Aviation Meteorological Forecaster Competency 2

Forecast Aeronautical Meteorological Phenomena and Parameters

Take-off data Forecast
(AMF AC 1.2, 1.3, 2.1.1, 2.1.2, 2.1.3, 2.2 and 4.3)

Jannie Stander
RTC
Pretoria

South African Weather Service

AIM OF THIS PRESENTATION

At the end of this presentation, you will be able to:

- Compile Take-off data and use it to demonstrate competency in **AMF AC 1.2, 1.3, 2.1.1**, **2.1.2, 2.1.3, 2.2 and 4.3**

- Complete weekly quizzes related to Take-off data forecasts using this presentation as an example.

South African Weather Service

Take-off Forecast

- Take-off forecasts contains information on expected conditions over the runway complex.

- Variables included are temperature (AMF AC 2.1.1), wind variations (AMF AC 2.1.2) and pressure (QNH) (AMF AC 2.1.3) and other elements, as agreed locally.

- It is supplied on request to operators and flight crew members within the 3 hours before the expected time of departure.

- The format (AMF AC 2.2) of the forecast is subject to agreement between the Met Authority and the operators concerned.

- These take-off forecasts must be kept under continuous review (AMF AC 1.2) and amendments (AMF AC 1.3) must be issued promptly.

- The criteria for the issuance of amendments to forecast elements are to be agreed between the Met Authority and the operators concerned.

- These should be consistent with the SPECI criteria.

South African
Weather Service

Take-off Forecast procedure

- Establish the general expected weather conditions at the Aerodrome as established in AMF Competency 1. This involves what is the season/cloud cover/is it raining and the history of the past weather.

- Start with the latest available METAR for the station concerned.

- Apply the NWP model to temperature. Interpolate according to weather conditions – cloudy versus sunny, summer versus winter, rain etc.

- Apply the NWP model wind forecast (3 or 6 hourly). Interpolate accordingly. Only change the wind if it changes significantly according to significant wind criteria or operational requirements.

- Consult the NWP at the same time as that of the METAR observation

- Establish the QNH bias correction for interior stations and adjust the QNH accordingly as per the NWP model output.

- Continuously monitor and amend forecast according to significant wind and temperature criteria.

South African Weather Service

Compile Take-of data

Example Task for Case Study 20 Oct 2018: Compile **Take-of data,** forecast hourly values of surface t**emperature (AMF AC 2.1.1)**, surface **wind (AMF AC 2.1.2**) and station **QNH (2.1.3, 4.3 and 4.4)** for FAOR valid from 08Z to 18Z.

- The first step in the forecast process for take-off data, is to consider the previous three hourly METARs with regards to surface wind, surface temperature and QNH for OR Tambo international Airport (06h00Z, 07h00Z and 08h00Z) as well as satellite data. The METARs are as follows:

METAR FAOR 20**0600**Z **05009KT** CAVOK **18**/11 **Q1025** NOSIG=

METAR FAOR 20**0700**Z **03010KT** **010V070** CAVOK **20**/11 **Q1025** NOSIG=

METAR FAOR 20**0800**Z **02007KT** **300V090** 9999 SCT040 **22**/11 **Q1026** NOSIG=

- The data indicates the wind is from the east as per the ridging high identified in AMF competency 1, analysis and diagnosis.
- The historical TREND indicates temperature increasing rapidly due to the sunny conditions. Pressure has increased slightly.
- Convective (Cumulus) cloud (4000 ft a.g.l) is developing, signifying possible thunderstorm development east of the surface and upper trough as per AMF competency 1 and this could affect the temperature later.

Start the Take-off data with reality(latest METAR)

DNC RGB 06Z

mpl ref: CRS

What can make your forecast go wrong later?
- Thunderstorms/cloud cover/rain can develop later in the day.
- Due to this thunderstorms and rain, temperatures will be lower, winds might temporarily change.
- You cannot change your forecast based on a forecast with a certain amount of accuracy. You will monitor and amend if necessary.
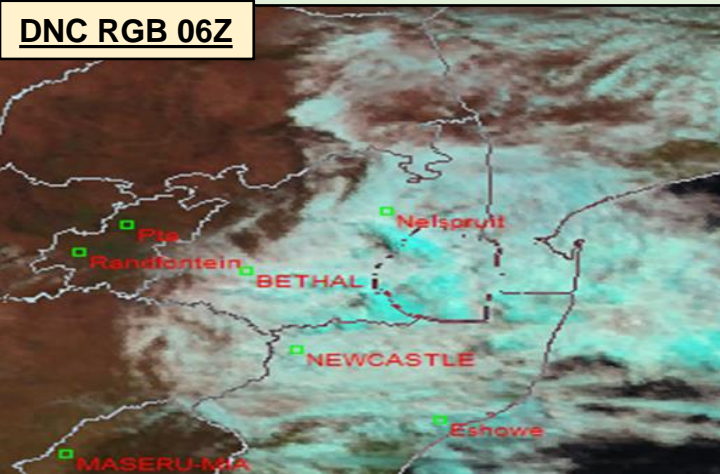
Forecast surface temperature (AMF AC 2.1.1)

- Surface temperature is affected by season/cloud cover/rain –
- Cloud and TSRA development later can cool temperatures significantly from what NWP is predicting.
- Temperature in NWP is solved explicitly, so given there is no Airmass change and no rain or thunderstorms, the NWP temperature at F+09, F+12, F+15 and F+18hr can be used quite accurately as is.
- For temperatures in between NWP forecast hours, interpolate – on a sunny summer's day, temperatures can rise by 2 degrees per hour but if it is a cloudy in winter, temperatures will remain or only rise by a degree every second hour.
- For this reason, it is good to look at the observed temperature curve of the previous day and use that information in conjunction with the NWP to determine the hourly future TREND.

DNC RGB 06Z
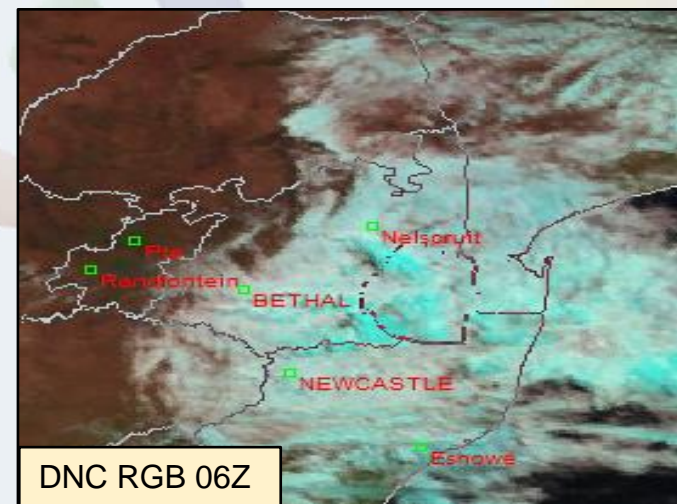
Reasons why your temp forecaster can go wrong later:
- Uncertainty as to when the cloud cover and thunderstorms will affect the aerodrome.
- During this time the temperature will drop too because of rainfall.
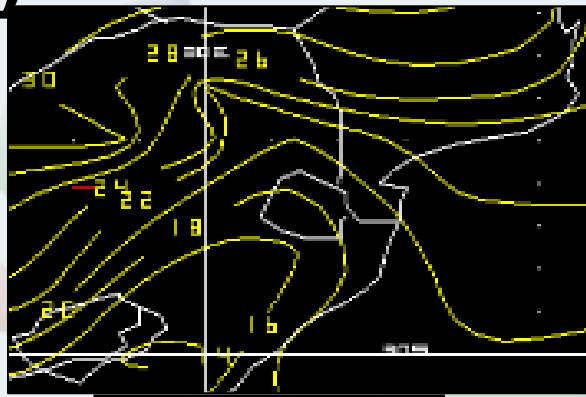- Not to worry, monitor (AMF AC 1.2) and amend (AMF AC 1.3) if necessary.

South African Weather Service

Forecast surface temperature (AMF AC 2.1.1)

TIME	TEMP in °C forecast Addresses AMF AC 2.1.1
08Z	22
09Z	24
10Z	24
11Z	25
12Z	26
13Z	25
14Z	24
15Z	24
16Z	22
17Z	20
18Z	18
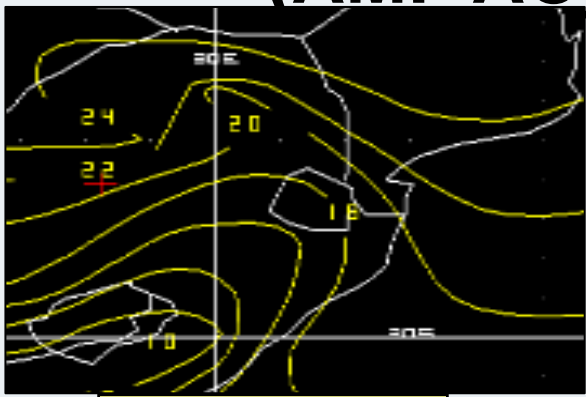
TEMP **2M** CLR4 **F06**

TEMP 2M CLR4 **F09**
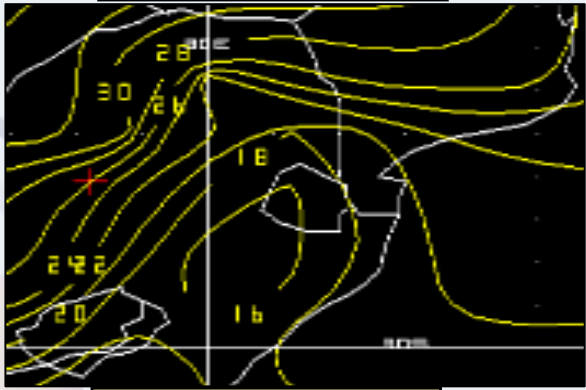
TEMP **2M** CLR4 **F12**
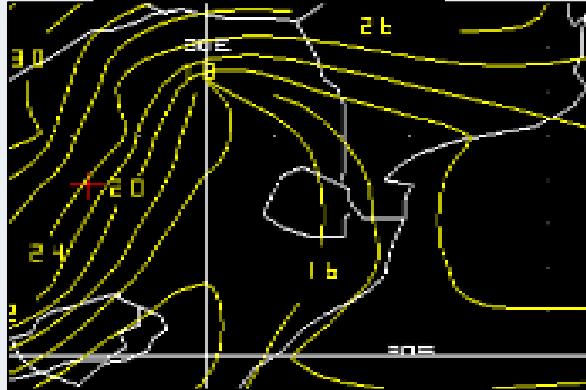
TEMP **2M** CLR4 **F15**
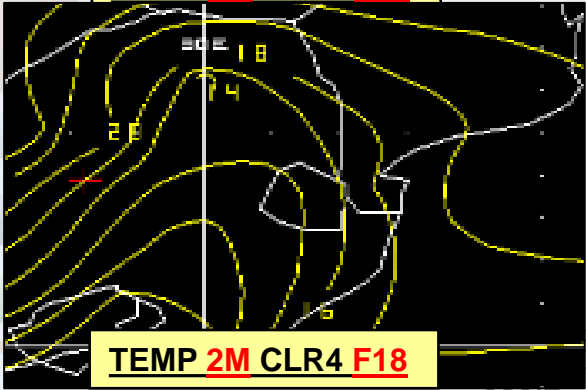
TEMP **2M** CLR4 **F18**

Start with latest observed temp

METAR FAOR **200600Z** 05009KT CAVOK **18**/11 Q1025 NOSIG=
METAR FAOR **200700Z** 03010KT 010V070 CAVOK **20**/11 Q1025 NOSIG=
METAR FAOR **200800Z** 02007KT 300V090 9999 SCT040 **22**/11 Q1026 NOSIG=

Forecast surface wind (AMF AC 2.1.2)

- The reason causing the specific surface wind direction and speed in the METAR needs to be investigated.

- Wind flow is caused by surface pressure changes due to the dominating surface pressure weather system – as in AMF Competency 1.

- At FAOR the surface high is busy ridging from the east and the surface pressure is increasing which could generate stronger/possibly gusty winds.

- Resultantly, the wind will be easterly and possibly stronger than the NWP would suggest.

- For wind between forecast hours F+09, F+12, F+15 and F+18hr, interpolate – following the wind direction and weather system.

- Provide one dominant direction and only change the direction if it changes significant from what was previously stated.

N.B.
- The observed wind at OR Tambo is usually slightly stronger than the NWP forecast (+-5 KT).
- Evaluate this for your own forecast area when working.

South African
Weather Service

Forecast surface wind (AMF AC 2.1.2)

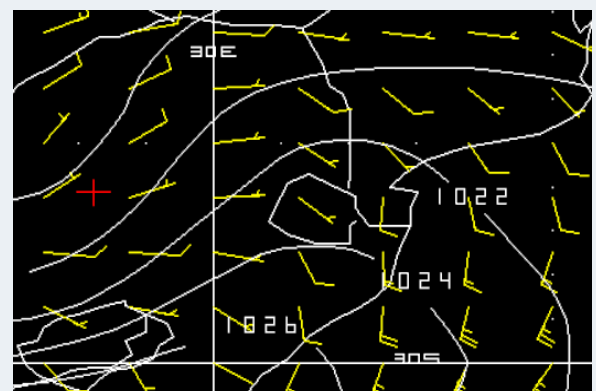| TIME	TEMP in °C forecast Addresses AMF AC 2.1.1	QAN in kts forecast Addresses AMF AC 2.1.2
08Z	22	02007KT
09Z	24	02007KT
10Z	24	02007KT
11Z	25	02007KT
12Z	26	11010KT
13Z	25	11015KT
14Z	24	11015KT
15Z	24	11015KT
16Z	22	11015KT
17Z	20	11015KT
18Z	18	11015KT
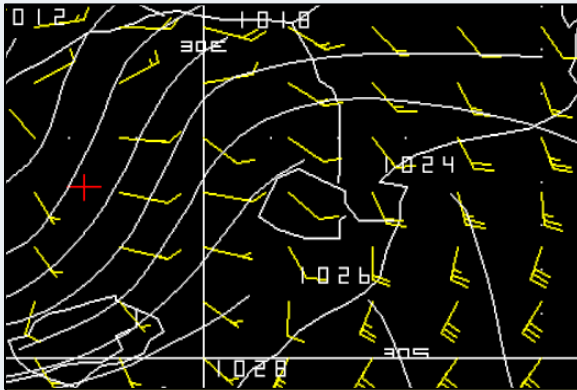
PMSL CIN2 CLR3/BKNT 10M CLR4 F06
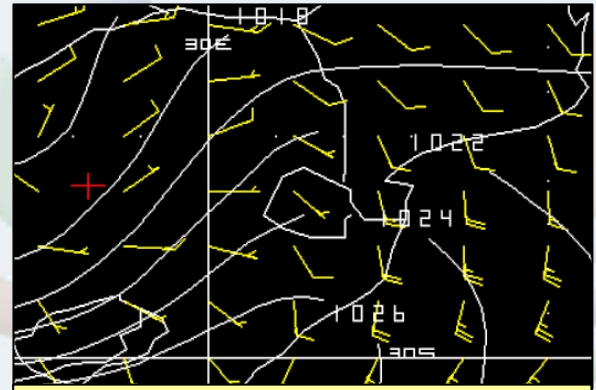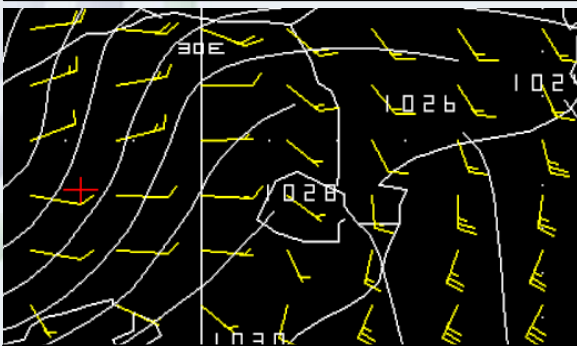

PMSL CIN2 CLR3/BKNT 10M CLR4 F09
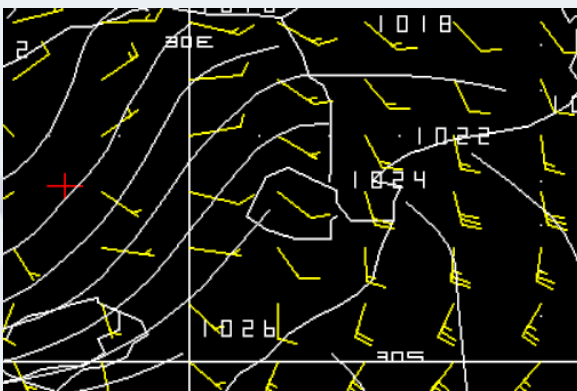
PMSL CIN2 CLR3/BKNT 10M CLR4 F12

PMSL CIN2 CLR3/BKNT 10M CLR4 F15

PMSL CIN2 CLR3/BKNT 10M CLR4 F18

Start with latest observed wind

METAR FAOR **200600Z** **05009KT** CAVOK 18/11 Q1025 NOSIG=
METAR FAOR **200700Z** **03010KT** **010V070** CAVOK 20/11 Q1025 NOSIG=
METAR FAOR **200800Z** **02007KT** **300V090** 9999 SCT040 22/11 Q1026 NOSIG=

Forecast QNH (AMF AC 2.1.3 and 4.2)

QNH is affected by:

1. Diurnal pressure changes -

- During a sunny day pressure will decrease to a lowest value at the hottest time of the day.

- Pressure will increase after sunset to a highest value before sunrise.

2. Movement of the Weather system -

- At FAOR the surface high is busy ridging from the east and the pressure is increasing but the diurnal change may be greater and thus the pressure will decrease – whichever is dominating.
- Along the coast the diurnal changes due to surface heating are less and the pressure is more driven by the movement of weather systems.
- For pressure values between forecast hours F+09, F+12, F+15 and F+18hr, interpolate – considering the diurnal pressure changes and affect of the weather system.
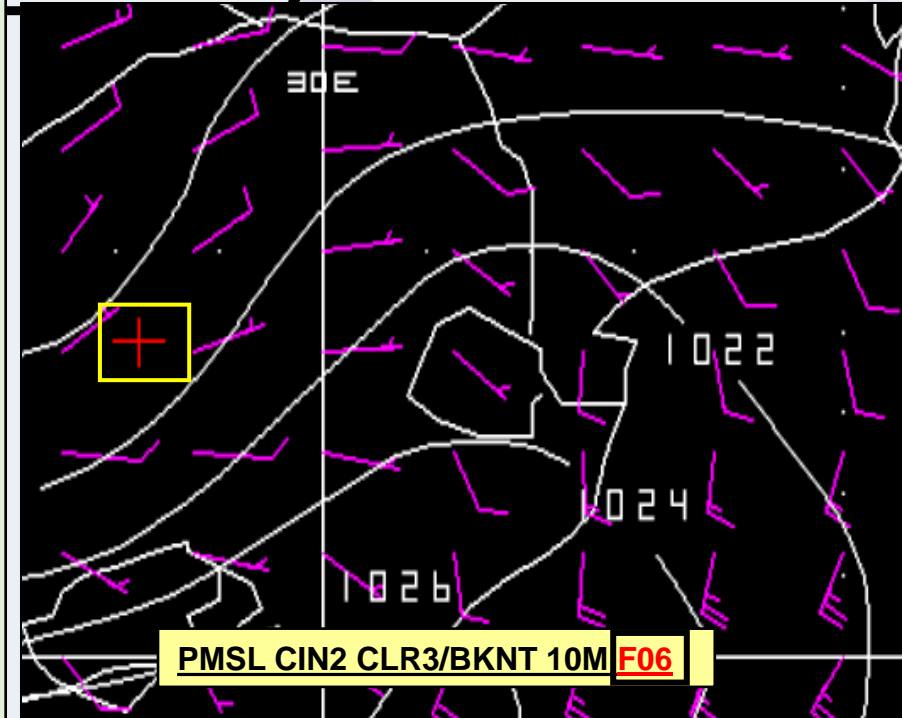
South African Weather Service

Determine QNH bias correction for interior stations (AMF 4.2)

- **Only for interior stations**, a bias correction needs to be applied since the South African interior topography is a plateau situated around 1500m amsl. NWP sea level pressure is thus not usable for the interior.

- To resolve this, a bias correction is applied (AMF AC 4.2).

- The NWP model QNH at **06Z** is compared to the observed QNH at **06Z** (METAR) to find the change/bias (AMF AC 4.2) that should be applied.

- The observed QNH at **06Z** is **1025hPa**

- The NWP predicted mean sea level pressure of **1019 hPa** at **06Z** as seen on the right, therefore the change (bias correction) that needs to be applied in this specific case is **+6hPa**.

Note:
For any interior station, this bias calculation needs to be done every time and the bias correction will differ from case to case. **It wont be 6 hPa every time.**

- Interpolation is applied for values between NWP model times.
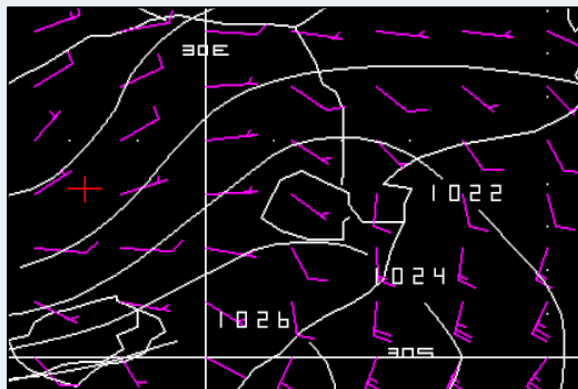

PMSL CIN2 CLR3/BKNT 10M **F06**

METAR FAOR **200600Z** 05009KT CAVOK 18/11 **Q1025** NOSIG=
METAR FAOR 200700Z 03010KT 010V070 CAVOK 20/11 **Q1025** NOSIG=
METAR FAOR 200800Z 02007KT 300V090 9999 SCT040 22/11 **Q1026** NOSIG=
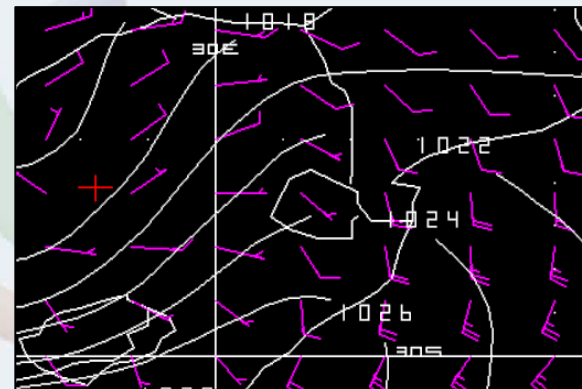
South African Weather Service

Forecast QNH (AMF AC 2.1.3 and 4.2)

TIME	TEMP in °C forecast Addresses AMF AC 2.1.1	QAN in kts forecast Addresses AMF AC 2.1.2	QNH in hPa forecast Addresses AMF AC 2.1.3 and AMF AC 4.2 (provide bias correction used) and 4.3 BIAS = 1025-1019 = +6 hPa (NWP QNH too low)
08Z	22	02007KT	Q1026
09Z	24	02007KT	1018 (NWP)+6 = Q1024
10Z	24	02007KT	Q1024
11Z	25	02007KT	Q1023
12Z	26	11010KT	1016 (NWP) +6 = Q1022
13Z	25	11015KT	Q1022
14Z	24	11015KT	Q1022
15Z	24	11015KT	1016 (NWP)+6 = Q1022
16Z	22	11015KT	Q1024
17Z	20	11015KT	Q1025
18Z	18	11015KT	1021 (NWP) +6 = Q1027

TAKE-OFF DATA FOR OR Tambo on 20 Oct 2018
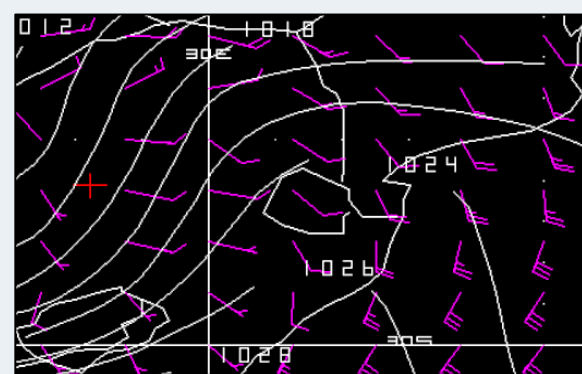

PMSL CIN2 CLR3/BKNT 10M F06
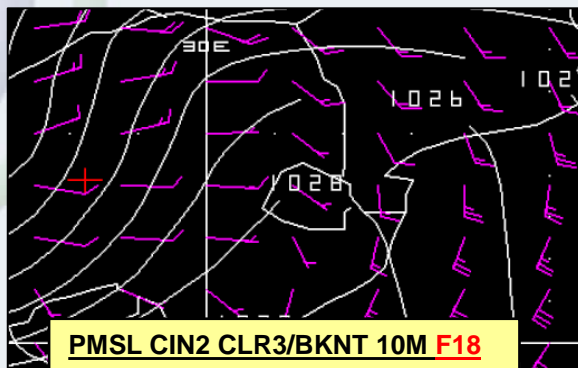

PMSL CIN2 CLR3/BKNT 10M F09
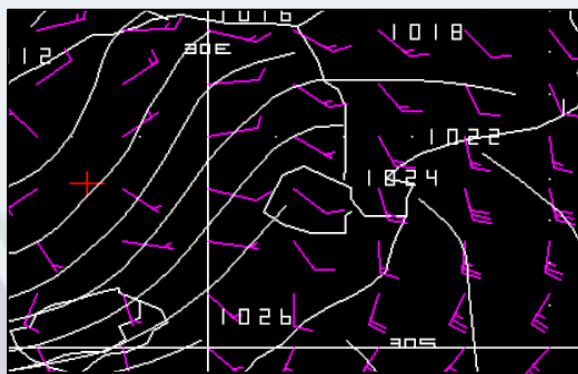
PMSL CIN2 CLR3/BKNT 10M F12

PMSL CIN2 CLR3/BKNT 10M F15

PMSL CIN2 CLR3/BKNT 10M F18

METAR FAOR **200800Z** 02007KT 300V090 9999 SCT040 22/11 Q1026 NOSIG=

South African Weather Service

Continuously monitor the forecast and amend (AMF AC 1.2 and 1.3, 4.3)

Continuously monitor **(AMF AC 1.2)** real time data and amend **(AMF AC 1.3, 4.3)** take-off data, if necessary, according to significant weather criteria.

Answer:

- Once you have completed the take-off data, issue it immediately by emailing it.

- Continuously monitor temperature and wind, not occasionally.

- Continuously monitor your predicted values using METARs and amend when the forecast conditions **significantly** differ from the observed (AMF AC 1.2, 1.3, 4.3) according to SPECI criteria.

- You will be given hourly METARs and be expected to continuously monitor them and identify if there are significant changes with regards to temperature and wind.

- Let's look at how the monitoring will be done from 09Z to 12Z

DNC RGB 09Z
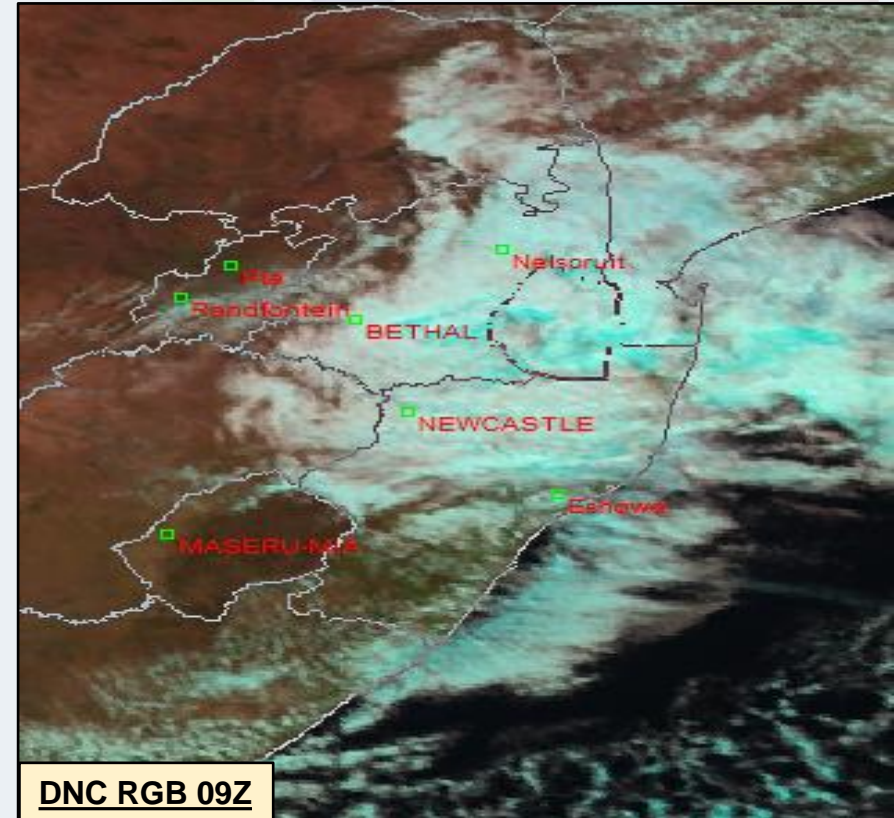
South African Weather Service

Continuously monitor and amend at 09Z (AMF AC 1.2 and 1.3)

METAR FAOR **200900Z** **36010KT** 9999 SCT044 **24**/11 Q1025 NOSIG=

TIME	TEMP in °C forecast Addresses AMF AC 2.1.1	QAN in kts forecast Addresses AMF AC 2.1.2	QNH in hPa forecast Addresses AMF AC 2.1.3 and AMF AC 4.2 (provide bias correction used) and 4.3 BIAS = 1025-1019 = +6 hPa (NWP QNH too low)	Monitoring of forecast Give observed values Addresses AMF AC 1.2 and 4.3	Amending Forecast State Yes or No and refer to specific amendment criteria for Temp and Wind. Addresses AMF AC 1.3
08Z	22	02007KT	Q1026	-	-
09Z	24	02007KT	1018 (NWP)+6 = Q1024	36010KT 24 Q1025	No for Temp and Wind: Although the wind has passed from below 10kt to 10kt, the direction has not changed by more than 60° and temperature is the same (has not changed by >=2 °C.

South African Weather Service

Continuously monitor and amend at 10Z (AMF AC 1.2 and 1.3)

METAR FAOR **201000Z** <u>**02006KT 290V090**</u> 9999 FEW040CB SCT044 SCT048TCU <u>**22**</u>/10 Q1025 TEMPO 5000 TSRA=

TIME	TEMP in °C forecast Addresses AMF AC 2.1.1	QAN in kts forecast Addresses AMF AC 2.1.2	QNH in hPa forecast Addresses AMF AC 2.1.3 and AMF AC 4.2 (provide bias correction used) and 4.3 <u>BIAS = 1025-1019 = +6 hPa (NWP QNH too low)</u>	Monitoring of forecast Give observed values Addresses AMF AC 1.2 and 4.3	Amending Forecast State Yes or No and refer to specific amendment criteria for Temp and Wind. Addresses AMF AC 1.3
08Z	22	02007KT	Q1026	-	-
09Z	24	02007KT	1018 (NWP)+6 = Q1024	36010KT 24 Q1025	No for Temp and Wind: Although the wind has passed from below 10kt to 10kt, the direction has not changed by more than 60° and temperature is the same (has not changed by >=2 °C
10Z	24 <u>22</u>	02007KT	Q1024	02006KT 22 Q1025	No for wind: Has not passed 10kt and changed by more than 60° Yes for temp: It is = 2 °C out
11Z	25 **23**	02007KT	Q1023		
12Z	26 <u>24</u>	11010KT	1016 (NWP) +6 = Q1022		

South African Weather Service

Continuously monitor and amend at 11Z (AMF AC 1.2 and 1.3)

METAR FAOR **201100Z** **29009KT 210V340** 9999 TS SCT038CB SCT044 SCT048TCU **23**/05 Q1024 TEMPO 5000 TSRA=

TIME	TEMP in °C forecast Addresses AMF AC 2.1.1	QAN in kts forecast Addresses AMF AC 2.1.2	QNH in hPa forecast Addresses AMF AC 2.1.3 and AMF AC 4.2 (provide bias correction used) and 4.3 BIAS = 1025-1019 = +6 hPa (NWP QNH too low)	Monitoring of forecast Give observed values Addresses AMF AC 1.2 and 4.3	Amending Forecast State Yes or No and refer to specific amendment criteria for Temp and Wind. Addresses AMF AC 1.3
08Z	22	02007KT	Q1026	-	-
09Z	24	02007KT	1018 (NWP)+6 = Q1024	36010KT 24 Q1025	No for Temp and Wind: Although the wind has passed from below 10kt to 10kt, the direction has not changed by more than 60° and temperature is the same (has not changed by >=2 °C
10Z	24 22	02007KT	Q1024	02006KT 22 Q1025	No for wind: Has not passed 10kt and changed by more than 60° Yes for temp: It is = 2 °C out
11Z	25 23	02007KT	Q1023	29009KT 23 Q1024	No for wind: Has not passed 10kt and changed by more than 60° No for Temp: It is now on track (red value)
12Z	26 24	11010KT	1016 (NWP) +6 = Q1022		

2022/02/25

16

African
r Service

Continuously monitor and amend at 12Z (AMF AC 1.2 and 1.3)

METAR FAOR **201200Z** **14011KT 110V190** 9999 -TSRA SCT025CB FEW040CB **20**/13 Q1024 NOSIG=

TIME	TEMP in °C forecast Addresses AMF AC 2.1.1	QAN in kts forecast Addresses AMF AC 2.1.2	QNH in hPa forecast Addresses AMF AC 2.1.3 and AMF AC 4.2 (provide bias correction used) and 4.3 BIAS = 1025-1019 = +6 hPa (NWP QNH too low)	Monitoring of forecast Give observed values Addresses AMF AC 1.2 and 4.3	Amending Forecast State Yes or No and refer to specific amendment criteria for Temp and Wind. Addresses AMF AC 1.3
08Z	22	02007KT	Q1026	-	-
09Z	24	02007KT	1018 (NWP)+6 = Q1024	36010KT 24 Q1025	No for Temp and Wind: Although the wind has passed from below 10kt to 10kt, the direction has not changed by more than 60°and temperature is the same (has not changed by >=2 °C
10Z	24 **22**	02007KT	Q1024	02006KT 22 Q1025	No for wind: Has not passed 10kt and changed by more than 60° Yes for temp: It is = 2 °C out
11Z	25 **23**	02007KT	Q1023	29009KT 23 Q1024	No for wind: Has not passed 10kt and changed by more than 60° No for Temp: It is now on track (red value)
12Z	26 **24** **20**	11010KT	1016 (NWP) +6 = Q1022	14011KT 20 Q1024	No for wind: Has not passed 10kt and changed by more than 60° Yes for temp: It is = >2 °C out

South African Weather Service

Templ ref: CRS–CC-PRES-TEMP-003.2 Doc Ref no: RTC-PRE-030.2_Take-off Data Forecast

References

- Latest edition of RTC-CN-020_Aviation Practical Course Notes

South African Weather Service