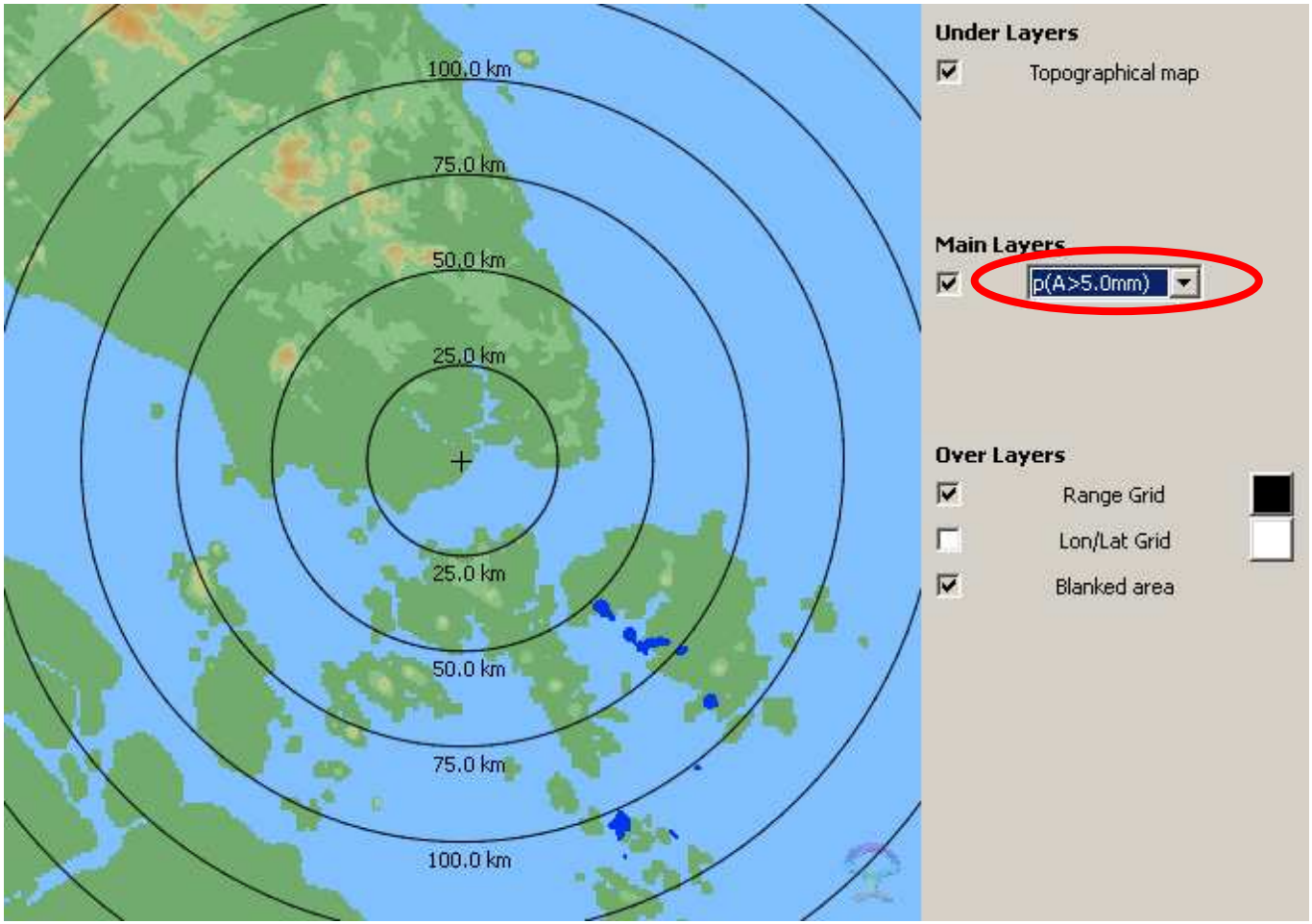

rain threshold

Thank you for your attention

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