Using MSG to identify and track convection over southern Africa (Nowcasting SAF software – RDT)

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- 2. First example
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1. Introduction

- Satellite Application Facilities (SAFs) are dedicated centres for processing satellite data, achieved by utilizing specialist expertise from the European Union Member States.

- The Agreement of Co-operation of a Satellite Application Facility supporting Nowcasting and Very Short-Range Forecasting (VSRF) was signed by EUMETSAT and the Spanish Met Service (INM) in December 1996.

- The project started in February 1997 aiming to produce the software to deal with the Nowcasting and Very Short Range Forecasting using the characteristics of the MSG SEVIRI data and the NOAA and EPS AVHRR data (EUMETSAT Satellites).

- Amongst the list of products developed by the Nowcasting SAF (NWC SAF) is a so-called "Rapidly Developing Thunderstorms" product.

- It is using mainly geostationary (MSG) satellite data but also NWP and provides information on significant convective systems, from meso-scale (200 to 2000 km) down to smaller scales (< 1 km).

- The objectives of RDT are twofold:
  - The identification, monitoring and tracking of intense convective system clouds
  - The detection of rapidly developing convective cells,

- There are 3 stages in the process:
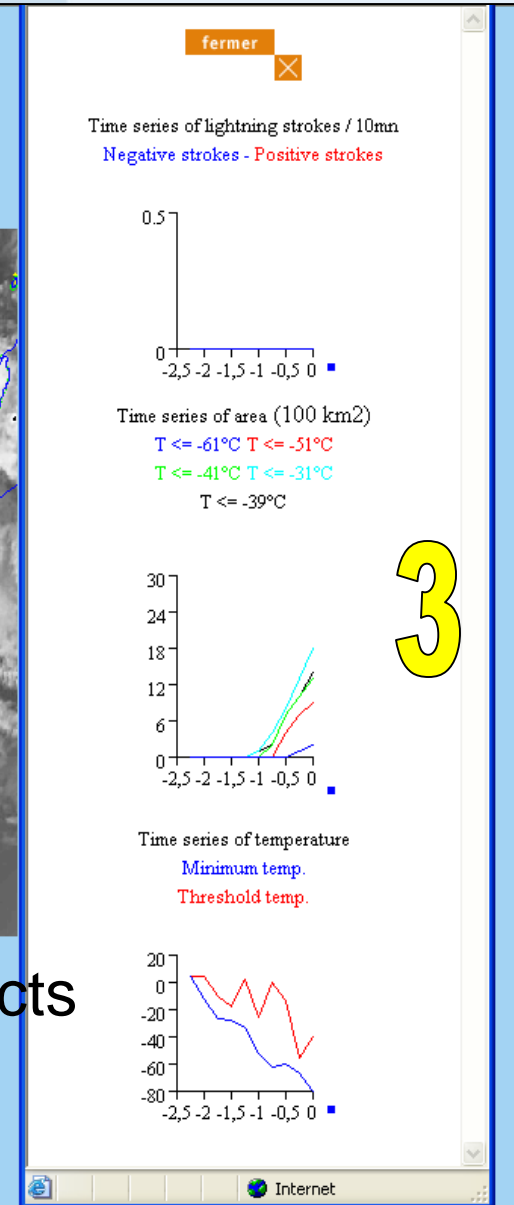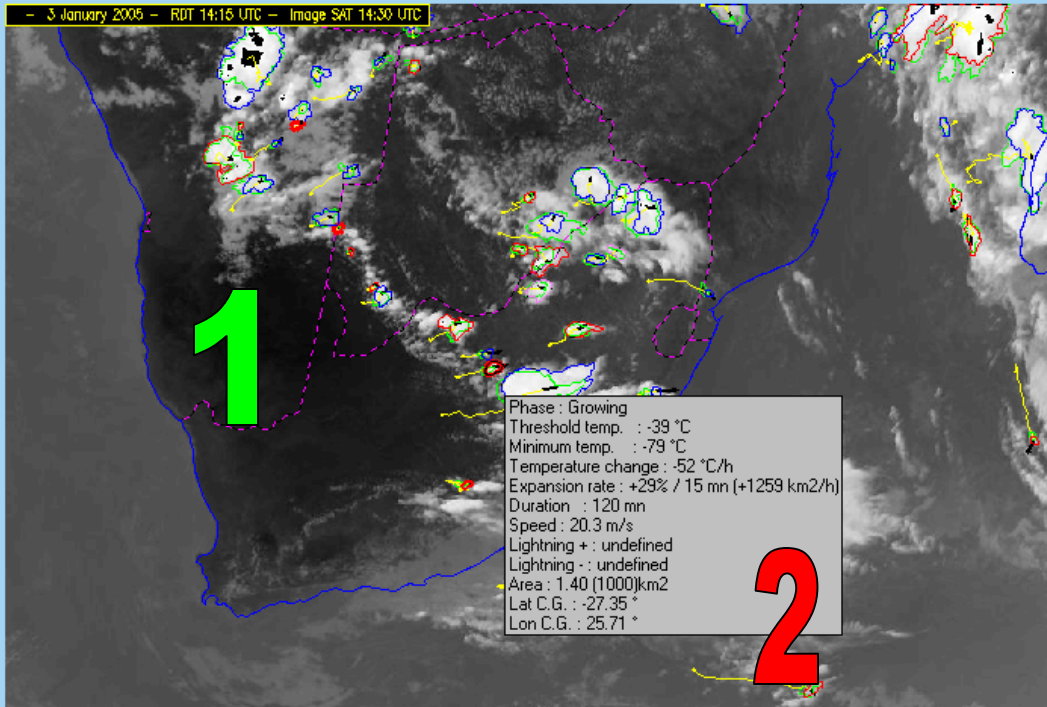 - Detection
  - Tracking
  - Discrimination

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2. First example

- In 2005 the developers ran the software over the South African domain and supplied the output to us

Visualisation

✓ **1** Localisation and movement of RDT objects

✓ **2** Static informations (interactive gauge)

✓ **3** Historic characteristics

Visualisation

‒ 3 January 2005 ‒ RDT 14:00 UTC ‒ Image SAT 14:15 UTC
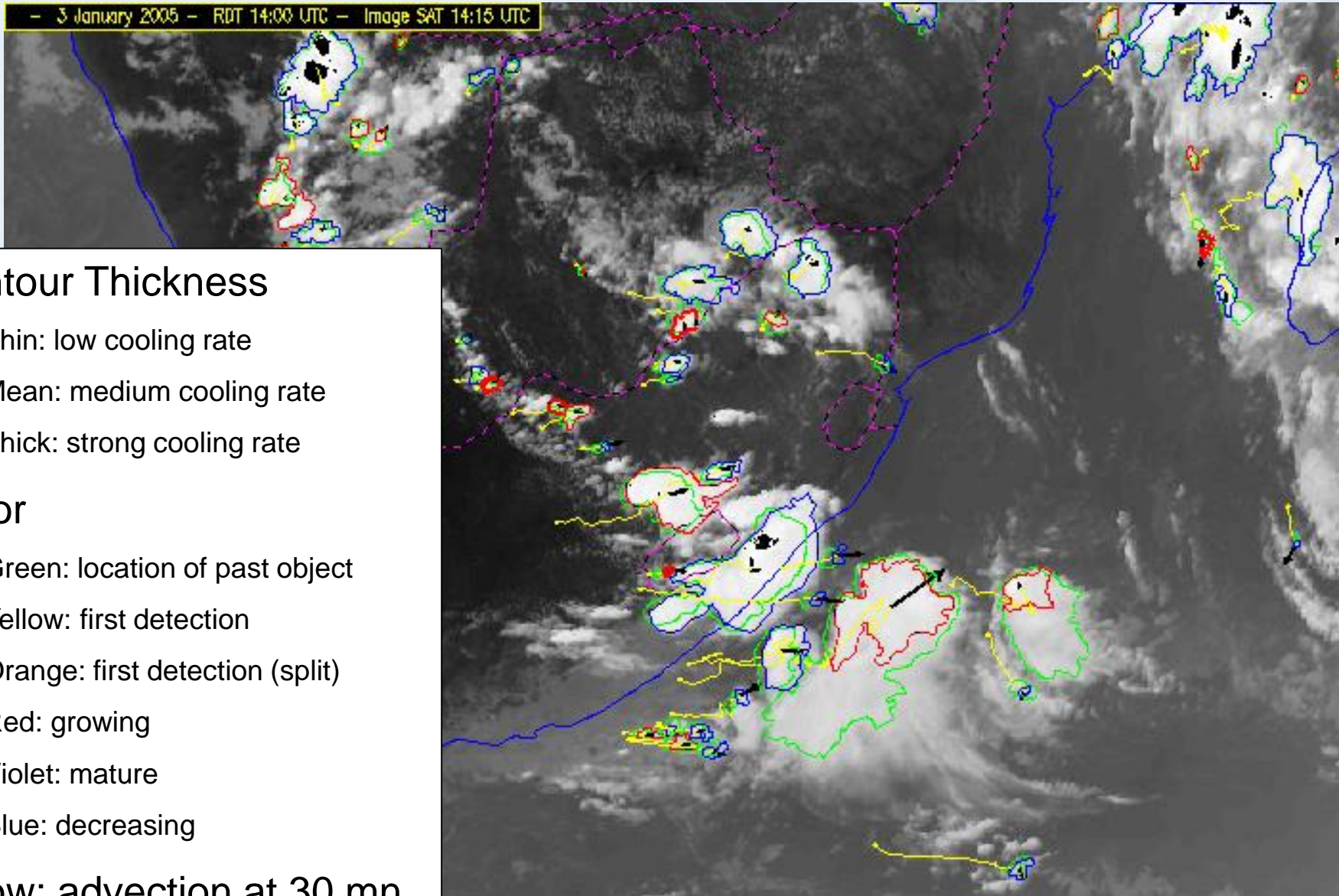
➤ Contour Thickness
- Thin: low cooling rate
- Mean: medium cooling rate
- Thick: strong cooling rate

➤ Color
- Green: location of past object
- Yellow: first detection
- Orange: first detection (split)
- Red: growing
- Violet: mature
- Blue: decreasing

➤ Arrow: advection at 30 mn

➤ Yellow line: trajectory

- The RDT is one of the various satellite and NWP based applications which can be extremely useful for data sparse countries.

- The product is operationally available in Europe, but has *not been used or tested over regions in Africa*.

- An objective validation of the RDT (using the 2011 version of the software) has been lead <u>over Europe</u> from April to October (NH summer). Lightning activity has been used as ground truth. The overall probability of detection is 74% to 77%.

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Application of RDT

- This research will aim to implement the RDT software to run over the southern African region.

- Using on MSG and Unified Model data

- To provide **forecasters, aviation meteorologists and hydrologists** information about the development, life cycle and dissipation of convection in regions *where radar systems do not provide coverage (in between radars over South Africa) or no radars systems are available (most of South Africa's neighbouring countries).*
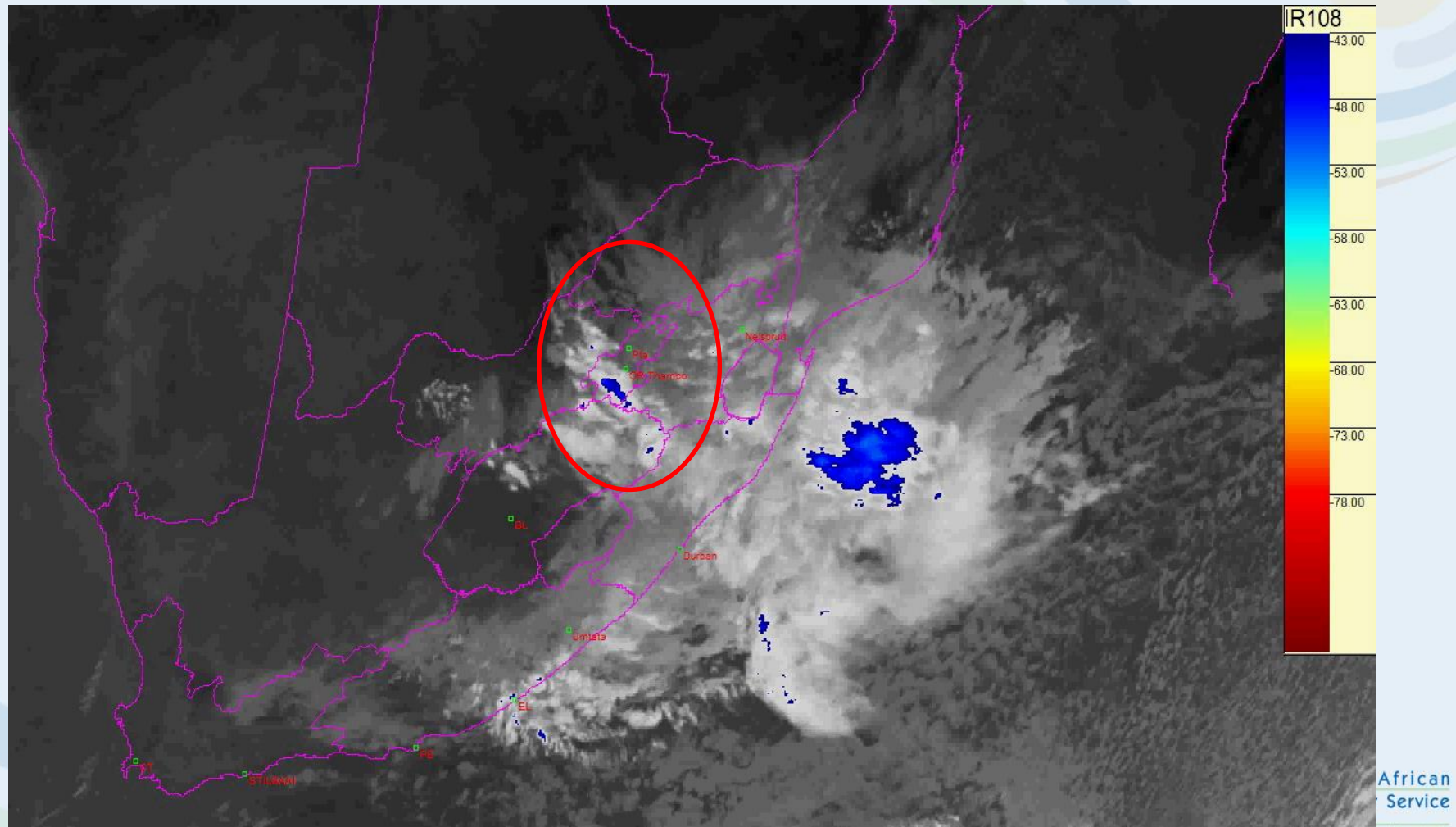
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3. Example over SA
6 September 2012

Slides for this case: courtesy Bathobile Maseko
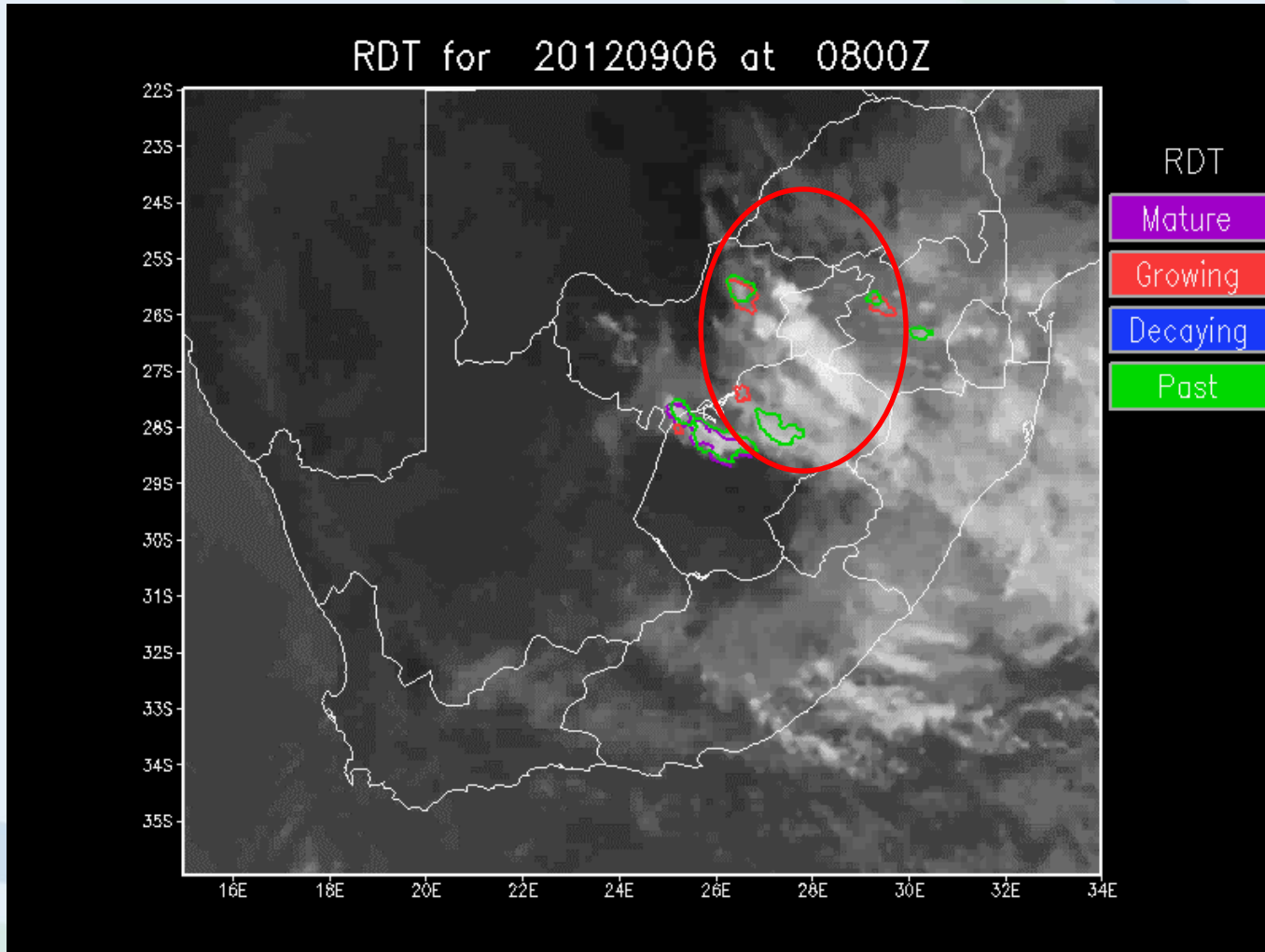
Synoptic Weather Map Background

- On 6 September 2012 an extensive surface trough was situated over the country and with upper-air cut-off low over the central interior as well as a high pressure system east of the country.

- Conditions were favourable for convection initiation

- A storm occurrence was reported in Lanseria airport at 1030UTC

UM 12km horizontal resolution – xaant Run:
500hPa Geopotential Height

12hr Forecast from 00Z 06 SEP 2012 – for 12Z 06 SEP 2012

UM 12km horizontal resolution – xaant Run:
850hPa Geopotential Height

12hr Forecast from 00Z 06 SEP 2012 – for 12Z 06 SEP 2012
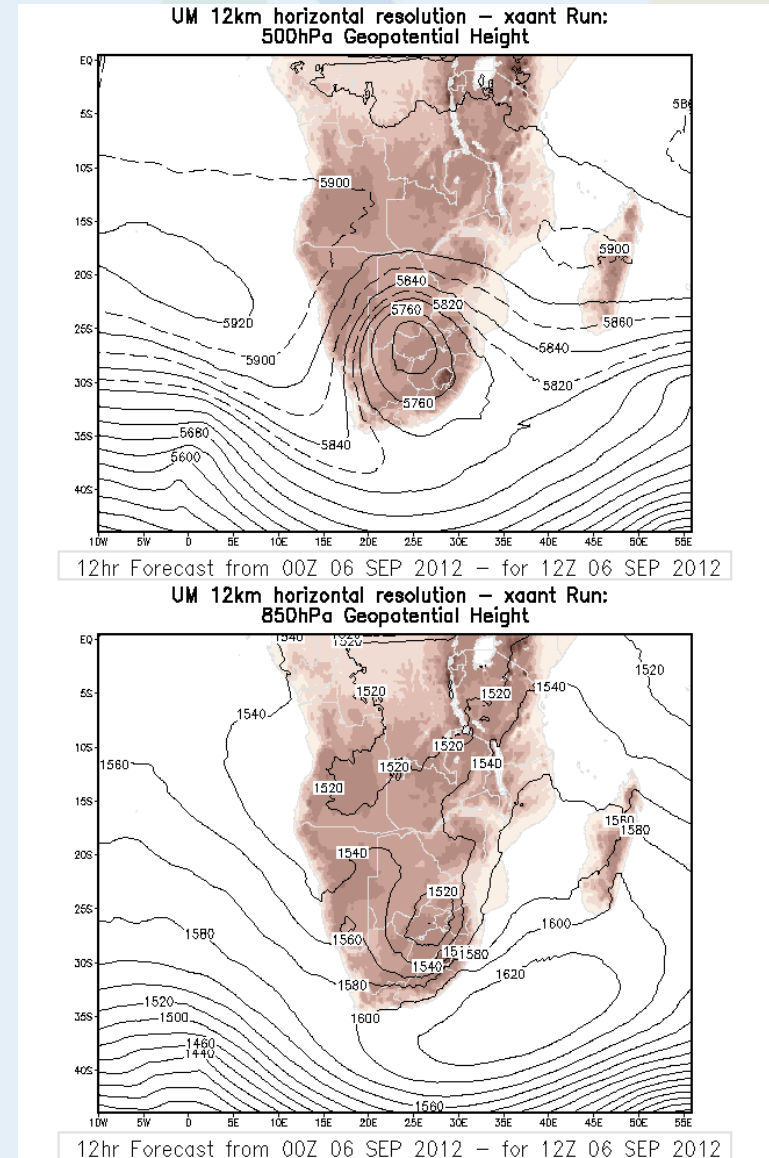
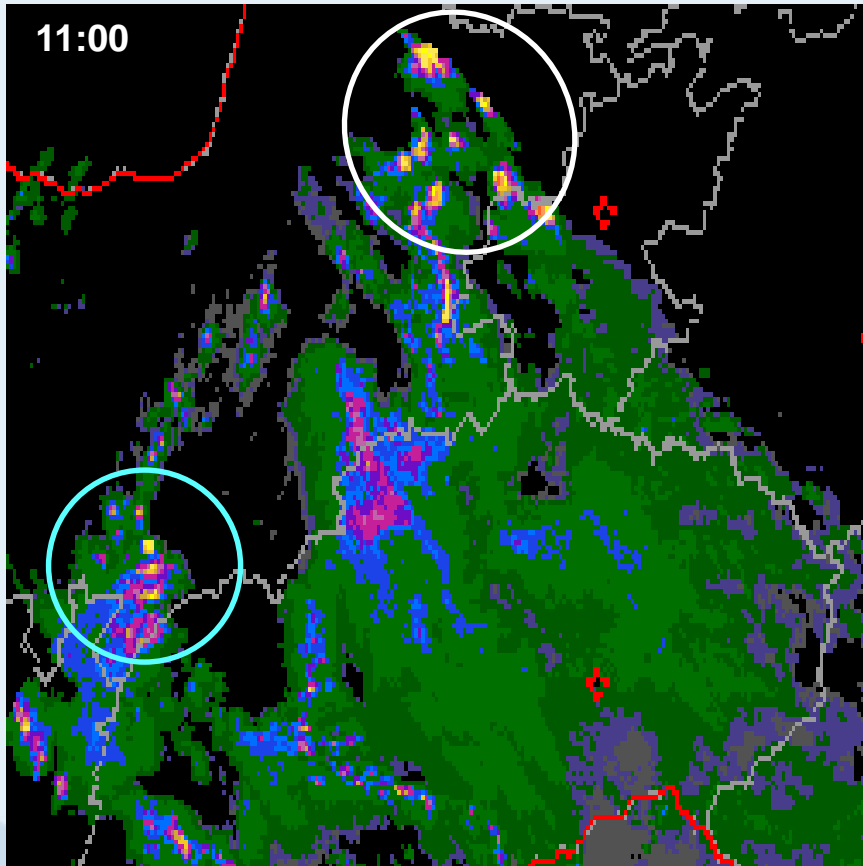# Very cold cloud tops 0700 to 1000 UTC

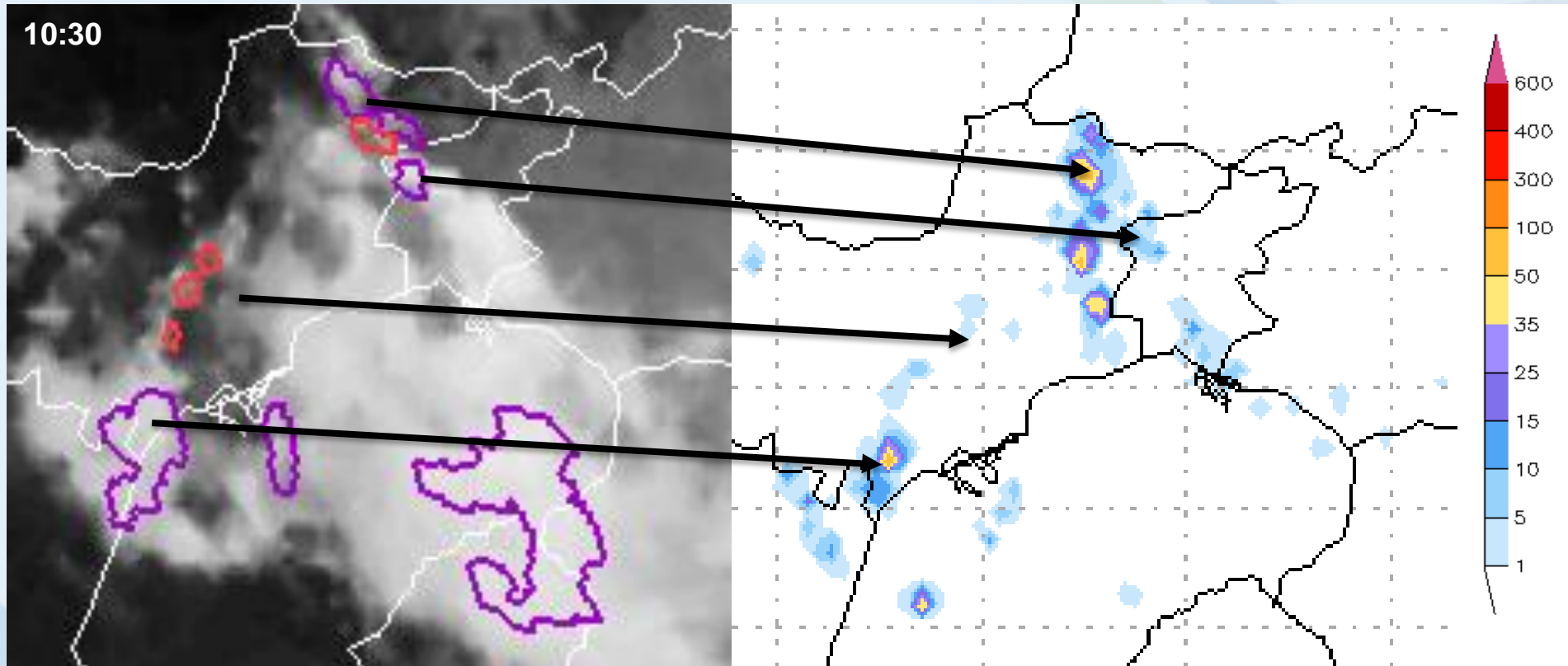# RDT output for 20120906 from 0800 to 1100 UTC

Comparing RDT to radar image at 10:30
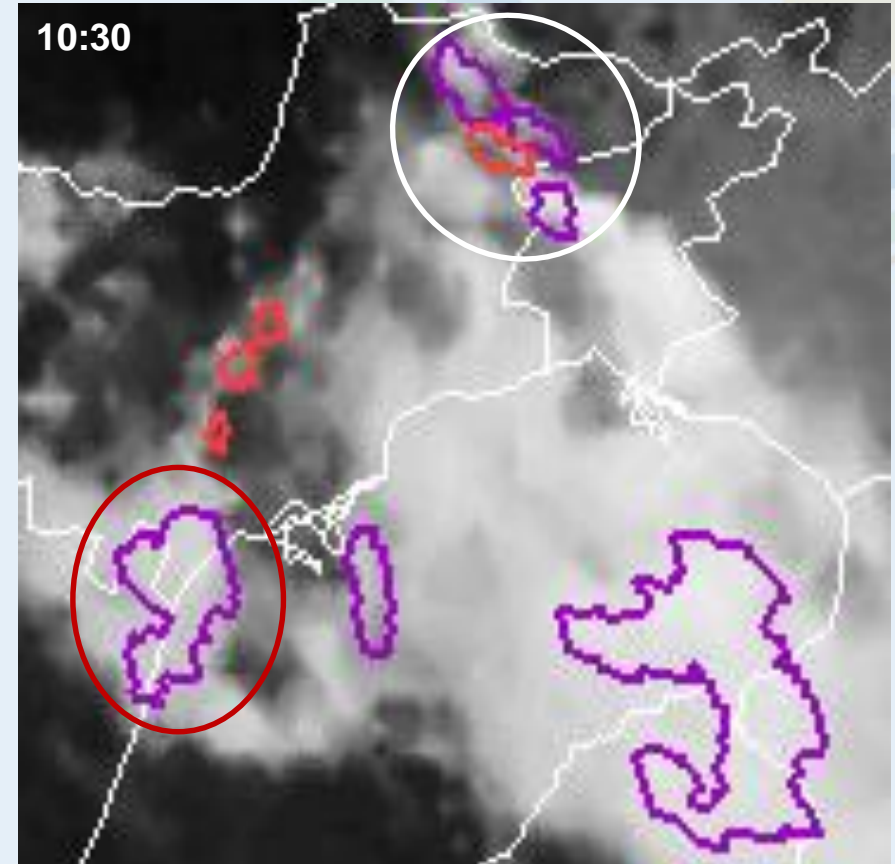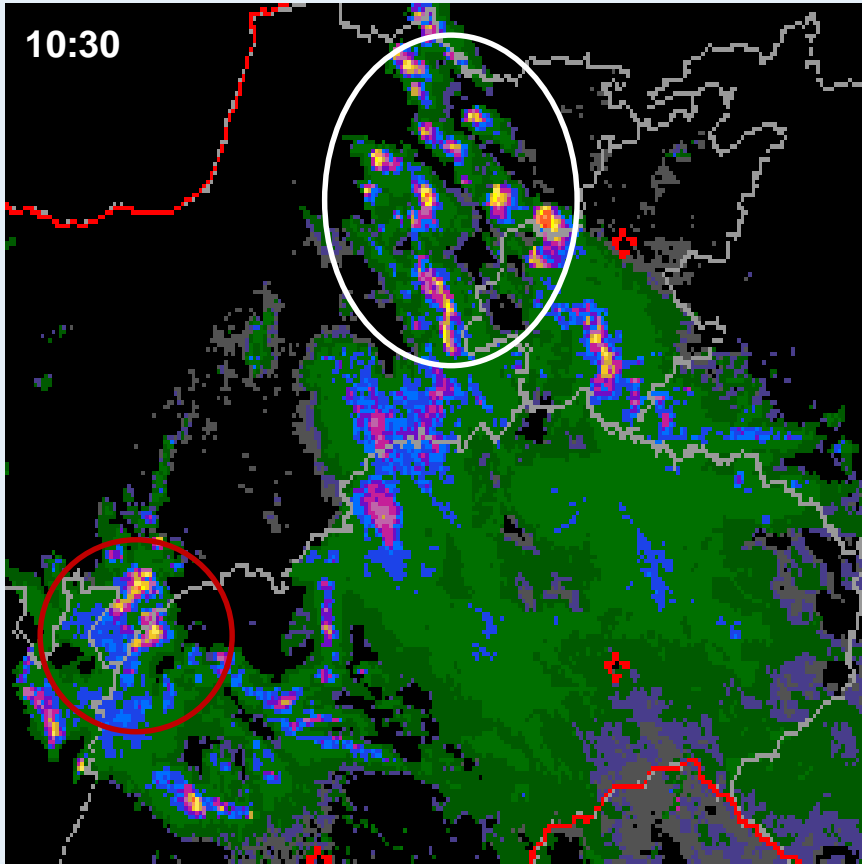
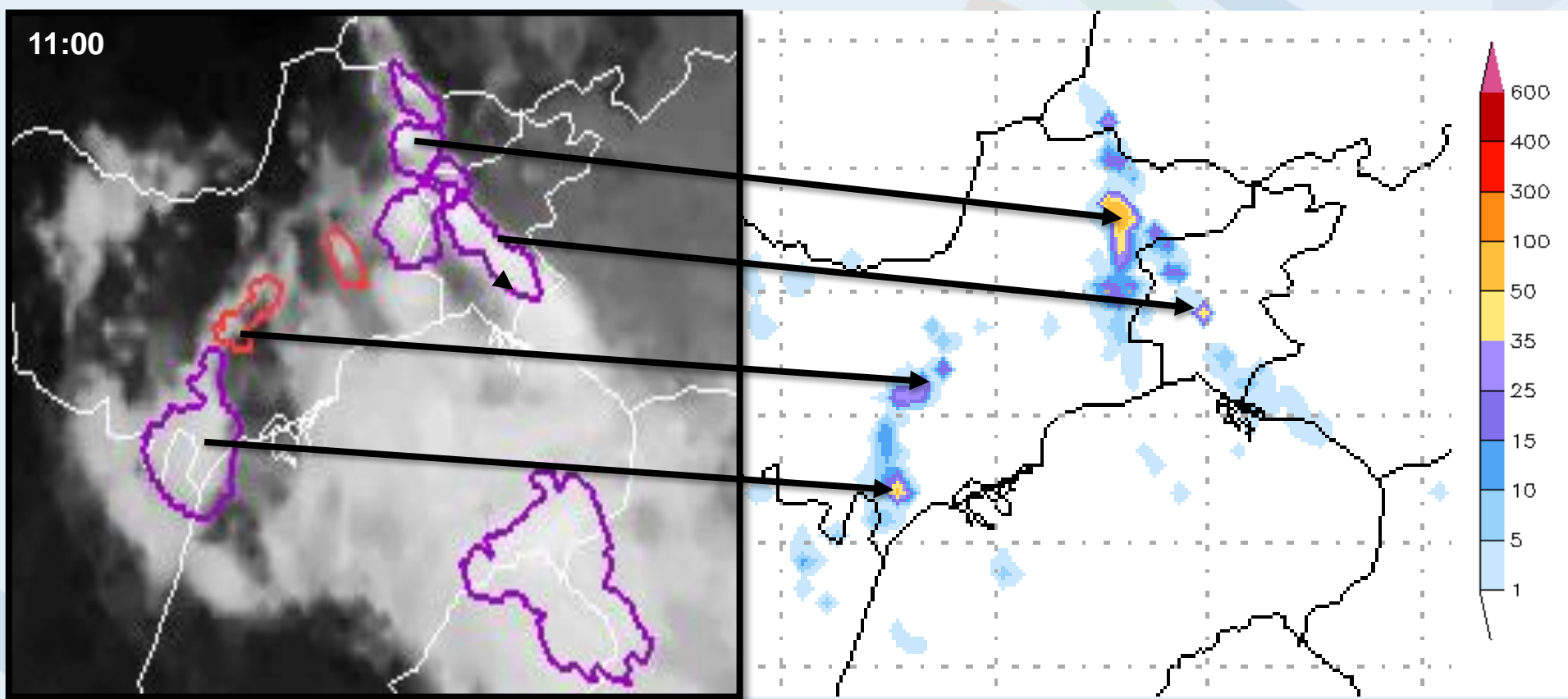# Comparing RDT to radar image at 11:00

Comparing RDT to lightning

10:30

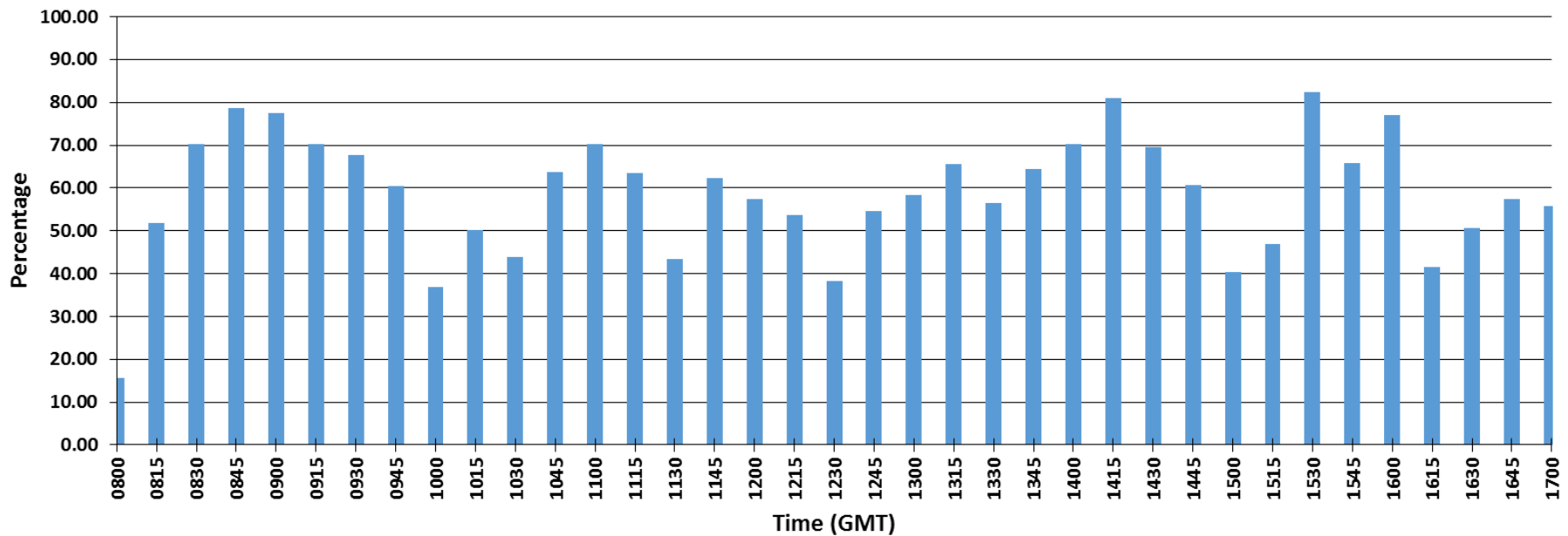**Total amount of lightning strokes from 1030 – 1100 UTC**
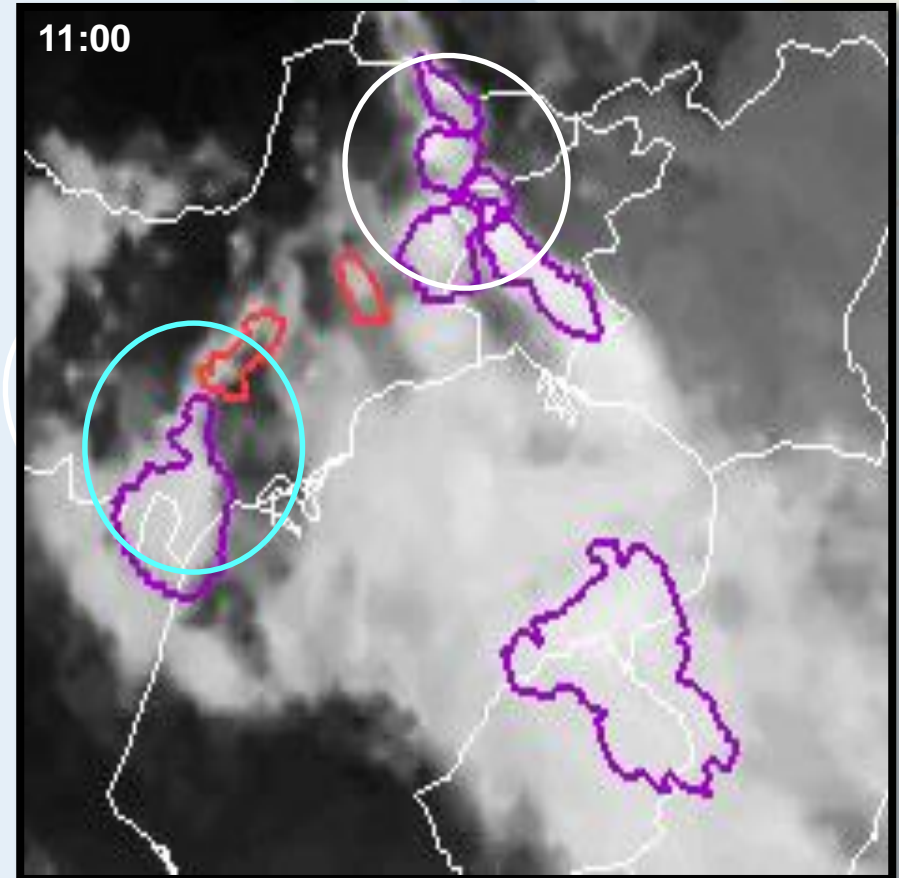
Comparing RDT to lightning
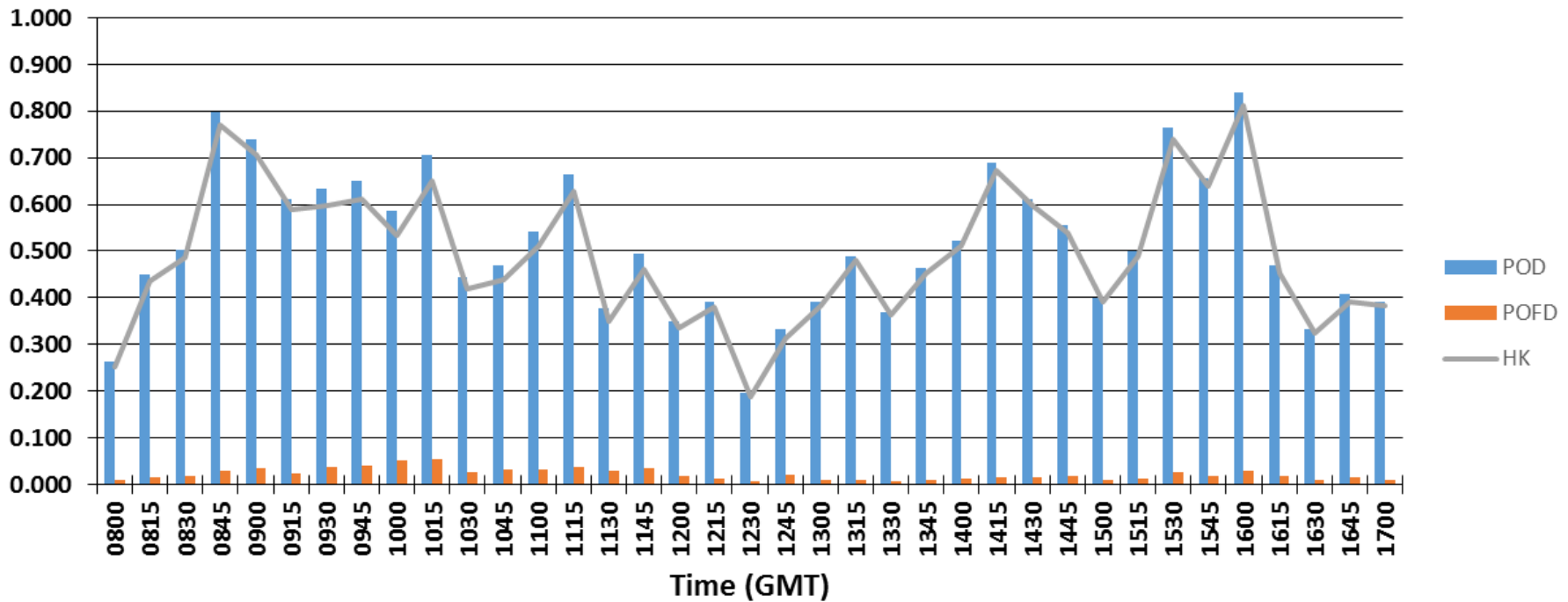

Total amount of lightning strokes from 1100 – 1130 UTC

Percentage of the total lightning inside the RDT polygons

Percentage of the total lightning inside the RDT polygons for 20120906

Statistics calculated by Morne Gijben

Hanssen Kuiper (HK) and POD for RDT evaluated against lightning occurrence in the 30 minutes following

Statistics calculated by Morne Gijben

Examples over SA:
20 October 2012

Slides for this case: courtesy Bathobile Maseko

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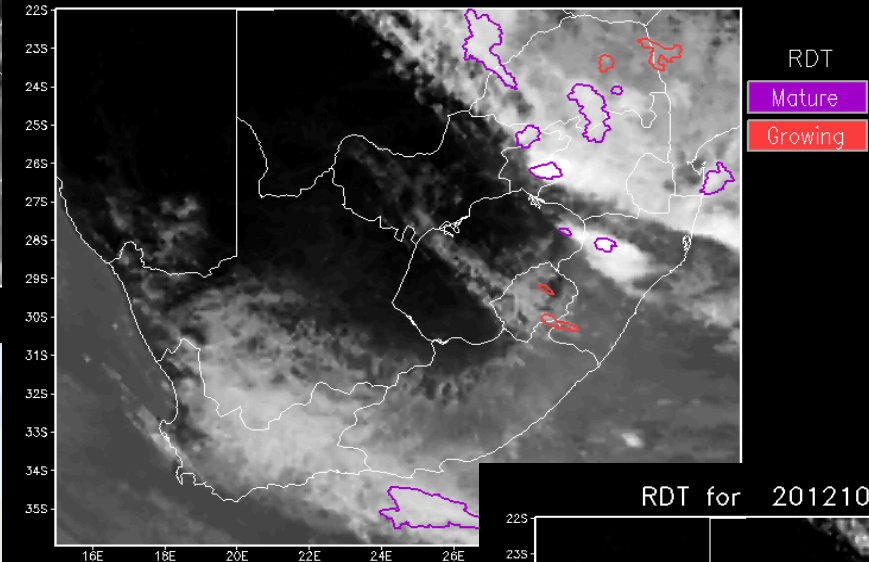ISO 9001 Certified Organisation

Case 20 October 2012

- The heavy rainfall event that impacted the southeast region of South Africa

- Gauteng experienced rain accompanied by large hail for about five minutes on Saturday between 2pm and 3pm (or 1200 to 1300 UTC).
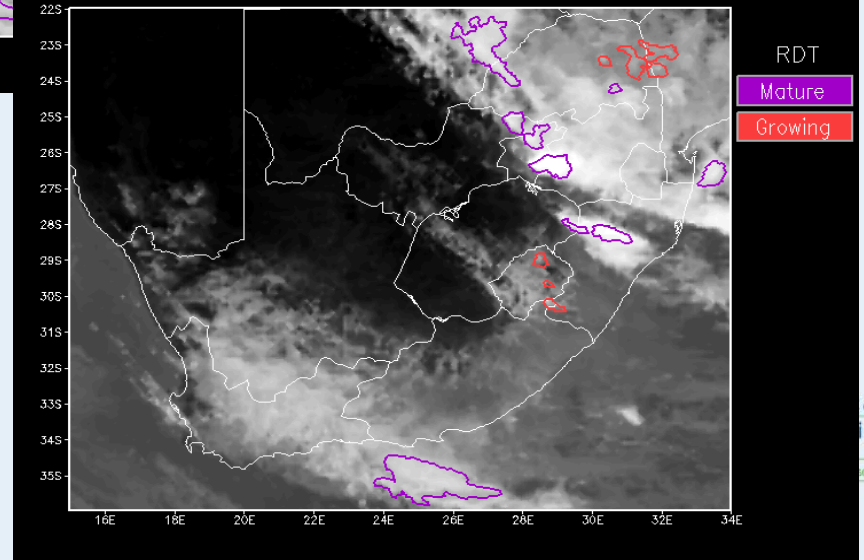
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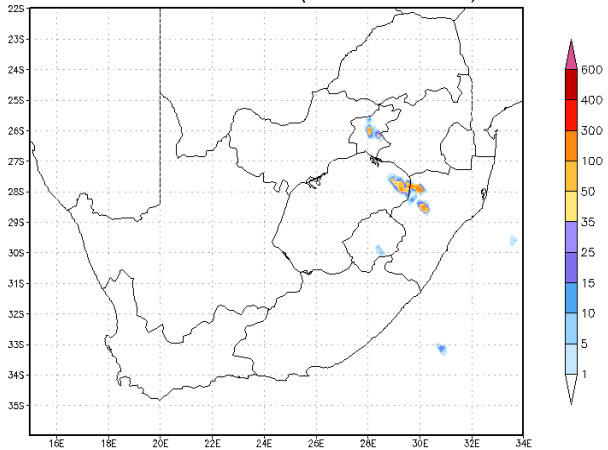ISO 9001 Certified Organisation

RDT for 20121020 at 1200UTC

RDT
Mature
Growing
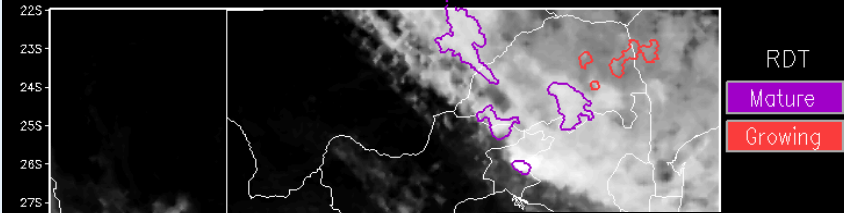
RDT for 20121020 at 1215UTC

RDT
Mature
Growing

RDT for 20121020 at 1230UTC

RDT
Mature
Growing

LTG for 20 Oct 2012 (1200-1230 UTC)

600
400
300
100
50
35
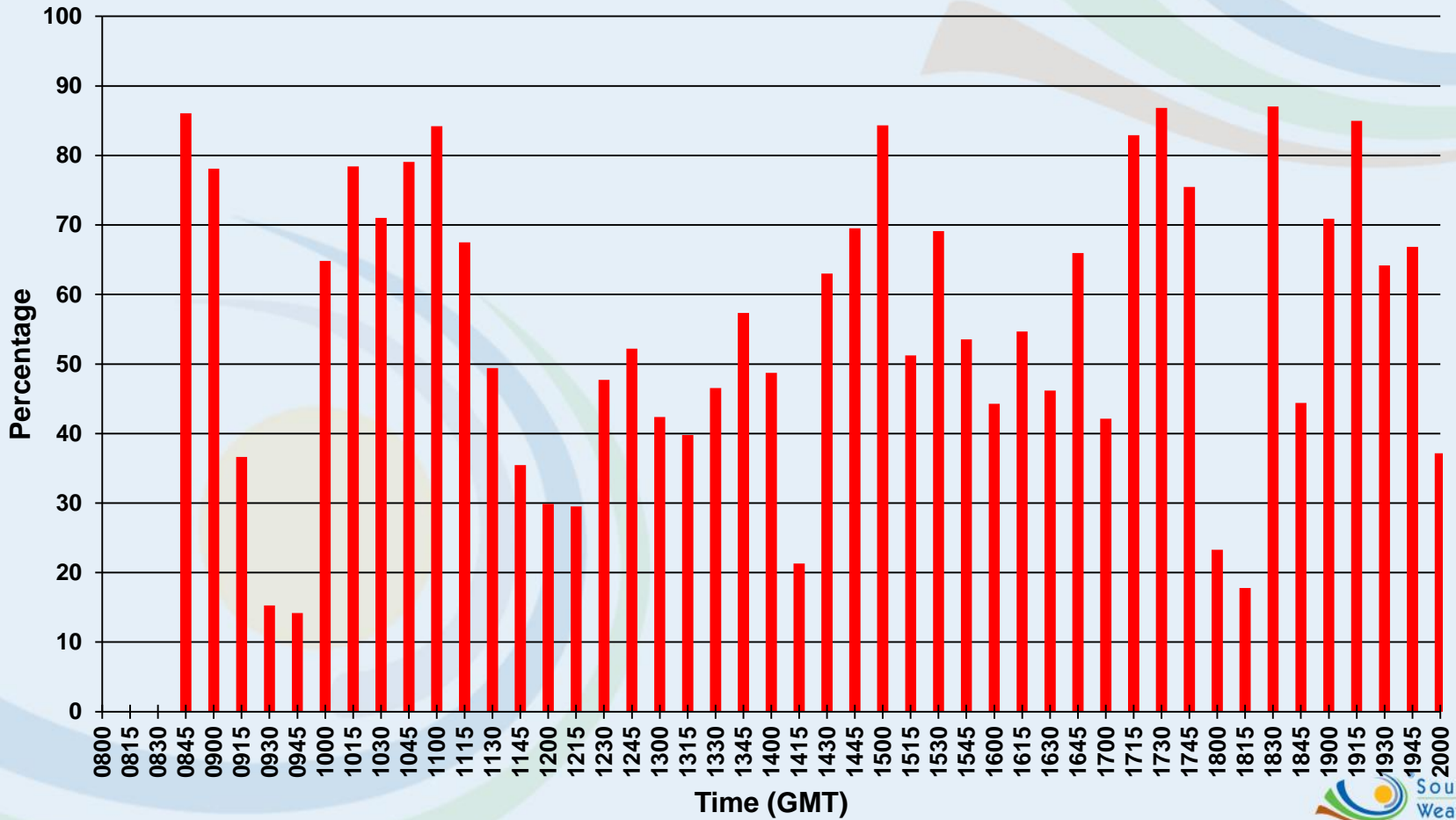25
15
10
5
1

RDT vs radar at 12:30 UTC
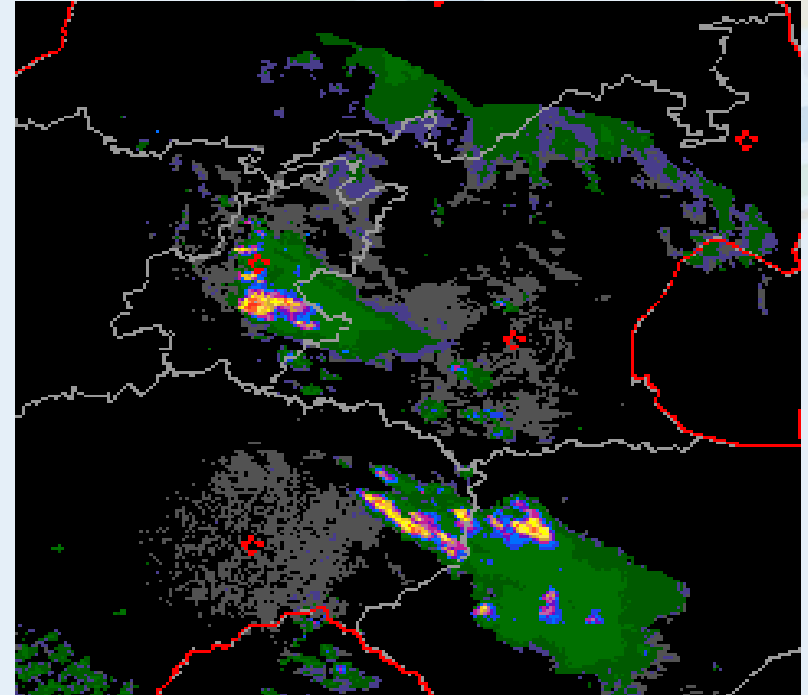
Percentage of the total lightning inside the RDT polygons for 20121020
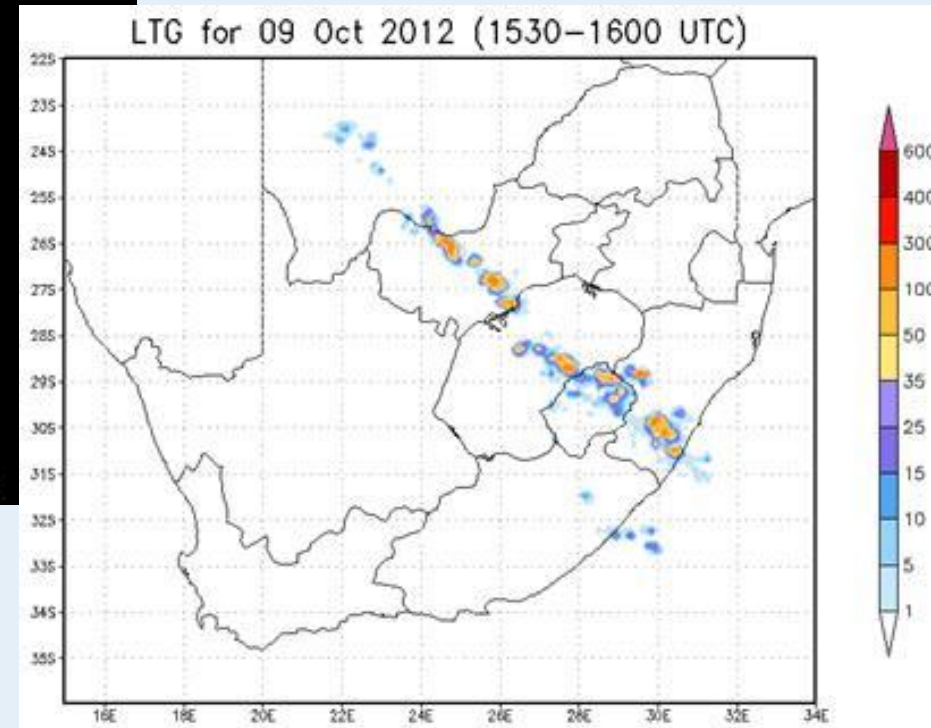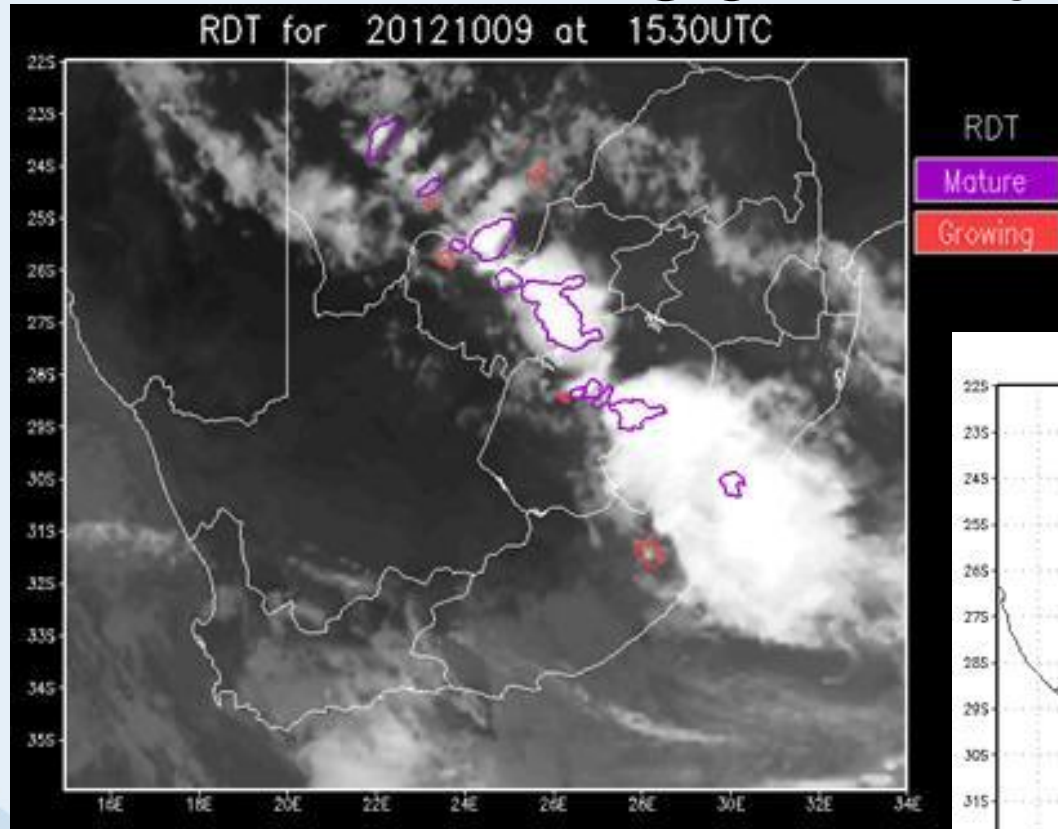
Statistics calculated by Morne Gijben

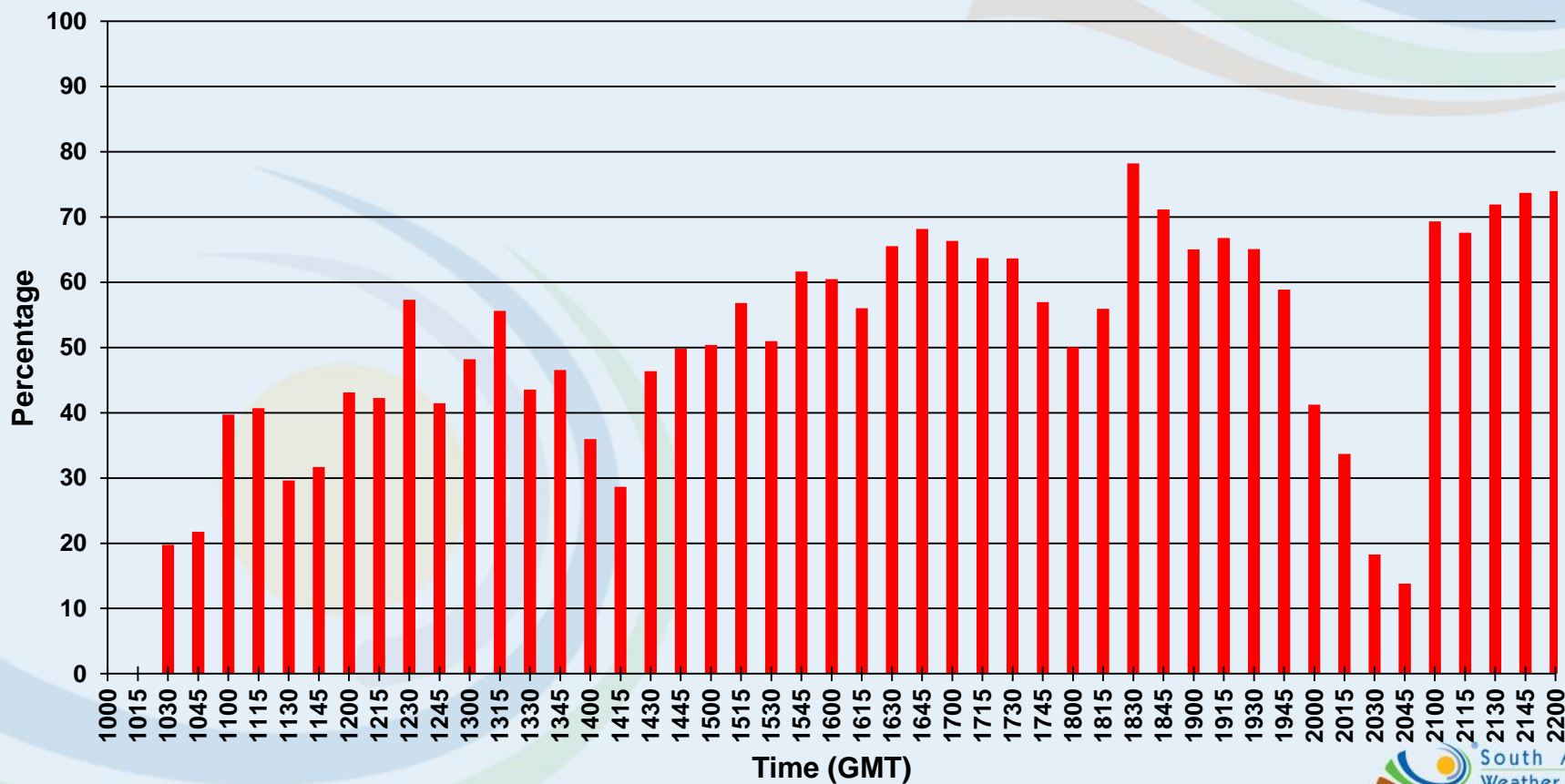# Examples over SA:
9 October 2012

Slides for this case: courtesy Cassandra Pringle

RDT vs lightning in the following 30 minutes

Percentage of the total lightning inside the RDT polygons for 20121009

Statistics calculated by Morne Gijben

RESULTS

- From these visual evaluations, there generally seems to be good correspondence between indicated growing and mature storm cells from RDT, and actual lightning locations.

- These first case results indicate that this product can be very useful in servicing the SADC region in nowcasting, identifying and tracking severe storms, especially for aviation purposes (in the absence of radar systems).

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Case studies for validation

- 31 December 2011 – 10Z to 22Z
- 23 June 2012 – 06Z to 18Z
- 6 Sep 2012 - 10Z to 18Z
- 09 October 2012 – 10Z to 22Z
- 17 October 2012 – 12Z to 22Z
- 20 October 2012 – 08Z to 20Z
- 08 November 2012 – 06Z to 18Z
- 09 November 2012 – 10Z to 22Z
- 10 December 2012 – 00Z to 18Z
- 19 January 2013 – 10Z to 22Z

Future plans

- Ten cases over SA domain
- Enlarge domain of RDT to include most of SADC and validate ten cases against MSG RGBs (visual comparison)
- Possibly get global lightning data to use
- RDT maps can be part of RSMC in the near future