South African Weather Service: The Value of Observations (Information)

Nico Kroese
Nico.Kroese@weathersa.co.za

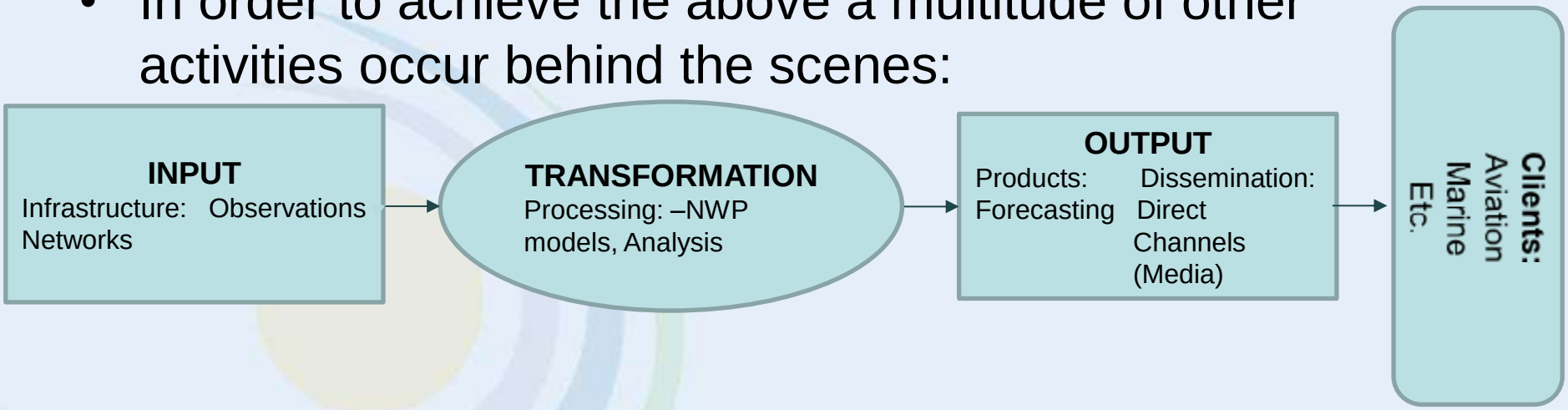
South African Weather Service

CONTENTS

South African Weather Service

1. Introduction

- NMS's are typically mandated to: Weather Forecasts, Monitor, collect and archive data
- In order to achieve the above a multitude of other activities occur behind the scenes:



- In order to support the above activities SAWS has developed a wide range of products and services.
- Focus is on some of the "Cinderella" (lesser known) products and services.

South African Weather Service

Value Chain of SAWS Operational Activities

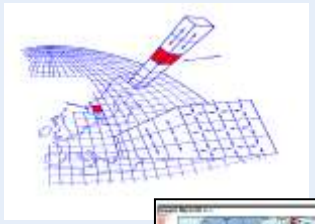
Infrastructure → Observations & Data Collection → Data Processing & Archiving → Products & Services → Clients

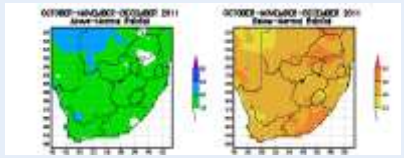
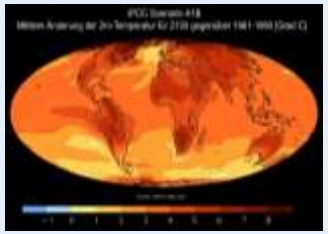
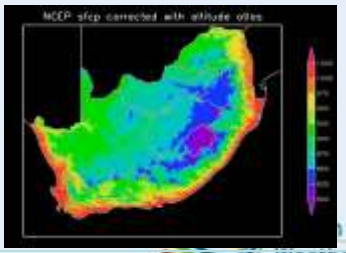








Document Reference: RES-PSN-SRS-20110603-001.1
Document Template Reference: AWC-PSN-001.1 Date of last revision: 3 June 2011

South African Weather Service

2. Why assign value?

- In the ‘public good’ domain, there is no market signal to indicate when supply meets demand
- Valuation provides a ‘**shadow price’** to help right-size the observation system

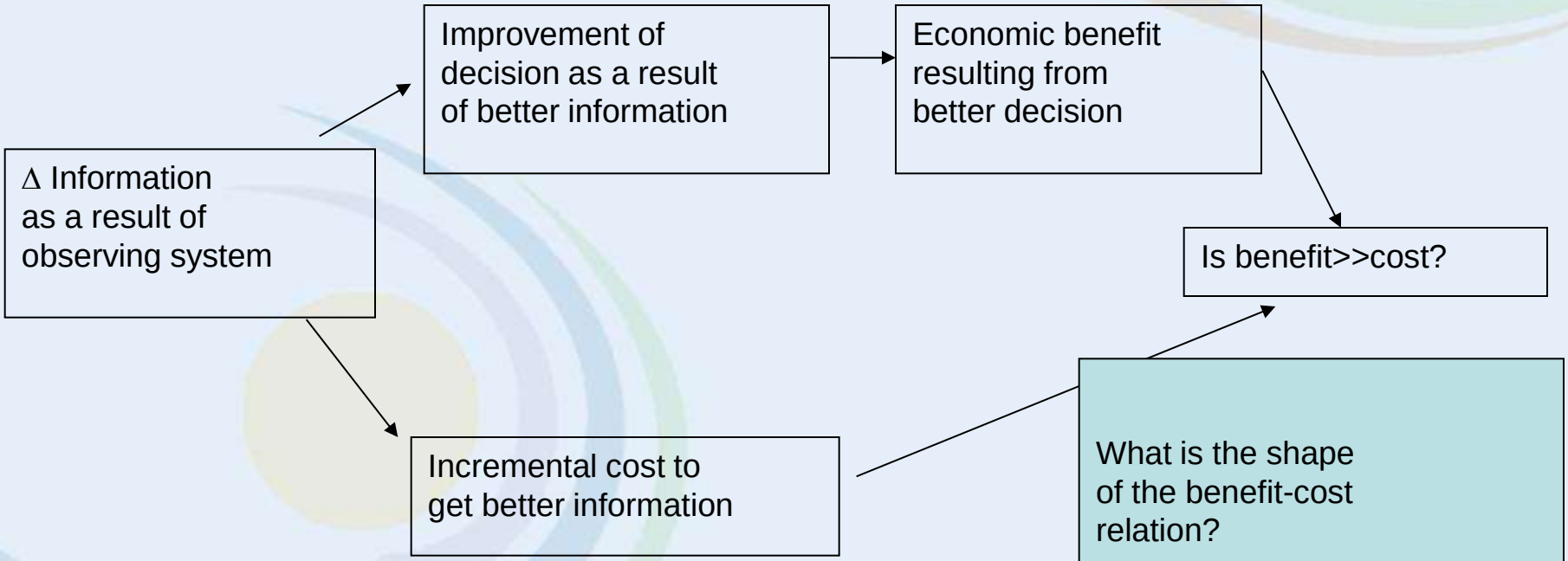
South African Weather Service

Approaches to right-sizing

- **Statistical :** sample intensity needed to meet a given level of confidence
- **Cost-benefit:** marginal cost of additional observation = marginal benefit derived
- **Decision-based:** what information is needed, and how accurate does it have to be, to lead to a change in decision

South African Weather Service

Building a value chain for observation systems



Fritz, S., R.J. Scholes, M.Obersteiner , J. Bouma and B. Reyers. 2008. A conceptual framework for assessment of the benefits of a Global Earth Observation System of Systems. *IEEE Systems Journal*, 2(3), 338-348

What constitutes a “good” observation (Information)?

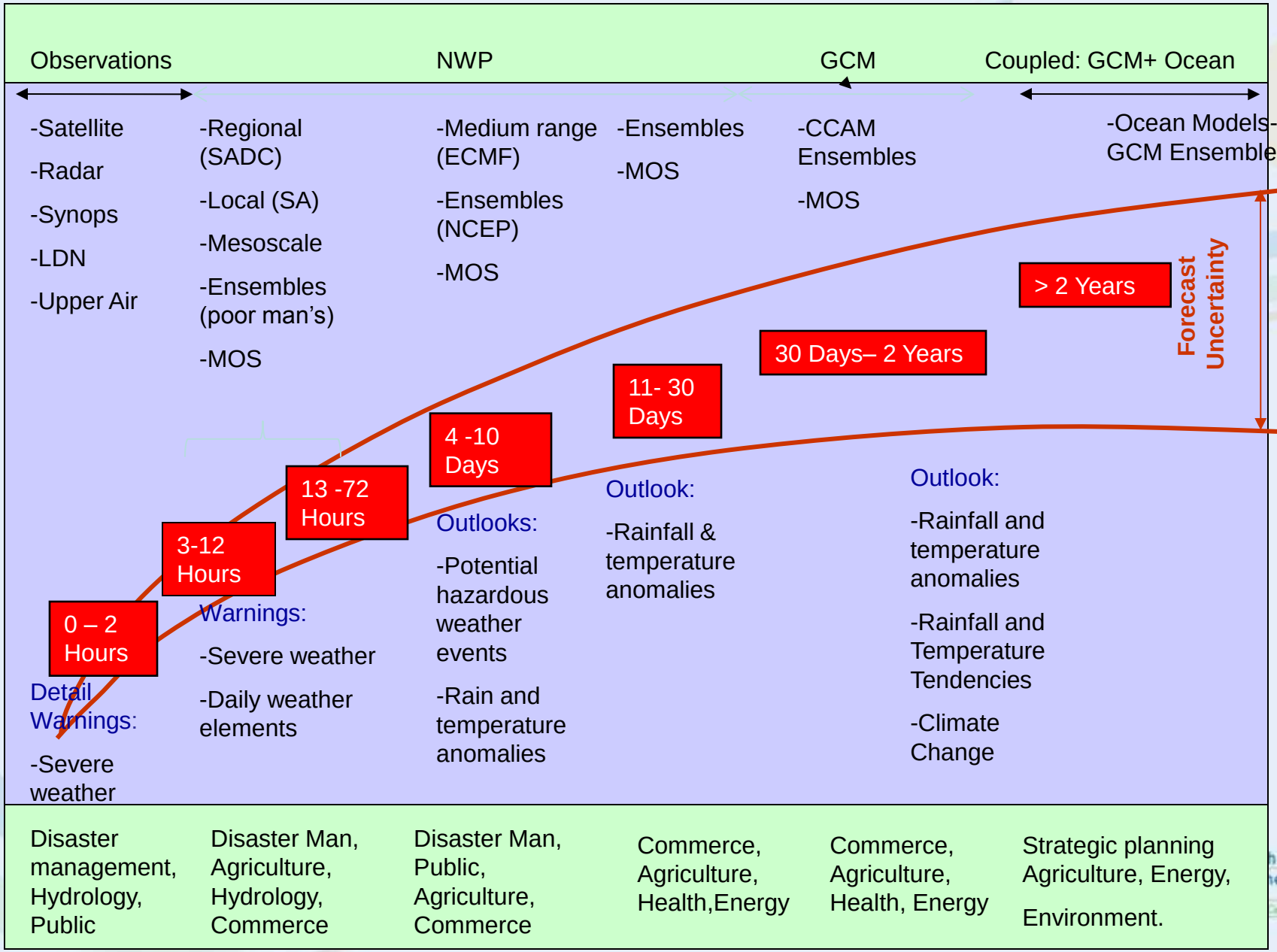
- Available (Accessible)
- Accurate (calibrated instrument)
- Timeous
- Relevant
- Did it affect a decision?

South African Weather Service

3a. Forecasting

- Traditionally the first service that comes to mind.
- Most activities carried out “behind the scenes” – are geared towards supporting the Forecasting Service.
  - New products are being developed to support the forecaster with the objective of obtaining a more accurate forecast.
- One aspect of Forecasting weather and climate is that the phenomena occur on a variety of time scales

The SAWS "Seamless" Forecasting System



3b. Climate Services

- Another big mandate for a NMS is to act as :
  - Custodian of meteorological data
  - Quality control of data
  - Archiving data
  - Making data accessible

Typical Climate Services

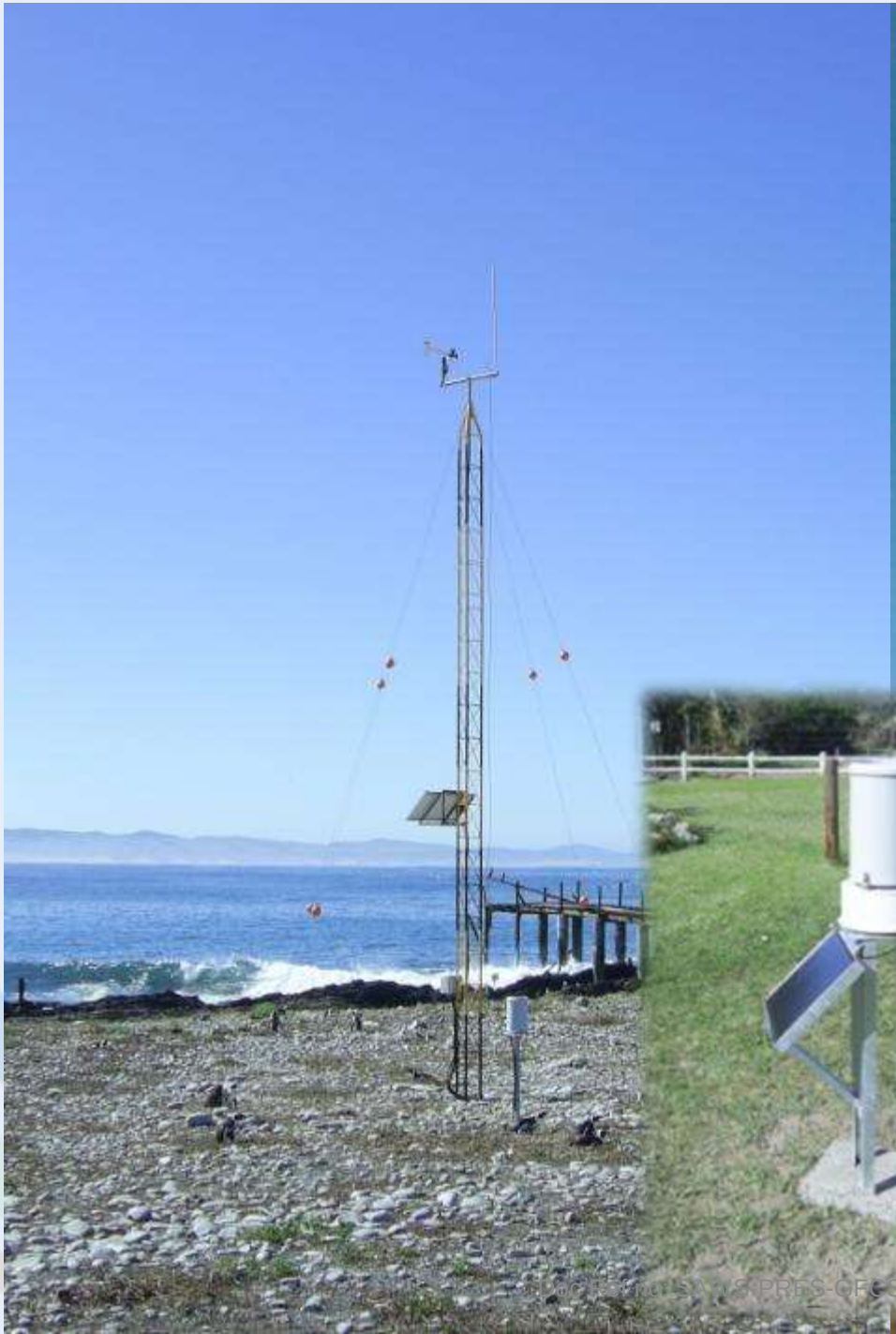
- Images
- Reports
- Surface data
- Other data sets e.g. model data
- Tables
- Graphs
- Consultations
- Near real-time data
- Publications

South African Weather Service

3c. Infrastructure(In–house Manufactured)

- Automatic weather stations (AWS) (Standard / Aviation)
- Automatic Rainfall Stations (ARS)
- Community Rainfall Stations (CRS)
- Hybrid CCTV / AWS systems

South African Weather Service

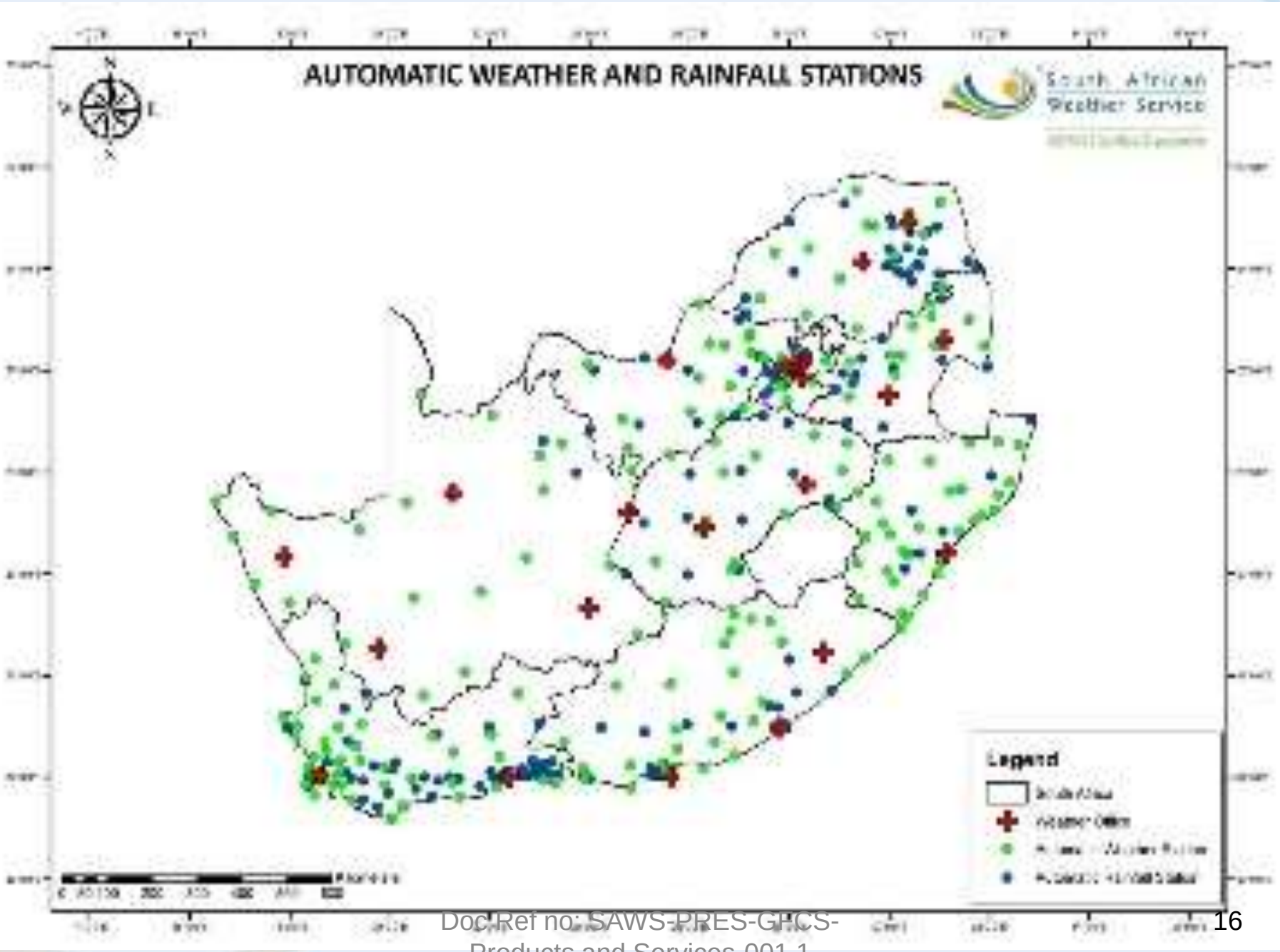


Hybrid AWS

Nelson Mandela Municipality
AWS and Pan Tilt Zoom camera

Fettes Street – close to PE Stadium

Port of Ngqura


AUTOMATIC WEATHER AND RAINFALL STATIONS
South African Weather Service
Legend

3d. Applications & Other

- NMS's are required to assist in non-meteorological disciplines as meteorological data play a critical role.
- Examples:
  - Transport – Aviation ,Marine
  - Agriculture
  - Hydrology
  - Health
  - Renewable Energy etc.

- "NEW MANDATES"

  Air Quality (SAAQIS)

  Global Atmospheric Watch(GAW)

Air Quality: South African Air Quality Information System (SAAQIS)

- Three Main Functions
  1. Hosting SAAQIS Website;
     - Ambient air quality monitoring data from government owned monitoring stations
     - Associated information and documentation
  2. Operation of Ambient Air Quality Monitoring Stations in National Air Quality Priority Areas
  3. Development and Operation of National Atmospheric Emissions Inventory System

Future – Air Quality Modelling and Forecasting

South African Weather Service

Global Atmosphere Watch Laboratory at Cape Point

South African Weather Service

Trace gases and other parameters measured at Cape Point

- CO_2, CH_4, N_2O as well as CO and surface O_3
- Halocarbons (in-situ): $CFCl_3$, CCl_4, CH_3CCl_3, $CCl_2F\text{-}CClF_2$ and CCl_2F_2
- SO_2
- Aerosol optical properties (since Nov 2005)
- ^{222}Rn (tracer)
- Total gaseous mercury (TGM)
- Solar radiation: UVA, UVB, global (total & diffuse)
- Wet precipitation chemistry
- Passive sampling for NO_2, NH_3, SO_2 and O_3
- Met parameters: wind, pressure, temperature, humidity, rainfall
- Aerosol Measurments
- SANAE Surface Ozone and SAOZ spectrophotometer

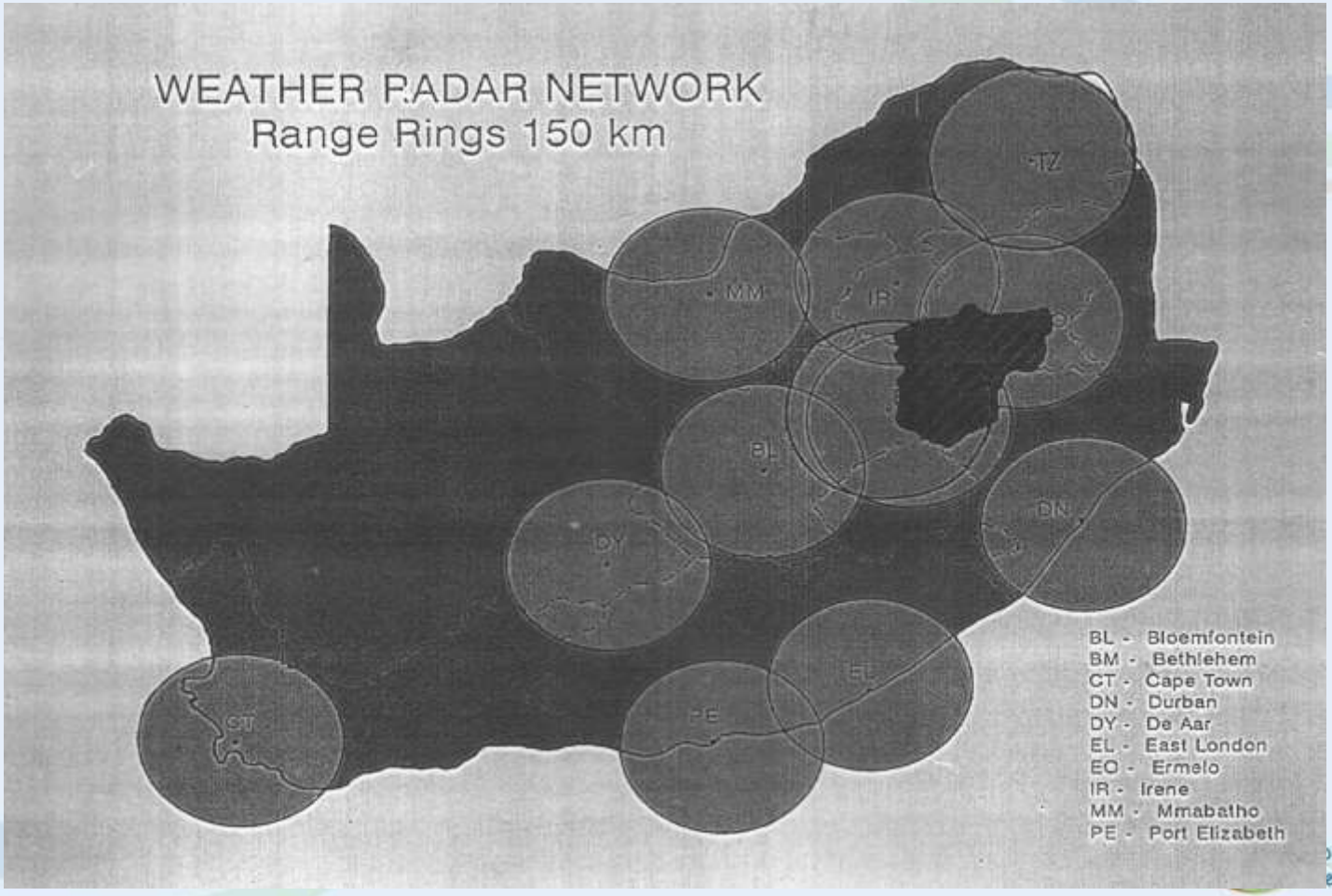
4a. Case Study 1: 1996 Vaal Dam Floods

Height of Vaal Dam wall was raised in 1985.
Accommodate 26% additional capacity for flood management.

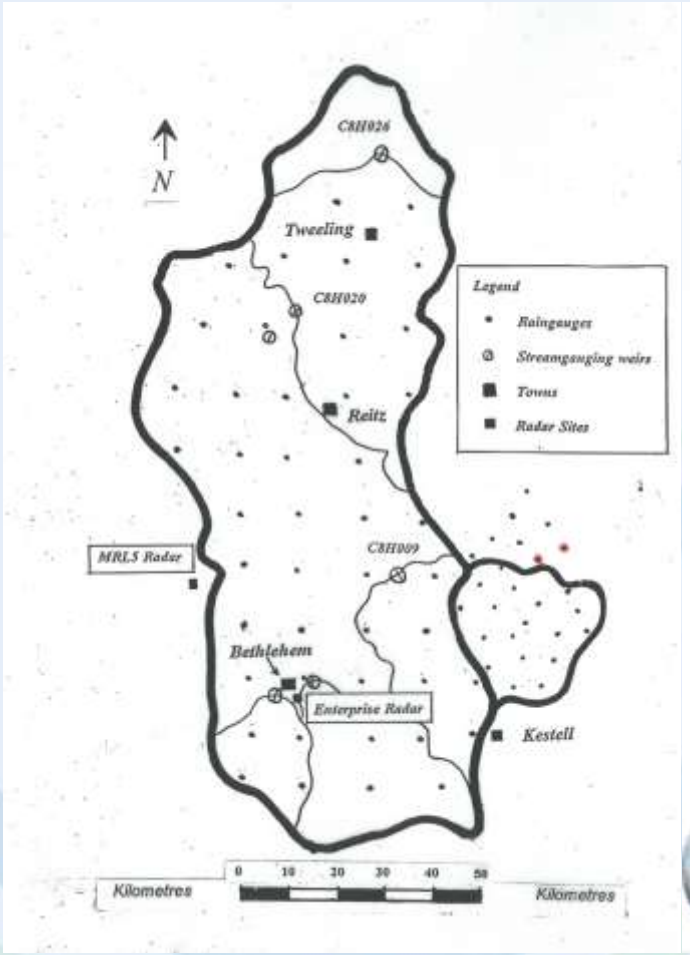
Vaal Dam Catchment with measuring points

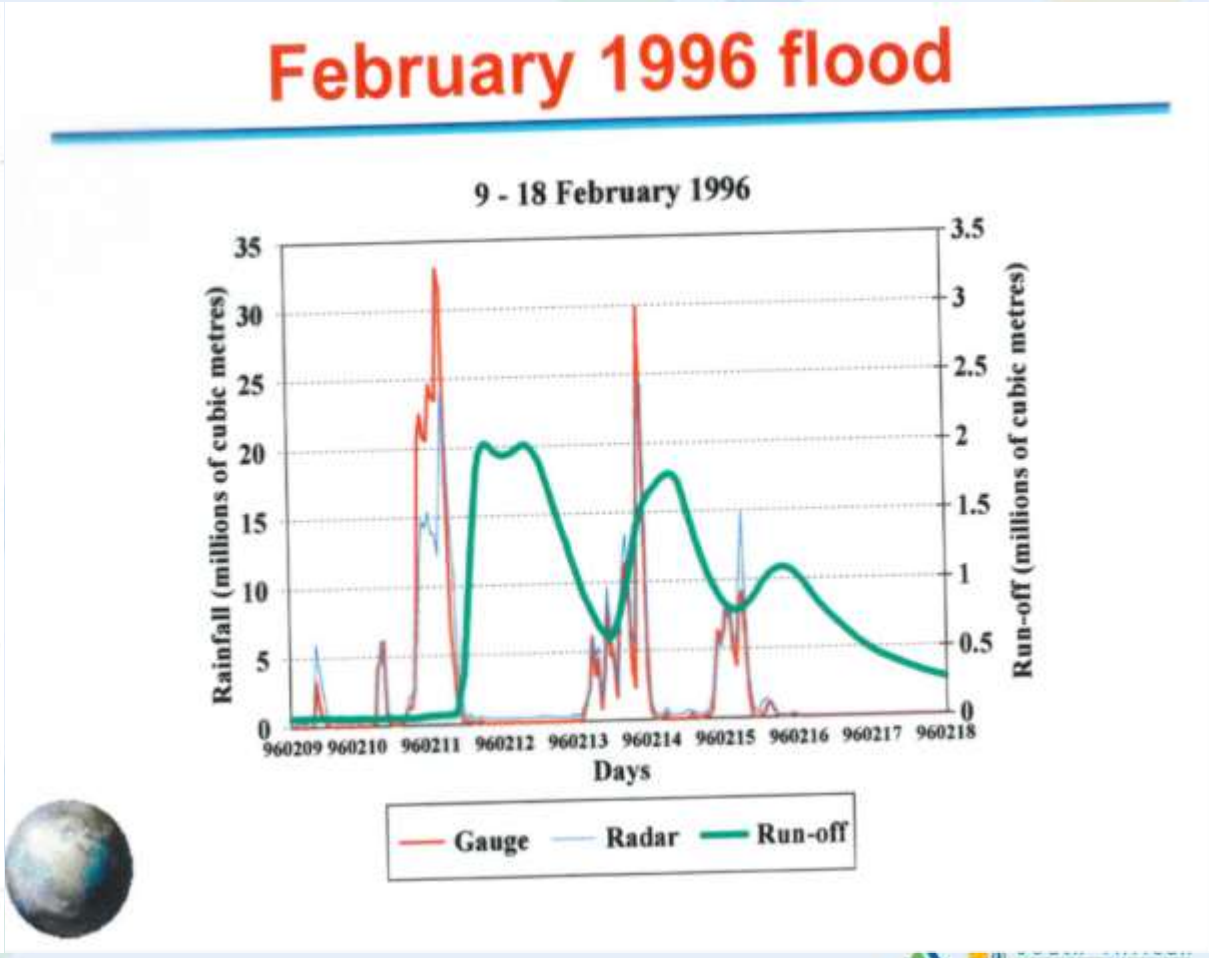
South African Weather Service

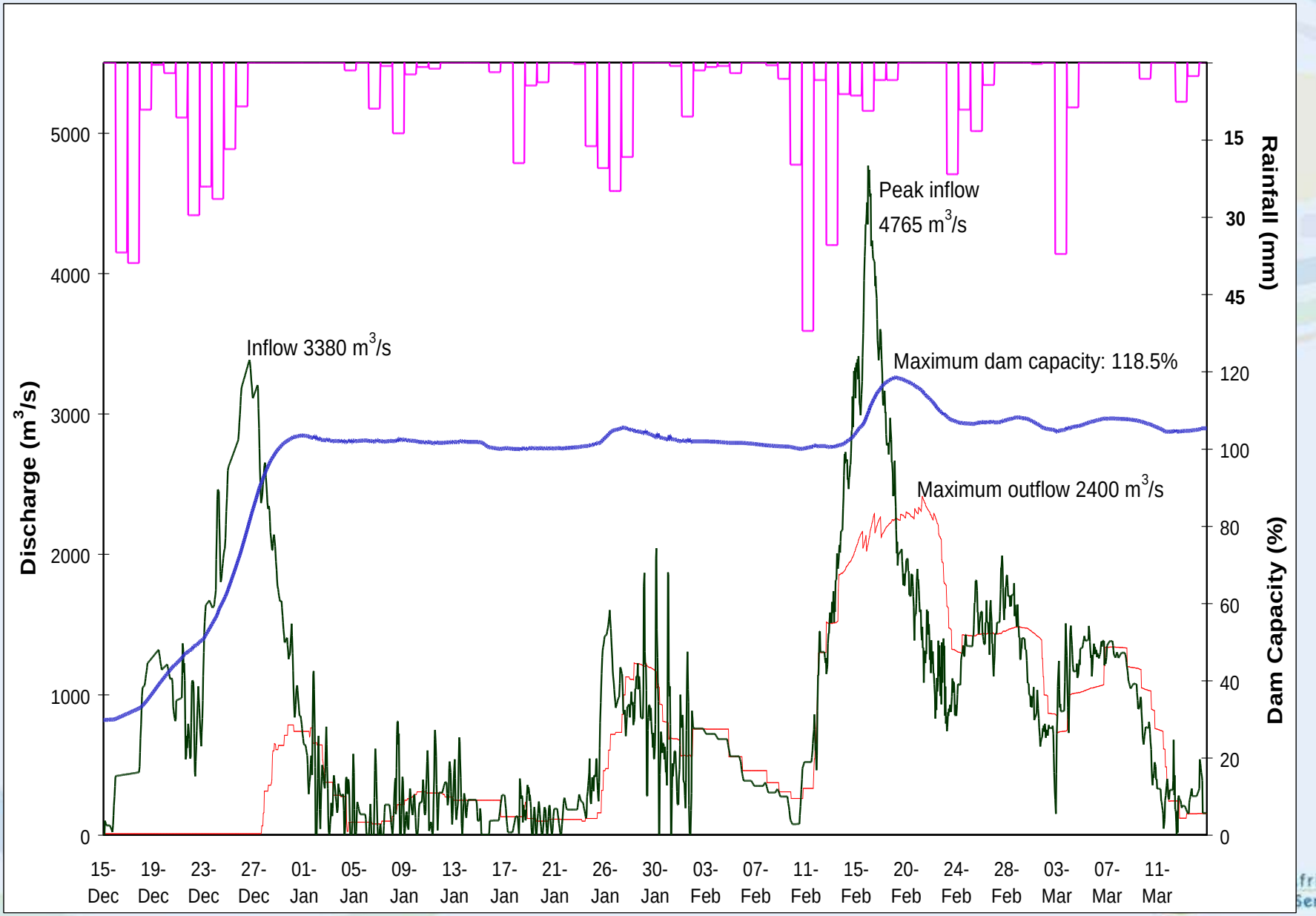
SAWS Weather Radar Network in 1996



Liebenbergsvlei River Catchment






Peak inflow
4765 m3/s
Inflow 3380 m3/s
Maximum dam capacity: 118.5%
Maximum outflow 2400 m3/s
Discharge (m3/s)
Rainfall (mm)
Dam Capacity (%)
0
1000
2000
3000
4000
5000
15
30
45
0
20
40
60
80
100
120
15-Dec
19-Dec
23-Dec
27-Dec
01-Jan
05-Jan
09-Jan
13-Jan
17-Jan
21-Jan
26-Jan
30-Jan
03-Feb
07-Feb
11-Feb
15-Feb
20-Feb
24-Feb
28-Feb
03-Mar
07-Mar
11-Mar

Comments from DWA

- *When to start making use of the flood absorption capacity of the dam (Vaal Dam 26%)? (The volume of the 1996 flood at Vaal Dam was larger than 3 x the volume of the Vaal Dam.*

- *Weather forecasts: Short, medium and long term weather forecasts, satellite and radar images and 24-hour rainfall figures play a major role in operating decisions during the flood.*

(Dept. of Water Affairs)

Evaluation –Case Study 1

Description	YES/NO
1. Available?	Yes
2. Timely?	Yes
3. Accurate?	No
4. Relevant?	Yes
5. Did it impact on a decision ?	Yes
6. Did the decision/s lead to a positive result?	Yes

Cost Savings: R100's of millions

4b. Case Study 2: Resolution of land cover mapping

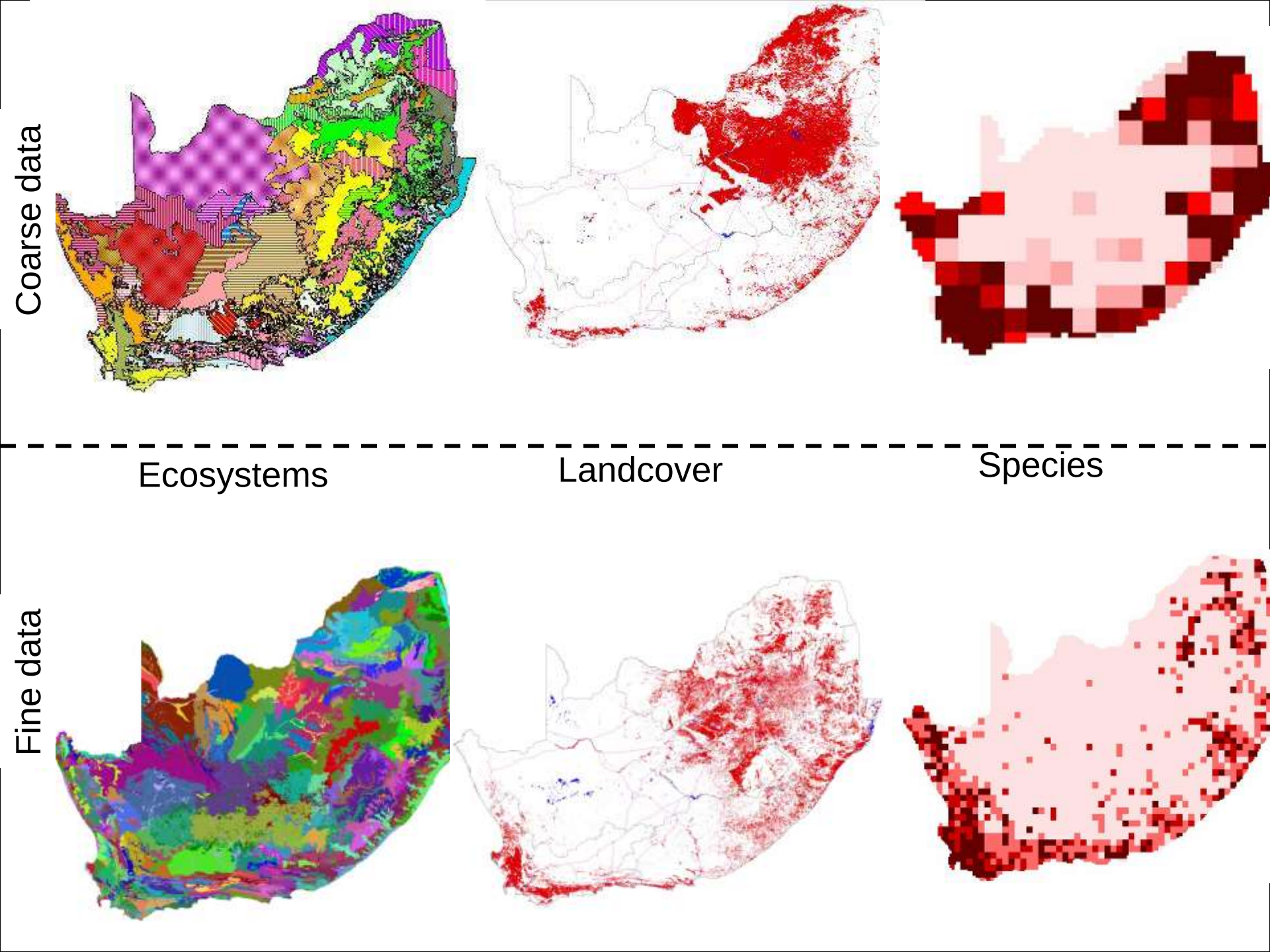
- Global land cover maps have a resolution of 1 km, and are free

- The South African national land cover mapping procedure requires and delivers maps at a higher resolution (30 m), at a cost of ~R10 million every five years

- **Is the cost of the increased resolution justified?**

South African Weather Service

Scholes, RJ and B Reyers 2009 GEOBENE final Report, CSIR


Coarse data
Fine data
Ecosystems
Landcover
Species

Case Study 2 (continued)
Resolution of land cover mapping

Results:

- The land acquisition cost for an optimal protected area layout as predicted using the coarse data was higher than the cost using the finer-scale data.

- Restoration efforts were better targeted using finer data.(High Resolution)

- The differences were greater than the cost of acquiring better data.

South African Weather Service

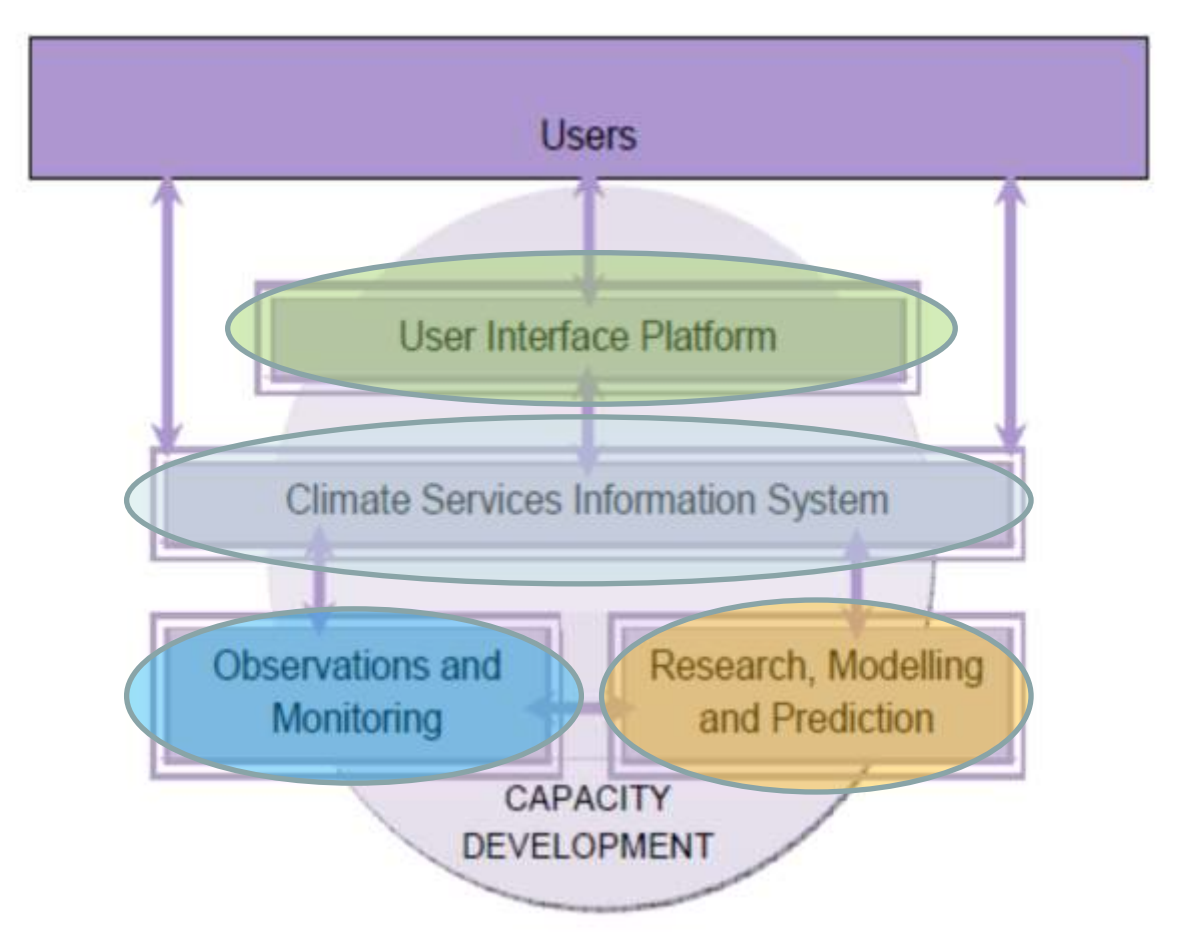
Scholes, RJ and B Reyers 2009 GEOBENE final Report, CSIR

Evaluation –Case Study 2

Description	YES/NO
1. Available?	Yes
2. Timely?	Yes
3. Accurate?	No
4. Relevant?	Yes
5. Did it impact on a decision ?	Yes
6. Did the decision/s lead to a positive result?	Yes

Cost Savings: R10’ of millions

Links to GFCS objectives



South African Weather Service

5. Challenges & Conclusions

- Questions to address:
  - What future observation platforms / networks / practices are needed? –Social Media, alternative sources (Sharing of data between institutions), Crowd Sourcing (UKMO-WOW) (Can we afford to carry on with business as usual?)
  - Addressing GFCS objectives will require **new** and established multi-institutional **partnerships** and new concepts of teamwork and collaborative research. "New structures" ?
  - Capacity being established – where do they practice their careers? Operational Institutions – Are we ready to accommodate newly skilled scientists ?

South African Weather Service

5. Challenges & Conclusions (continued)

- To Support GFCS activities in future:
  - Maintain the importance and traditions of current best practices

    -BUT-

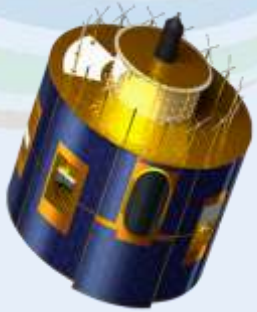
    Invest in new technologies/methodologies that directly impact Climate Change
  - E.g. Modelling efforts to follow the “Earth Systems“ approach.
  - Investment in non-traditional observation instruments and platforms (Aircraft, Hybrid AWS, Air quality)
  - Instruments: SAAQIS and GAW Observations to become “routine”. Measurements of parameters such as:
    - Aerosol loading in Atmosphere
    - Aerosol Optical depth
    - Absorption & Scattering Coefficients
    - Black Carbon Mass
    - Cloud Parameters: Cloud Condensation Nuclei Characteristics

Unconventional Platforms: Satellite

- Geostationary Satellites: EUMETSAT

  Comprehensive utilisation

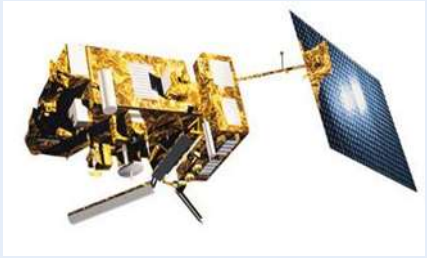
  Room for improvement (climate applications)



- Polar Orbiter (Environmental Satellites)

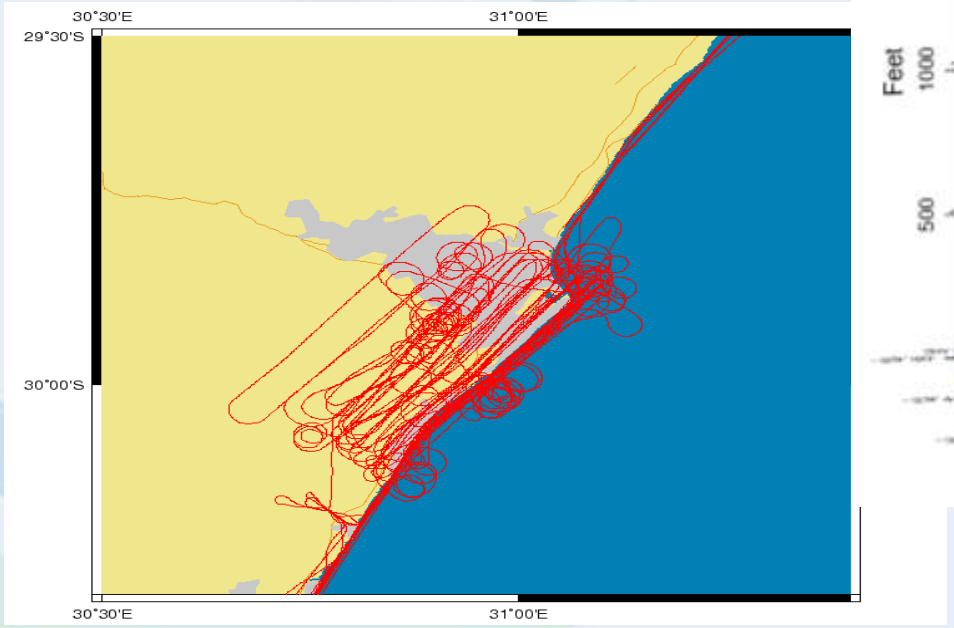
  Limited utilisation (Temporal resolution)

  New fields to explore (air quality etc.)

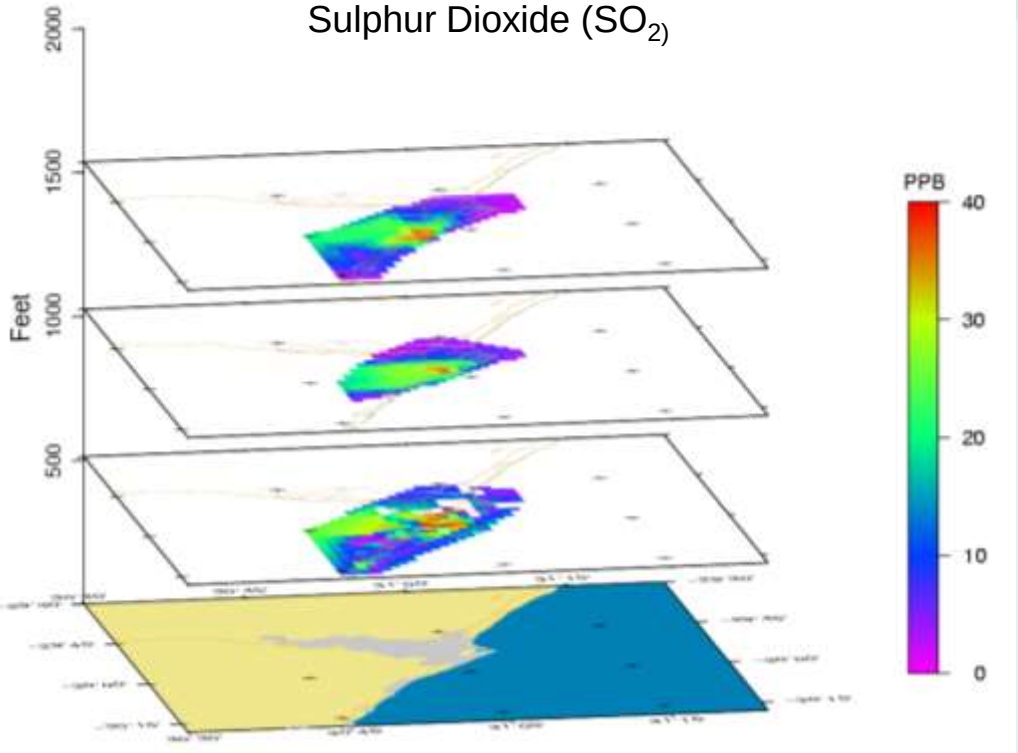


South African Weather Service

Unconventional Platforms: AIRCAFT OBSERVATIONS



Sulphur Dioxide ($SO_{2)}$



South African Weather Service

Unconventional Platforms: Social Media, Institutional sharing etc.

1**. Mobile phone as observational platforms:**

- Applications for mobile phones
- Pros and Cons

2. Institutional Sharing:

- Observation Infrastructure = Fragmented.
- Meteorological variables are core to any observations for projects and /or programmes

Thank you for the time afforded to listen to this presentation

"**BUT**"

Let us think and act on he challenges!