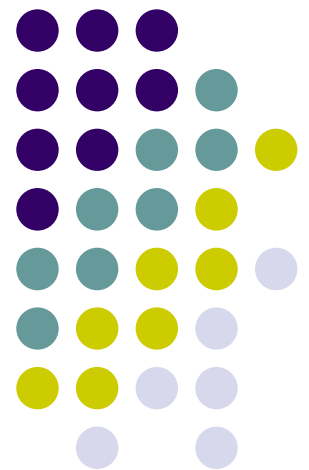# Application of Forecast Probabilities: SA input
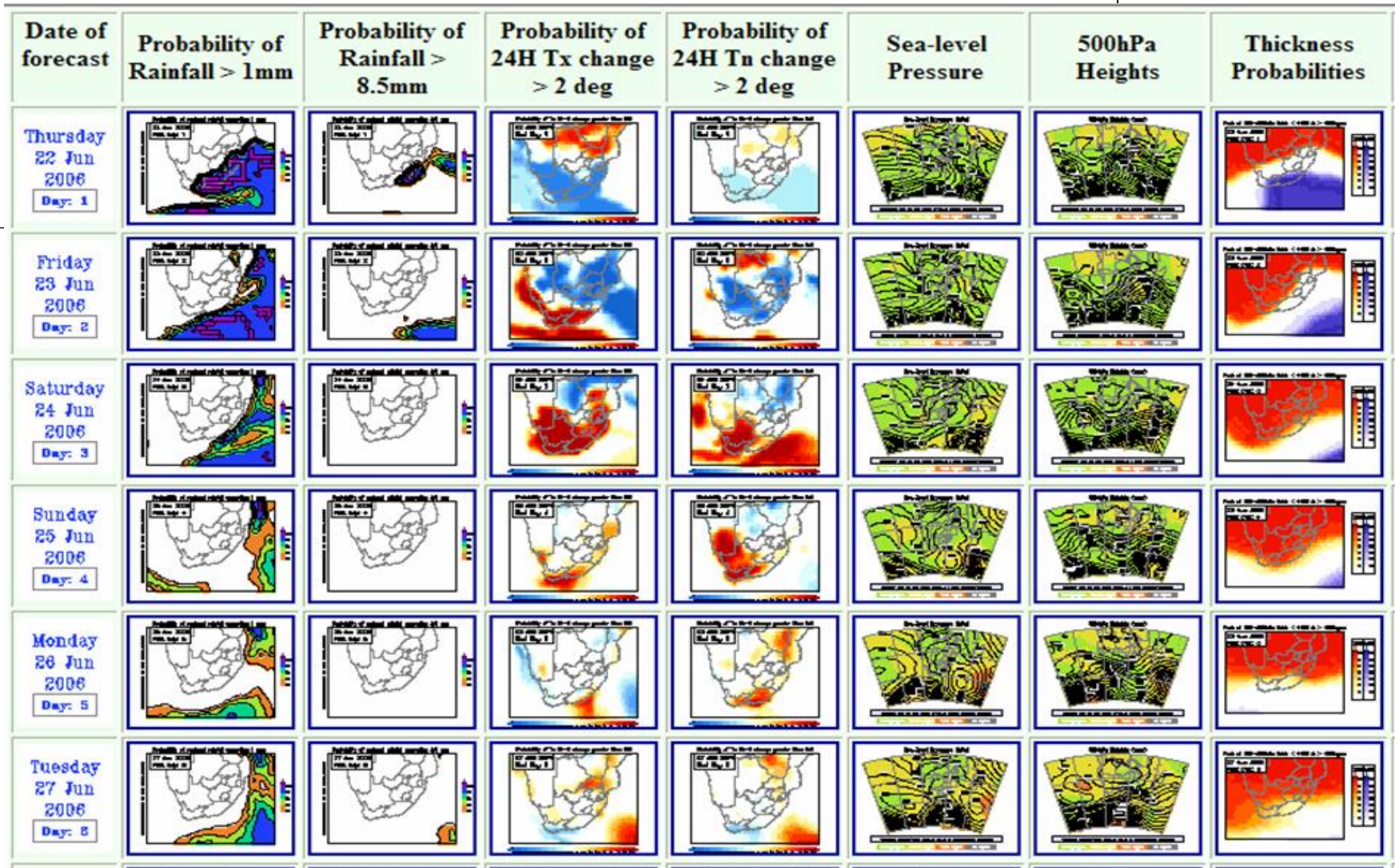
Eugene Poolman
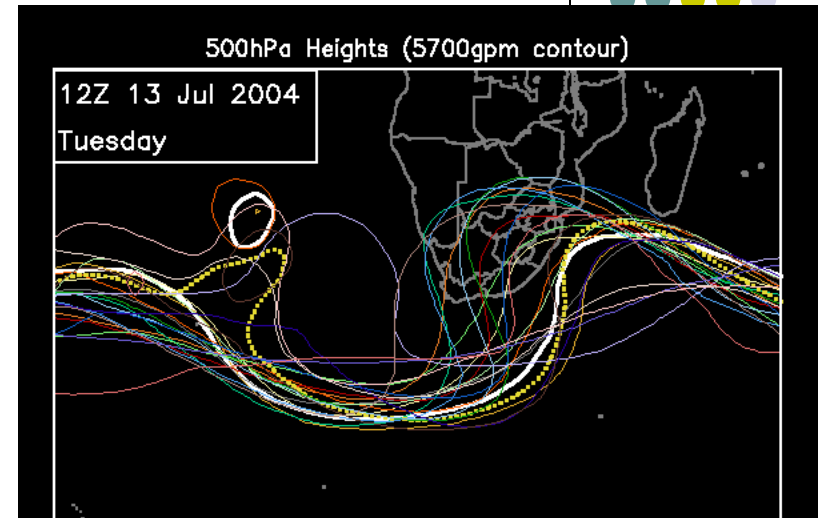## SAWS

South African
Weather Service

Web-based Ensemble prediction product

Forecast for 13 July: 6 days in advance
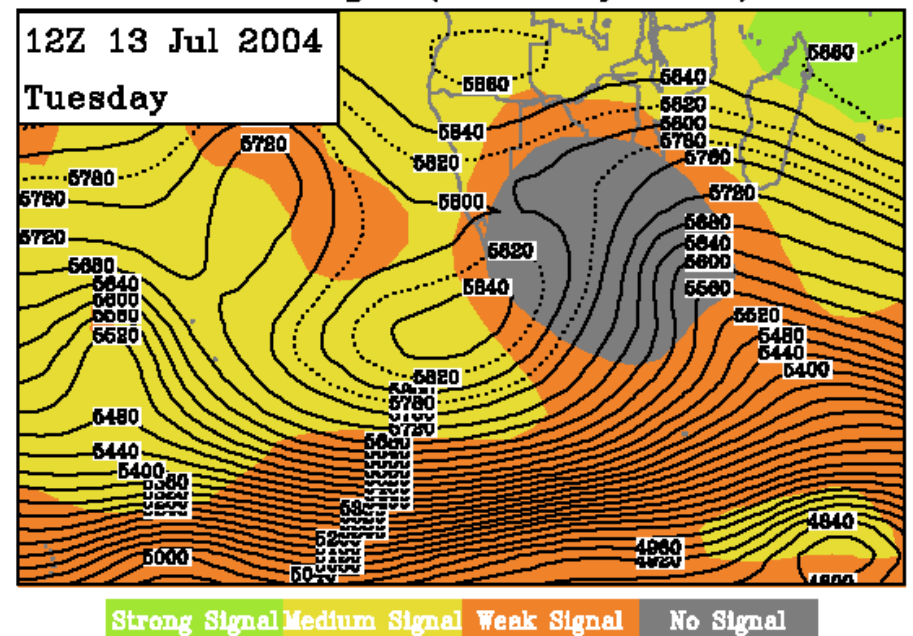

Prob of 850–500hPa Thick < 4100 & > 4200gpm

13 Jul 2004

500hPa Heights (5700gpm contour)

12Z 13 Jul 2004
Tuesday
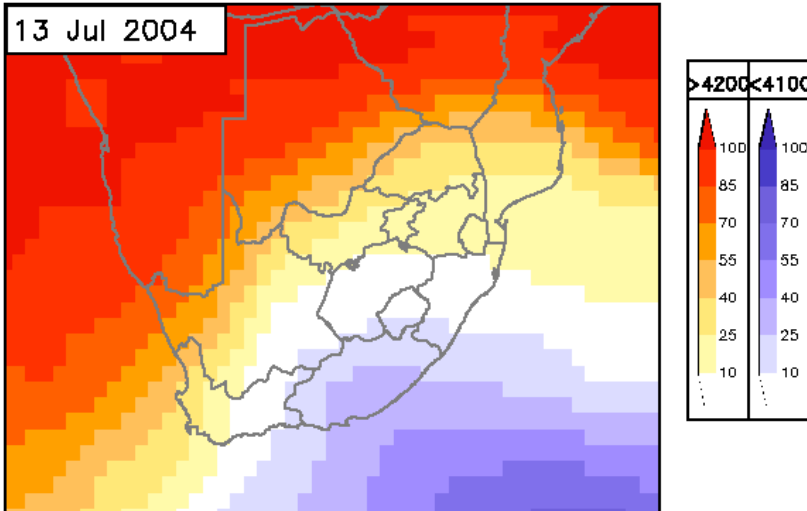
Probability of Tx 24-H change greater than 2 deg

13 Jul 2004
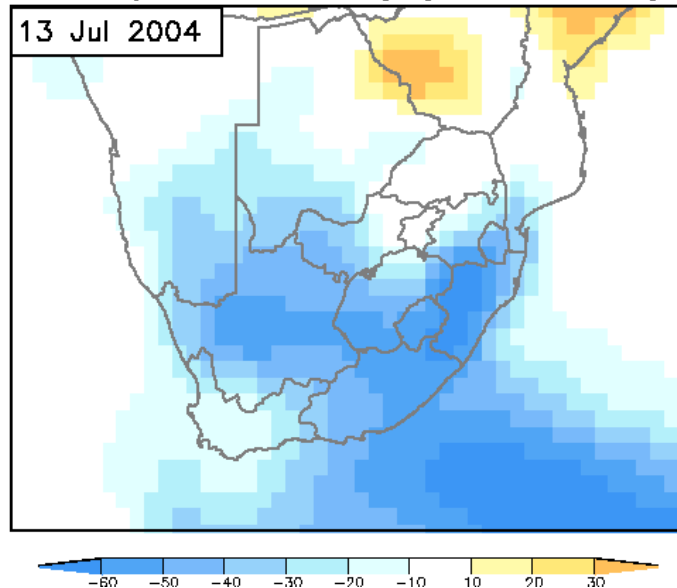
500hPa Heights (uncertainty shaded)

12Z 13 Jul 2004
Tuesday

Strong Signal Medium Signal Weak Signal No Signal

Benefits of ensemble prediction
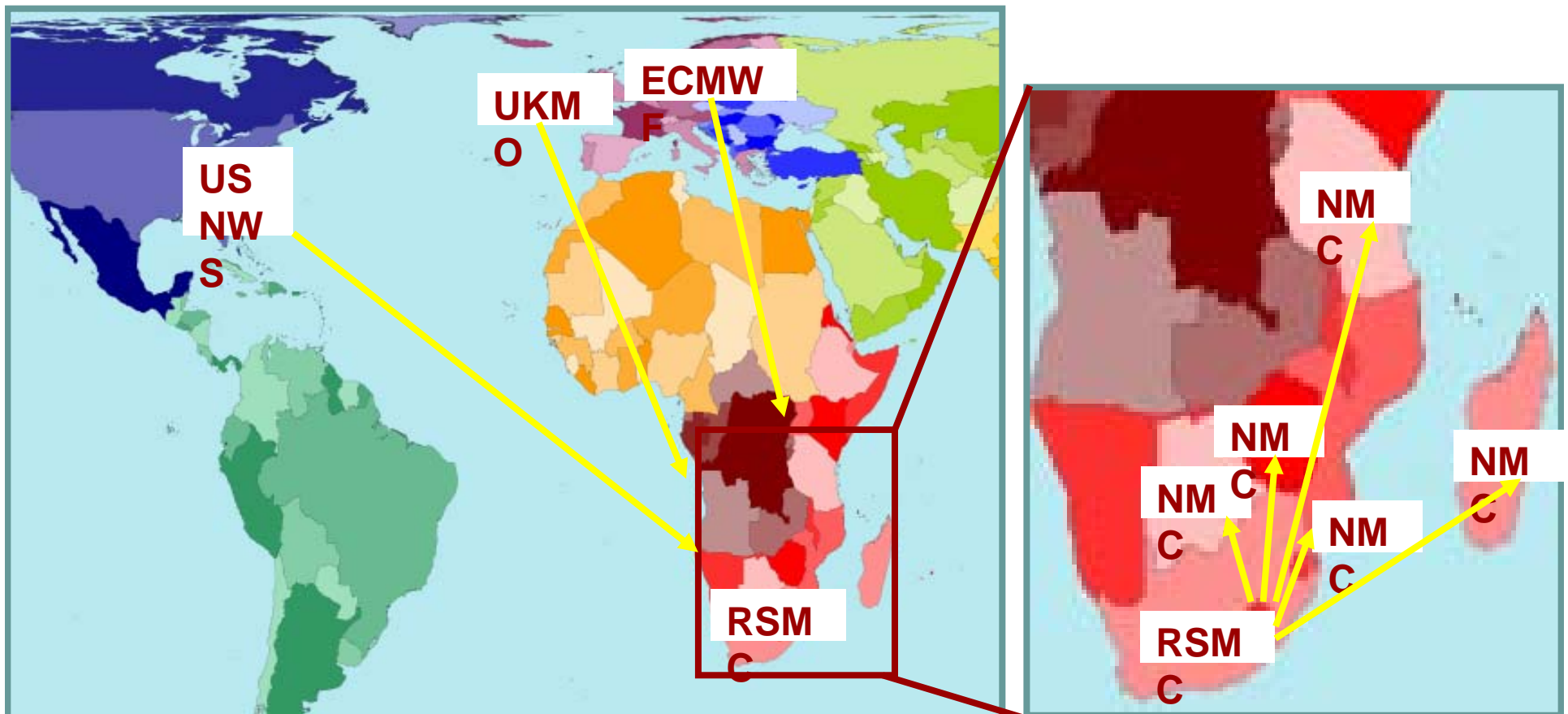
- It provides forecasters
  - with a set of 23 possible future scenarios,
  - that can be used to compute the probabilities of possible future weather events.
- It allowed forecasters to extend reasonable predictability far beyond the traditional 2 day forecasts
- SAWS uses ensemble products to issue advisories for the next 3-7 days on hazardous weather

Rainfall probablilities on TV
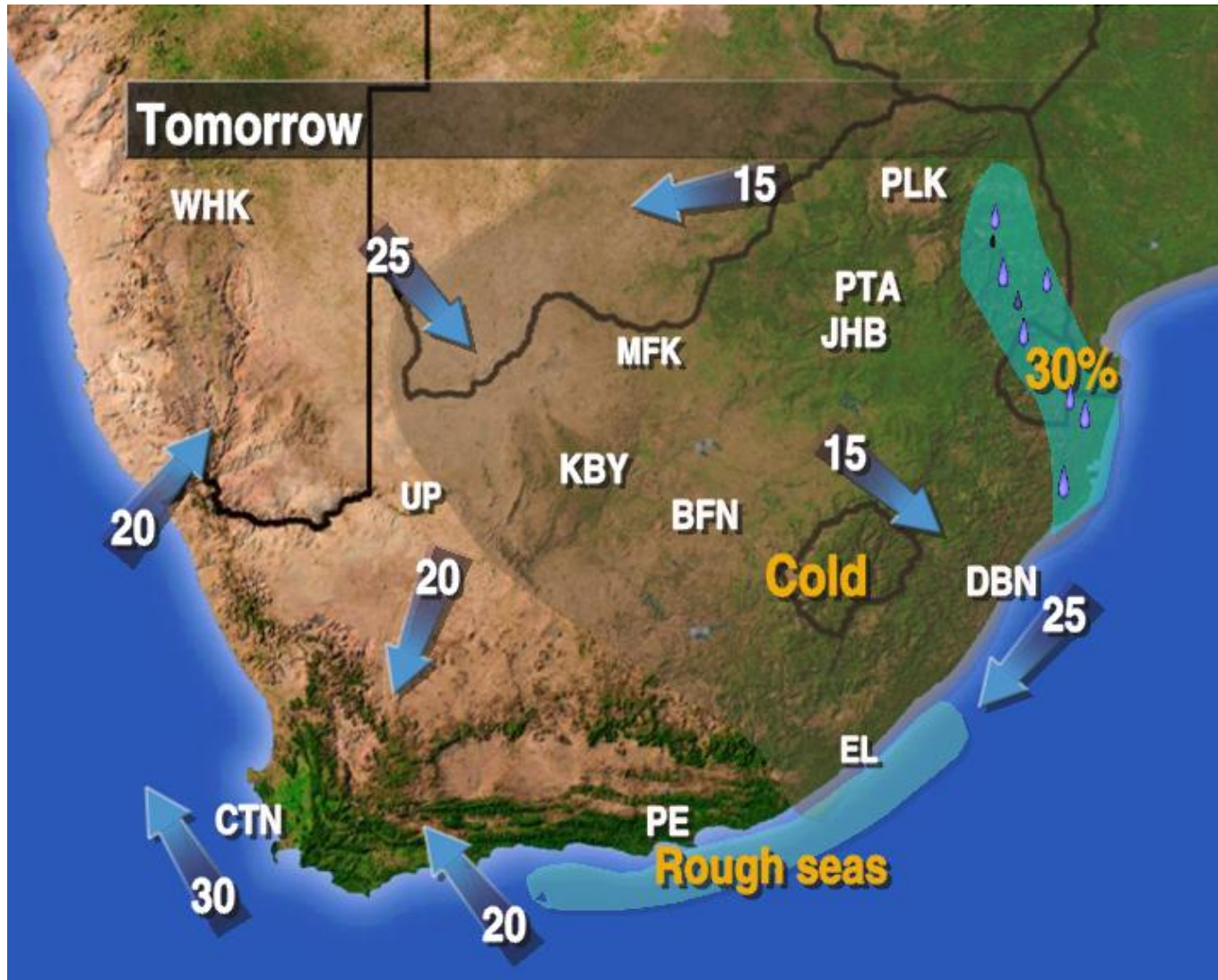
Severe Weather Forecasting in SADC:

- Special products from Global centres to RSMC-Pretoria
- RSMC prepares guidance forecasts for next 5 days and disseminates daily to 5 NMCs
- NMCs use guidance forecast in preparing warnings when appropriate to disaster management authorities

high confidence

>50mm in 24 hours

>50mm in 24 hours

high confidenc

moderate confidence

>50mm in 24 hours

high confidence

RSMC-PRETORIA
GUIDANCE FORECAST
DAY 1

Wednesday 7th February 2007

>50mm in 24 hours

medium risk

medium risk
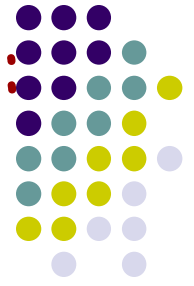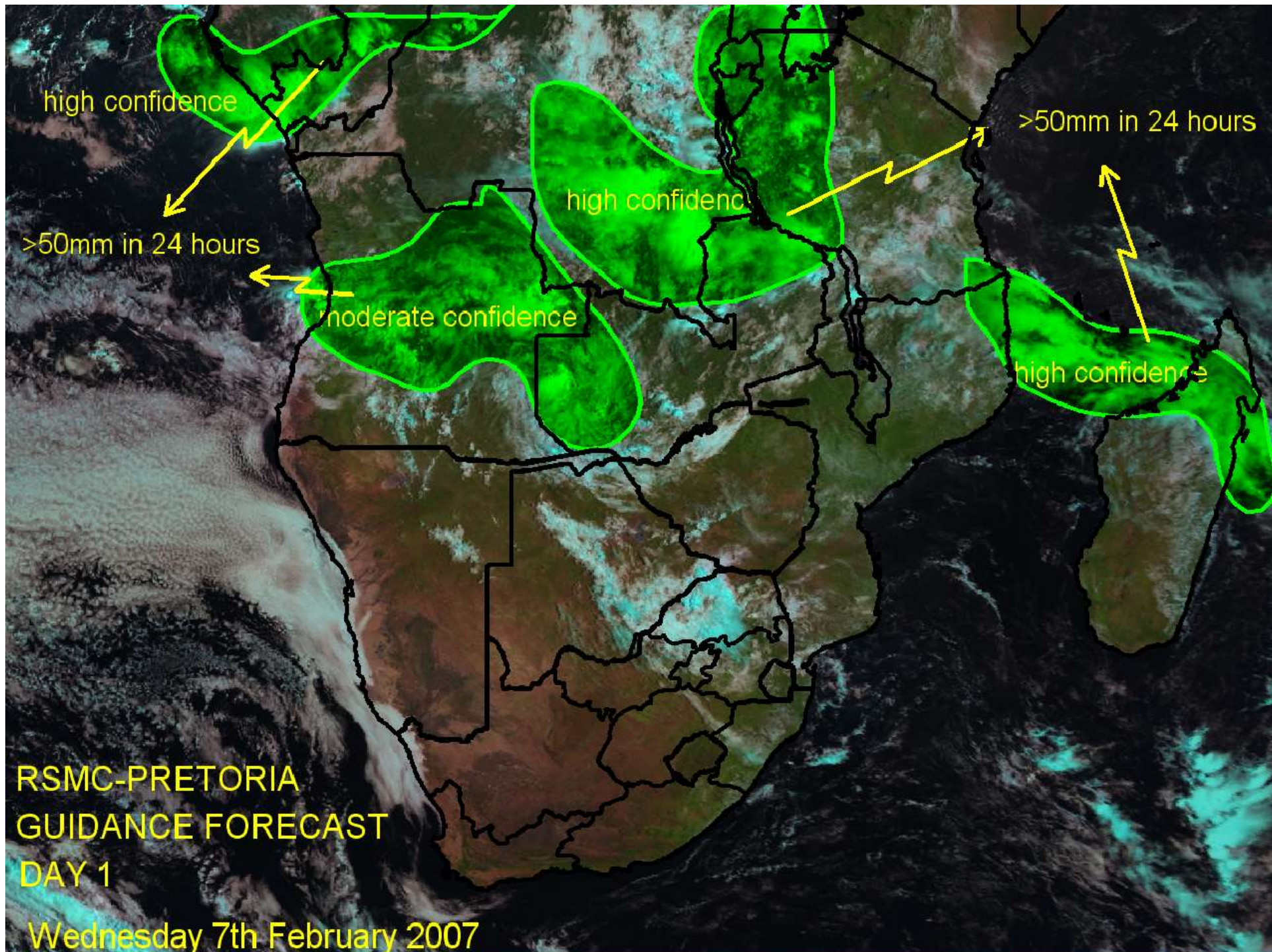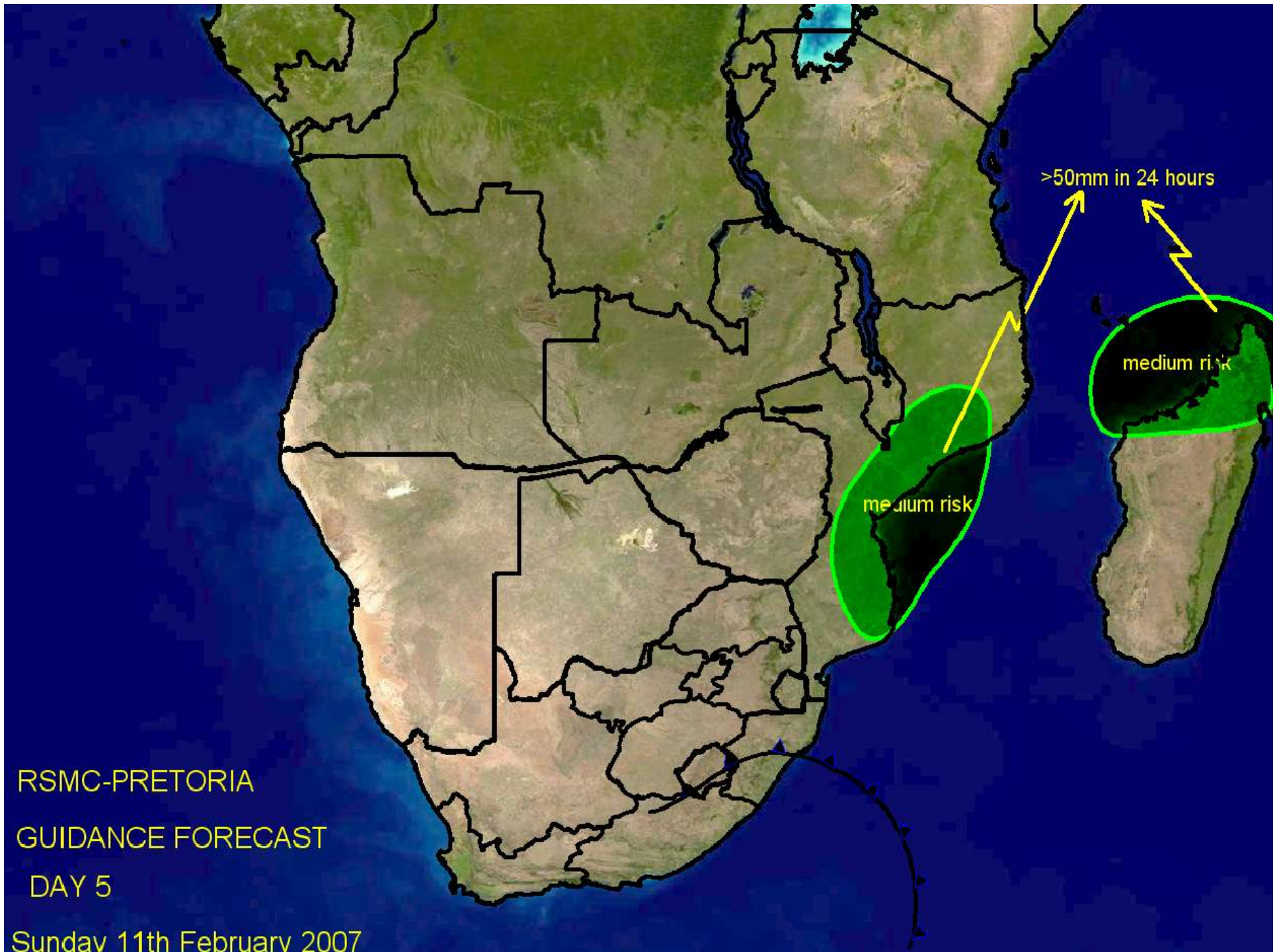
RSMC-PRETORIA

GUIDANCE FORECAST

DAY 5

Sunday 11th February 2007

Probability of ABOVE for AUGUST

Probability of BELOW for AUGUST

Probability of ABOVE for SEPTEMBER

Probability of BELOW for SEPTEMBER

Probability of ABOVE for OCTOBER

Probability of BELOW for OCTOBER
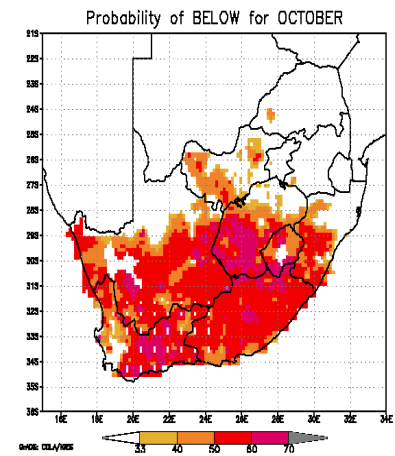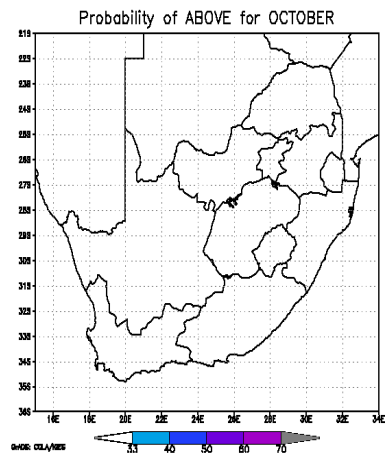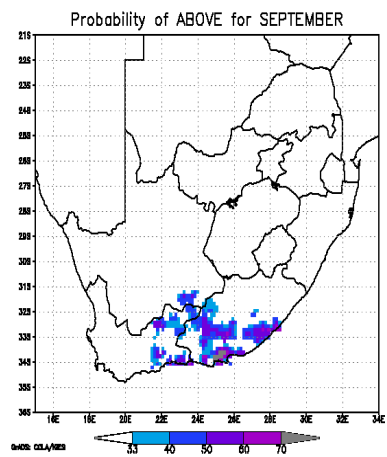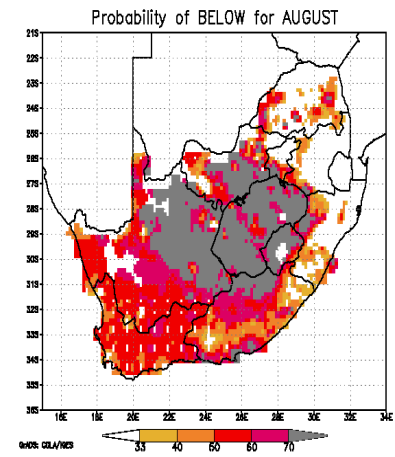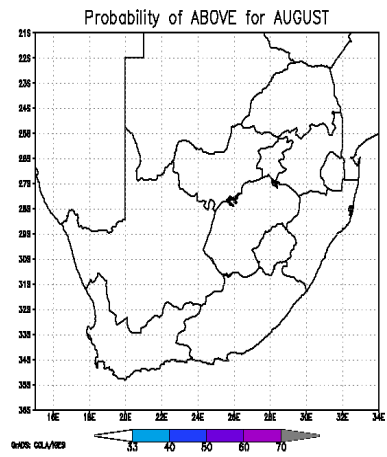
Expected Total Rainfall for the period September-October-November 2007

AREA 1:

40% chance that the total rainfall for this period will be ABOVE-normal.
35% chance that the total rainfall for this period will be normal.
25% chance that the total rainfall for this period will be BELOW-normal.

AREA 2:

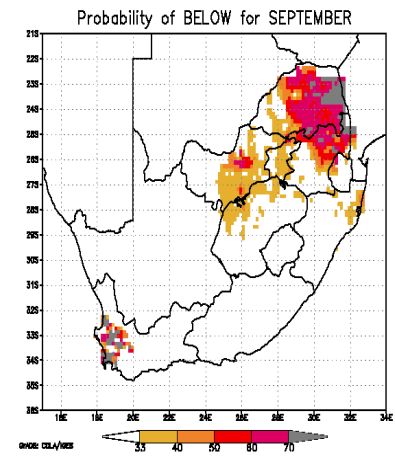| |
|---|
| 20% chance that the total rainfall for this period will be ABOVE-normal. |
| 35% chance that the total rainfall for this period will be normal. |
| 45% chance that the total rainfall for this period will be BELOW-normal. |

AREA 3 :

35% chance that the total rainfall for this period will be ABOVE-normal.
40% chance that the total rainfall for this period will be normal.
25% chance that the total rainfall for this period will be BELOW-normal.

AREA 2
20 A
35 N
45 B

AREA 3
35 A
40 N
25 B

AREA 1
40 A
35 N
25 B

Issued 08/2007

Probability (%)

Below-normal: 60 55 50 45 40
Normal: 40 45
Above-normal: 40 45 50 55 60
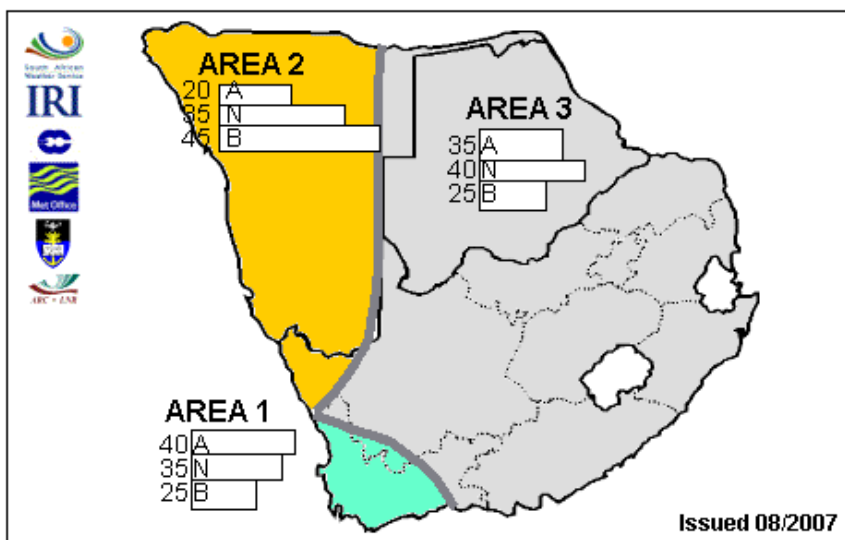
Please send comments to longrange@weathersa.co.za

Expected Total Rainfall for the period Oct-Nov-Dec 2007
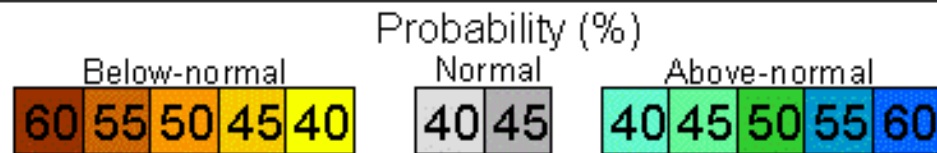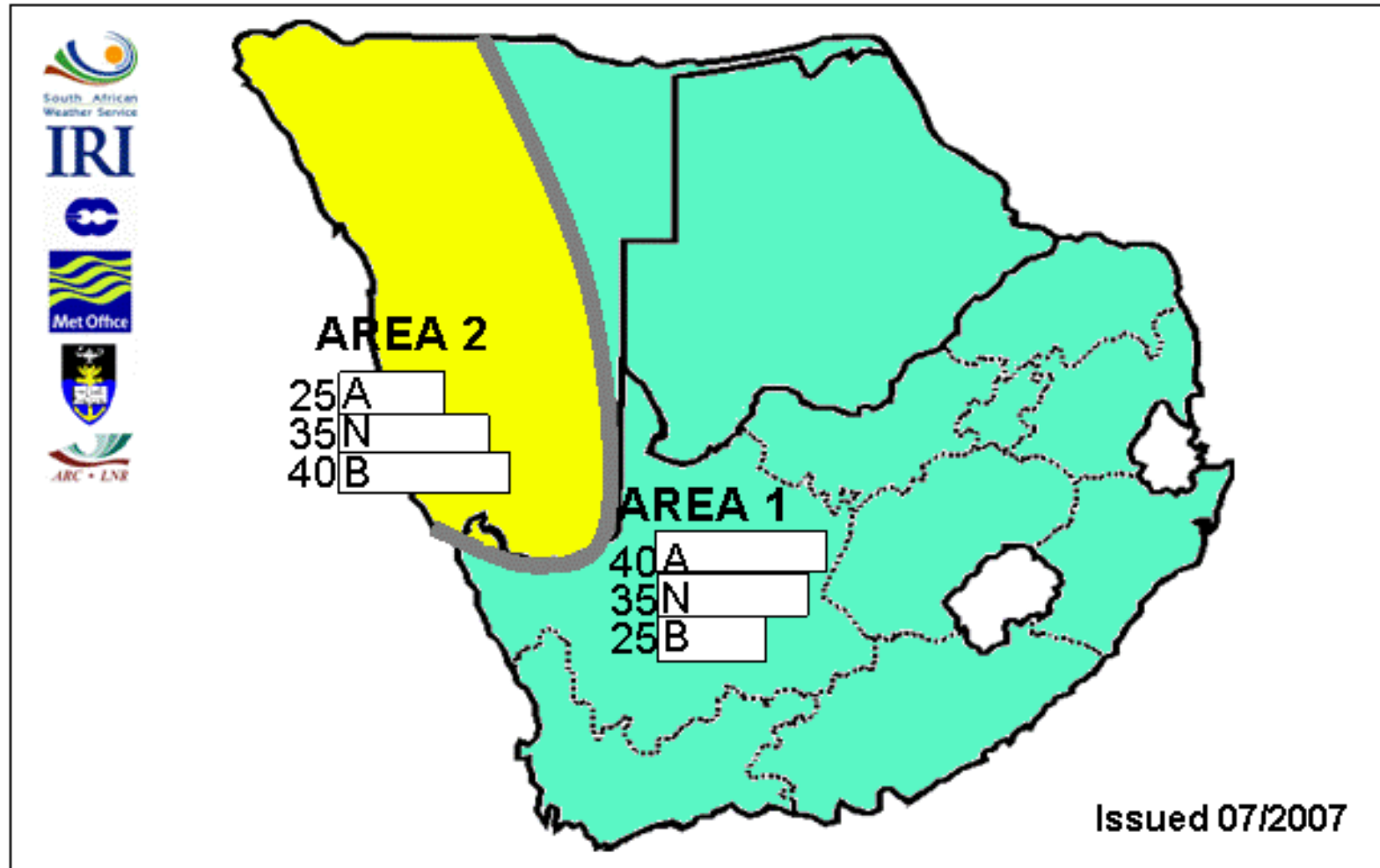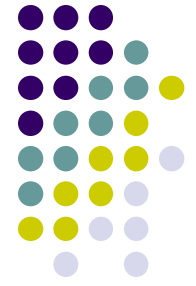
January-February-March
observed rainfall categories for each homogeneous rainfall region during La Niña (1960-2003)

above
normal
below

Copyright: AG Bartman, LRF (SAWS)
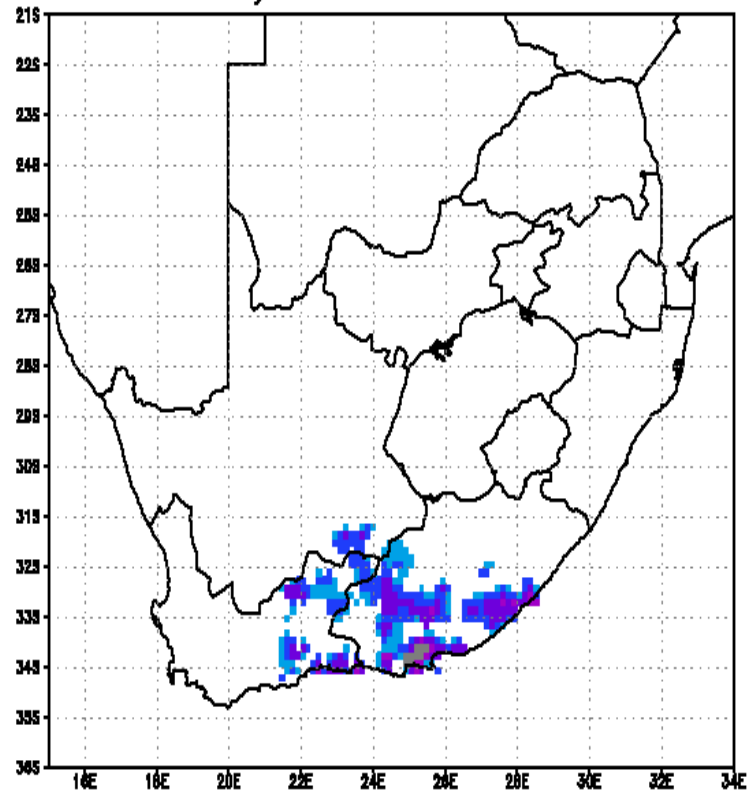
Probability of ABOVE for SEPTEMBER

Probability of BELOW for SEPTEMBER

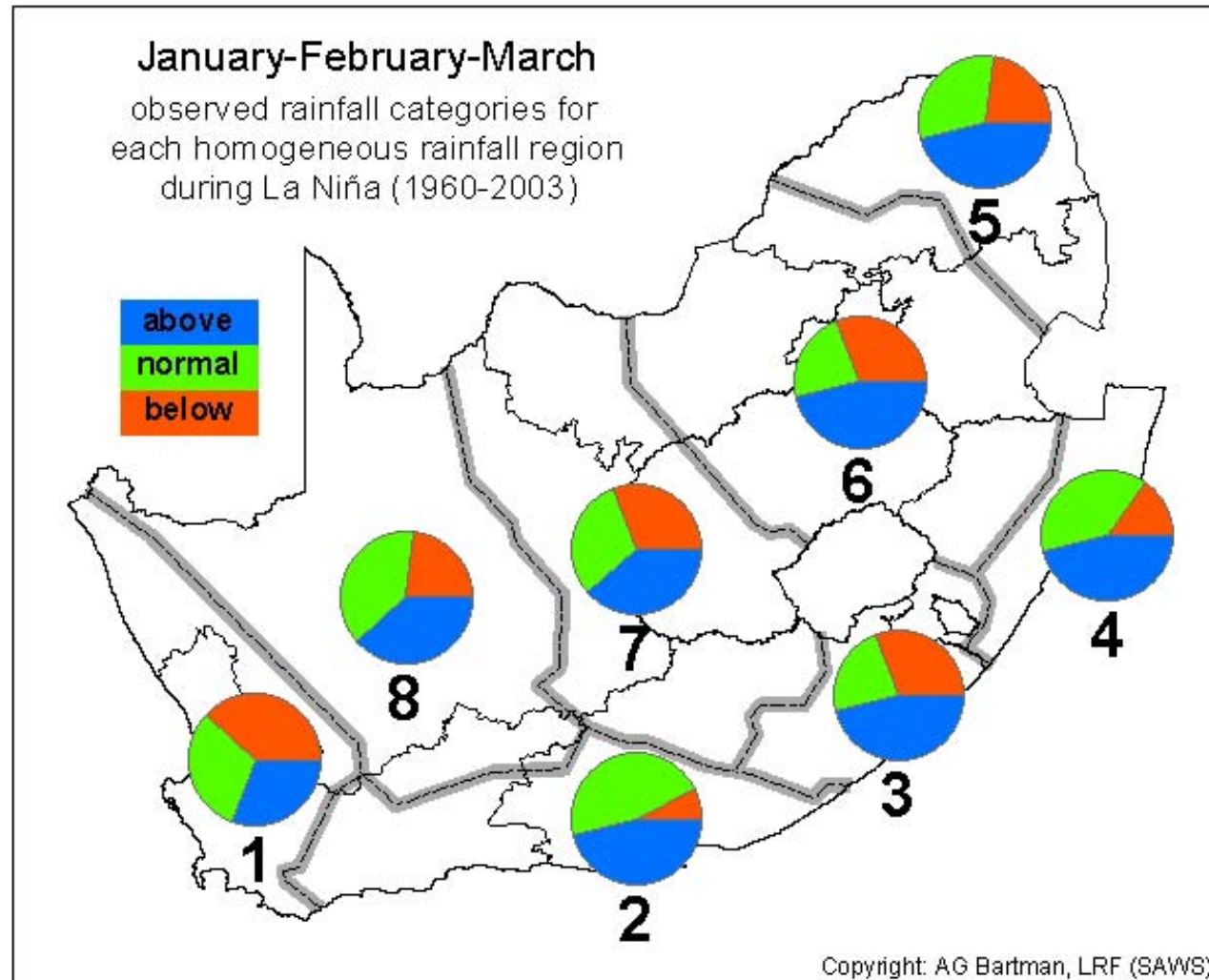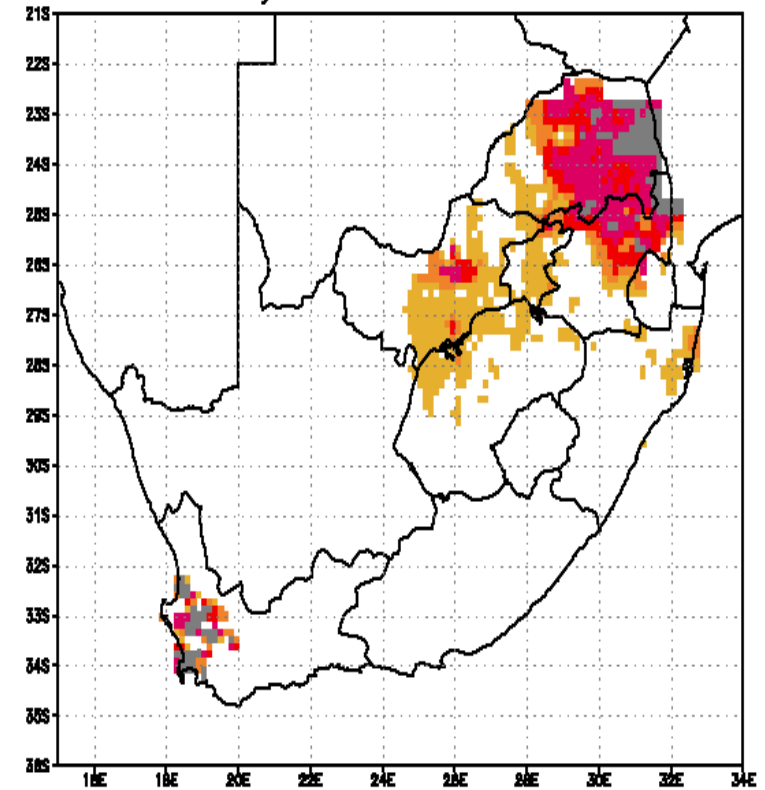| User	Reason	Uncertainty need	Method	Forecaster
Mohair farmers	Need 24 hrs to shed goats in to rain+cold+wind	Risk of adverse weather	Worded, SMS	Determine prob from EPS
Maize farmers	Rain forecasts for planting,	Seasonal outlook, specific	All	
Maize farmers	Wind and dust damage to crops	Risk of strong wind (>15 kts)	Worded	Forecast still deterministic
Grain traders	Market	Likelihood of rain, amount, distribution	Web, phone for confirmation	
Chokka boats (squid)	Inshore sea conditions	Sea state. "How sure are you"	Cell phone from boats	Deterministic, forecaster impression
Road engineering	No rain when tarring roads	Even a small chance of rain will stop operations	Worded - probabilities	False alarm is high, but POD also
Brickworks	Takes 6 hours to cover all brick drying outside	% of rain: 30% is their threshold	Web, maps	
Disaster management	Preparedness, early warning	Risk of hazardous weather, rather over warn, as early as possible	Worded, maps: SMS, email	
General Public				

Subjective Probability Estimation

Table 1: Forecaster Probability Calculator: Representative PoP and related terminology

Thunderstorm and Shower Probability (Distribution x Confidence)			
	Areal Distribution (over 24 hours)		
Forecaster Confidence	Few	Numerous	Extensive
Doubtful	Nil (0%)	Nil (0%)	Isolated (30%)
Possible	Nil (0%)	Isolated (30%)	Scattered (60%)
Definitely	Isolated (30%)	Scattered (60%)	Widespread (80%)

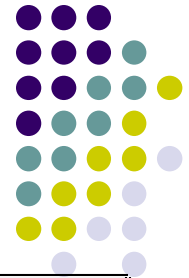| Rain Probability (Areal distribution: extensive or 80-100%)			
	Temporal Distribution (over 24 hours)		
Forecaster Confidence	Now and then	On and off	Continuous
Doubtful	Chance (30%)	Chance (30%)	Chance (30%)
Possible	Likely (60%)	Likely (60%)	Likely (60%)
Definitely	Occasional (80%)	Intermittent (80%)	General (100%)

Table 2: Forecaster Definitions (Input)

| AREAL COVERAGE (Showers and Thundershowers)	
Few	Little aerial coverage over 24 hours because: - No clear dynamical system. - Trigger typically heat or weak lower convergence in the absence of a clear dynamical system. - Tephi moderately unstable for T/S
Numerous	Good aerial coverage over 24 hours because: Clear dynamical system, such as an upper trough with associated divergence/uplift patterns, or a clear tropical convergence/ divergence pattern.
Extensive	Almost entire area covered over 24 hours because: - Strong dynamical system, like a proper cut-off low, strong tropical low, etc. - Rarely for thunderstorms
TEMPORAL DISTRIBUTION (Rain)	
Occasional	Rain now and then with longer dry spells in between. Weak front or high ridging, etc.
Intermittent	Rain on and off with short dry spells in between. Well developed front, strong ridging, etc.
General	Rain continuous all over area and all the time. Well defined cut-off low or tropical low
FORECASTER CONFIDENCE (Based on guidance by models, data & forecaster experience)	
Doubtful	There are some indication by a model or some data, although evidence are not convincing, most models disagree
Possibly	Some models or data agree, others not convincing. There is still some doubt.
Definitely	All guidance very strong and supportive, data clearly support, all models agree on identified phenomenon, forecaster absolutely convinced from experience, or already happening

Table 3: Public products definitions (Output)

THUNDERSTORMS& SHOWERS (i.e. precipitation usually from convective clouds)		
Term	PoP	Definition
Isolated	30%	A couple of storms over the area, low chance of being affected where person is
Scattered	60%	Numerous storm over the area, good chance of being affected where person is
Widespread	80%	Storms over most of the area, very good chance of being affected where person is

RAIN (i.e. precipitation usually from non-convective clouds)		
Term	PoP	Definition
Chance	**30%**	**Possibility of rain is low**
Likely	60%	High possibility of rain
Occasional	80%	Rain is definitely expected; will occur now and then with longer dry spells in between.
Intermittent	80%	Rain is definitely expected; will occur on and off with short dry spells in between.
General	100%	Rain continuous all over area and all the time (NB: this is irrespective of the intensity, it can be light rain and not necessarily heavy rain).

ASSOCIATED PUBLIC PHRASES	
Thundershowers or showers	**Rain**
Isolated thundershowers (showers)	A chance of rain
Scattered thundershowers (showers)	Rain is likely
Widespread thundershowers (showers)	Occasional (intermittent)(general) rain is expected

A Rainfall Verification Product: Forecast Reliability for day 2

% Cases of Rain > 0.3mm

60 – 79% FCST PROB

- This measures the % of time rainfall occurred at stations when 60% rain was predicted
- For good reliability the % should be between 50 and 70%, or yellow and orange
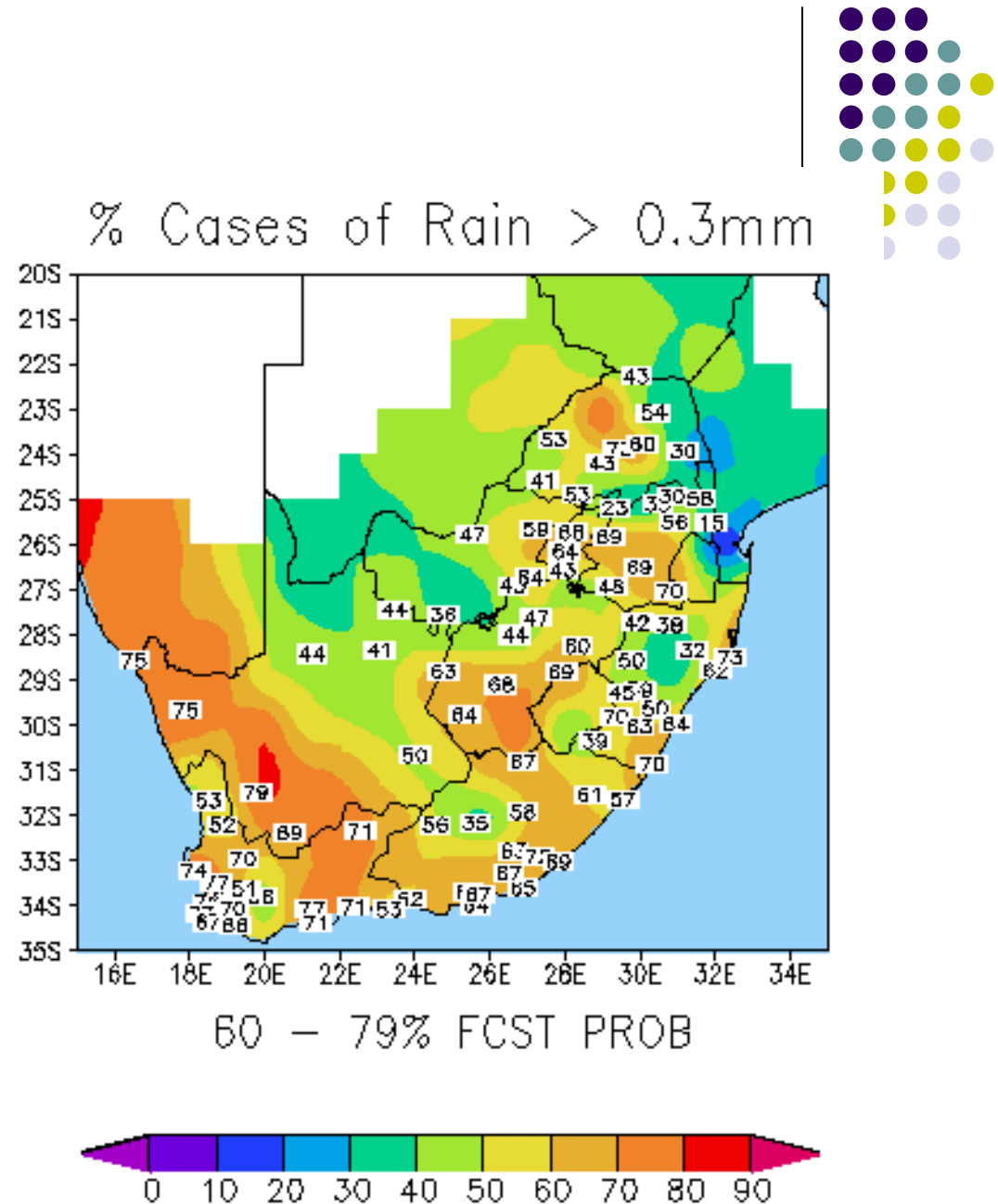
Some General Comments

- Approach too top down (scientist/forecaster driven) and not enough user involvement
- Many do not know they ask for uncertainty information
- Others do not know that they can benefit from uncertainty info
- Users are at different levels – capacity building
- Need to cater for each user's specific needs: differ between them, one product does not suit all
- Must be able to reflect against a baseline = need for verification of probabilistic forecasts
- Need to cater for different needs per timescale