

# RADAR STUDIES AND APPLICATIONS IN SOUTH AFRICA

South African Weather Service



South African  
Weather Service

# Commissioning of radar

Off-loading radar in Duban Harbour (April 1994)



Radar arriving at Witbanksfontein (10 May 1994)



Radar Assembly completed (July 1994)

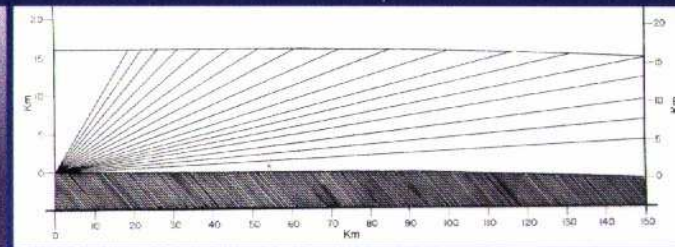
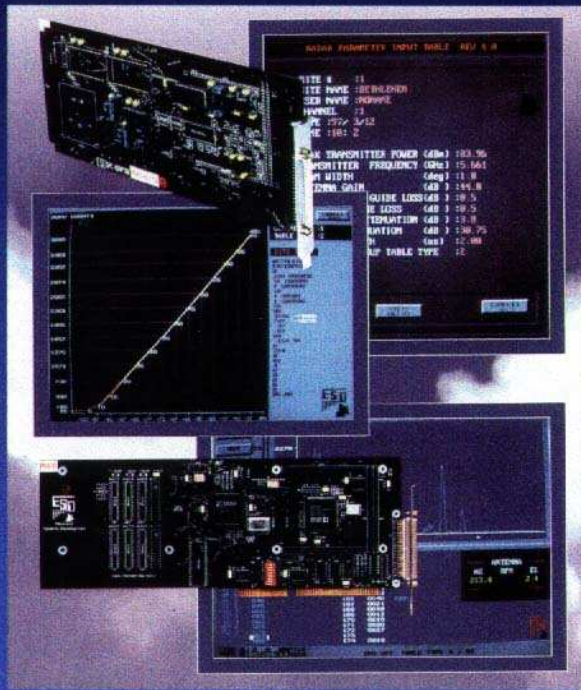


Radar Antenna Assembly



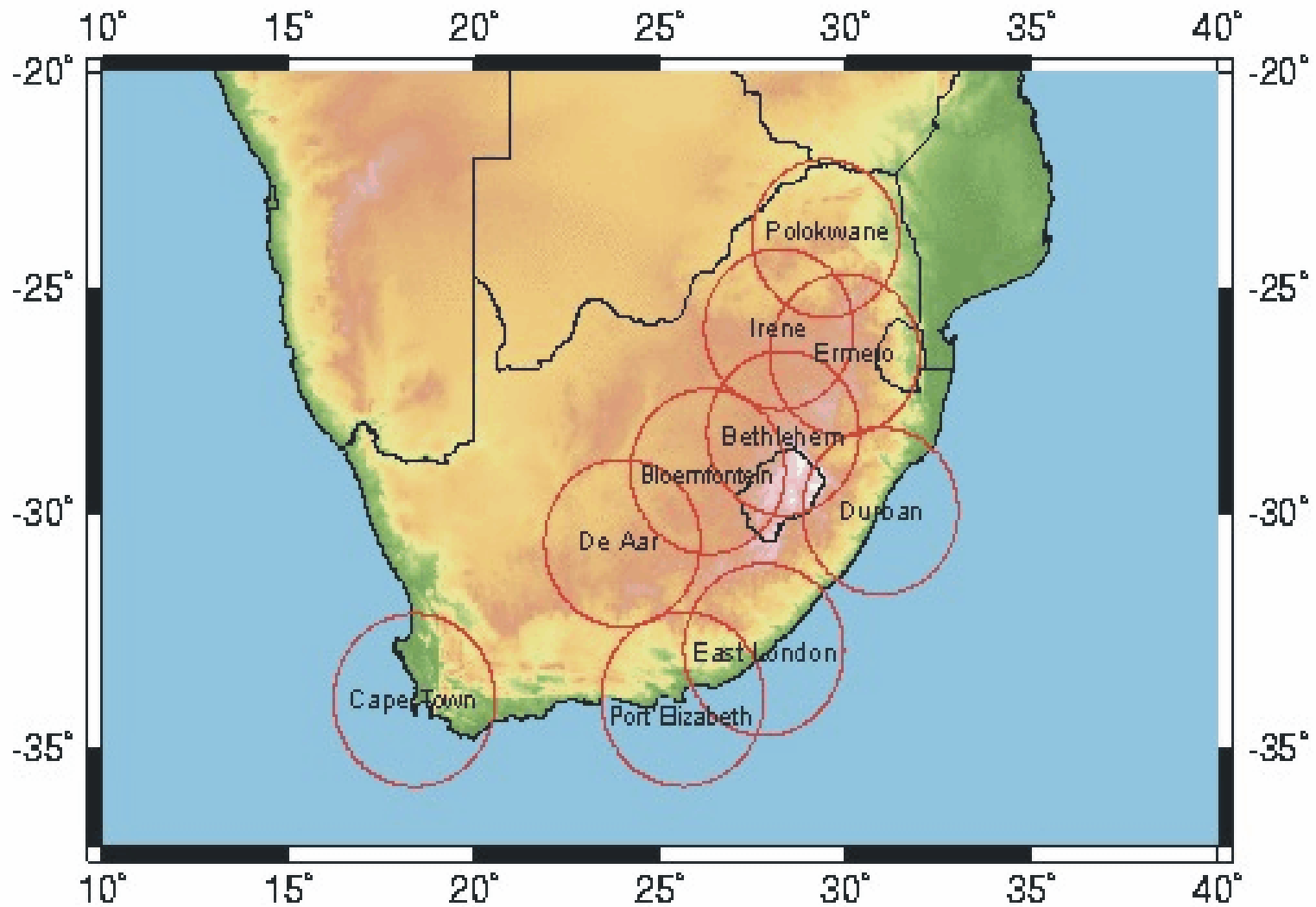
# MRL5 Radar Upgrades

## DATA COLLECTION AND PROCESSING

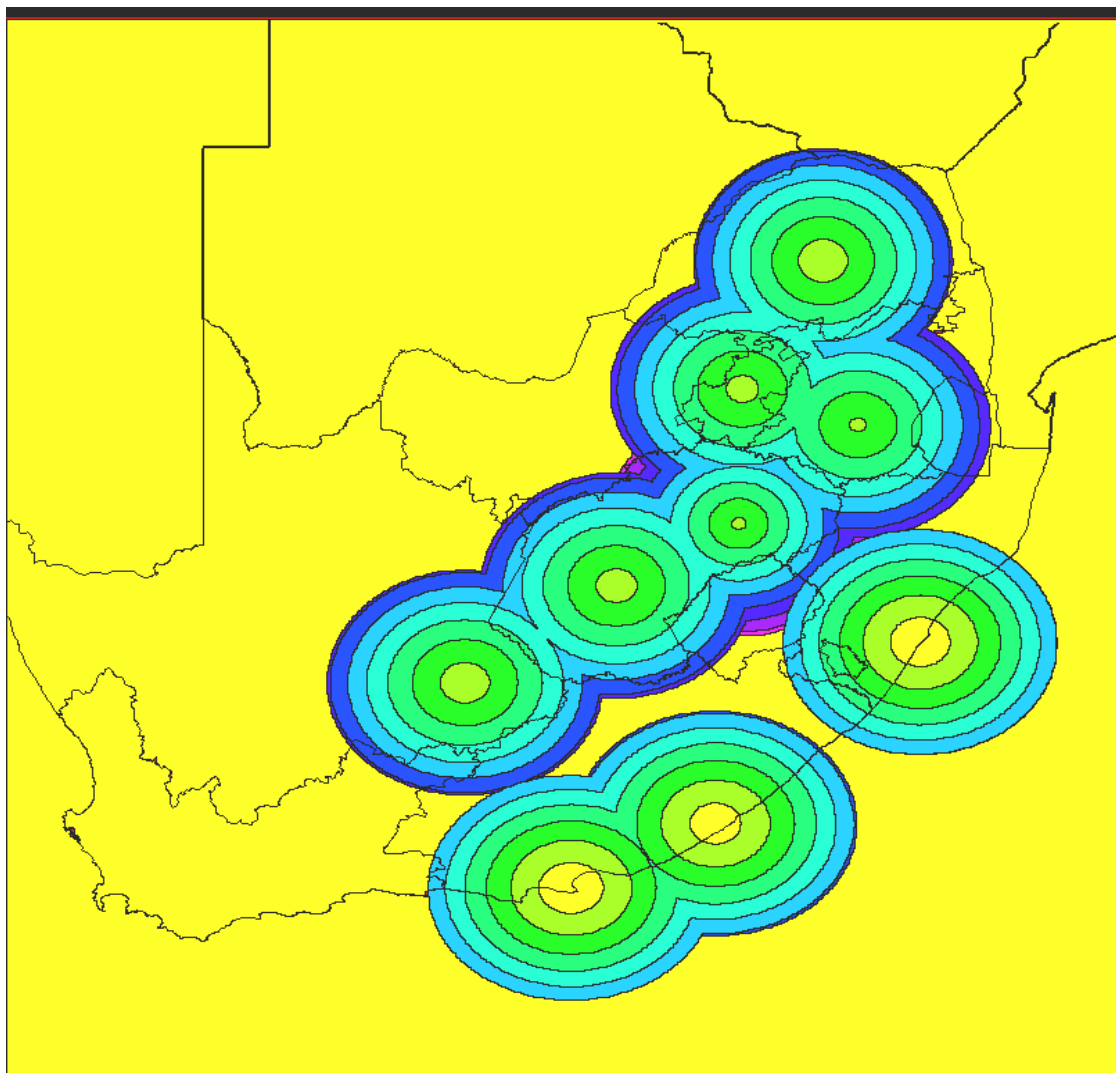


Full rotations at 18 elevation steps  
224 range bins each 900 m, 0 - 200 km

# The National Weather Radar Network (NWRN)



# RANGE LIMITATIONS

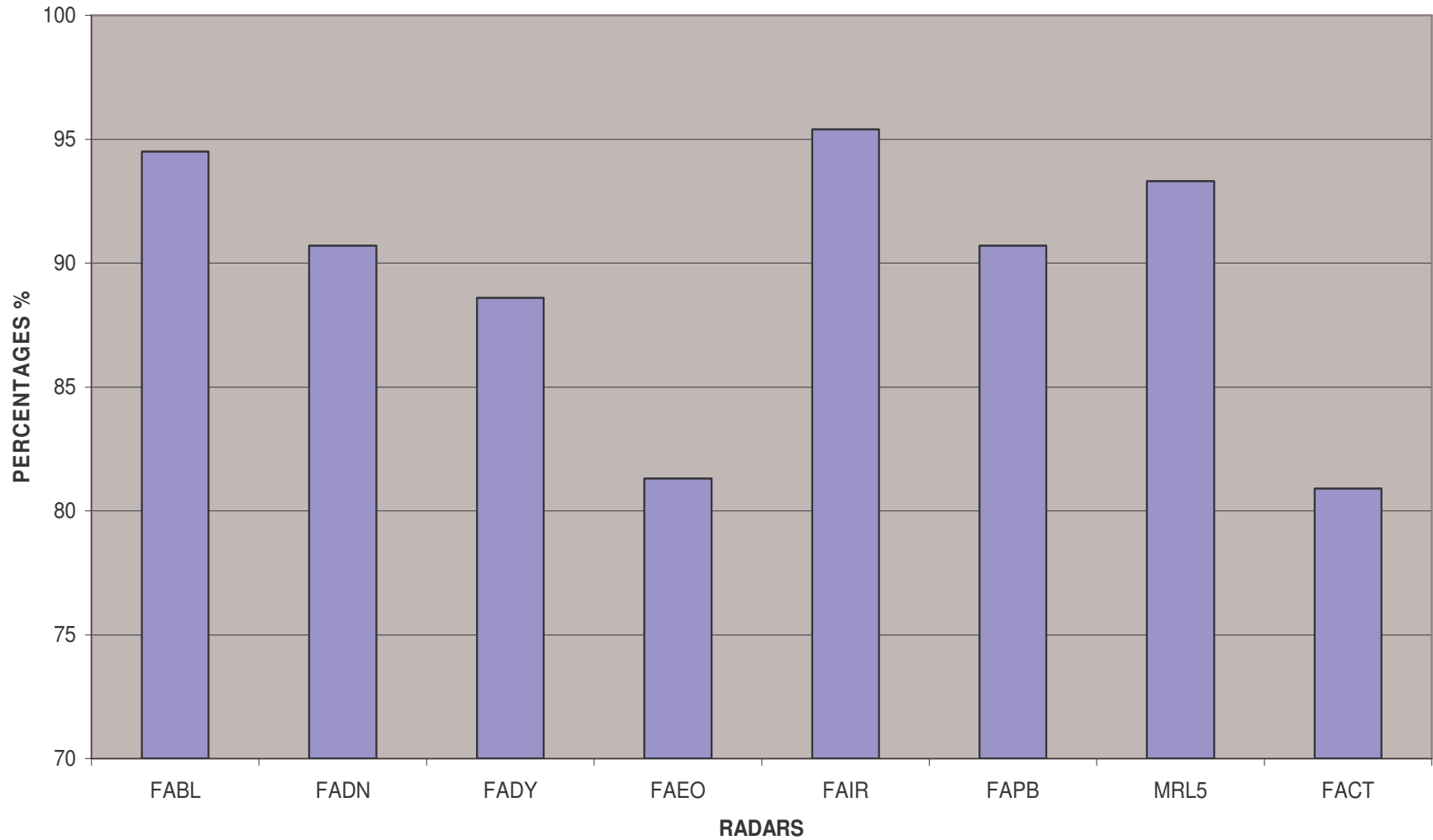


Height of radar beams at 200 km is 7 km with 1 degree basescan.

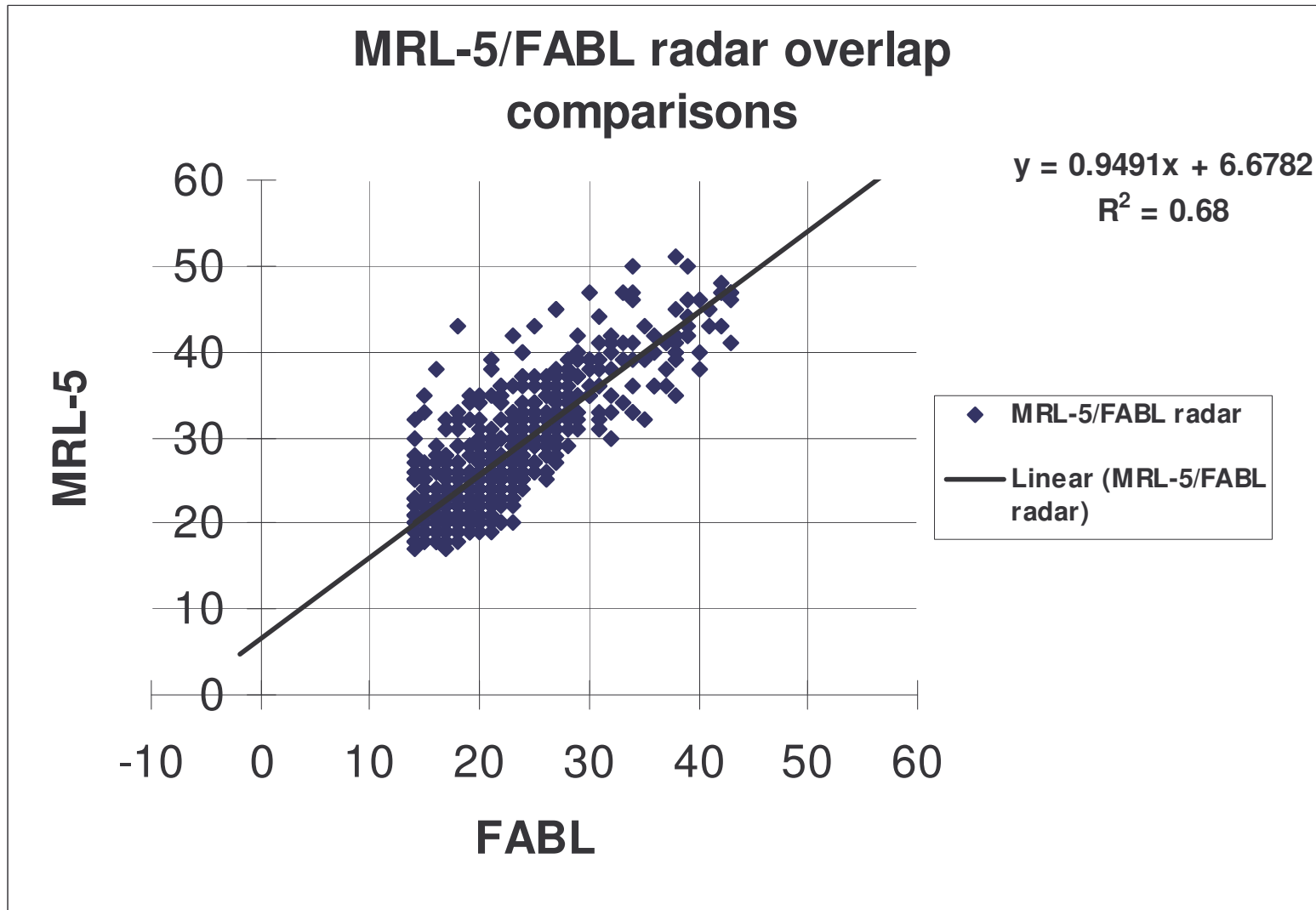


# Network Performance

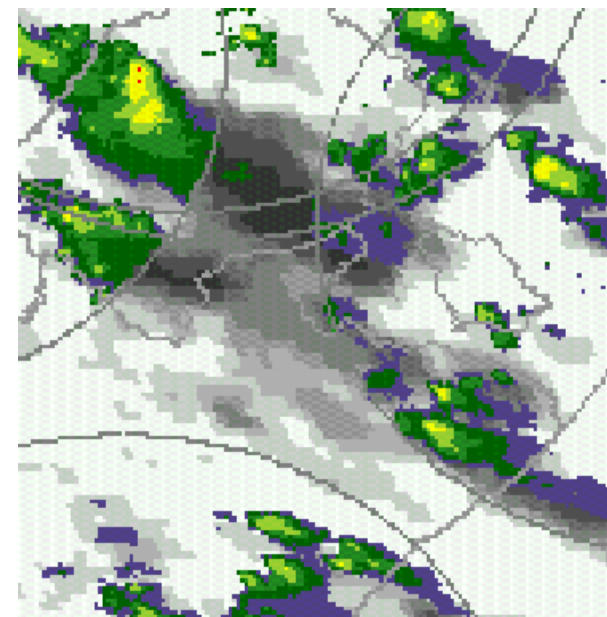
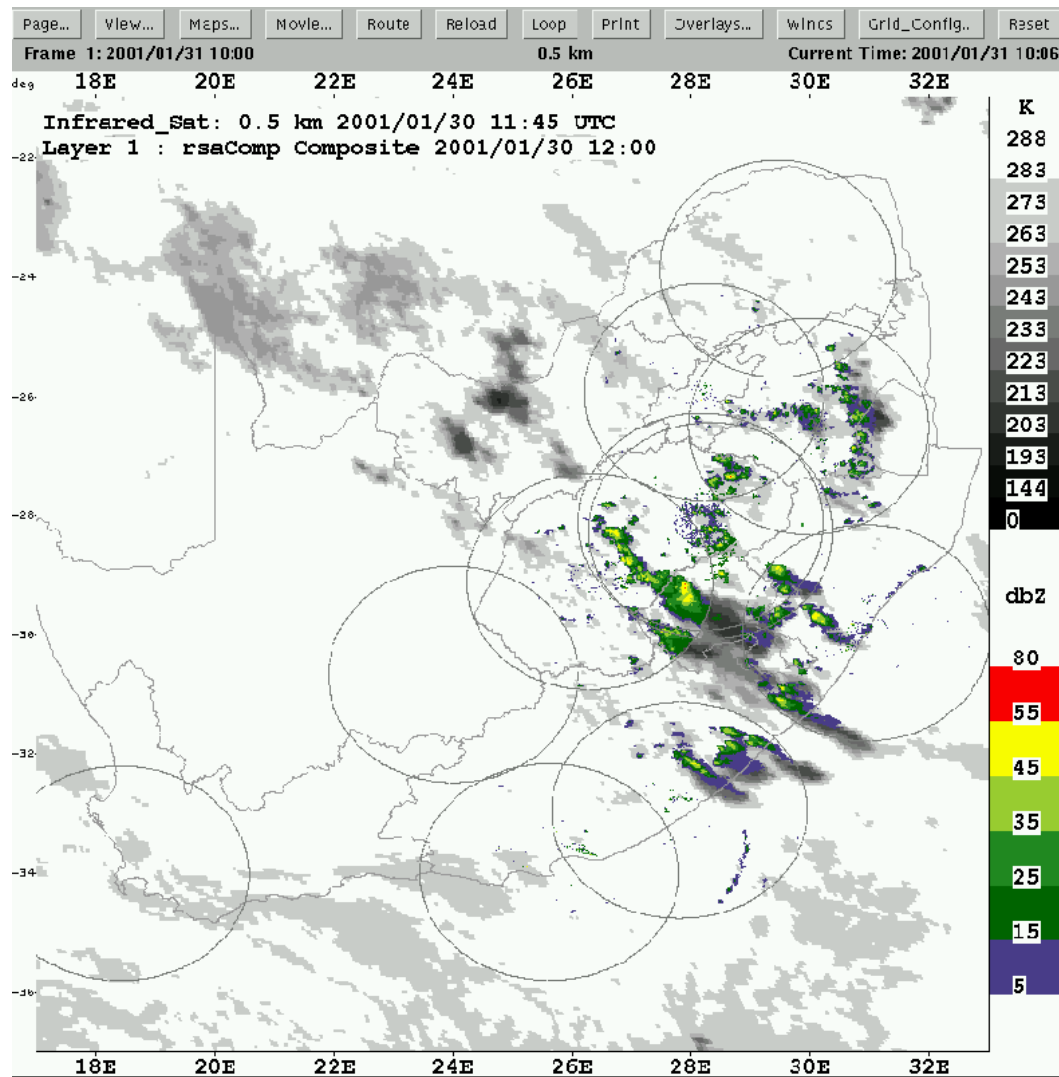
**RADAR RELIABILITY FROM FEB 2001-MARCH 2003**



# Radar overlap comparisons



# THE RADAR NETWORK: LACK OF COVERAGE OVER THE UMTATA AREA

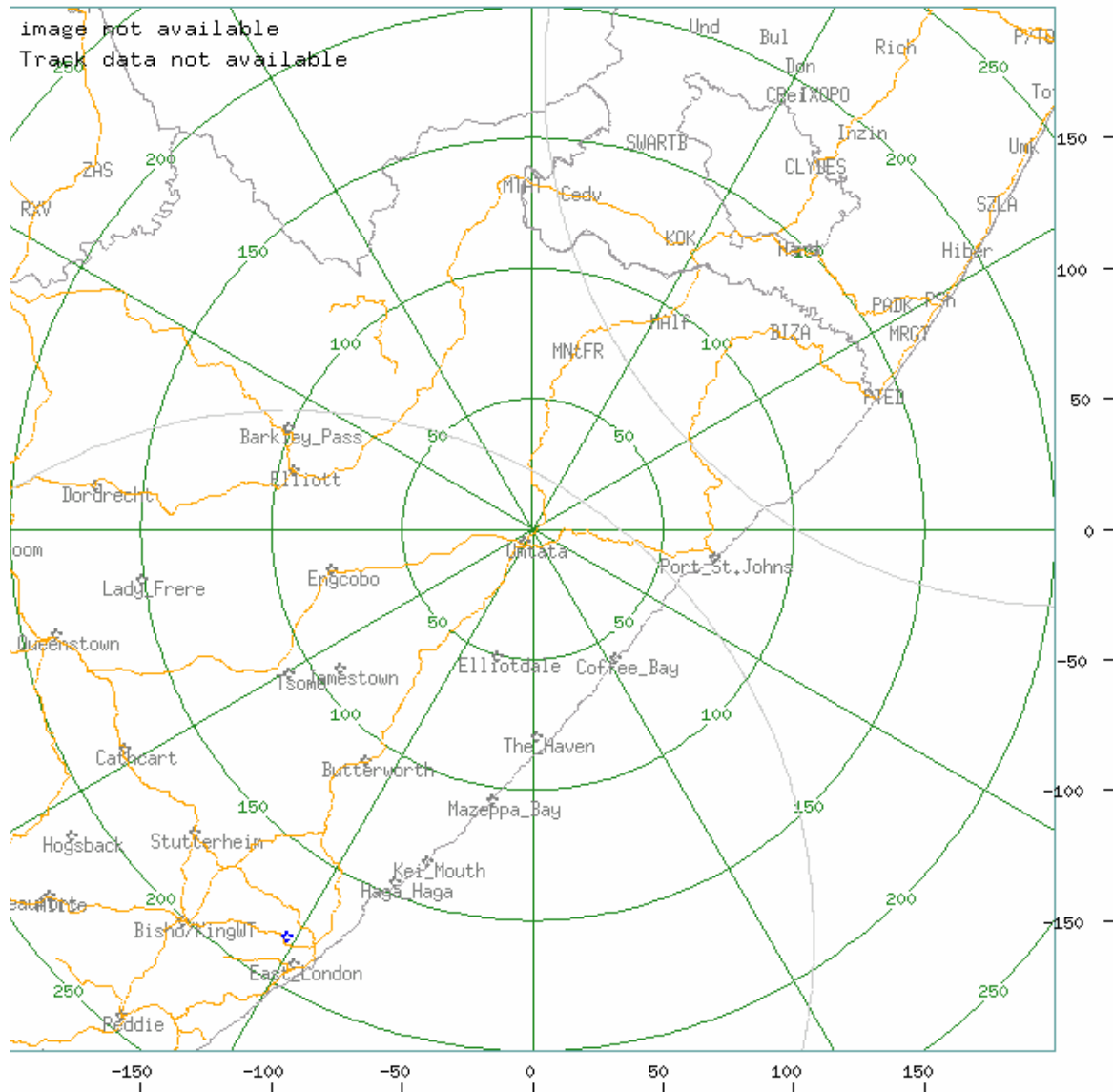




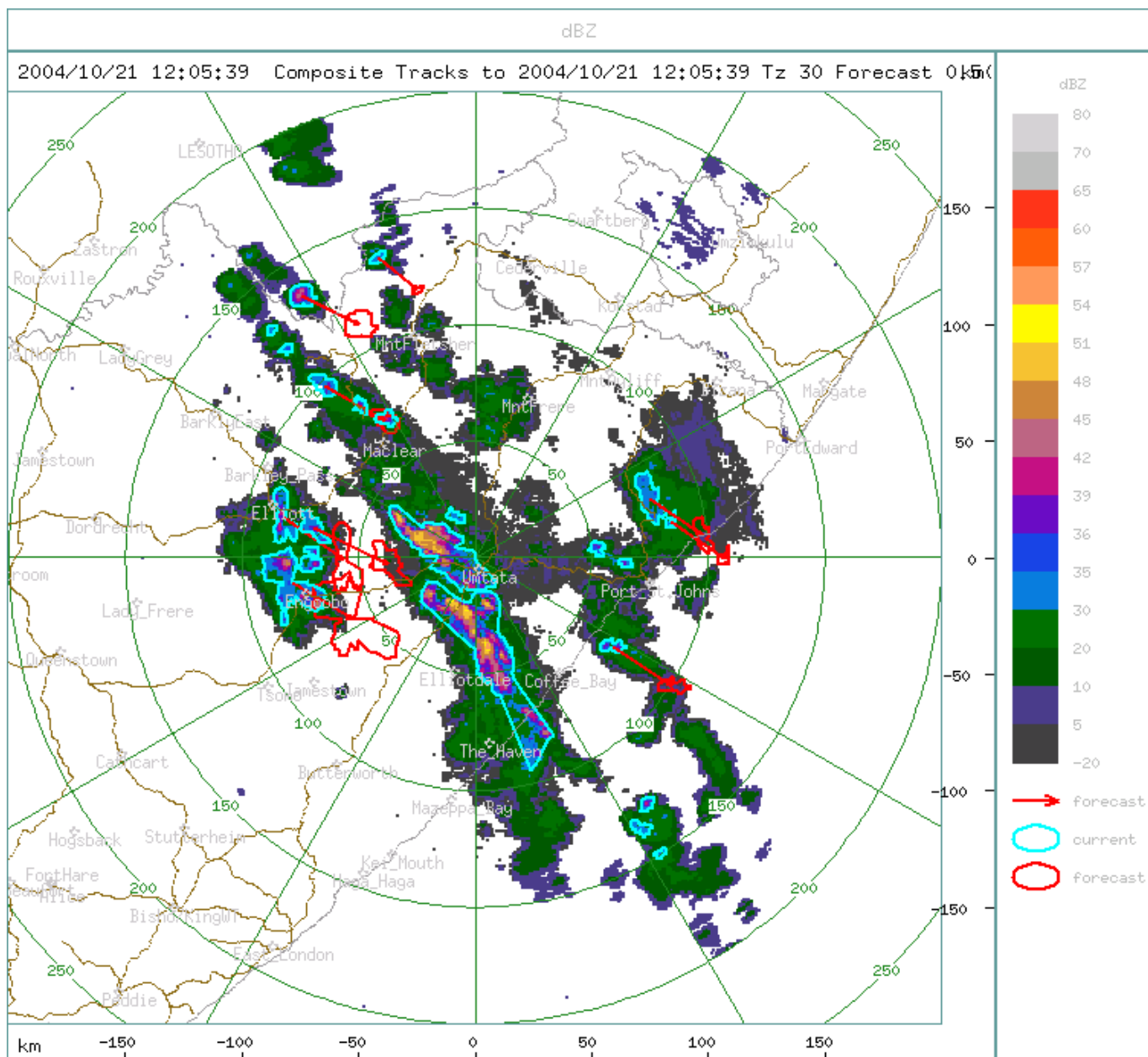
# THE UMTATA RADAR: ITS COVERAGE

0000/00/00 00:00:00 Composite

image not available  
Track data not available



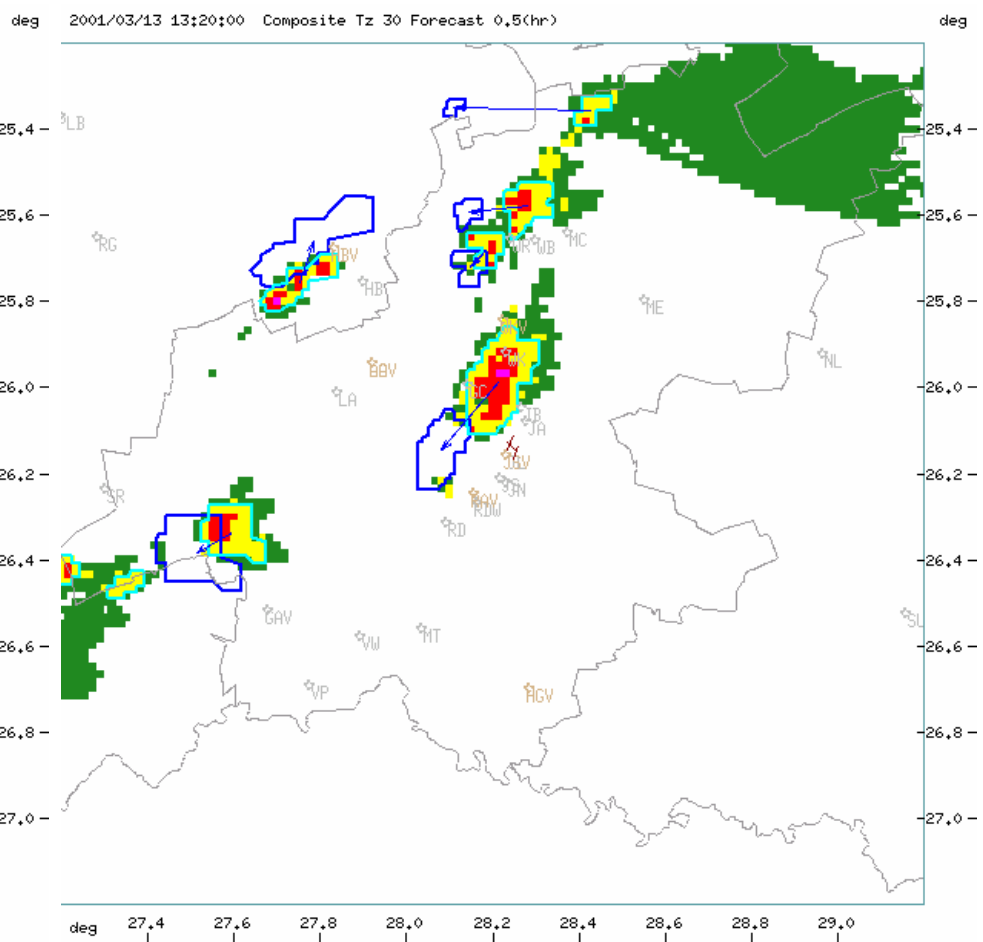
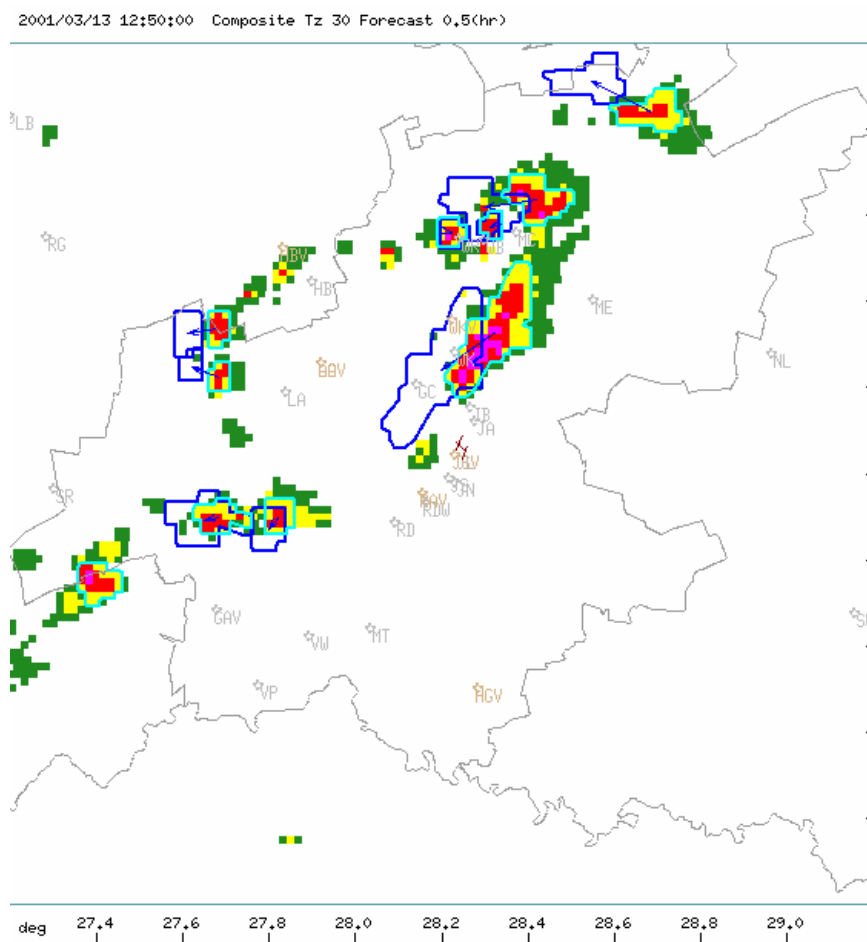
# THE UMTATA RADAR: FIRST DATA



# 30 MINUTE TITAN STORM PREDICTION

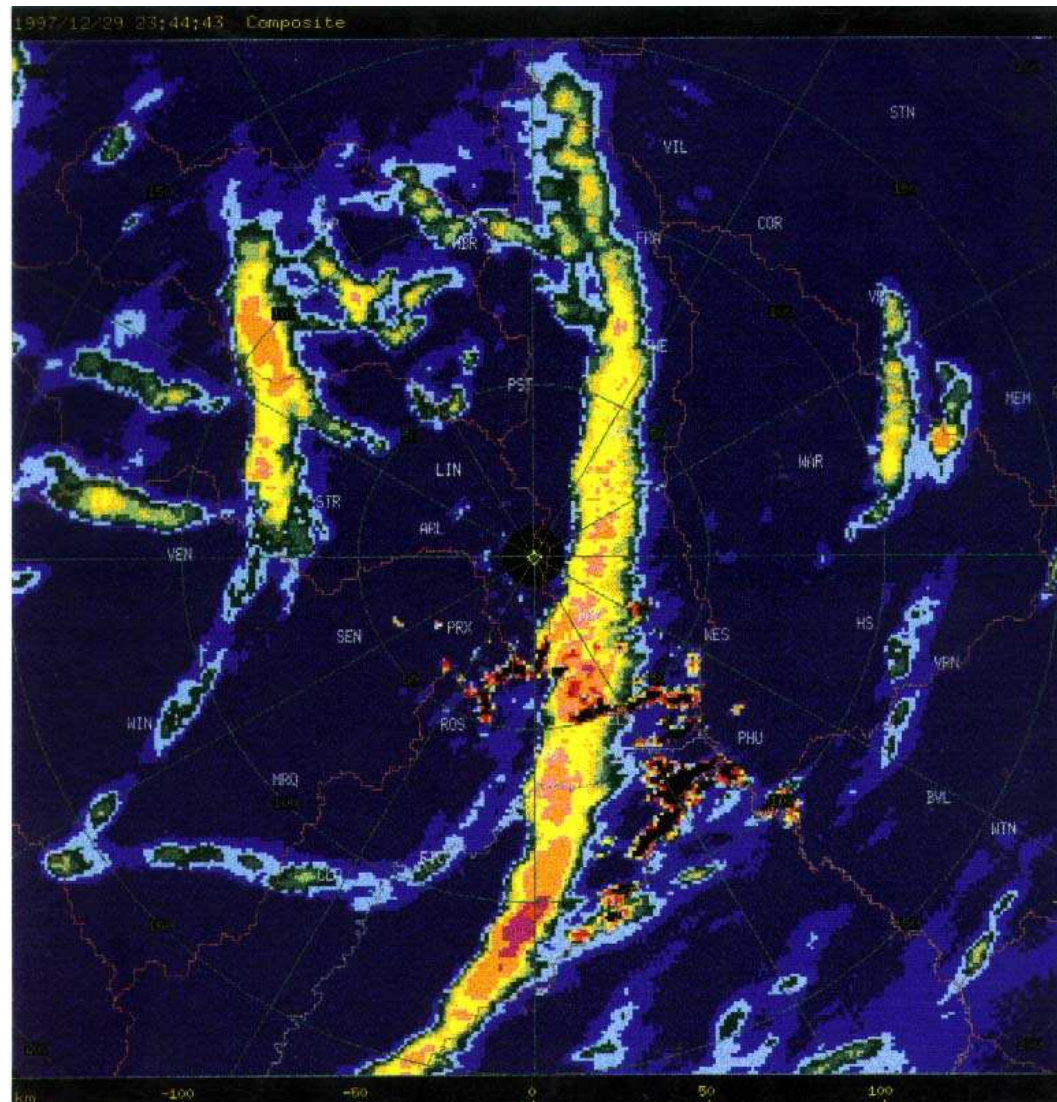
12:50 with 30 minute forecast

13:20

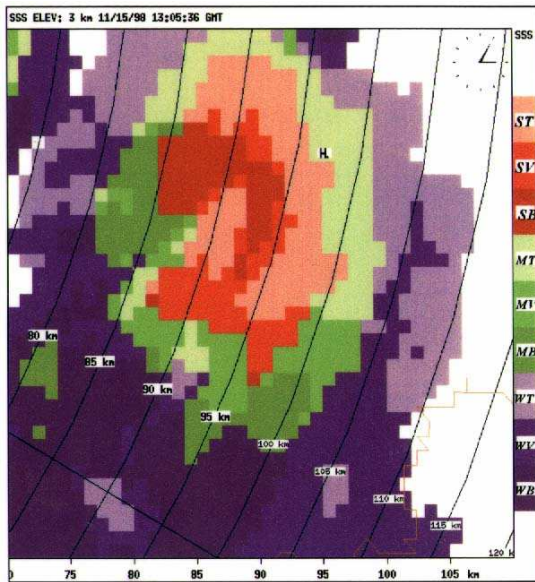




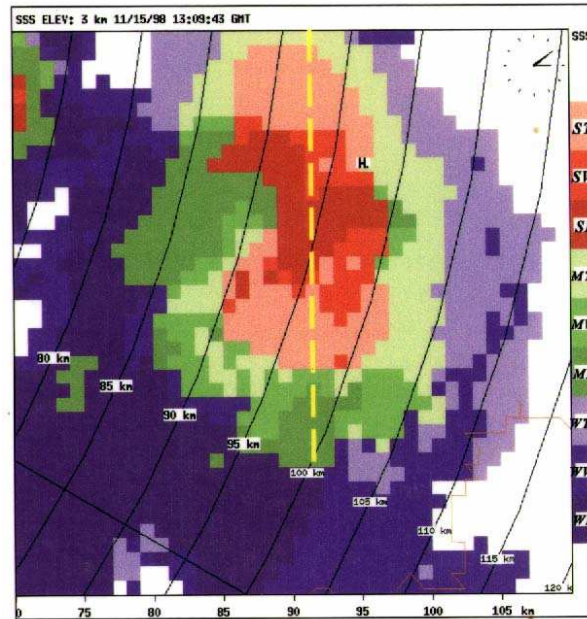
# Hail Storm over the Eastern Free State (29 December 1997)



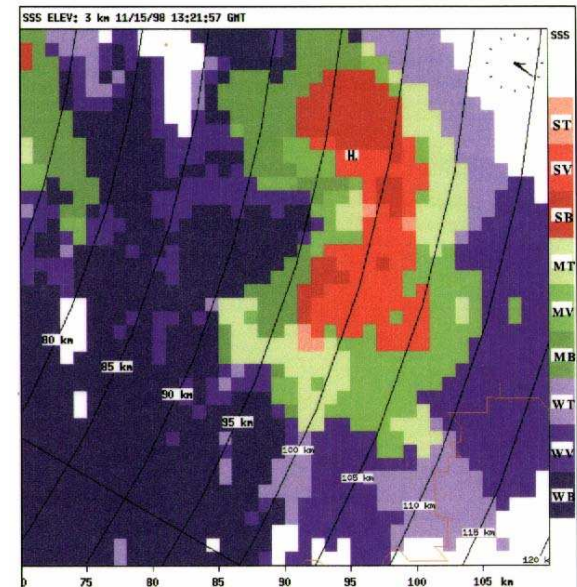
# Harrismith Tornado (18 November 1998)



13:05



13:09

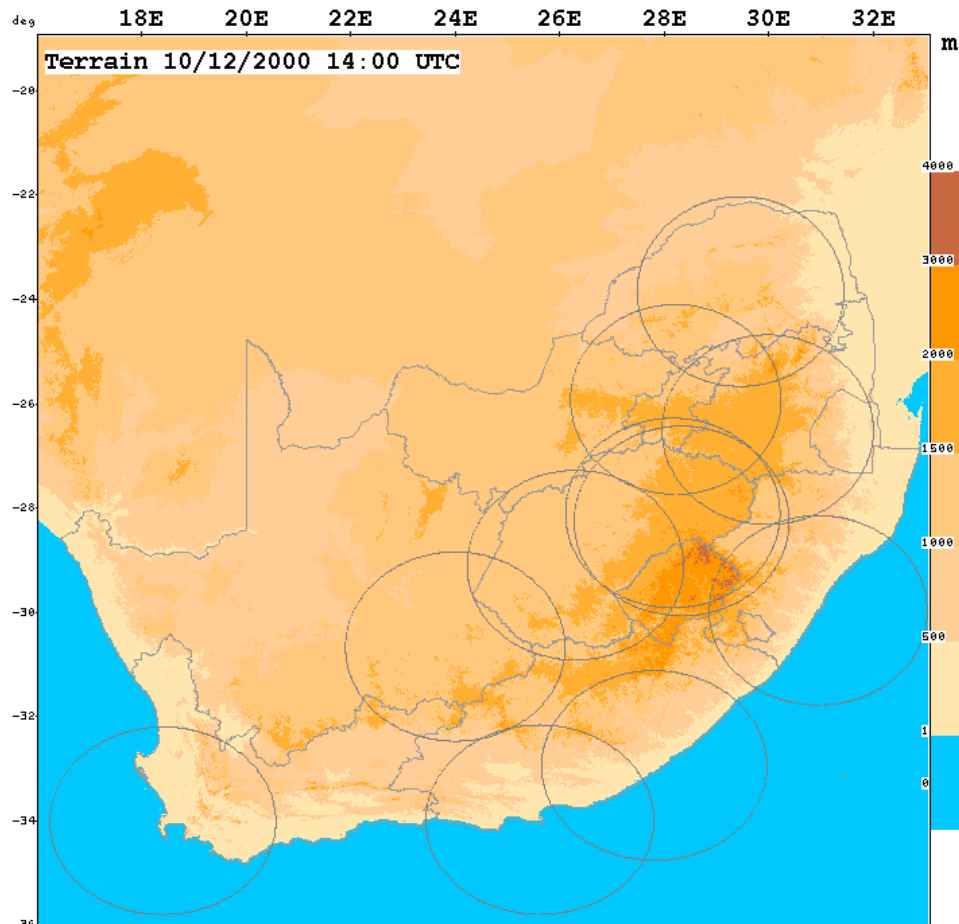


13:21

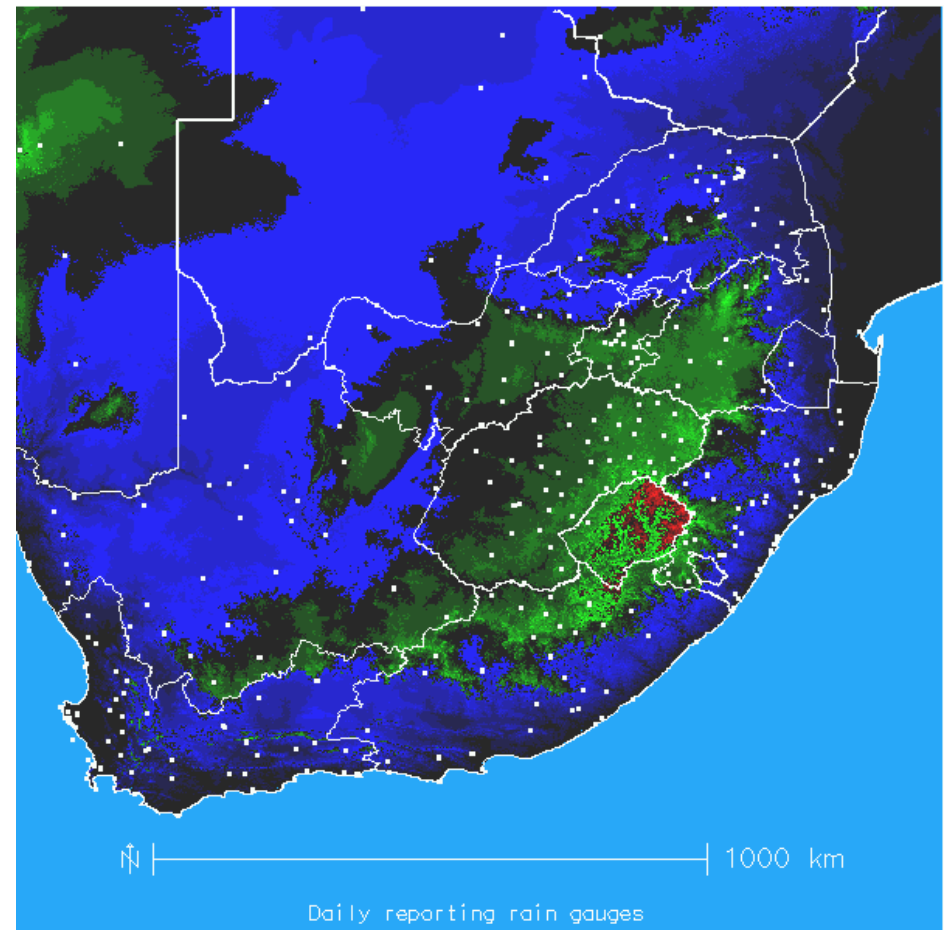


# THE SOUTH AFRICAN WEATHER RADAR NETWORK AND RAIN GAUGE INFRASTRUCTURE

## RADAR NETWORK

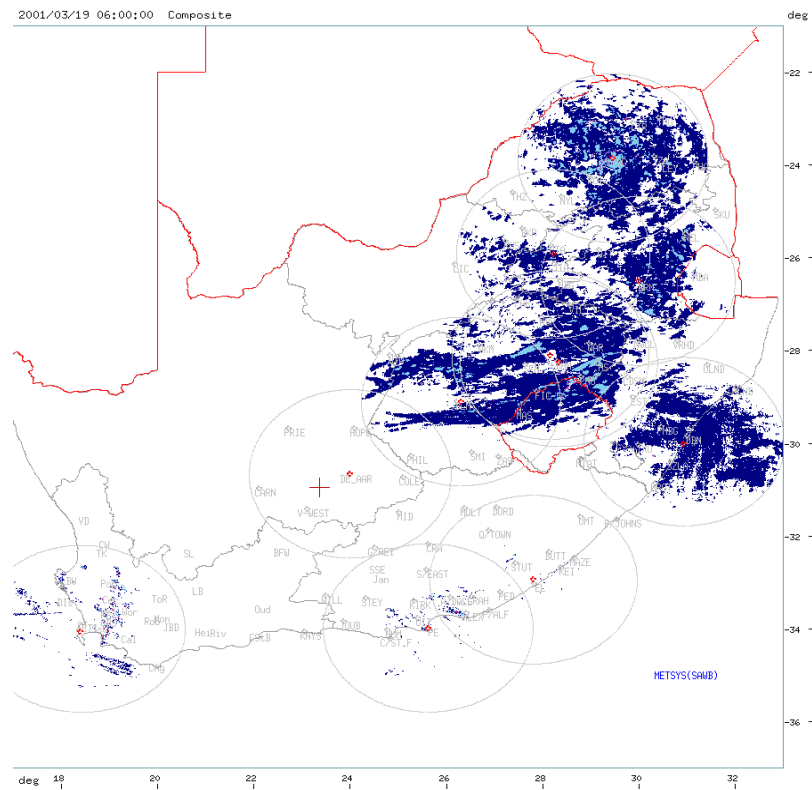


## DAILY GAUGES



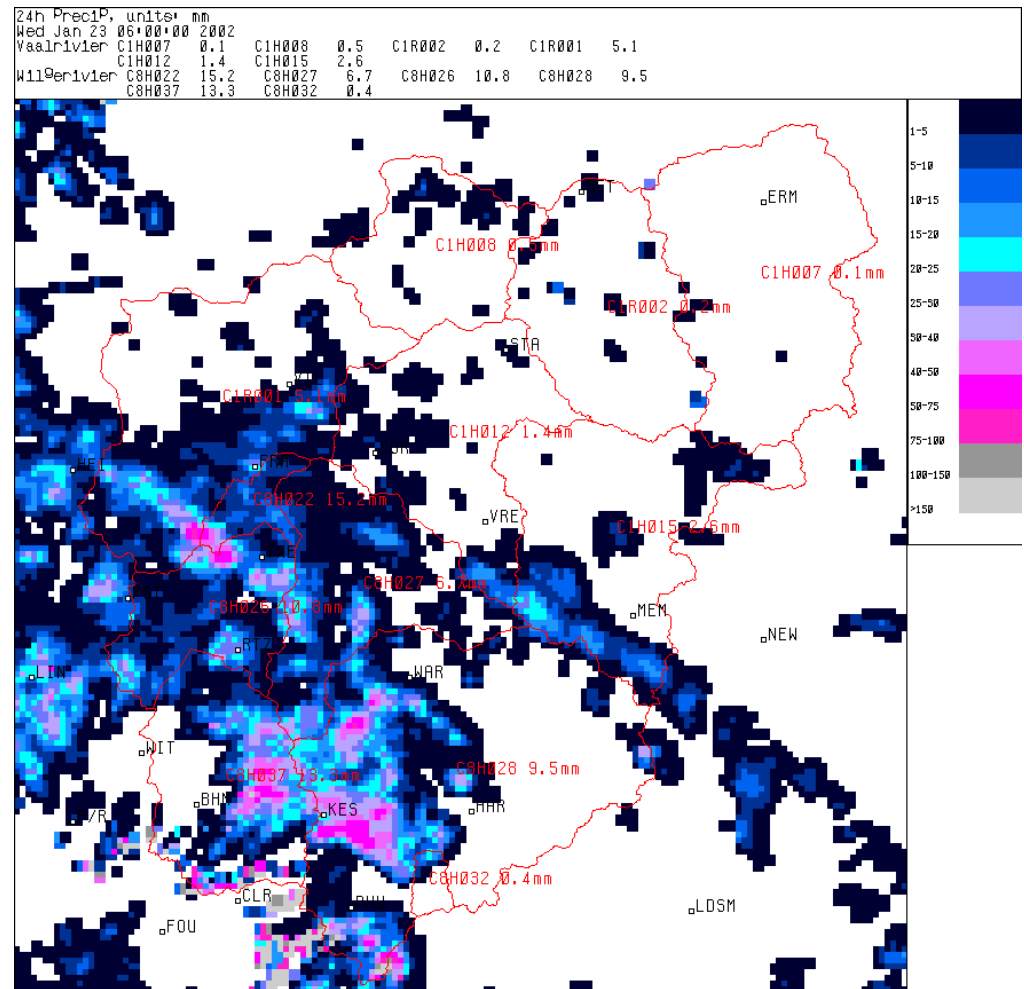
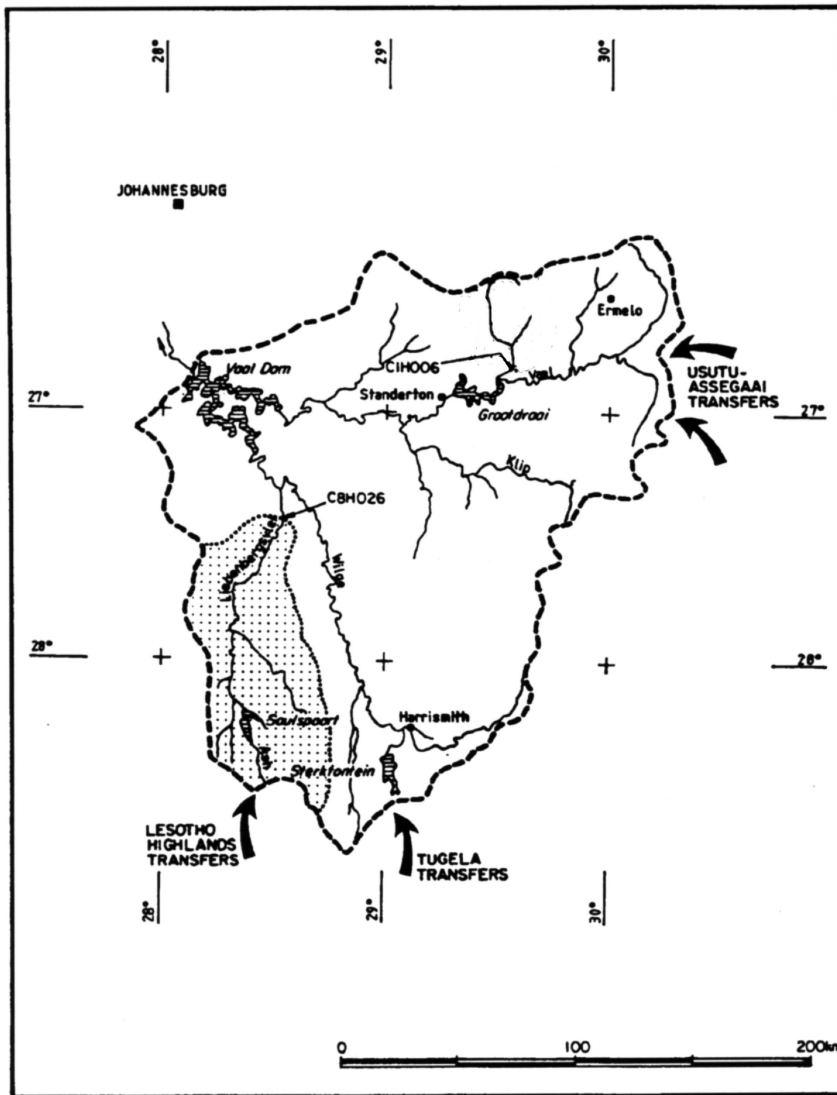


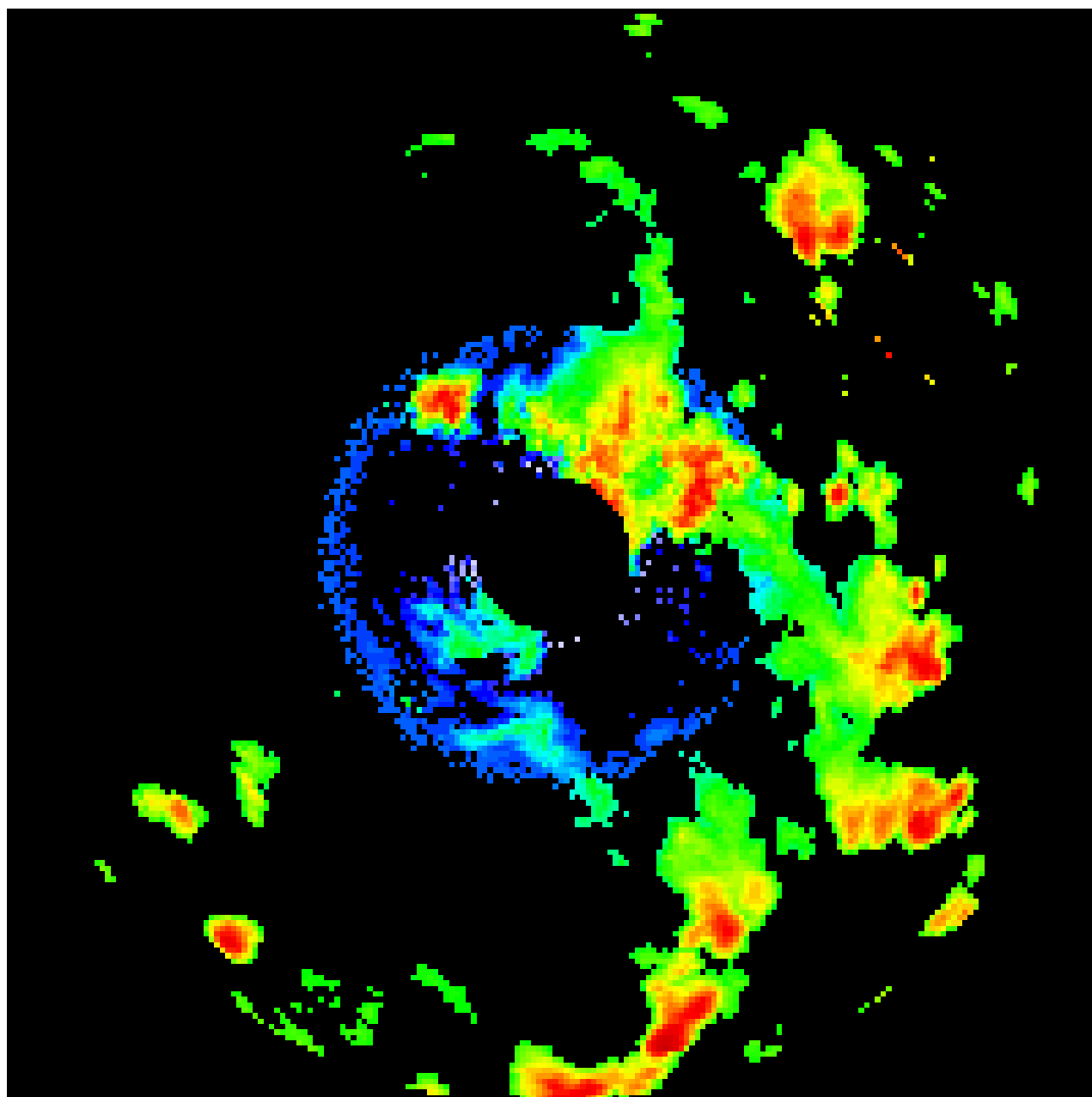
## rainfall estimation



- Real-time
- High spatial presentation
- Rainfall intensity
- Pre Flood warning
- Drought detection
- Catchment management
- Hydrological modelling
- Ecological management
- Disaster mitigation
- Operational management (Gautrain)
- Commodity trading (Grain)
- Open air events (2010)
- Insurance/Judicial
- Airport/Aviation/Transport

# THE VAAL DAM CATCHMENT AND DAILY RADAR ESTIMATED RAINFALL FIELDS







# A RADAR, RAINGAUGE STREAM FLOW COMPARISON DURING THE FEBRUARY 1996 FLOOD

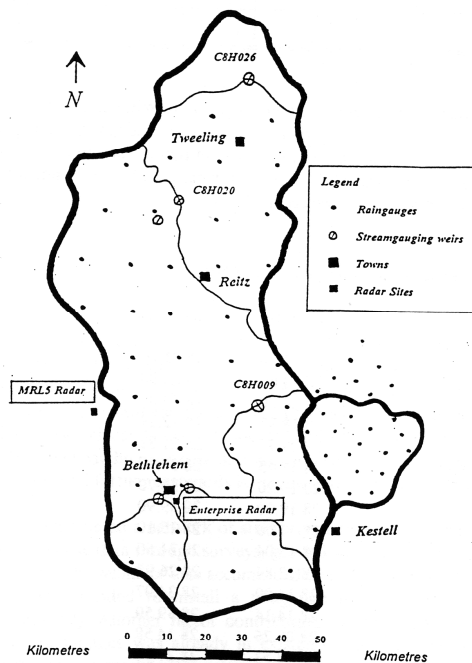
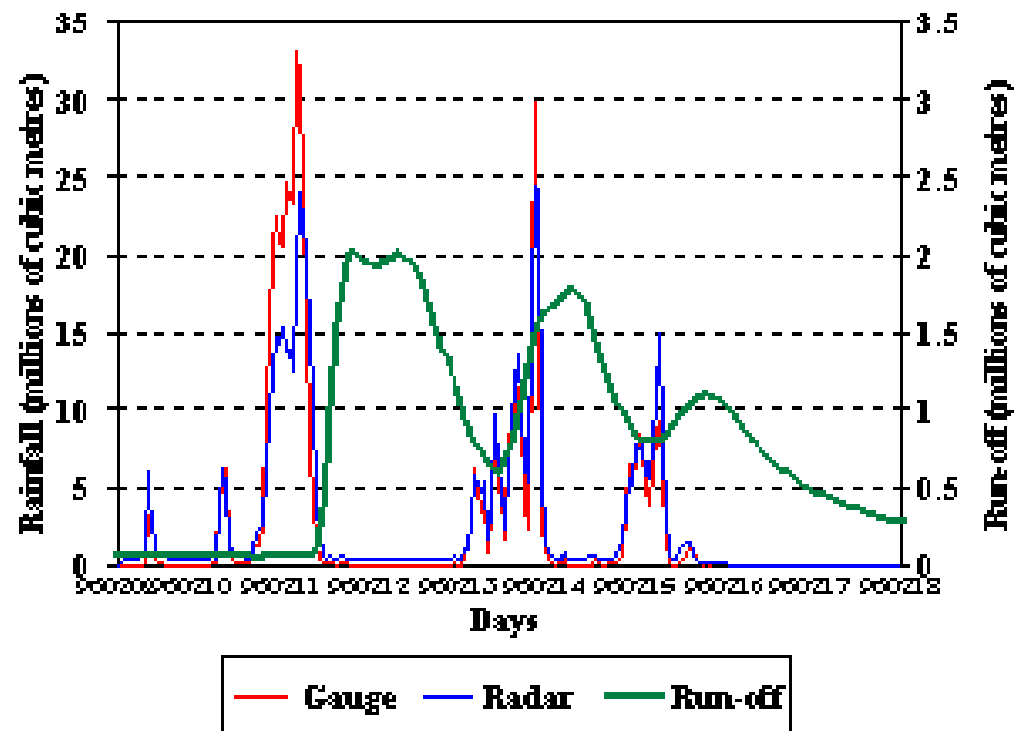


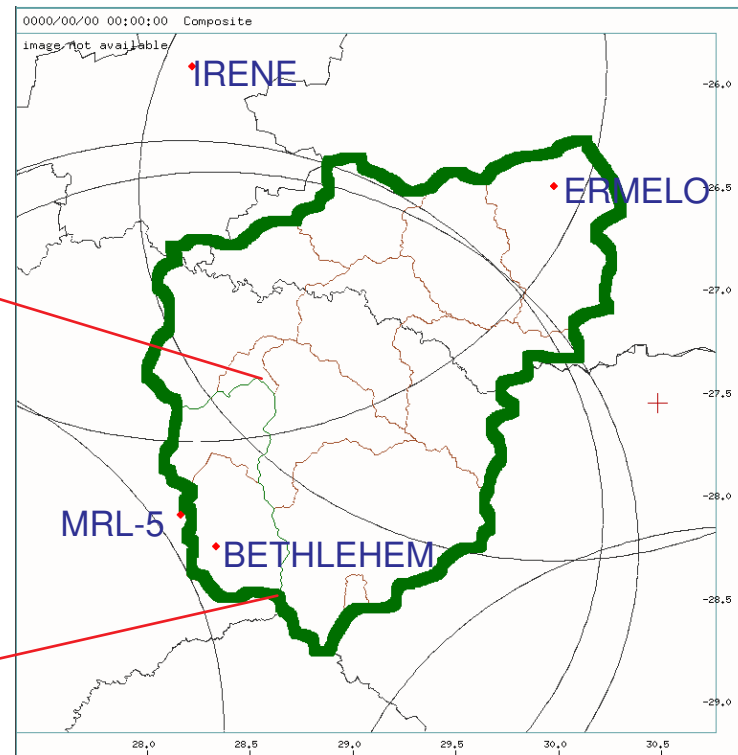
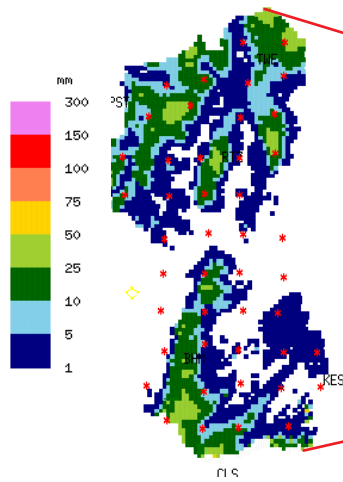
Figure 7.1 : Map of the Liebenbergsvlei catchment showing the raingauge network as well as the location of the different stream gauging weirs. Also shown is the position of the Vaalbankspruit catchment.

9 - 18 February 1996



# A CASE STUDY FOR 13 MARCH 1995

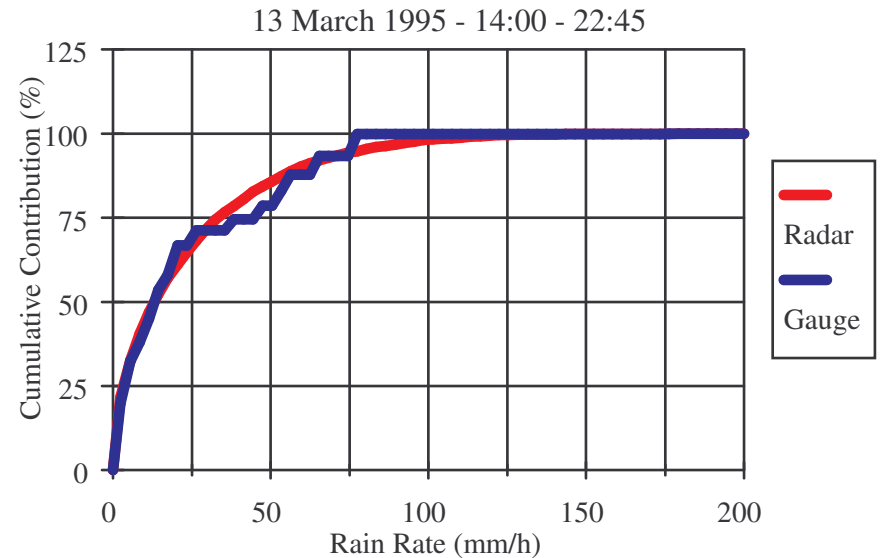
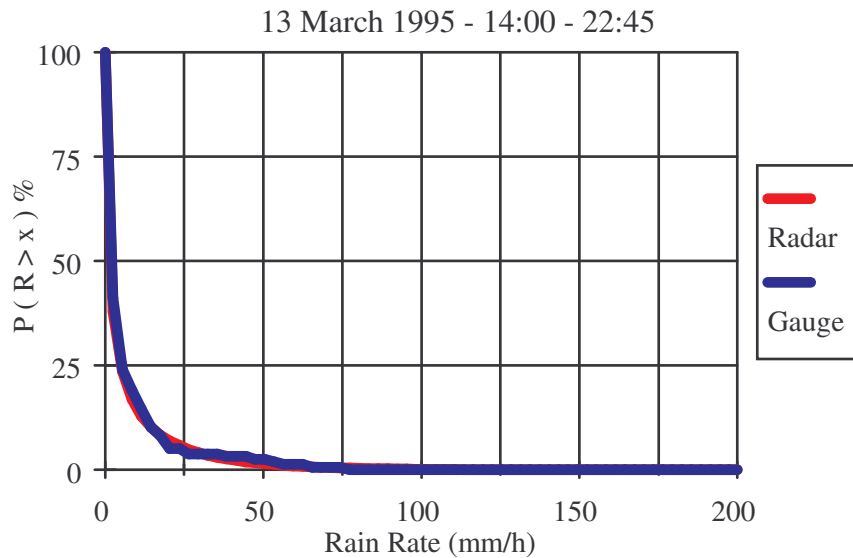
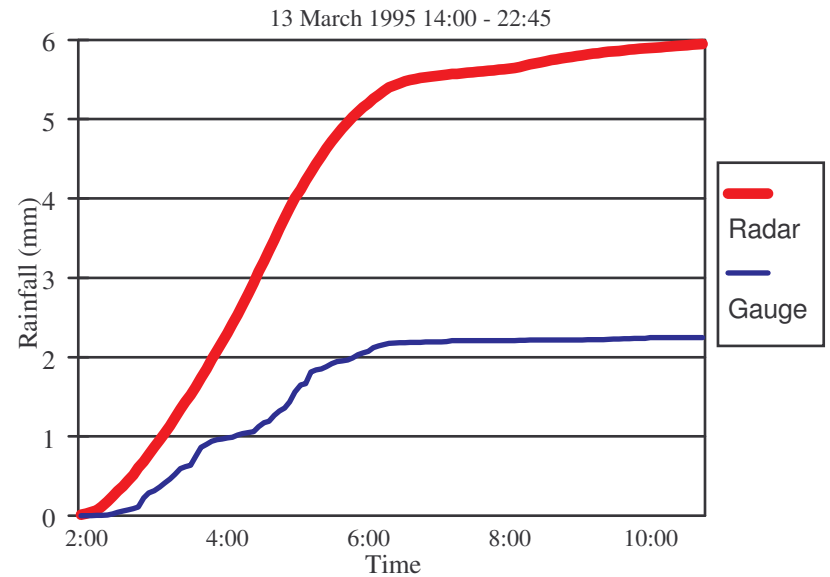
Vaal Dam catchment,  
radar coverage and  
45 research rain  
gauges over the  
Liebenbergsvlei sub-  
catchment



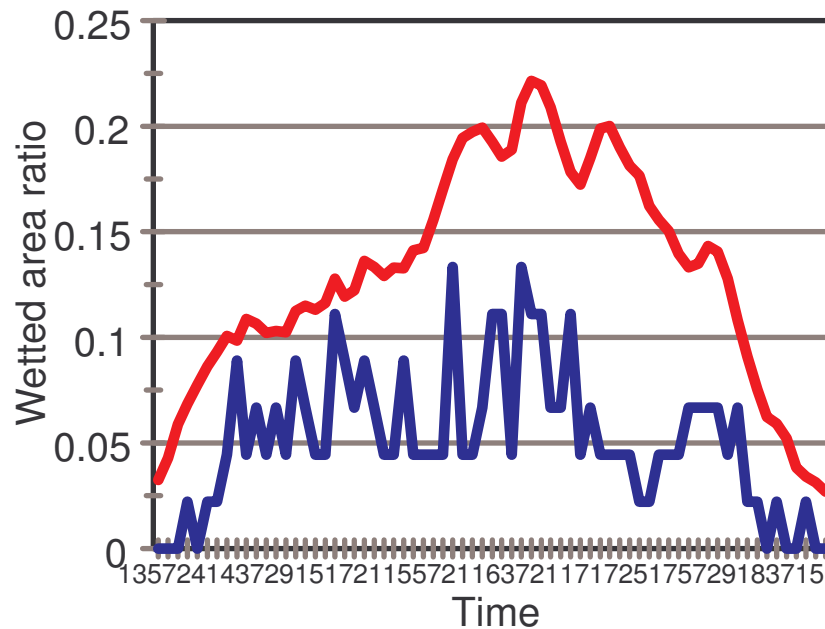


# A CASE STUDY FOR 13 MARCH 1995

Underestimation of area rainfall under convective condition when using only rain gauges



# A CASE STUDY FOR 13 MARCH 1995



Difference between radar and rain gauge wetted area  $\sim 2.5$

In South Africa  $\sim 300$  daily reporting rain gauges over  $\sim 1.2$  million  $\text{km}^2$ , one gauge per  $4000 \text{ km}^2$

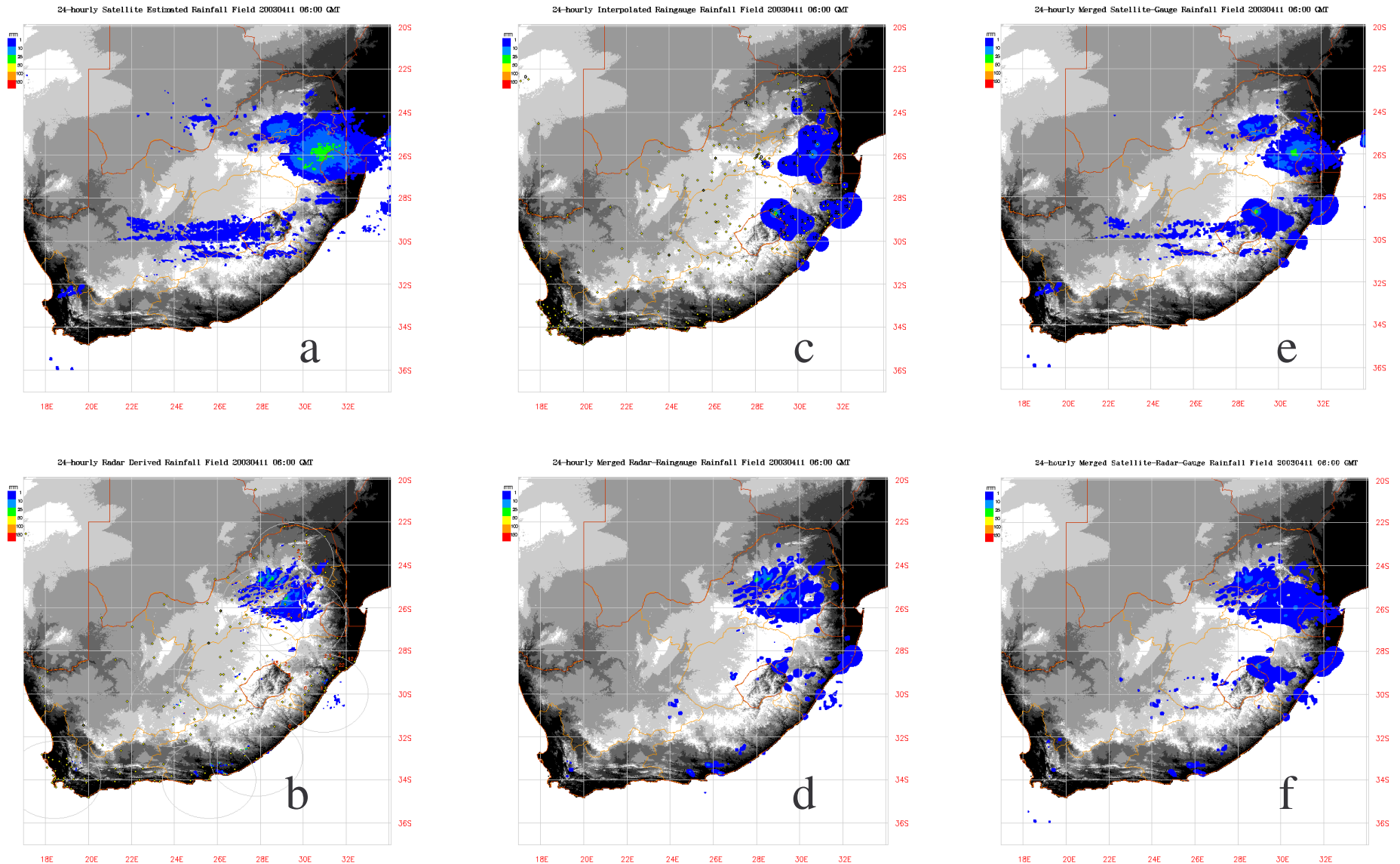
For 13 March 1995:

Probability of over estimation  $\sim 0.26$   
Probability of under estimation  $\sim 0.74$   
< half the area rainfall  $\sim 0.57$   
< quarter of rainfall  $\sim 0.52$



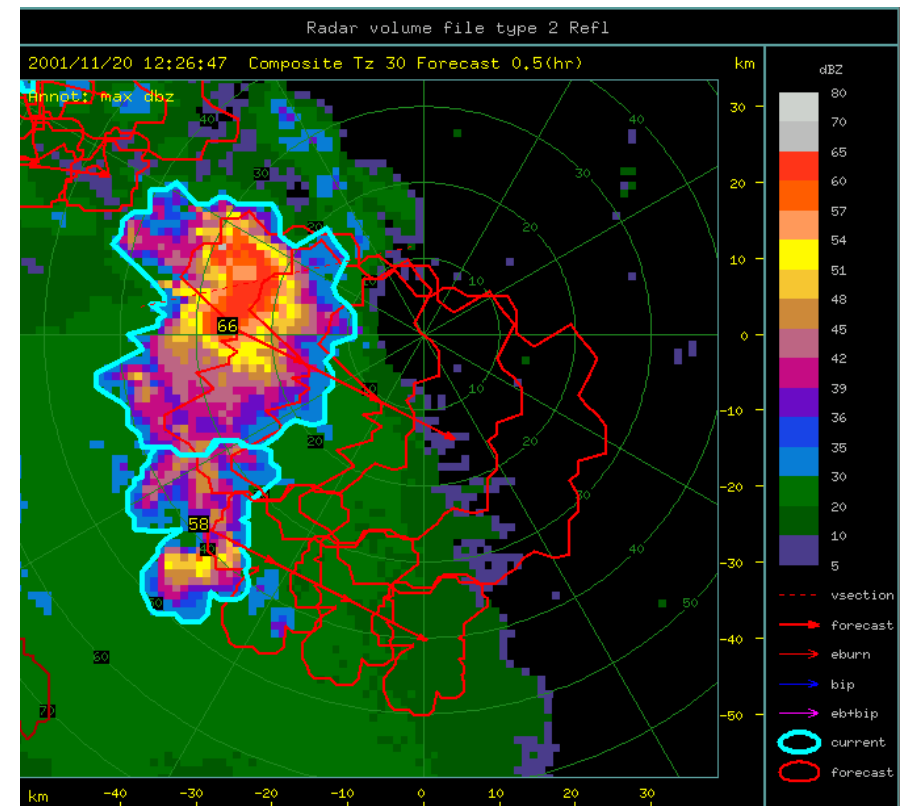
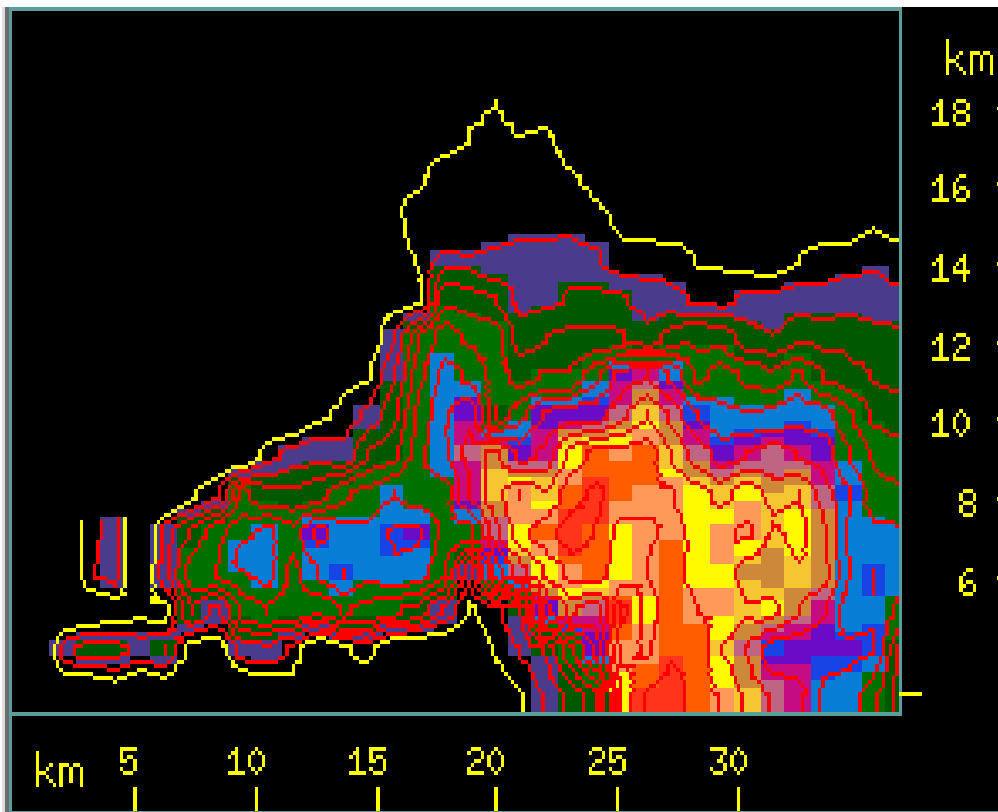
# Satellite - Radar Merging

SIMAR products a). Satellite, b). Radar, c). Gauge, d). Radar-gauge, e). Satellite-gauge, f). Merged

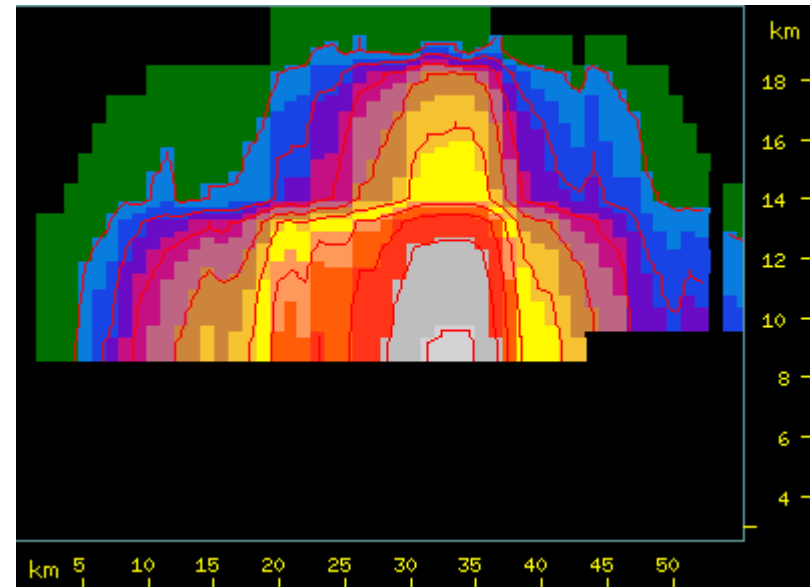
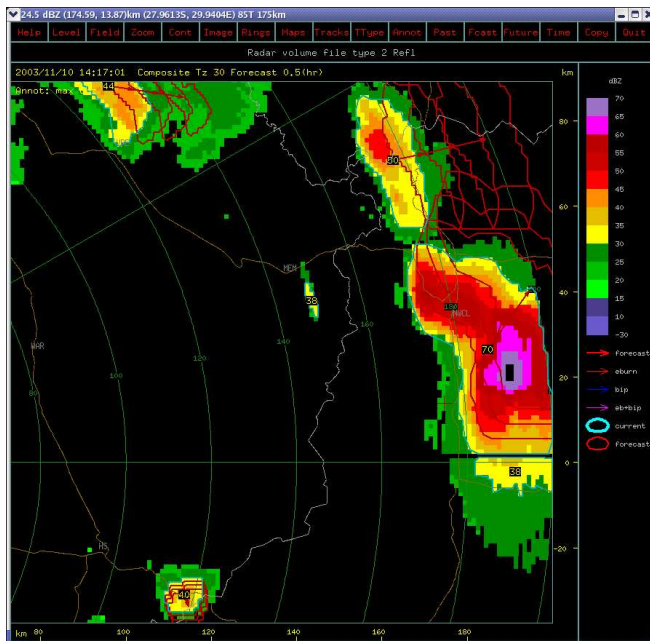


# Severe Weather

## Bloemfontein Hail storm of November 2001



## range limitations



10 November 2003  
Utrecht (KZN)

Severe storm lower half  
not detected at long range