

International Civil Aviation Organization



FIFTH MEETING OF THE ASIA/PACIFIC METEOROLOGICAL REQUIREMENTS WORKING GROUP (MET/R WG/5) OF THE ASIA/PACIFIC AIR NAVIGATION PLANNING AND IMPLEMENTATION REGIONAL GROUP (APANPIRG)

Bangkok, Thailand, 19 – 21 April 2016

Agenda Item 4: MET information required to support end user systems

AUSTRALIAN AVIATION WEATHER SERVICES FOR AIR TRAFFIC MANAGEMENT

(Presented by Ashwin Naidu of Australia)

SUMMARY

This paper presents information of aviation weather services and products provided to the aviation industry in Australia. The paper also provides information on the products that are planned to be produced in the near future.

1. Introduction

1.1 The Bureau of Meteorology (the Bureau), as established by the Australian Government's Meteorology Act 1955, is the Meteorological Authority and the primary provider of aviation weather services in Australia airspace. The service is funded by the aviation industry on a cost-recovery basis and is recovered from the industry by Airservices Australia (Airservices) via the Meteorological Service Charge.

1.2 The Aeronautical Services Handbook (ASH) is the Bureau's Aviation Weather Services' operations manual. It specifies national policy and standards, and describes the practices and procedures followed by the Bureau in the provision of meteorological services to aviation. The following section summarises the current aviation products and services produced by the Bureau as contained in the ASH. The later sections also provide a summary of some of the products and services that are proposed for the future.

1.3 Airservices was established by and operates under the Air Services Act 1995. Airservices provides air traffic services and an aeronautical information service (AIS) within Australia. Airservices is responsible for distributing the meteorological products to the industry.

2. Aviation Observations and Reports

2.1 Aerodrome Weather Reports

2.1.1 Aerodrome weather reports (METAR/SPECI) are based on information originating from Automatic Weather Stations (AWS). At some aerodromes, observers add visual information prior to dissemination.

2.1.2 Fully automated METAR/SPECI messages will be indicated by the inclusion of the word AUTO after the date/time group, and will include any automated visibility, cloud and present weather data in the body of the message.

Examples:

```
SPECI YSSY 111900Z 16018KT 9999 SCT008 BKN030 15/14 Q1008 WS  
RWY16L WS RWY16R RMK RF00.0/000.0
```

```
METAR YBCG 091300Z AUTO 23003KT 9999 // NCD 14/13 Q1023  
RMK RF00.0/000.0
```

2.2 Aerodrome Terminal Information Services (ATIS)

2.2.1 Aerodrome Terminal Information Services (ATIS) is provided at aerodromes where a control tower is established. Control towers usually receive information directly from the AWS, and other anemometers, at the aerodrome. As necessary, the meteorological office may assist the tower controller by providing observations of those elements that are not available in the control tower. Procedures for providing this information are determined by local agreement.

2.3 Aerodrome Weather Information Service (AWIS)

2.3.1 Aerodrome Weather Information Service (AWIS) provides a facility to access real time (one-minute) meteorological observations from the automatic weather station at more than 200 airports. The observations can be accessed via phone or, at selected locations, via VHF radio transmissions.

2.3.2 Basic AWS provide wind direction and speed, temperature, humidity, pressure setting and rainfall. Most aviation AWS also provide automated cloud and visibility elements and soon weather elements will be added.

2.3.3 Information provided in AWIS broadcasts are in a similar format to that of an ATIS broadcast.

2.4 Aircraft Weather Reports

2.4.1 Aircraft weather reports (AIREP) augment meteorological observations available from other sources, particularly over data sparse areas. The letters ARP precede a routine AIREP and ARS a special AIREP.

2.4.2 There is a requirement for a pilot to make an AIREP when requested or when certain conditions are encountered. In particular, Special AIREP are made as soon as practicable after a pilot encounters any SIGMET condition that has not been forecast, or any other meteorological condition which is likely to affect the safety or markedly affect the efficiency of other aircraft operations.

Examples:

ARP SH802 YSRI 2205 F095 RMK/REP CLD OVERCAST AT 200FT CLEAR TO
STH AND EAST.

ARS VOZ744 3130S15239E 0655 F160 RIME AND CLEAR ICE REPORTED IN
THE LEVEL BAND F160-F260

2.4.3 AMDAR (Automated Meteorological Data Relay) provides frequent automatic meteorological information at cruise, descent and ascent phases. Reports include information on the coordinates of the report, time of report, level (with indicator F), temperature, wind, turbulence (with indicator TB), and maximum derived equivalent vertical gust (indicator VG).

2.4.4 Reporting by Royal Australia Airforce (RAAF) aircraft is authorised by the RAAF Flight Information Publication (FLIP). The selection of aircraft requested to report is made at the discretion of the Bureau officer briefing the aircrew, taking into account any requests for the information by officers responsible for preparing forecasts over the routes or areas concerned.

3. Aerodrome Forecasts and Briefings

3.1 Aerodrome Forecasts (TAF)

3.1.1 An aerodrome forecast (TAF) is a statement of meteorological conditions expected in the airspace within a radius of five nautical miles of the aerodrome reference point.

3.1.2 Australian TAF Categories and associated TAF Services are defined according the table below:

Cat.	Aerodrome Type	Routine TAF Service
A	International	Issued 6-hourly. Valid for 24 or 30 hours. Commencement times are 00, 06, 12 and 18 UTC
B	Large Passengers > 150 000 or Movements >75 000	Issued 6-hourly. Valid for 12 or 18 hours. Commencement times are 00, 06, 12 and 18 UTC.
C	Medium Passengers > 50 000 or Movements > 10 000	Issued 6-hourly. Typically valid for 12 hours. Commencement times are 02, 08, 14 and/or 20 UTC, except in Western Australia where commencement times are 04, 10, 16 and/or 22 UTC.
D	Small Aerodromes meeting passenger and movement thresholds, or other operational criteria	Issued 6- or 12-hourly. Valid for up to 12 hours. Commencement times are typically 20 and/or 02 UTC, except in Western Australia where commencement times are typically 22 and/or 04 UTC.

Table 1- Definitions of Aerodrome Categories and Associated TAF Service

3.1.3 Australian TAFs are based upon the ICAO standard but also include some additional fields, such as:

- a) INTER to represent significant intermittent variations in prevailing conditions with less than 30 minutes in each instance and which, in the aggregate, are not expected to cover more than half the given period;
- b) Air Temperature forecasts, preceded by the letter T for times HH, HH+3, HH=6 and HH+9 where HH is the time of commencement of validity of the TAF;
- c) QNH forecasts, preceded by the letter Q for times HH, HH+3, HH=6 and HH+9 where HH is the time of commencement of validity of the TAF.
- d) Air Temperature and QNH fields are removed before a TAF is disseminated internationally, however, the INTER section remains.

Example of an Australian TAF:

```
TAF YPDN 290430Z 2906/3012
33050G70KT 3000 +RA BKN010
FM291400 33030G50KT 8000 -RA FEW005 BKN010
TEMPO 2908/2914 VRB80G130KT 2000 +TSRA BKN005 SCT040CB
INTER 2914/3008 VRB40G70KT 3000 +TSRA BKN005 SCT040CB
RMK FM290800 SEV TURB BLW 5000FT
T 32 39 28 26 Q 1002 999 997 992
```

3.2 Trend Forecasts (TTF)

3.2.1 A TTF is a statement of meteorological conditions expected in the airspace within a radius of 5 nautical miles of the aerodrome reference point. It comprises an aerodrome weather report and a concise statement of any expected significant changes of wind, visibility, weather and cloud and/or a concise statement of moderate or severe low level turbulence expected in the 3 hour period from the time of the report.

3.2.2 The TTF are only prepared for a few locations in consultation with the industry and the Australian Defence Force.

3.2.3 TTF is not compliant with the ICAO Trend forecast. In Australia, the TTF offers operational benefits to pilots in that it can be used for flight (fuel) planning purposes for very short flights as well as a landing forecast.

3.2.4 TTF forecast is currently under review and is proposed to be ceased in late 2017, or early 2018. Instead a TAF is routinely issued every 3 hours (rather than standard 6 hourly) and amended whenever the forecast policy changes.

3.2.5 Examples of an Australian TTF:

```
TTF METAR YPDN 120600Z 30009KT 9999 FEW030TCU 32/23 Q1010
RMK RF00.0/000.0 TCU TO SE
TEMPO 0630/0900 3000 TSRA BKN030CB
```

```
TTF SPECI YBCS 111745Z 23014G29KT 4000 1200NE +TSRA SCT030CB
BKN100 26/22 Q1003 RMK RF05.2/010.8
FM1815 23010KT 9999 NSW FEW030 BKN060
```

3.3 Airport Weather Briefing (AWB)

3.3.1 The Airport Weather Briefing (AWB) product is provided for some capital city aerodromes and is used by both operators and Air Traffic Services. They are an extension to the TAF service aimed at expanding on the information provided in the TAF.

3.3.2 AWBs are issued in conjunction with the routine TAF but take a lower priority and are not amended or updated.

4. Forecast for Operations Below 20 000 Feet

4.1 Ditching Reports

4.1.1 A Ditching Report is essentially a “nowcast” of conditions at a location where an aircraft in difficulty will attempt a forced landing. This information will assist the pilot to make decisions about how to prepare for landing with minimum risk to safety.

4.1.2 A Ditching Report takes has the highest priority of all other products and services and is prepared immediately upon request. Often in such an emergency, only a few minutes are available to provide the report before the aircraft descends to the surface.

4.2 Search and Rescue (SAR) Forecasts

4.2.1 Search and Rescue (SAR) are prepared by the relevant Meteorological Watch Offices (MWO) upon request from the Rescue Coordination Centre (RCC) at the Australian Maritime Safety Authority (AMSA).

4.2.2 In the case of a SAR operation by the RCC outside Australia's area of responsibility, the Perth MWO receive requests for the area south of Indonesia, and the Darwin MWO receive requests for the remainder of Indonesian waters plus those of Papua New Guinea.

4.2.3 A service in support of SAR operations takes priority over routine tasks and is essentially second to Ditching Reports.

4.2.4 SAR Forecasts are kept under continuous watch and are amended as required.

4.3 Area Forecasts (ARFORs)

4.3.1 Area Forecasts (ARFORs) are designed primarily to meet the needs of pilots of general and regional aviation for operations below FL200 and has an emphasis on plain language. Forecasts should be concise, although not at the expense of adequately providing all relevant information.

4.3.2 The ARFOR provides a forecast of weather conditions for the specified area. It is a document whereby pilots and Air Traffic Services staff determine how, when, where and if particular aircraft operations can occur within the ambit of the Air Navigation Act and its Regulations. As it is the basis for critical operational decisions, the Area Forecast is prepared as lucid and unambiguous as possible.

4.3.3 ARFORs are routinely prepared with a validity period of mostly 12 hours; however, it can be issued for validity period maximum of 15 hours, or minimum of 9 hours.

4.3.4 Some of the ARFORs also contain forecasts for critical locations. Critical locations are defined as a pass or gap through a mountain range which may be available for use by VFR pilots when poor conditions prohibit flight across the ranges elsewhere. The main concern at these locations is whether the pilot can fly over these regions visually.

4.3.5 ARFORs are prepared generally for 24 hours for all regions in Australia except for the areas where the air traffic volume is very low are not justified to get routine ARFORs. In these cases a Flight Forecast are prepared for individual flights.

4.3.6 Area Forecasts are kept under constant review and are amended as required.

4.3.7 The Bureau is planning to reduce the vertical extent of the ARFORs to FL100 late this year so that there is no overlap between the ARFOR and medium-level SIGWX chart (FL100-250).

4.3.8 The Bureau is planning produce Graphical Area Forecasts (GAF) in the future which will replace the text-based ARFORs. See section 7.1 for further details.

4.4 Local Area Forecasts

4.4.1 Local Area Forecasts may be prepared for specific purposes, e.g. for a RAAF training area. These forecasts are usually similar to Area Forecasts but may contain additional information and are provided in accordance with local agreements with civil or military aviation authorities.

4.4.2 Local Area Forecasts are also prepared for all landing sites in the Australian Antarctic Territory except for Wilkins Runway (for which a TAF is issued).

4.5 Route Forecasts (ROFORs)

4.5.1 Route Forecasts (ROFORs) contain forecast information of wind direction/speed and temperature along a specific route at specific levels.

4.5.2 ROFORs are automated product and are issued from a Central Aviation Weather Centre.

4.5.3 An Antarctic Low-level ROFOR package is produced on request for flights, both interstation and deep-field, within Australian Antarctic Territory.

4.6 Flight Forecasts (FLIFORs)

4.6.1 Flight Forecasts for operations below 20 000 feet are not usually provided if valid Area Forecasts are available.

4.6.2 Flight forecasts contain information for the same elements that make up an Area Forecast, except they are defined along a specific route.

4.6.3 Similar to ARFORs, Flight Forecasts are kept under continuous watch and are amended as necessary.

4.7 Area QNH Forecasts

4.7.1 Aircraft cruising at or below 10 000 feet maintain altitude according to the indication of a pressure-operated altimeter, the sub-scale of which is set to Area QNH.

4.7.2 Area QNH is critical to the safe operation of aircraft at or below 10 000 ft.

4.7.3 Area QNH Forecasts must be within plus or minus 5 hPa of the actual QNH at any low level point (below 1 000 feet above MSL) within or on the boundary of the area QNH zone during the period of validity of the forecast. The difference between adjacent zones is not to exceed 5 hPa.

4.7.4 Area QNH Forecasts apply to low-level stations. Generally air temperatures in Australia are higher than those for corresponding levels for the International Standard Atmosphere and the density is usually less than the value used in computation of the International Standard Atmosphere. Therefore pressure altitudes, using QNH as a sub-scale setting on the altimeter, are less than the actual altitudes in most cases. When actual temperatures are lower than in the International Standard Atmosphere, the reverse applies. These differences normally become increasingly significant with increasing altitude and therefore Area QNH Forecasts should not be regarded as applying to high-level stations.

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4.7.5 Area QNH Forecasts are valid for three hours commencing 0100 UTC and each three hours thereafter.

4.7.6 Area QNH Forecasts are amended if the actual QNH of any point below 1 000 feet above MSL within or on the boundary of the zone becomes, or is expected to become, different from the area QNH by more than five hectopascals during the period of validity of the forecast.

4.7.7 Example:

AREA 40 QNH

AREA 40 QNH 07/10 AREA 40 N OF YMLS/YBSU 1010, REST 1014

4.8 NOTAMs

4.8.1 The Bureau, in accordance with ICAO Annex 15 Aeronautical Information Services, is required to request Aircservices to issue a NOTAM (Notice to Airmen) for a disruption to the provision of the Bureau's Aviation Weather Services program.

4.9 International General Aviation

4.9.1 Forecasts for international general aviation are prepared by the MWO responsible for the location in which the flight commences. Assistance may be sought from Melbourne Aviation Weather Centre, or other MWOs as appropriate.

5. Forecast for Operations Above 20 000 Feet

5.1 Route Forecasts (ROFORs)

5.1.1 Similar to Low-level ROFORs, high-level ROFORs contain forecast information of wind direction/speed and temperature along a specific route at specific levels.

5.1.2 All automated ROFORs, with the exception of Antarctic ROFORs, are the responsibility of the Aviation Weather Centre in Bureau's National Operations Centre (BNOC).

5.1.3 A high-level graphical ROFOR package is produced on request for the A319 Hobart/Wilkins flights.

5.2 Flight Forecasts

5.2.1 Flight Forecasts for operations above 20 000 feet are not usually provided if valid SIGWX, Grid Point Winds and Temperatures, Route Sector Winds and Temperatures, and Wind and Temperature Charts are available.

5.2.2 Flight forecasts may be required for some flights (e.g. defence or private jet), which are not catered for by the standard products.

5.2.3 Flight Forecast contains forecast information of wind direction/speed and temperature for a specific flight along a specific route.

5.2.4 Flight Forecasts above 20 000 are generally produced using WAFC data. Significant errors or variations are notified to the WAFC for amendment action.

5.3 Significant Weather Charts

5.3.1 Significant Weather (SIGWX) charts are produced in accordance with the Standards and Recommended Practices of ICAO Annex 3.

5.3.2 The Aviation Weather Centre (AWC) located within BNOc produces medium-level SIGWX charts for the area south of equator to latitude 50 degrees S bounded by longitudes 100 degrees E to 180 degrees E for operations between FL100 and FL250. It also automatically produces high-level SIGWX charts for the same region from WAFS BUFR data for operations between FL250 and FL630. Light forecasts may be required for some flights (e.g. defence or private jet), which are not catered for by the standard products.

5.3.3 The forecast policy depicted in medium-level SIGWX charts may be used as guidance in preparation of domestic Area Forecasts, however the Area Forecast shall reflect the latest opinion of forecast policy.

5.3.4 The SIGWX chart is valid for a fixed time. It is used for operations within a period starting 3 hours before, until 3 hours after the validity time of the chart.

5.3.5 Medium-level SIGWX charts are updated one hour prior to the start of the validity period (four hours prior to the validity time).

5.3.6 Examples:

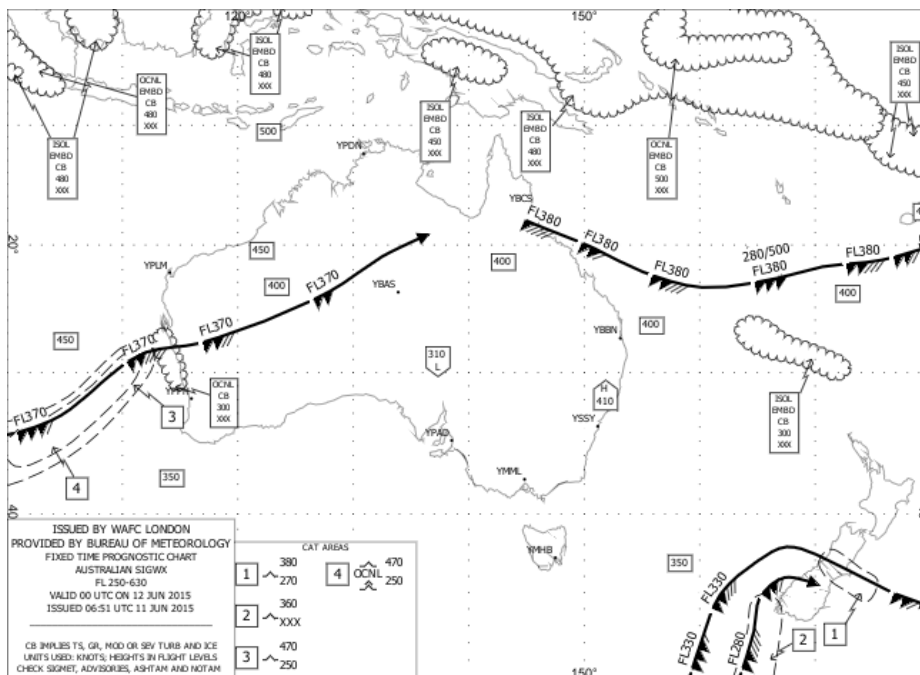


Figure 1: High-Level SIGWX Chart (FL250 – 630)

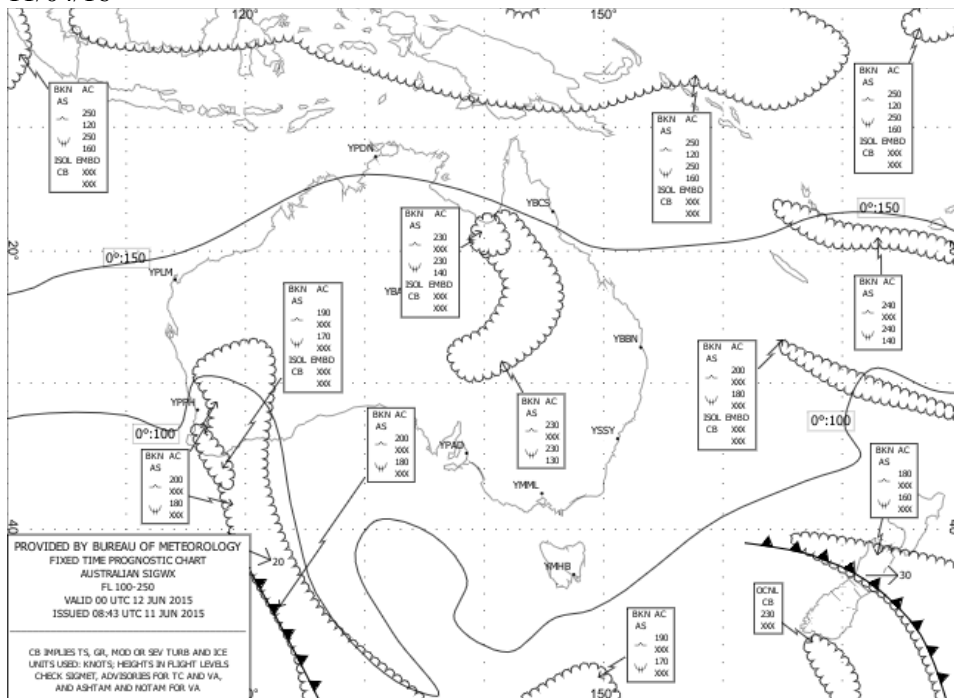


Figure 2: Medium-Level SIGWX Chart (FL100 – 250)

5.4 Wind and Temperature Charts

5.4.1 ICAO's World Area Forecast System (WAFS) produces global wind and temperature data in gridded binary (GRIB) format.

5.4.2 The Aviation Weather Centre (AWC) in BNOB automatically produces Wind and Temperature charts for ICAO regions E, F and K. The AWC also produces an Australian region chart from the GRIB data.

5.4.3 Example:

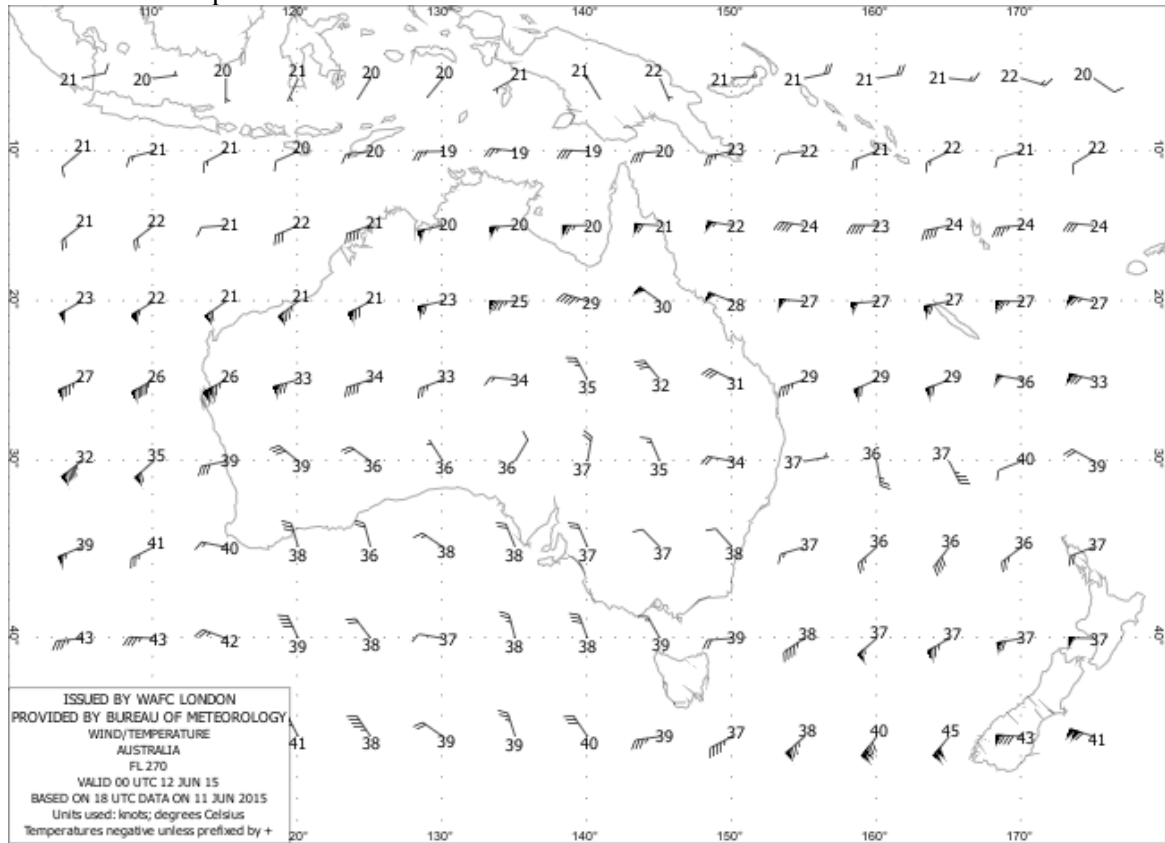


Figure 3 – Australian Region Wind and Temperature Chart

5.5 Grid Point Wind and Temperature Forecasts

5.5.1 A grid-point wind and temperature chart provides a text-based display of forecast wind and temperature data for multiple levels.

5.5.2 These charts are generated from data sourced from one of the two World Area Forecast Centres (WAFCs).

5.5.3 The charts are issued every six hours for the next 24 hours. They are valid for the given time but are applied to operations from three hours before to three hours after the valid time. Receipt of a forecast for a particular validity time will automatically amend and supersede any prior issues for that time. Both issue time and validity time are given on the forecast.

5.5.4 Example:

115° E		115° E		115° E		115° E		115° E		115° E		115° E		115° E		115° E		115° E		115° E		
21 016 -68	19 008 -68	24 007 -67	28 009 -68	27 016 -68	25 025 -68	28 026 -68	28 032 -68	28 048 -69	29 045 -68	29 049 -67	28 050 -67											
22 022 -53	18 011 -53	36 004 -53	29 010 -53	28 020 -52	27 026 -53	28 039 -53	30 046 -53	32 043 -52	30 043 -52	30 043 -52	31 042 -51											
21 024 -40	19 012 -40	38 008 -40	27 014 -41	28 020 -40	27 027 -40	28 037 -39	28 047 -39	28 048 -39	28 038 -39	30 033 -39	30 024 -40											
24 013 -15	19 012 -15	16 015 -16	19 018 -15	24 018 -14	25 023 -14	26 033 -13	26 042 -14	27 039 -14	28 034 -16	29 028 -14	27 021 -14											
13 023 -04	14 025 -05	16 028 -04	18 026 -05	21 019 -05	23 024 -04	28 027 -06	30 028 -06	31 021 -05	33 011 -05	00 005 -04	26 001 -04											
27 024 -67	27 021 -67	27 024 -68	27 037 -68	27 045 -67	27 047 -67	27 052 -66	27 055 -67	27 072 -66	28 073 -67	29 087 -69	28 084 -69											
25 035 -53	24 035 -53	25 032 -40	25 035 -40	26 043 -40	26 045 -40	26 058 -40	26 078 -40	28 072 -40	29 087 -40	29 081 -41	29 072 -40											
25 032 -29	26 033 -30	26 030 -30	25 042 -30	25 061 -29	26 059 -29	26 067 -29	27 080 -29	28 084 -30	29 079 -30	29 078 -30	27 073 -32											
24 026 -17	23 034 -18	22 040 -17	21 059 -16	22 051 -15	25 049 -14	26 051 -14	28 059 -17	30 047 -21	30 043 -20	29 033 -19	27 033 -17											
21 008 -06	21 018 -06	22 029 -06	22 029 -07	22 033 -08	23 028 -08	28 025 -10	31 036 -12	32 030 -10	30 042 -07	30 012 -07	24 015 -06											
26 057 -68	26 051 -69	26 072 -52	27 074 -54	25 061 -63	25 060 -63	27 064 -62	26 059 -61	26 062 -59	28 067 -62	28 068 -62	27 093 -66											
25 056 -40	25 060 -39	25 062 -39	25 088 -40	25 089 -38	25 089 -38	26 078 -48	26 078 -48	28 072 -46	28 072 -49	29 106 -53	28 122 -54											
25 063 -30	25 069 -29	24 080 -29	24 092 -31	24 097 -31	25 088 -30	25 071 -33	28 050 -37	34 049 -40	30 051 -40	28 049 -38	27 059 -37											
25 044 -20	24 053 -21	23 072 -19	24 071 -19	24 047 -25	24 035 -24	26 025 -25	30 023 -26	32 037 -24	29 036 -23	24 032 -22	25 040 -21											
25 030 -07	25 036 -08	25 053 -08	26 047 -11	24 022 -10	24 011 -14	26 018 -15	31 019 -15	28 015 -14	35 022 -14	26 023 -10	23 020 -11											
27 105 -65	26 107 -64	25 102 -60	32 048 -48	33 043 -51	30 030 -53	26 018 -56	24 020 -56	26 030 -59	26 030 -59	26 039 -60	25 038 -60											
25 114 -53	25 103 -51	26 122 -46	26 122 -46	25 090 -45	26 050 -46	26 032 -44	25 040 -46	29 043 -49	29 063 -55	28 080 -56	27 099 -55											
26 113 -42	24 115 -42	24 108 -43	26 094 -38	26 078 -39	25 045 -42	25 021 -44	28 024 -44	33 040 -52	31 032 -54	28 049 -52	25 058 -50											
25 101 -35	25 113 -34	24 141 -36	26 073 -38	26 045 -42	28 011 -43	25 007 -42	35 012 -44	34 047 -44	32 023 -42	27 034 -41	24 049 -40											
24 061 -23	23 088 -23	25 063 -23	28 037 -30	28 028 -28	30 010 -28	14 005 -29	01 016 -30	00 016 -28	32 016 -25	27 013 -26	15 019 -28											
25 034 -13	22 040 -14	25 029 -17	29 033 -17	29 018 -16	33 010 -17	18 006 -16	02 014 -17	02 027 -17	03 014 -17	08 007 -15	16 016 -14											
26 097 -59	26 100 -56	25 079 -51	30 048 -52	30 036 -54	27 022 -56	25 018 -56	24 020 -56	26 030 -59	26 030 -59	26 039 -60	25 038 -60											
25 122 -54	24 096 -53	25 060 -50	28 049 -45	29 034 -45	29 029 -44	26 014 -47	22 010 -50	34 013 -56	32 015 -61	26 037 -62	25 029 -61											
25 137 -50	24 095 -47	23 058 -47	30 033 -49	31 026 -48	33 018 -50	33 010 -49	05 015 -52	04 025 -55	30 012 -53	25 035 -52	24 021 -55											
25 118 -41	23 068 -44	23 037 -46	30 022 -46	00 027 -45	34 015 -44	00 014 -44	03 014 -45	02 017 -44	31 020 -43	30 009 -45	19 014 -46											
25 048 -30	24 031 -32	20 024 -33	30 021 -31	31 022 -30	32 015 -30	34 012 -30	05 015 -30	35 020 -29	35 012 -30	01 009 -29	18 013 -28											
23 045 -17	24 026 -18	19 026 -19	30 017 -20	32 029 -17	31 015 -17	34 012 -15	04 015 -17	35 010 -17	02 012 -17	11 002 -15	17 019 -15											
27 064 -56	27 049 -53	29 041 -50	32 048 -48	33 043 -51	30 030 -53	26 018 -56	20 016 -55	22 020 -56	22 017 -58	23 026 -58	23 036 -58											
26 089 -55	26 056 -58	26 037 -54	31 039 -51	32 044 -48	32 034 -47	29 019 -48	27 012 -54	27 012 -58	26 021 -61	29 017 -63	26 032 -64											
26 090 -54	26 057 -53	25 036 -56	33 042 -55	34 035 -55	32 016 -53	32 015 -48	32 032 -52	31 025 -54	29 015 -56	27 023 -57	24 046 -56											
26 068 -48	26 042 -46	25 031 -50	34 037 -49	33 026 -46	30 018 -45	33 015 -43	33 037 -45	31 020 -45	35 014 -47	28 024 -47	25 040 -46											
26 061 -34	27 033 -34	25 034 -34	32 026 -31	33 023 -29	34 018 -30	30 022 -30	05 027 -30	36 018 -30	34 008 -30	25 017 -29	23 038 -29											
25 041 -22	24 025 -21	30 022 -19	35 032 -19	35 032 -19	28 013 -18	28 012 -19	32 024 -18	01 025 -19	21 004 -19	21 009 -18	21 033 -19											
28 052 -50	29 047 -51	30 040 -48	33 053 -46	31 055 -48	30 050 -51	28 038 -52	24 029 -54	24 027 -56	23 031 -57	22 038 -57	23 056 -58											
127 055 -54	28 053 -54	29 040 -55	32 050 -51	32 051 -54	32 047 -52	31 035 -52	29 020 -53	29 017 -57	28 017 -62	24 041 -66	23 071 -66											
					32 027 -54	30 018 -51	34 019 -52	30 021 -55	30 011 -56	23 035 -55	22 068 -56											
					32 021 -31	34 012 -31	38 052 -31	35 018 -31	34 008 -31	23 044 -30	22 063 -30											
					33 028 -18	34 016 -19	35 029 -20	31 017 -17	25 022 -18	23 050 -19	22 061 -18											
					30 059 -50	29 056 -51	27 052 -52	24 049 -54	23 055 -56	23 073 -57	23 088 -51											
					31 059 -57	31 050 -59	30 038 -60	28 037 -64	24 053 -65	23 075 -64	23 107 -62											
					31 051 -49	30 036 -54	32 035 -54	29 031 -55	24 051 -55	23 079 -59	21 118 -56											
					32 047 -32	31 029 -32	30 036 -32	27 044 -32	25 047 -31	23 068 -31	22 108 -34											
					32 053 -19	33 032 -19	32 029 -20	26 037 -20	24 042 -19	23 063 -20	22 076 -25											

Figure 4 – High-level Grid Point Wind and Temperature Chart for Australian Region

5.6 Route Sector Wind and Temperature (RSWT) Forecast

5.6.1 Route Sector Winds and Temperatures (RSWT) are specialised products derived from upper air wind and temperature forecasts and services to facilitate flight planning are provided as required.

6. Meteorological Watch and Warning Services

6.1 Meteorological Watch

6.1.1 Meteorological watch services involve the following functions:

- a) Continuous surveillance of observations and reports, and
- b) Review and amendment of forecasts and warnings.

6.1.2 It is vital that forecasts and warnings are continually reviewed in light of new information as it is received. Delays in the amendment of forecasts or warnings may jeopardise the safe and economical operation of flights within Australian airspace.

6.2 SIGMET

6.2.1 SIGMET is a warning issued to provide urgent advice to aircraft in flight, or prior to departure, of actual or expected potentially hazardous weather developments or trends.

6.2.2 SIGMET must be available to aircraft in ample time to ensure that any possible avoidance or precautionary action can be taken, and therefore forecasters should endeavor to issue SIGMETs advising of forecast phenomena at least one hour prior to the validity commencement. It is intended that the information provided will serve all operations by civil and military aircraft.

6.2.3 SIGMETs are issued for phenomena based on the ICAO standard and requirements, and as relevant to Australian FIR.

6.2.4 All Australian SIGMETs are assigned a sequence number, such as A01, where A refers to the SIGMET event and is be used for any subsequent SIGMETs issued for that event within the given FIR and the two-digit number, 01, provides a sequential count of the number of SIGMETs issued for the event within the FIR. At present the two digit sequence number resets to '01' at 0001UTC each day.

6.2.5 Note, this is causing confusion among users when only one SIGMET is issued for a particular event before 0001 UTC and continues into the next day. The Bureau is proposing that the Australian SIGMET sequence numbers will no longer reset at 0001UTC, and instead the sequence numbering will continue until the SIGMET for the event is cancelled. Should more than 99 SIGMETs be issued for a particular event, the number portion of the sequence number will go from 99 to 02. 01 is reserved for new SIGMETs.

6.2.6 Examples:

```
WSAU21 AMMC 220155  
YMMM SIGMET E01 VALID 220315/220715 YMMCYMMM  
MELBOURNE FIR SEV TURB FCST WI S3445 E12615 - S4030 E12145 -S4030  
E12915FL230/330 STNR NC  
RMK: MW NEW
```

```
WSAU21 AMMC 220645  
YMMM SIGMET E02 VALID 220715/221115 YMMCYMMM  
MELBOURNE FIR SEV TURB FCST WI S3445 E12615 - S4030 E12145 -S4030  
E12915 FL230/330 MOV SE 10KT WKN  
RMK: MW EXTD E01 220315/220715
```

```
WSAU21 AMMC 220900  
YMMM SIGMET E03 VALID 220900/221115 YMMCYMMM  
MELBOURNE FIR CNL SIGMET E02 220715/221115  
RMK: MW CNL E02
```

6.2.7 The Bureau of Meteorology issues graphical representations of their text SIGMETs. The graphical SIGMET is intended to improve situational awareness. The text SIGMETs are still produced to be used for official flight planning purposes. Graphic representations of SIGMETs over the Australian FIR are produced for three levels:

- a) High level – FL100-FL630;
- b) Low level – SFC-FL100; and
- c) All levels – SFC-FL630.

6.2.8 Example:

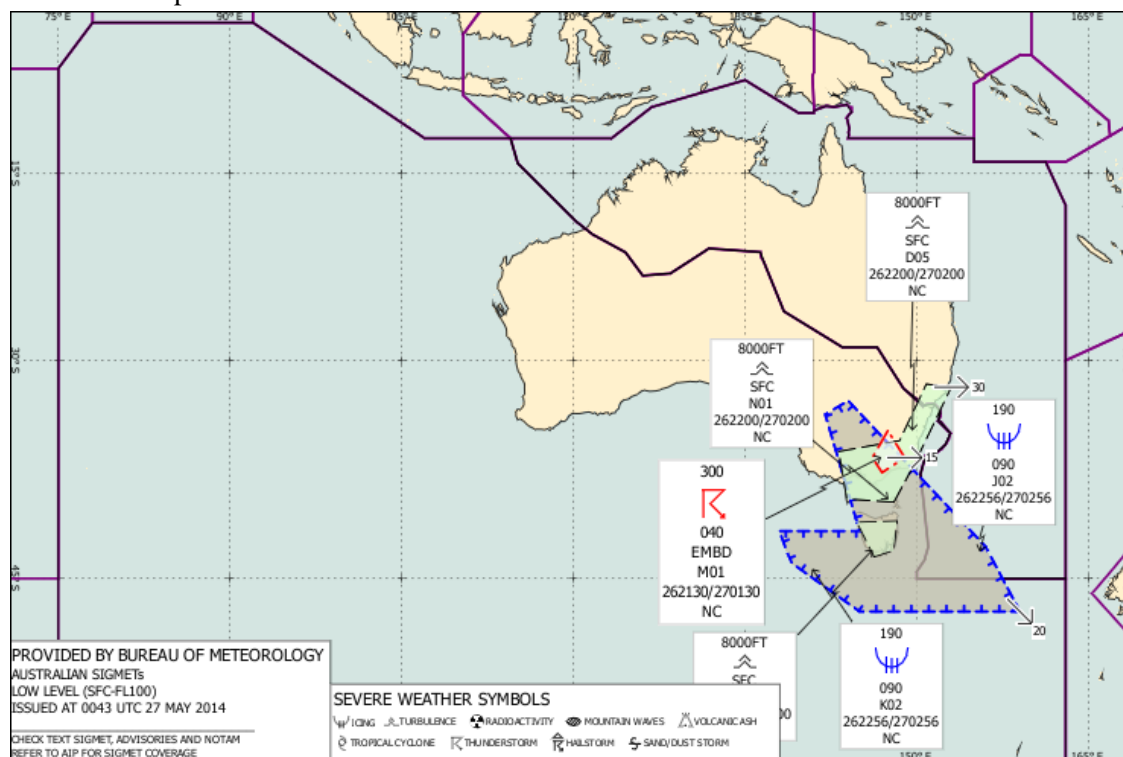


Figure 5 – Australian Graphical SIGMETs

6.3 AIRMET

6.3.1 AIRMET advices are issued to provide pilots with plain language warnings of certain meteorological phenomena that are not contained within the valid area forecast. AIRMET are complementary to the routine issue and amendment of low-level area forecasts and are issued by the office responsible for the low-level area forecast affected. The advice must be available to aircraft in ample time to ensure that any possible avoidance or precautionary action can be taken.

6.3.2 AIRMET information is passed on to pilots by Air Traffic Services and as such provides a good method by which the onset of phenomena that may affect the safety of low-level flights can be passed to aircraft operating in the affected area.

Example:

AIRMET 190530Z AREA 52 VALID 190530/190930 THUNDERSTORMS
OBSERVED AT 0525Z WITHIN AREA YCFH TO YMRE TO YCBP TO YALA
SFC/FL400 MOV S 05KT NC. AMEND AREA FORECAST FOLLOWS.

6.3.4 Australian AIRMETs are not strictly ICAO compliant and the Bureau is planning implement this later this year. See details in the later section.

6.4 Aerodrome Warning

6.4.1 Aerodrome warnings are issued to provide operators, aerodrome services and others with concise information on meteorological conditions that could adversely affect the aerodrome's facilities and services, and aircraft on the ground, including parked aircraft.

6.4.2 Aerodrome Warnings are issued for a limited number of locations only, and are disseminated by local arrangement to those immediately concerned.

6.4.3 Aerodrome Warnings are cancelled if the phenomenon ceases, or is expected to cease, during the validity period of the warning.

6.4.4 Example:

YPPH AD WRNG 1 VALID 030500/030800Z AERODROME WARNING NUMBER 1
FOR PERTH VALID 031300/031600 LOCAL ISSUED 030300Z (031100 LOCAL)
THUNDERSTORMS WITH HEAVY HAIL AND SURFACE WINDS 50KT MAX 60KT

6.5 Thunderstorm Alert for Aviation Ground Staff (TAAGS)

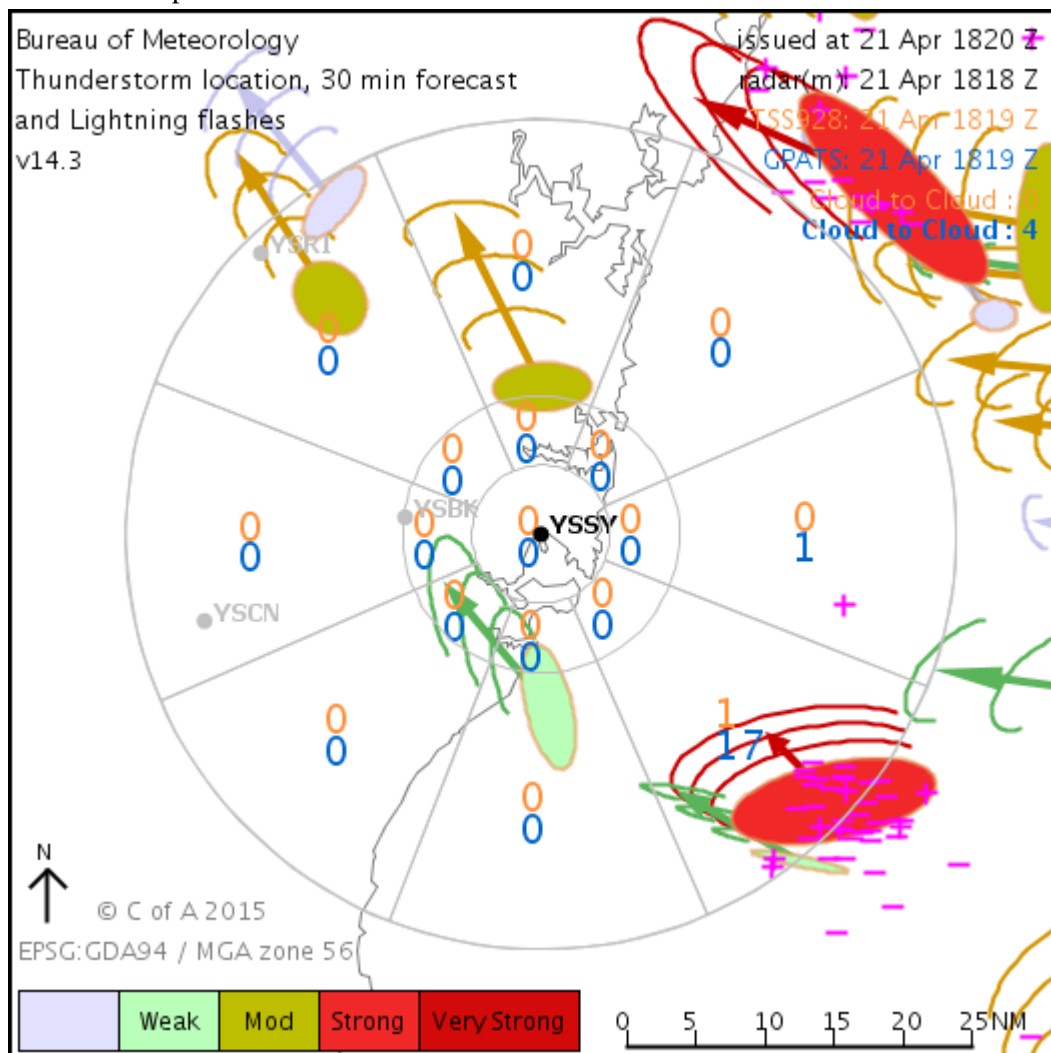
6.5.1 TAAGS is a manually-produced service comprising a 15nm alert, a 5nm alert and a cancellation product. It is only issued for Alice Springs, by the Darwin RFC. The service will cease with the implementation of ATSAS at this airport.

6.6 Automated Thunderstorm Alert Service (ATSAS)

6.6.1 At a number of major Australian airports there has been an increased awareness of the risks associated with lightning strikes on ground crew and their equipment. In response to this the Bureau has developed an automated thunderstorm alerting service that is designed to streamline the communication of relevant information to the industry so as to allow industry or airline representatives to assess the risks in an independent nature. The system uses radar and lightning data to identify and track thunderstorm cells.

6.6.2 The system routinely produces images showing the location of thunderstorm cells identified from radar and lightning data with respect to each major airport. The system provides alerts of Thunderstorms within 30NM, 10NM and 5NM of the aerodrome via email or SMS.

6.6.3 Example



6.7 Tropical Cyclone Advisories (TCA)

6.7.1 Tropical Cyclone Advisories (TCA) provide information concerning the position of the cyclone centre, its direction and speed of movement, central pressure and maximum surface wind near the centre.

6.7.2 The TCA should provide updated advisory information to meteorological watch offices for each tropical cyclone as necessary, but at least every six hours.

6.7.3 Advisories may be updated at any time there is a significant change in information.

6.7.4 Example:

FKAU01 ADRM 110130	
TC ADVISORY	
DTG:	20050311/0000Z
TCAC	DARWIN
TC	INGRID
NR	23
PSN	S1230 E13930
MOV	WNW 08KT
C:	978HPA
MAX WIND:	60KT
FCST PSN +6HR:	11/0600Z S1225 E13838
FCST MAX WIND +6HR:	65KT
FCST PSN +12HR:	11/1200Z S1216 E13746
FCST MAX WIND +12HR:	70KT
FCST PSN +18HR:	11/1800Z S1204 E13653
FCST MAX WIND +18HR:	75KT
FCST PSN +24HR:	12/0000Z S1153 E13559
FCST MAX WIND +24HR:	80KT
RMK:	NIL
NXT MSG:	20050311/0730Z

Table 2: Tropical Cyclone Advisory

6.8 Wind Shear Warnings

6.8.1 A Wind Shear Warning shall give concise information of observed, reported or expected wind shear, between runway level and (normally) 1600 feet above that level, which could adversely affect aircraft on the approach or take-off paths, on the runway during the landing or take-off phases and during circling approach. Where local topography has been shown to produce significant shear at heights in excess of 1600 feet above runway level, then 1600 feet should not be considered restrictive.

6.8.2 Wind Shear Warnings are produced for the major international airports and some regional airports based on local arrangements.

6.8.3 A continuous weather watch should be maintained on Wind Shear Warnings, which should be reviewed or updated when necessary.

6.8.4 Wind Shear Warnings are to be cancelled when wind shear ceases, or is expected to cease, during the validity period of the warning.

6.8.5 Example:

YPAD WS WRNG 01 031930Z
VALID 031930/032030Z
WS REP AT 1920Z ASSOCIATED WITH THE PASSAGE OF THE FRONT
SFC WIND: 34020G30KT
1500FT WIND: 17030G40KT

6.9 Volcanic Ash Advisories

6.9.1 The Darwin Volcanic Ash Advisory Centre (VAAC) is one of nine ICAO-designated VAACs set up within the framework of the International Airways Volcano Watch (IAVW). The Darwin VAAC area of responsibility includes Indonesia, Papua New Guinea and the southern Philippines. Advisories provide information on the location, extent and movement of ash cloud. Although primarily intended as guidance for MWO to formulate volcanic ash SIGMET for their own areas of responsibility, advisory messages have become a direct source of ash cloud warning information for many airlines.

6.9.2 VAAC Tokyo and Wellington provide reciprocal backup arrangements with VAAC.

6.9.3 The normal frequency of issue is every 6 hours but more often if significant new information becomes available. Under certain circumstances, such as when precautionary advisories are being issued or regular information is being received.

6.9.4 Example:

VA ADVISORY	
DTG:	20061007/0140Z
VAAC:	DARWIN
VOLCANO	RABAUL 0502-14
PSN:	S0416 E15212
AREA:	NEW_BRITAIN SW_PAC
SUMMIT ELEV	688M/2257FT
ADVISORY NR:	2006/7
INFO SOURCE:	RVO, MTSAT-1R, NOAA/AVHRR
SUMMIT ELEV:	688M/2257FT
AVIATION COLOUR CODE:	RED
ERUPTION DETAILS:	RVO ADVISE ERUPTION AT 06/2245Z, SAT IMAGE INDICATES TO FL600
OBS VA DTG:	07/0130Z
OBS VA CLD	SFC/FL200 S0430 E15200 - S0340 E15200 - S0420 E15250 – S0430 E15200 - S0430 E15200 MOV NE 15KT FL200/600 S0355 E15150 - S0500 E15135 - S0435 E15235 – S0355 15150 MOV SW 30KT
FCST VA CLD +6HR	07/0730Z SFC/FL200 S0445 E15150 -S0300 E15150 -S0410 E15345 - S0535 E15320 - S0445 E15150 FL200/600 S0350 E15140 - S0400 E14940 - S0645 E15025 – S0445 E15240 - S0350 E15140
FCST VA CLD +12HR	07/1330Z SFC/FL200 S0500 E15200 - S0135 E15125 -S0350 E15430 - S0640 E15430 - S0500 E15200 FL200/600 S0440 E15310 - S0225 E15250 - S0405 E14905 - S0855 E14945 - S0600 E15140 - S0440 E15310
FCST VA CLD +18 HR	07/1930Z SFC/FL200 S0500 E15200 - S0125 E15115 - S0405 E15515 – S0710 E15505 - S0500 E15200 FL200/600 S0220 E15235 - S0405 E14835 -S0905 E14940 – S0440 E15340 - S0220 E15235
RMK	NOAA 07/0015Z, MTSAT 07/0033Z SATELLITE IMAGERY INDICATE ERUPTION TO FL600. COLOUR CODE BASED ON SATELLITE OBSERVATIONS
NXT ADVISORY	http://www.bom.gov.au/info/vaac/advisories.shtml NO LATER THAN 20061007/0730Z

Table 3: Volcanic Ash Advisory

6.10 Volcanic Ash Graphical Advisory

6.10.1 Advisory messages for volcanic ash cloud are also issued in graphical format whenever a text product is issued. Using the information from the text advisory, Darwin VAAC issues these in portable network graphics (PNG) format, which are made available on the Darwin VAAC website.

6.10.2 Example:

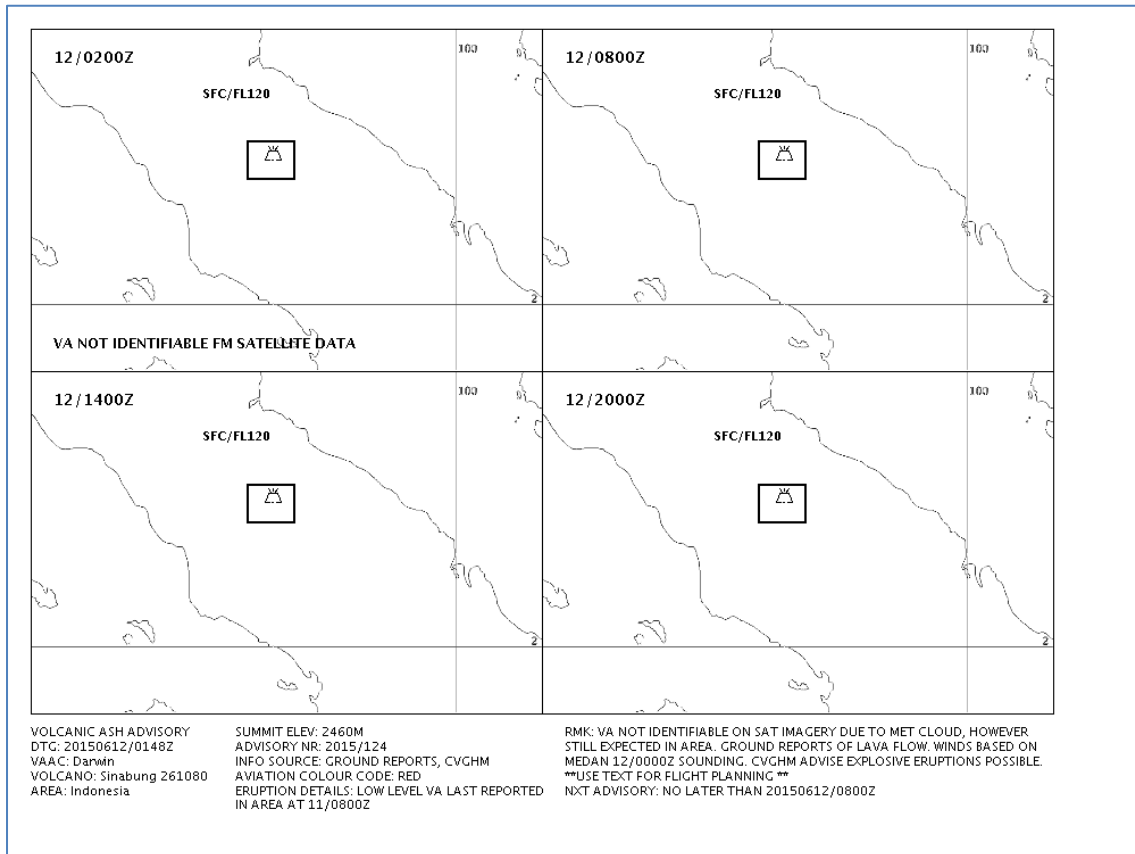


Figure 6 – Volcanic Ash Graphical Advisory

7. Future Services

7.1 Graphical Area Forecasts (GAF)

7.1.1 The Bureau of Meteorology currently produces Area Forecasts (ARFORs) for 28 areas across Australia. These ARFORs are provided in a text format and consist of an overview detailing the general meteorological situation followed by sections giving more detailed forecasts of various meteorological parameters (refer 4.3).

7.1.2 The formats of Australian ARFORs do not comply with ICAO Annex 3 specifications. In addition, the aviation industry has provided feedback that they would prefer Area Forecasts in a graphical format. In order to align the format with international best practice and to meet industry needs, the Bureau has progressed work in reviewing the requirements to support the implementation of Graphical Area Forecasts (GAF).

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7.1.3 GAFs will be produced for 10 areas across Australia. GAF will cover the area between the surface and FL100 as per ICAO requirements compared to the current area forecast which covers from the surface to FL200.

7.1.4 Low-level winds will not be included in GAF. Low-level winds and temperatures will be provided in a Grid Point Wind and Temperature (GPWT) format as produced for mid and high-level flights. The low-level GPWT chart will provide wind and temperature information for vertical levels of 1000FT, 2000FT, 5000FT, 7000FT, 10,000FT and 14,000FT.

7.1.5 GAF is planned to be implemented in late 2017.

7.1.6 Example:

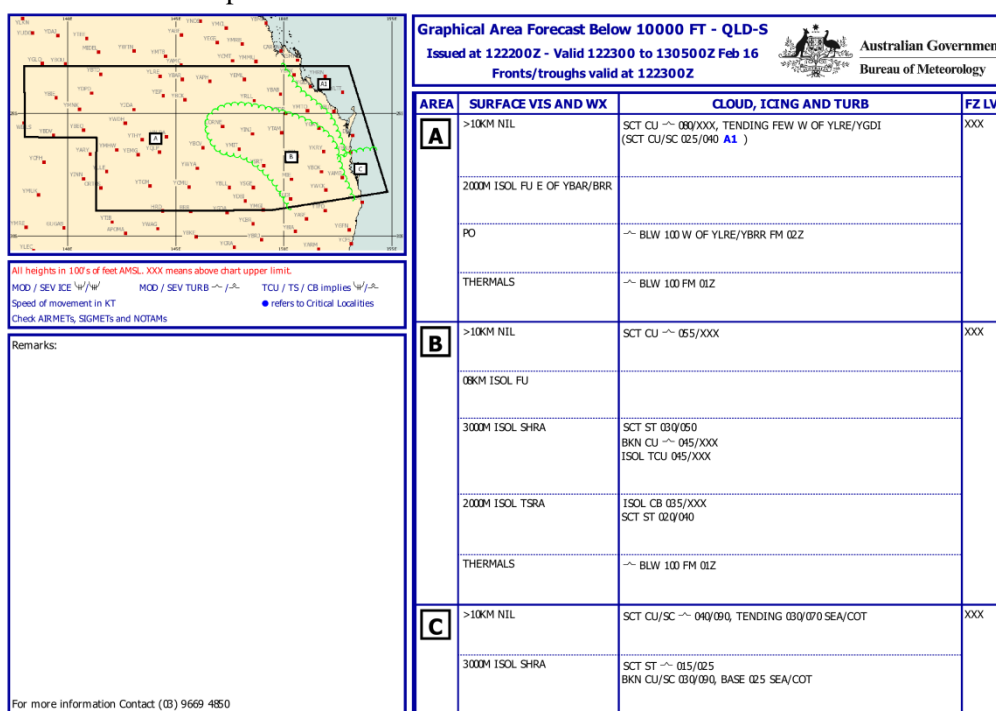


Figure 7: Graphical Area Forecast for QLD-S

7.2 ICAO Compliant AIRMET

7.2.1 The current format of the Bureau's AIRMETs does not fully comply with ICAO Annex 3 requirements.

7.2.2 In order to align the format with international best practice, the Bureau has progressed work in reviewing the requirements to support the implementation of ICAO compliant AIRMET.

7.2.3 ICAO compliant AIRMET is planned to be implemented in late 2016.

7.2.4 Following procedural/format requirements is proposed to be implemented with ICAO AIRMETs that are either different to current practices or that of ICAO specifications:

- a) AIRMETs will be issued to notify of any significant changes in freezing level;
- b) AIRMETs will not be issued to notify of improvements to weather on ARFOR (amended ARFORs or GAF Corrections can be issued)
- c) A remark ('RMK') line will be included, to list the identifiers of ARFOR/GAF that are impacted by the AIRMET as well as any remarks or additional information deemed necessary;
- d) AIRMETs can be issued per ARFOR/GAF (like current ARFOR practice) or per phenomena (like SIGMETs) at the forecasters discretion
- e) AIRMET will be cancelled when
 - i. The phenomena is no longer occurring or are no longer expected to occur in the area;
 - ii. A SIGMET for the same phenomena/event is issued; or
 - iii. Phenomena are included in a valid ARFOR/GAF.

7.2.5 Examples:

YMMM AIRMET 02 VALID 190530/190930 YPRM – YMMM MELBOURNE FIR ISOL TS OBS AT 0525Z WI YCFH - YMRE - YCBP - YALA SFC/FL400 MOV S 05KT NC
RMK: AREA 52

YMMM AIRMET 01 VALID 230800/231200 YSRF – YMMM MELBOURNE FIR MOD TURB FCST WI YCTM – YBIA – YGFN – YSNW SFC/FL080 MOV E 05KT NC
RMK: AREA 20, 21

7.3 Airport Weather Matrix

7.3.1 The Bureau is investigating in developing an Aviation Weather Matrix which will allow automatic generation of multiple forecast products which has many common properties, such as TAF, TTF, Airport Weather Briefing and/or Low Probability Forecast.

7.3.2 Aviation Weather Matrix will allow:

- a) Forecasters to focus on meteorology instead of formatting/typing multiple products;
- b) Enhance consistency of products;
- c) Creation of products easily with different resolutions for different users
- d) Creation of new products efficiently;
- e) Improvement in products.

7.3.3 BoM needs to develop first operational candidate (Prototype OC) of this capability within our new software platform (Visual Weather) and assess its operational concept.

7.3.4 This project would require industry support, including funding and requirements for the development of the concept.

7.4 MET Collaborative Decision Making (CDM)

7.4.1 The Bureau and Airservices are working on the future MET CDM concept of operations for major Australian airports. This concept examines a centralised model where the NOCMET would become responsible office for the delivery of all MET CDM ATFM products.

7.4.2 The MET CDM product is significantly different to the matrices trialed to date but would incorporate the information gathered from Airservices documentation and air traffic managers in the development of the CDM Reference Cards.

7.4.3 The proposed plan and further information on the concept of operations are contained in a separate paper titled as 'Collaborative Decision Making'.

7.5 Low Probability Forecasts

7.5.1 Currently, the Airport Weather Briefing (AWB) contains low probability products and Code Grey which is a specific low probability product designed for the fuel planning of long haul flights. The AWB is not amended, contains lots of general information and is currently only used by small number of users.

7.5.2 The Bureau and the aviation industry is considering to introduce a purpose built product which would be designed to cover low probabilities which has the potential to reduce conservatism in the TAF whilst informing the aviation community of underlying weather risks below the 30% thresholds in the TAF.

7.5.3 It is proposed that a low probability forecast would be issued with every routine TAF at major airports and be valid for a period to be determined (Nominally 12 hours). This low probability forecast would also be amended as required. It would contain 10% and 20% probabilities and use the TAF code within the message to ensure a minimal training requirement.

7.5.4 The code would be prefixed by an abbreviated product name which is proposed to be LOWPROB. The TAF has priority over LOWPROB.

Example:

```
LOWPROB YPDN 081130Z 0812/0900  
PROB10 TEMPO 0812/0815 1000 TSRA  
PROB20 TEMPO 0815/0820 1000 TSRA=
```

8. Action by the Meeting

8.1 The meeting is invited to note the information contained in this paper.
