



International Civil Aviation Organization

**The Second Meeting of the APANPIRG ATM Sub-Group
(ATM /SG/2)**

Hong Kong, China, 04-08 August 2014

Agenda Item 6: AOP, MET, AIM, SAR

METEOROLOGY ISSUES RELEVANT TO ATM

(Presented by the Secretariat)

SUMMARY

This paper presents a summary of ATM-related outcomes from the meetings of the Meteorological Requirements Task Force and Meteorological Hazards Task Force.

1. INTRODUCTION

1.1 The Meteorology/Air Traffic Management (MET/ATM) Seminar 2013 and the Third Meeting of the Meteorological Requirements Task Force (MET/R TF/3, formerly the MET/ATM TF) were held in Bangkok, Thailand, from 26 – 29 November 2013.

1.2 The Fourth Meeting of the Asia/Pacific Meteorological Hazards Task Force (MET/H TF/4) was held in Beijing, China, from 19 – 21 March 2014.

2. DISCUSSION

MET/ATM Seminar and MET/R TF/3

2.1 The MET/ATM Seminar 2013 included 20 presentations and information papers by Australia, Hong Kong china, Japan, USA, IFATCA and ICAO. The seminar presentations and papers are available on the ICAO Asia/Pacific Regional Office website at http://www.icao.int/APAC/Meetings/Pages/2013-MET-ATM_MET-R-RF3.aspx.

Review of the MET/R TF Terms of Reference

2.2 In reviewing the Terms of Reference (TOR) of the MET/R TF the meeting was reminded that the key objective of the MET/R TF was to improve safety, efficiency and sustainability of ATM and operators by ensuring aeronautical MET information was provided to meet current and future requirements in the Region. The meeting agreed to **Draft Decision 3/1 – Revised Terms of Reference**. The revised TOR are provided at **Attachment A**. Proposed changes include:

- Obtain and evaluate the current and future requirements for MET in support of ATM, as well as ATM in support of MET;
- Inclusion of digital information in investigation of sub-regional exchange of MET information;

- Coordination with ATFM/SG to provide expertise on MET services and information to assist the establishment of sub-regional ATFM;
- Enhancing regional implementation of MET services to support ATM in line with the Asia/Pacific Seamless ATM Plan, and the Global Air Navigation Plan and its Aviation System Block Upgrades (ASBU).

MET Requirements Arising from ICAO Asia/Pacific ATM Meetings

2.3 The meeting noted that a number of ATM initiatives either developed or under development would lead to requirements for meteorological reports and forecasts. These included planning for implementation of seamless ATM operations, collaborative air traffic flow management (ATFM) and ATM contingency operations. The meeting was informed of and discussed:

- MET elements of the Seamless ATM Plan, and its implementation phases;
- the requirement for identification of MET data to support capacity analyses and ATFM/CDM;
- the need for integration of MET information in ATC air situation displays.
- The re-convening of the Regional ATFM Steering Group (ATFM/SG)
- Proposed ATFM/SG TOR and the draft principles, and basic plan elements that would define the Regional Framework for Collaborative ATFM including the expectation of specific requirement for MET services.; and
- The benefits of a link between MET/R TF and ATFM/SG.

2.4 The meeting discussed the development of digital meteorological information exchange and adopted the following Decision:

Decision 3/3 - Capacity building for (digital) MET information exchange

That, an ad-hoc group consisting of Australia, Hong Kong, China, New Zealand and Singapore, in close collaboration with the ROBEX WG and assisted by the Secretariat, develops a proposal for capacity building activities in the APAC Region to foster the implementation of (digital) aeronautical meteorological information exchange, and reports to MET SG/18.

2.5 The Regional ATM Contingency Plan Task Force (RACP/TF) objective of developing and implementing a regional ATM contingency plan including recommended contingency response to severe meteorological phenomena was noted by the meeting, as was the link between RACP/TF and the Meteorological Hazards Task Force (MET/H TF). It was not considered necessary to formalize a link between RACP/TF and MET/R TF.

Seminar Outcomes

2.6 Outcomes from the MET/ATM Seminar were further discussed by the MET/R TF/3 plenary.

2.7 Few non-ATM seminar participants were familiar with ICAO Doc 9854 - *Global Air Traffic Management Operational Concept*, but there was a cross-reference between Doc 9854 and Doc 9377 – *Manual on Coordination between Air Traffic Services, Aeronautical Information Services and Aeronautical Meteorological Services*.

2.8 Australia had implemented a graphical SIGMET, as recommended in Annex 3, and New Zealand would do so in 2014. Discussions highlighted the need for cross-boundary alignment of graphical SIGMET information.

2.9 Long haul flights could incur a fuel penalty due to misalignment of SIGMET information at FIR boundaries. Accuracy and alignment of SIGMET information were vital to the management of global air traffic, as pilots and ATC based operational decisions on SIGMET information. The sharing of real-time meteorological data between neighbouring Meteorological Watch Offices (MWOs) could contribute to improved MET support for ATM across FIR boundaries.

2.10 While there were challenges in aligning phenomena across FIR boundaries due to differences in forecasting personnel and timeframes, and difficulties involved in fully coordinating and consulting with neighbouring offices, work was already being done between Asia/Pacific States.

2.11 The meeting agreed to the following Draft Conclusion for consideration by the Meteorology Sub-Group of APANPIRG (MET/SG):

Draft conclusion 3/4 - Cross-boundary alignment of graphical SIGMET information

That, ICAO be invited to:

- a) remind States of the end users' requirement for cross-boundary alignment of (meteorological) phenomena included in SIGMET information, including graphical products, by meteorological watch offices in the APAC Region; and*
- b) consider providing guidance to assist States in meeting the end users' requirement in a).*

2.12 The Meeting noted that harmonization and interoperability of aeronautical information was a key objective of the APAC Seamless ATM Plan. The meeting further noted the mapping of ASBU Module B0-AMET to Phase 1 of the Seamless Plan, with expected implementation by November 2015, and the additional regional implementation priorities not specifically captured in the ASBU framework that would require specific supporting MET information services. The meeting agreed to the following Decision:

Decision 3/5 – MET in the APAC Seamless ATM Plan

That, an ad-hoc group, consisting of Australia, China, Hong Kong, China, and Japan, develops a list to guide States on the aeronautical meteorological information or services necessary to support implementation of each element of the APAC Seamless ATM Plan, where applicable, and reports to the next meeting of the MET/R TF.

Notes:

- a) development of the list should take into account end users requirements and current scientific capabilities; and*
- b) the guidance should also include requirements for aircraft reporting.*

2.13 The Meeting noted that a number of States were developing or had developed customized (MET) products to support terminal area and ATFM operations, which were typically beyond the current scope of ICAO provisions. A number of examples are provided in **Attachment B**.

2.14 The Meeting recalled that a regional survey of ATFM requirements for MET services/products was conducted in 2010 and reviewed by the MET/ATM TF/2 in 2011. The Meeting agreed that a similar survey could be conducted to determine what MET products (particularly those not governed by ICAO provisions) are currently provided by States in the region and what tailored MET services are being provided to ANSPs. The survey should also seek information on the product formats used. The Meeting agreed to the following Decision:

Decision 3/6 - MET/ATM requirements survey

That, the ICAO conducts a survey of region-specific ATM requirements for aeronautical meteorological services/products in 2014, which could assist APAC Seamless ATM Planning.

2.15 The Meeting was also apprised on outcomes from the volcanic ash exercise VOLKAM13, involving MET, ATM and operators from Japan, Russian Federation and United States, which participants considered to be beneficial especially in terms of the subsequent ATM response to the October 2013 eruption of Sheveluch Volcano in Kamchatka. The Meeting noted that Japan considered similar volcanic ash contingency exercises conducted elsewhere in the APAC region would also contribute positively to the safety of aircraft operations in actual volcanic ash events, particularly in view of the relative abundance of active volcanoes in the APAC region and the associated potential risks to aviation.

2.16 The Meeting agreed to the following Decision:

Decision 3/7 - Volcanic ash exercise in the APAC region

That, the ICAO forwards the relevant discussion outcomes from the MET/ATM Seminar and MET/R TF/3 Meeting to the MET/H TF to assist the development of a volcanic ash contingency exercise elsewhere in the APAC Region, involving MET, ATM and operators, based on the VOLKAM experience and volcanic ash exercises in other parts of the world.

2.17 The Meeting noted that the purpose of conducting MET/ATM Seminars (and MET/R TF Meetings) was to provide a forum for exchange of information on the current and future region-specific requirements for MET in support of ATM.

Decision 3/8 - Future MET/ATM Seminar

That, a steering committee consisting of Japan and the Secretariat develops a proposal for the next MET/ATM Seminar, including recommended timing and a draft programme, and reports to MET SG/18.

MET Information in Support of ATM

2.18 A summary of MET information in support of ATM was provided by the Secretariat in terms of the international standards and recommended practices in Annex 3 and the supplementary regional operational requirements in the *APAC Regional Air Navigation Plan (Doc 9673)*, Part VI – MET. The meeting noted the possible development of a Procedures for Air Navigation Services – Meteorology (PANS-MET) document, which would be discussed further at the MET Divisional Meeting in July 2014. The PANS-MET document would be intended to include procedural components of the provisions for MET information supporting transition to the future global ATM system.

ATM Information in Support of MET

2.19 The Meeting noted that Annex 3 contained requirements for air-reports of prescribed MET elements or conditions observed by aircraft on international air routes to be recorded, reported and exchanged between specified units. It was also noted that the APAC Seamless ATM Plan (in Phase I) required that ATM systems should provide information to meteorological authorities or offices where required.

MET/H TF/4

2.20 While mostly technical in nature, some outcomes of the MET/H TF/4 are of interest to ATM/SG.

2.21 A survey of present capabilities of Asia/Pacific States to prepare and issue SIGMETs for radioactive clouds, conducted by MET/H TF, had noted that end users of SIGMET may require guidance and/or training on the use of the information provided in such SIGMETs. This item was listed in the list of MET/H TF Agreed Actions for follow-up by the Secretary.

2.22 A survey on tsunami information indicated that States generally had the capacity to provide national tsunami warning systems to the public, which could also include aerodromes, but few had implemented aerodrome warnings for tsunami.

2.23 The meeting noted the initial work of an ad-hoc group formed to develop a framework for APAC regional contingency plans for phenomena that include volcanic ash, tropical cyclone, radioactive cloud and tsunami. In view of the requirement for MET/H TF to provide input on these matters to RACP/TF the Secretariat would coordinate to obtain a list of requirements from RACP/TF to guide the ad-hoc group's work.

2.24 It was noted that the ICAO Meteorology Divisional Meeting in July 2014 would consider a draft concept of operations for space weather information services.

Meeting Reports

2.25 The full reports, papers and presentations for the above meetings are available on the Asia/Pacific Regional Office website as follows:

- MET/ATM Seminar and MET/R TF/3 –

http://www.icao.int/APAC/Meetings/Pages/2013-MET-ATM_MET-R-RF3.aspx

- MET/H TF/4

<http://www.icao.int/APAC/Meetings/Pages/2014-MET-HTF4.aspx>

3. ACTION BY THE MEETING

- 3.1 The meeting is invited to:
- a) note the information contained in this paper; and
 - b) discuss any relevant matters as appropriate.

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TERMS OF REFERENCE
of the
METEOROLOGICAL REQUIREMENTS TASK FORCE (MET/R TF)

Terms of Reference	<p>Under guidance from ICAO Secretariat:</p> <ul style="list-style-type: none"> a) Obtain and evaluate the current and future requirements for MET (including space weather) in support of ATM (includes ATFM), as well as ATM in support of MET, in the ASIA/PAC Region and update Regional Air Navigation Plan accordingly and provide guidance material to assist States to develop MET services to meet these requirements; b) Assess aviation aeronautical meteorological services, systems and architecture in the region and how they can integrate weather information into ATS/aircraft operator ATM, airspace user systems and decision support tools; c) Investigate sub-regional exchange of MET information (including digital) and associated agreements that facilitate ATM operations particularly over busy routes that overlap different FIRs; d) Promote coordination between MET and ATM communities in the ASIA/PAC Region to enhance the level of understanding of MET requirements and capabilities in support of ATM; e) To study the successful involvement of MET in the development of CDM/ATFM in other regions with a view to future application in ASIA/PAC; f) Monitor global policy associated with source data and delivery of MET information for ATM; g) Coordinate with MET/H TF on framework for ATM contingency plan for specific phenomenon including volcanic ash, radioactive cloud, tropical cyclone and Tsunami with reference to developments made by the global ICAO groups and WMO developments; h) Coordinate with the ATFM/SG to provide expertise on MET services and information to assist the establishment of sub-regional ATFM and to identify what kind of MET services/information can be considered as the most important for it; i) Enhance regional implementation of MET services in support of ATM in line with the priorities defined in the ASIA/PAC Seamless ATM Plan, closely referring to the Global Air Navigation Plan (GANP) and the Aviation System Block Upgrades (ASBUs); and j) Report to the MET Sub-group of APANPIRG for further co-ordination through the ICAO Secretariat with other relevant bodies (ATM SG, APSAPG, CNS SG).[‡] <p>and, Obtain and evaluate the current and future requirements for ATM in support of MET in the ASIA/PAC Region and update Regional Air Navigation Plan accordingly and provide guidance material to assist States to develop MET services to meet these requirements.</p>
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Examples of Meteorological Information Provided to ATM

Australia (SP/03): Australian Aviation Weather Services for Air Traffic Management

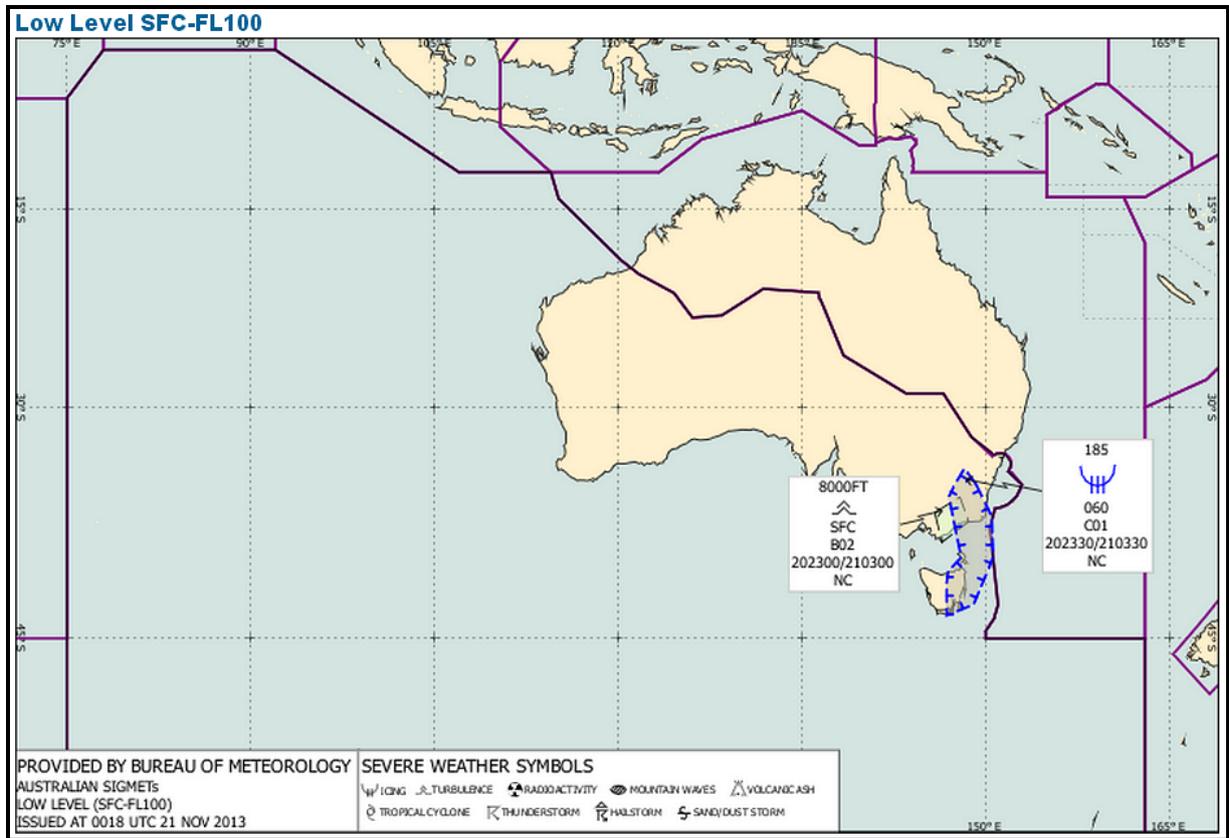


Figure 1: Graphical SIGMET (trial product)

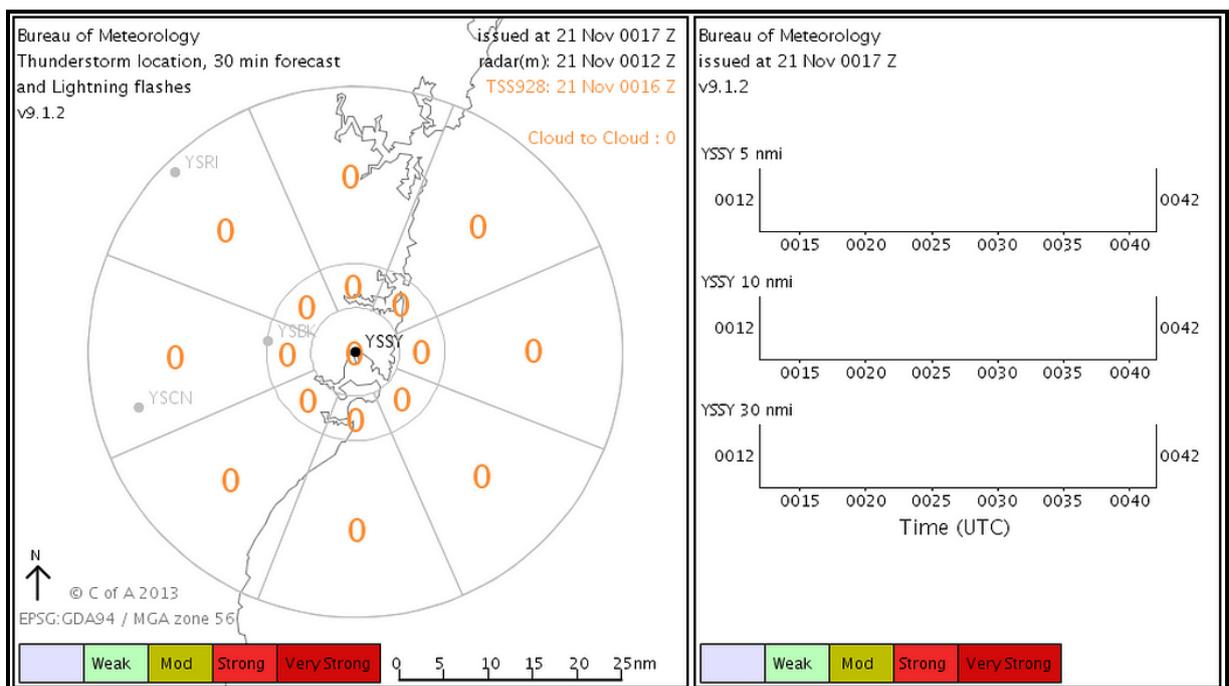


Figure 2: Automated Thunderstorm Alert Service (ATSAS)

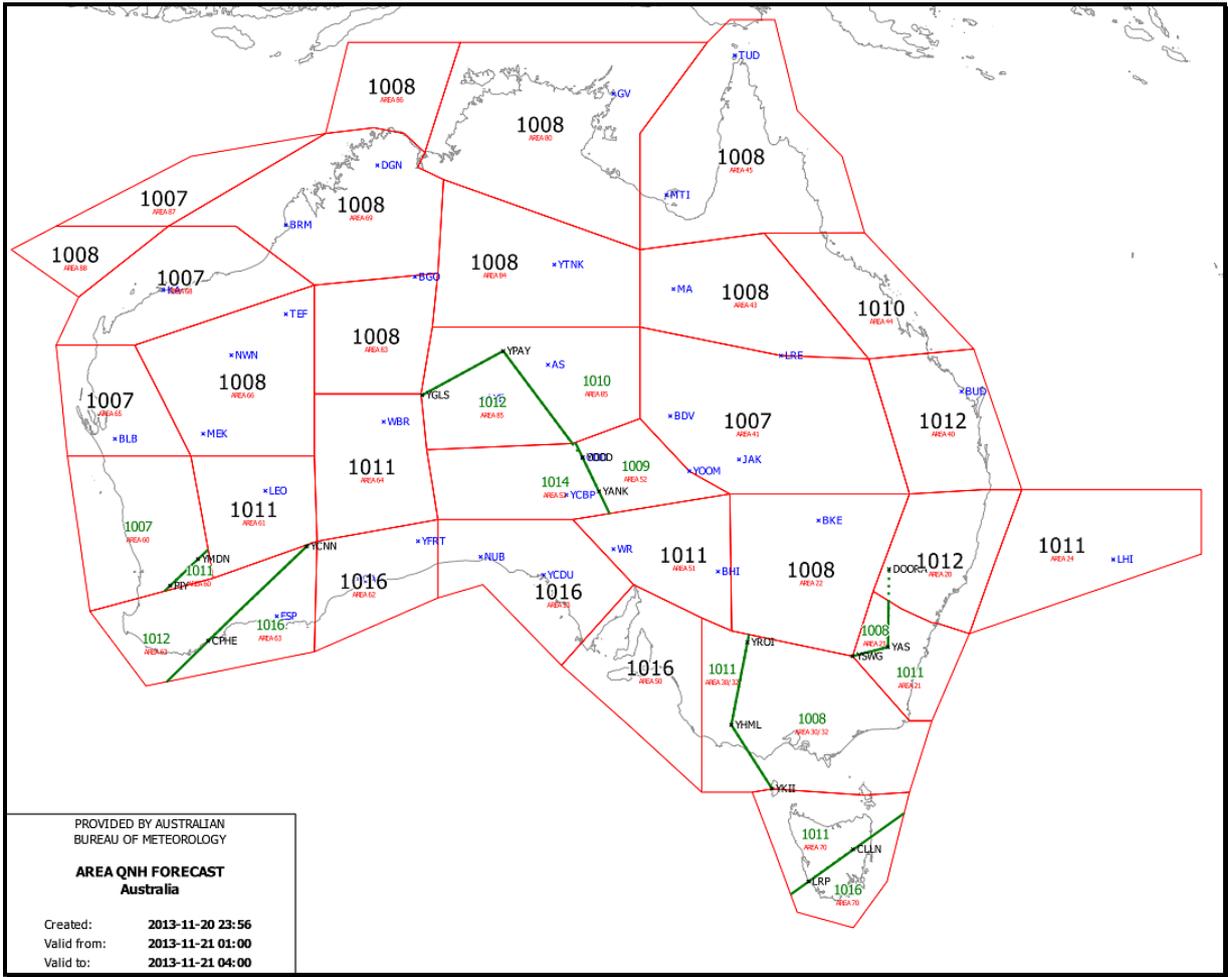


Figure 3: Area QNH Forecast

United States (SP/10): Changes in Meteorological Services in Support of International Air Navigation

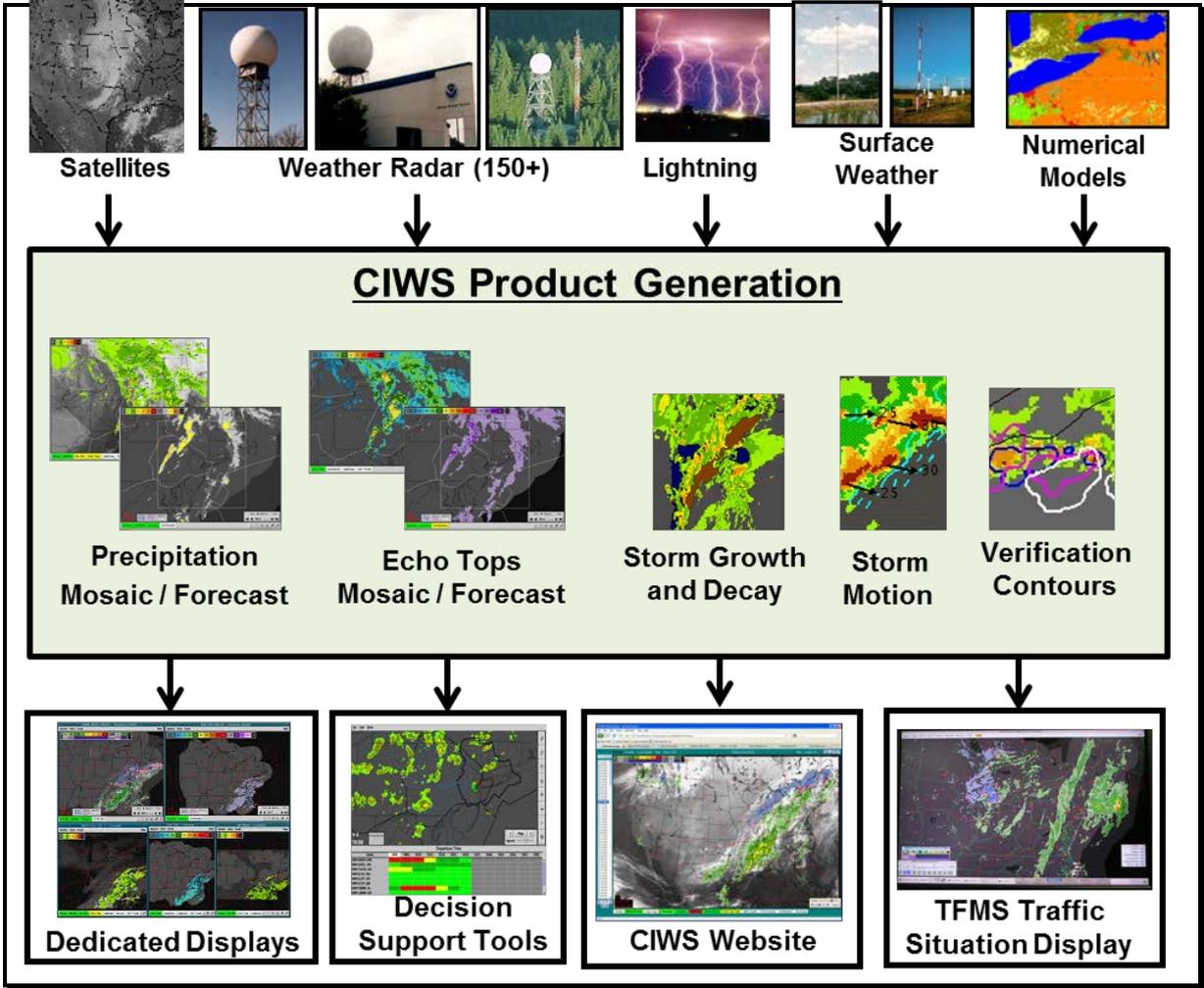


Figure 4: Corridor Integrated Weather System (CIWS)

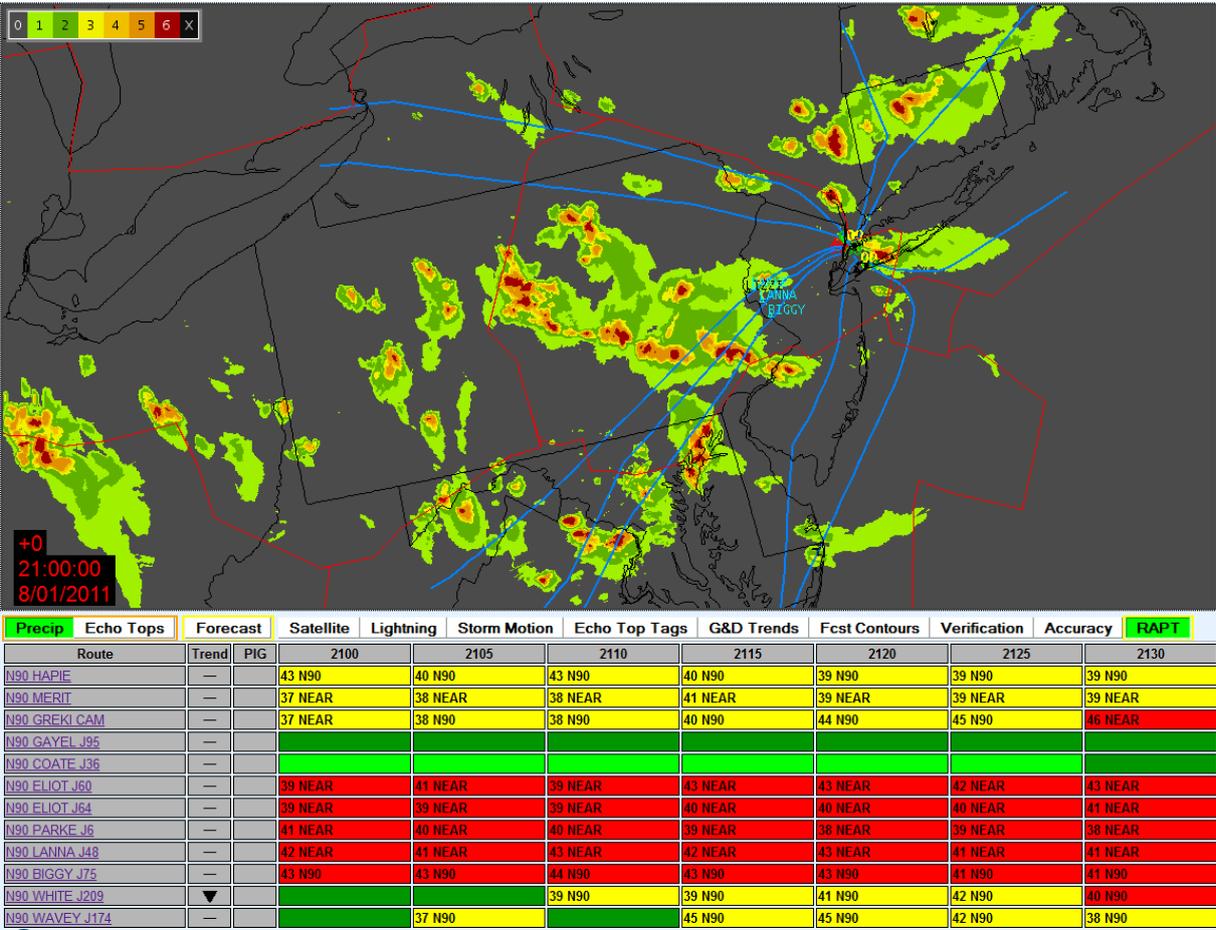


Figure 5: Route Availability Planning Tool (RAPT)

Japan (SP/14): Verification of ATMet Category Forecast

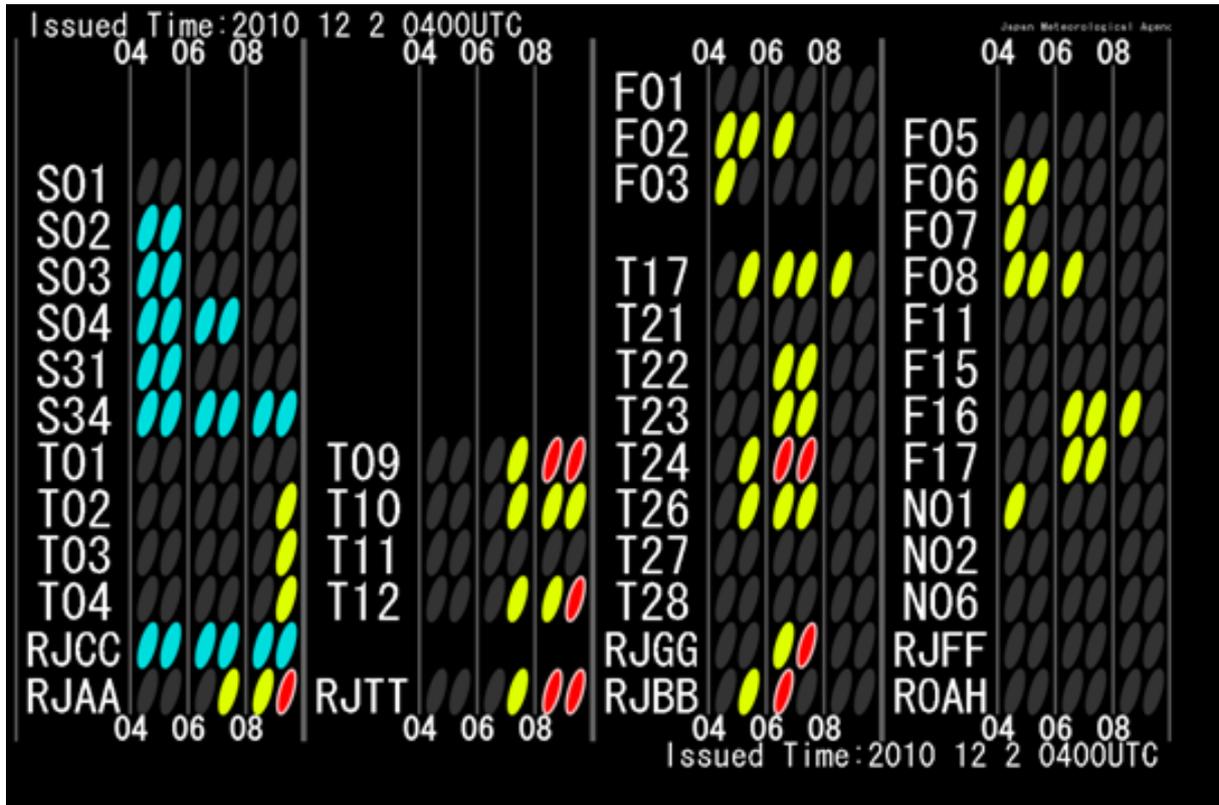


Figure 6: ATMet Category Forecast

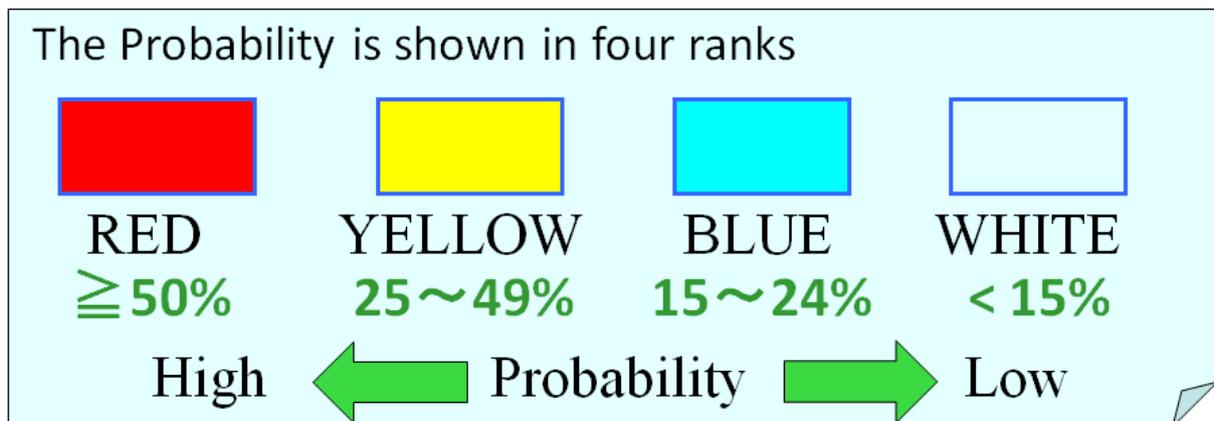


Figure 7: Legend for ATMet Category Forecast

target area color code	RJTT	RJAA	RJGG	RJBB	RJFF	ROAH	RJCC	ATC SECTOR
RED	wind speed \geq 40kt							the proportion occupied with CB (top \geq FL300) in the sector \geq 50%
	cross wind component to runway \geq 30kt							
	cross wind component to runway \geq 25kt with moderate or heavy precipitation							
	visibility < 600m	wind direction 030~060° or 210~240° and gust \geq 30kt					visibility < 800m with snow	
	ceiling < 300ft	visibility < 400m					ceiling < 400ft with snow visibility < 1000 with blowing snow	
	TS OHD							
	wind speed at surface \geq 30kt and wind speed below 5000ft \geq 60kt	snow fall rate \geq 1cm/1h					snow fall rate \geq 5cm/3h	
YELLOW	wind speed \geq 34kt with gust \geq 50kt							CB exists on selected airway or on selected area
	cross wind component to runway \geq 25kt							
	cross wind component to runway \geq 20kt with moderate or heavy precipitation							the proportion occupied with CB (top \geq FL300) in the sector \geq 20%
		wind direction 030~060° or 210~240° and gust \geq 25kt						
	CB in HANEDA sector	CB in NARITA sector					visibility < 400m	
	TS							visibility < 1600m with snow ceiling < 600ft with snow
	wind speed at surface \geq 30kt and wind speed below 5000ft \geq 50kt	moderate or heavy snow					snow fall rate \geq 3cm/3h when wind direction 250~110°	
BLUE	TS in TAF but CB doesn't exist in the aerodrome							the proportion occupied with CB (top \geq FL300) in the sector \geq 10%
						wind speed \geq 20kt with snow ceiling < 200ft		

Figure 8: Criteria for ATM Category Forecast

China (IP/05): Development of Meteorological Services for the Terminal Area in China

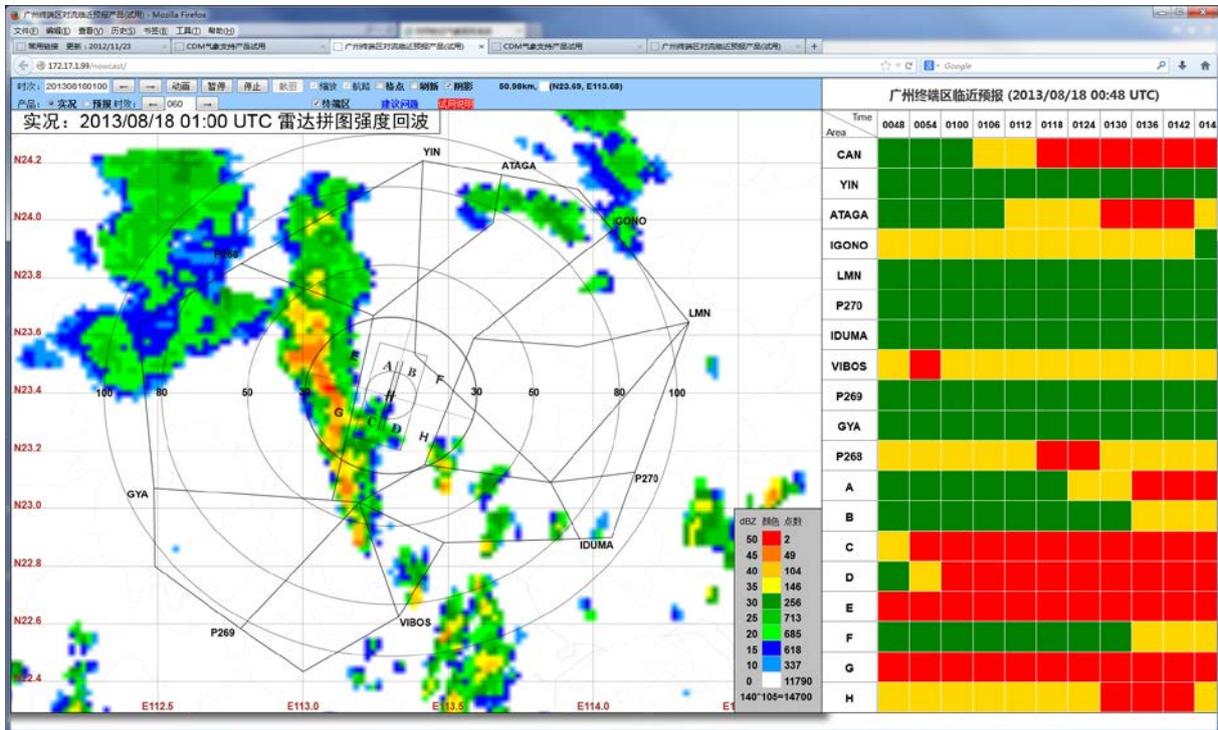


Figure 9: Observation of convection and its impact at Key ATC points

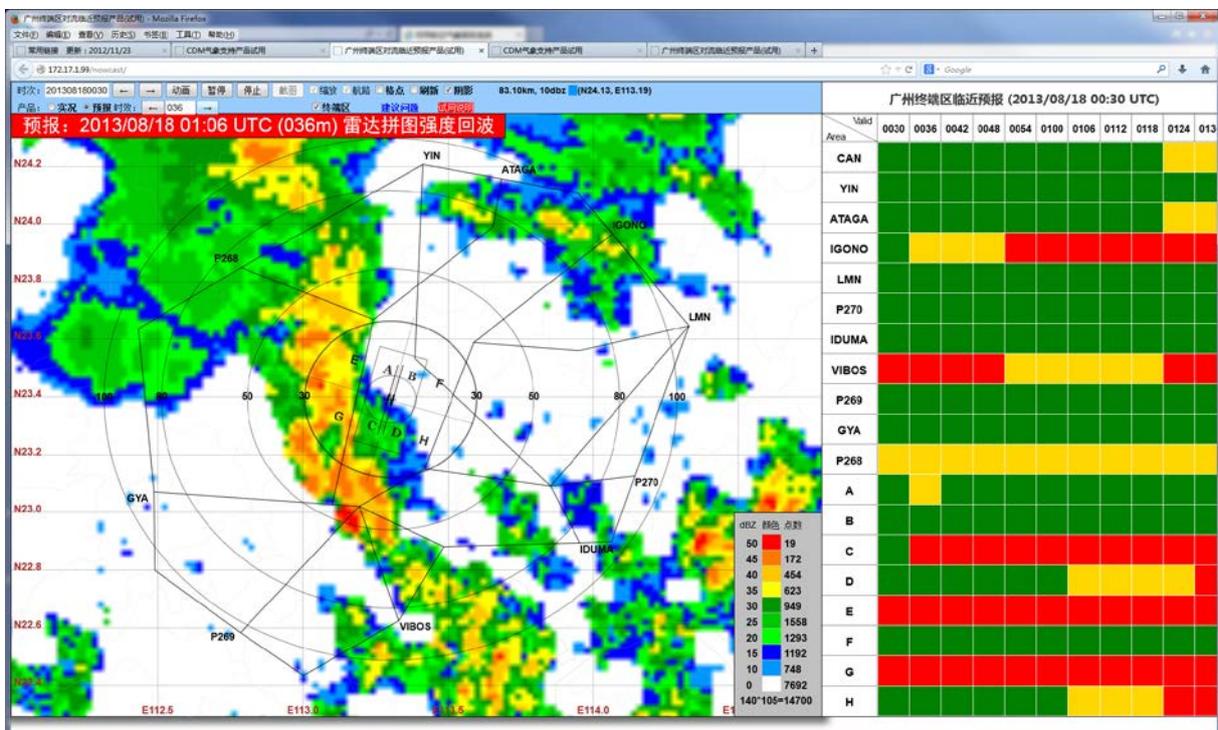


Figure 10: Forecast of convection and its impact at Key ATC points

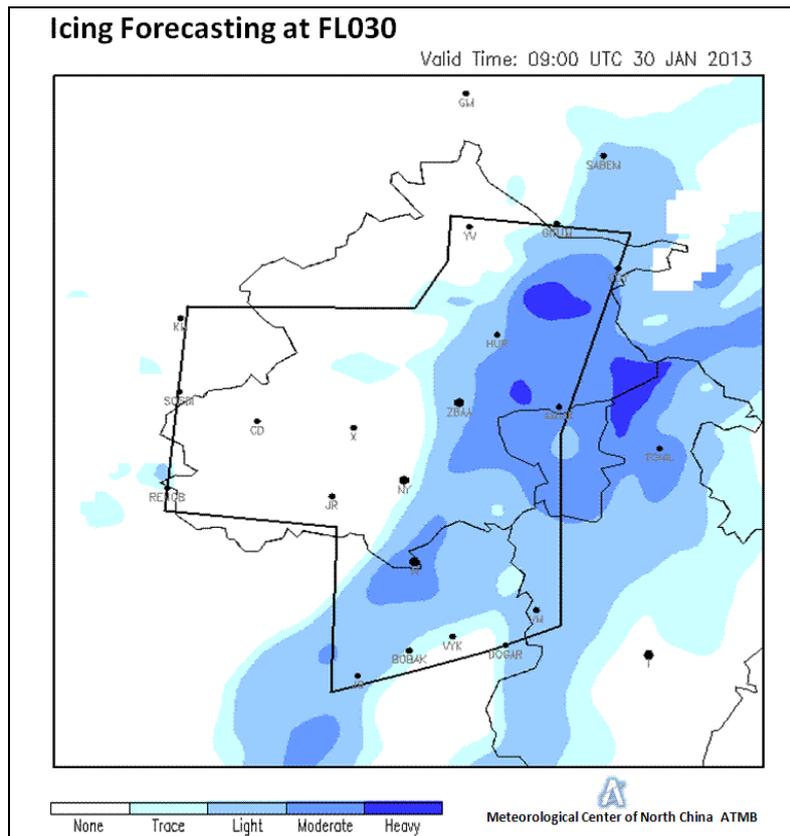


Figure 11: Icing forecast

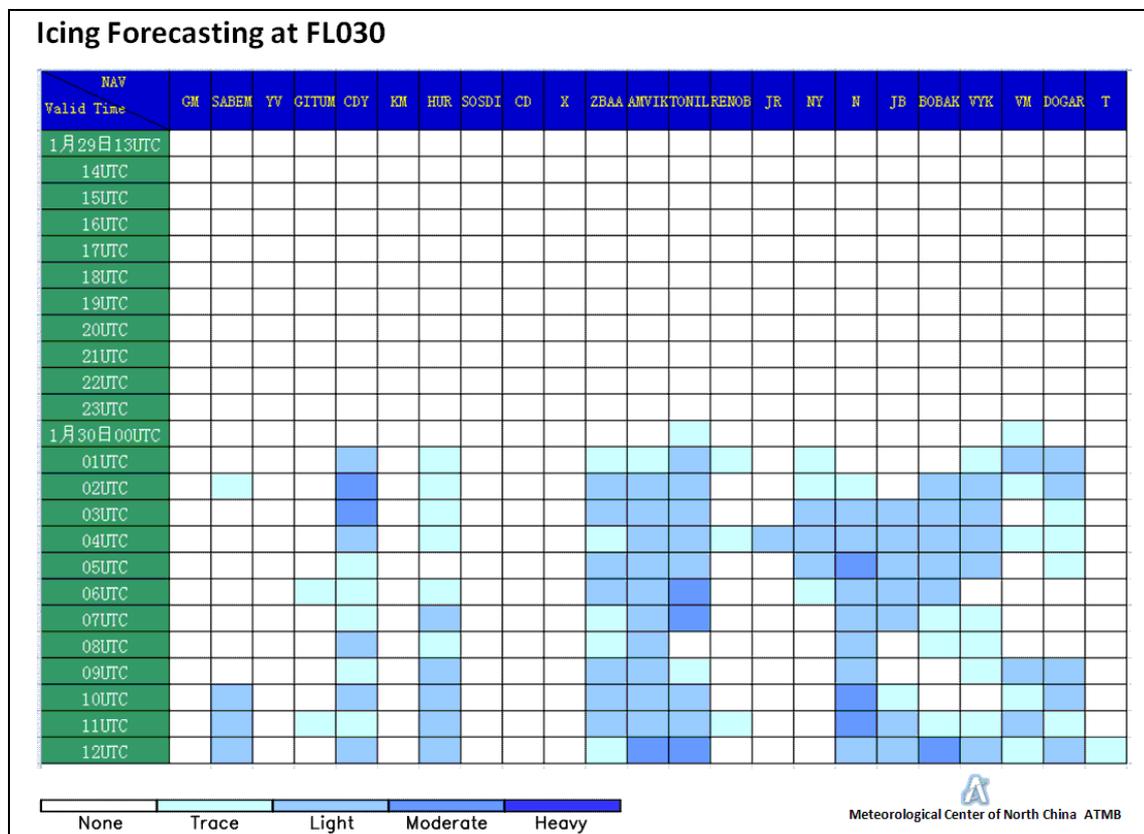


Figure 12: Icing forecast

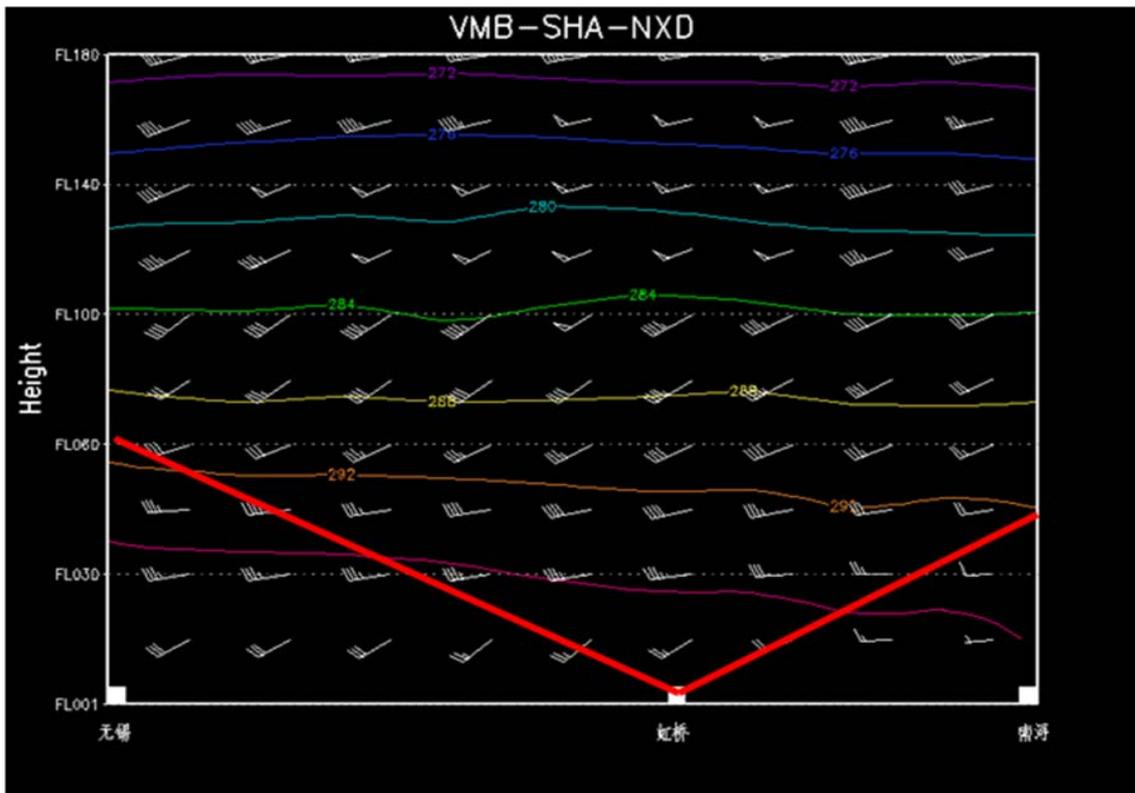


Figure 13: En-route wind and temperature

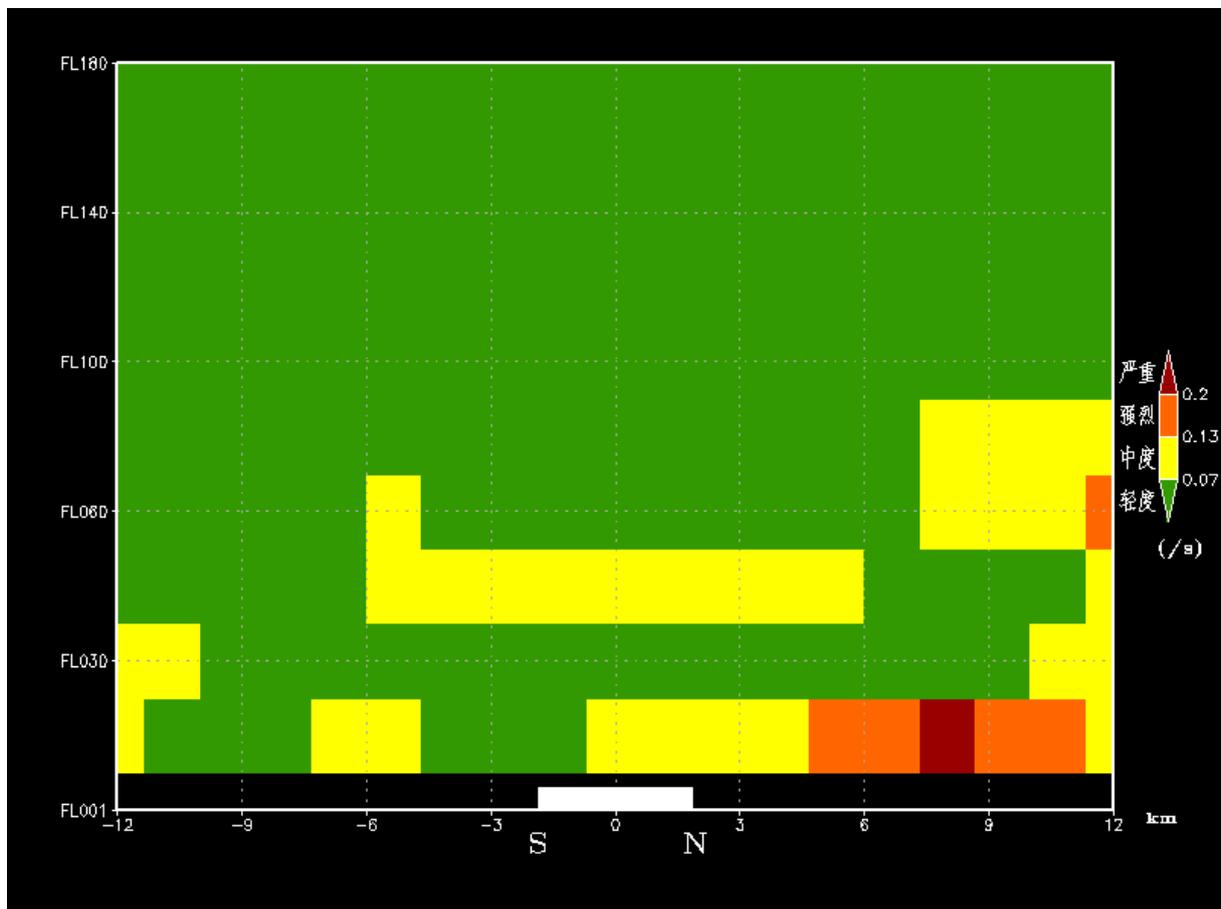


Figure 14: Wind shear along the runway

Australia (IP/03): Aerodrome Weather Briefing and Code Grey



Australian Government
Bureau of Meteorology

Sydney Airport Weather Briefing

Issued at 0450Z on 01/01/04

Sydney TAF
TAF YSSY 010436Z 0106/0212 03015KT CAVOK
FM18 01010KT CAVOK
FM02 03015KT CAVOK
T 27 25 23 21 Q 1009 1009 1009 1010

TAF Summary
A high in the Tasman is directing a northerly flow over Sydney. The fresh northeast winds will ease this evening and tend northerly overnight. The northeast sea breeze will return again tomorrow around mid-morning.

Thunderstorm Potential
There is a **10%** chance of some thunderstorm activity about the ranges west of Sydney tomorrow.

Other Possibilities
20% chance there will be more than 20 knots crosswind gusts on runway 16/34-tomorrow afternoon. 10% chance thunderstorms will develop overnight. A Code Grey has been issued (see below).

Sydney Outlook
Saturday: City min 22, max 30. Fine, mostly sunny. N/NE winds, freshening near the coast in the afternoon.
Sunday: City min 21, max 32. Fine. N/NE winds.

CODE GREY
PROB10 INTER 0114/0124 TS

Regards
Richard until 7pm, then Chris.
Sydney Airport Meteorological Unit

Notes:
*1. This briefing note is issued twice daily and is not amended between issues. For operational planning, reference should be made to the latest TAF or TTF.
2. Code Grey provides early advice of a possible later TAF amendment. It is used if there is a small but realistic chance of a thunderstorm or below special alternate conditions between 14 and 24Z. Special alternate conditions are BKN or OVC cloud below 700ft or visibility less than 2500m.*

Figure 15: Example of Sydney Airport Weather Briefing and Code Grey

Australia (IP/04): Collaborative Decision Making

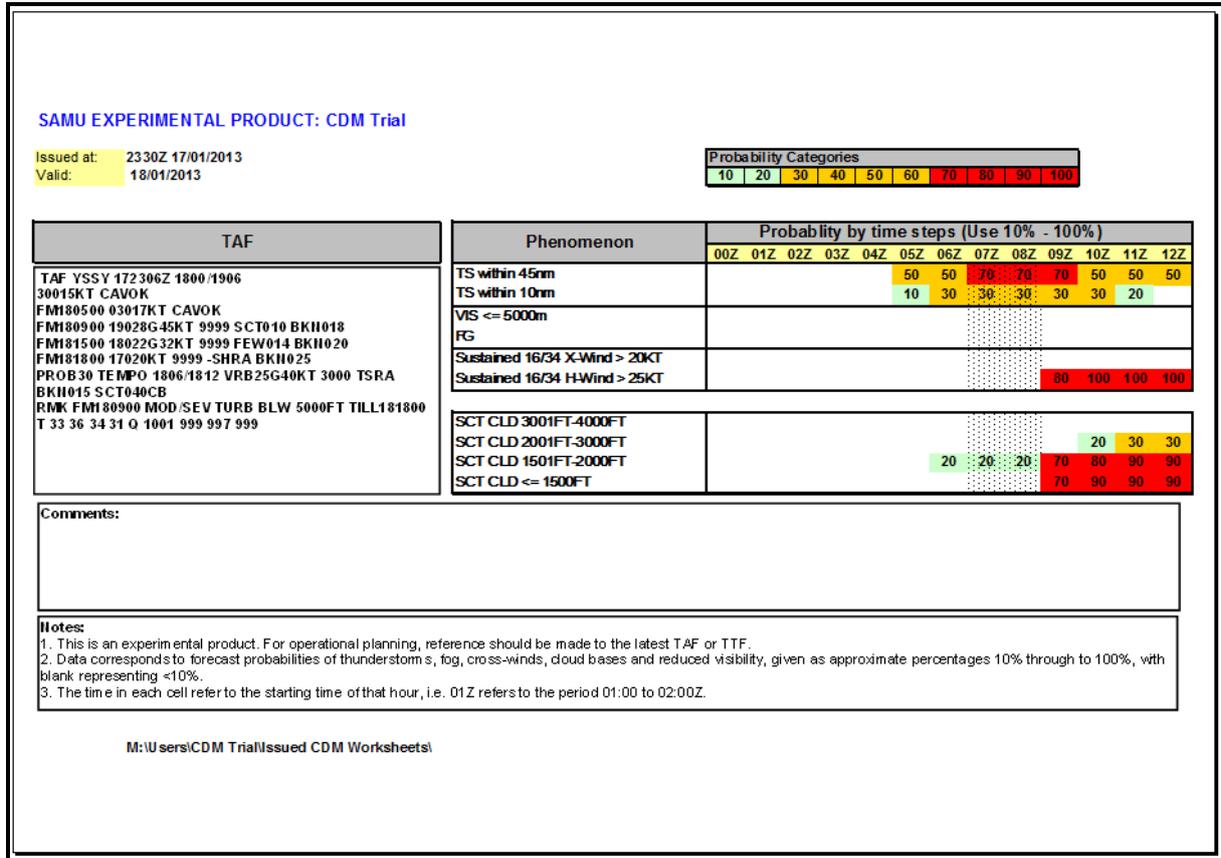


Figure 16: Example of a probability matrix for Sydney (which contains additional information to the TAF)

Hong Kong, China (WP/07): Meteorological Services to ATM (MSTA) Functional Displays

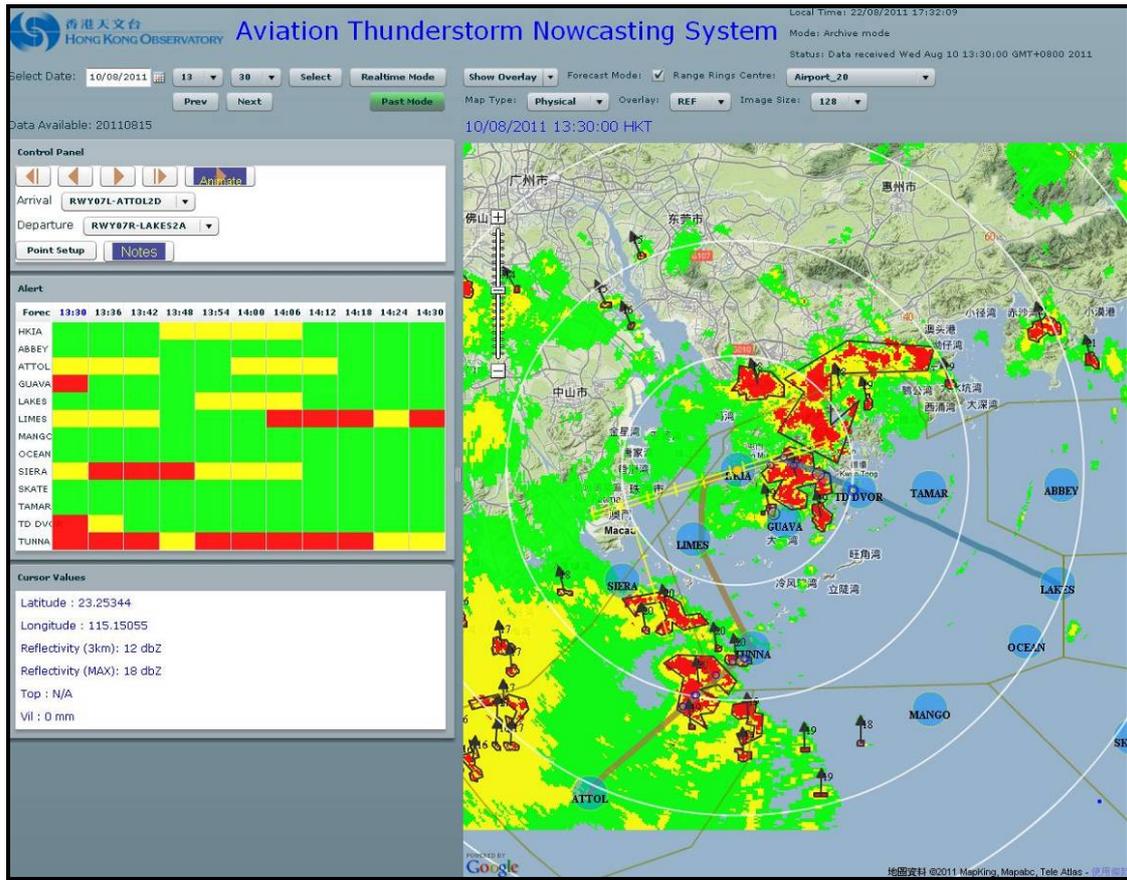


Figure 17: The display panel of the Aviation Thunderstorm Nowcasting System (ATNS)

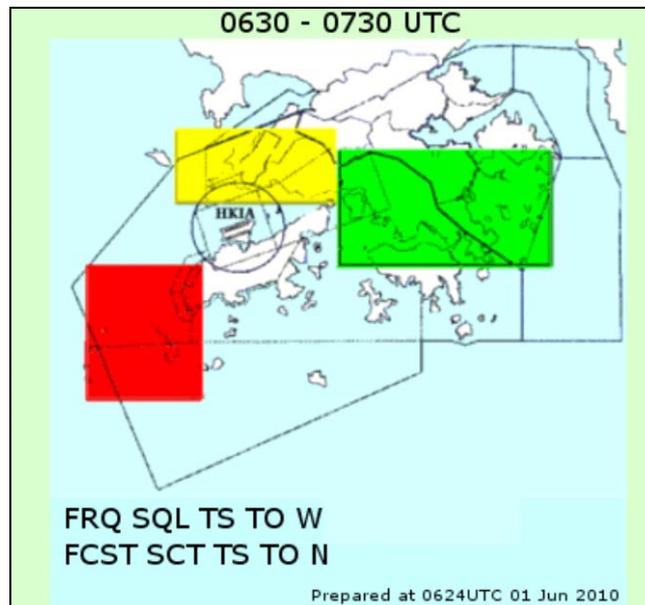


Figure 18: 1-hr now-cast for convective weather in the arrival/departure corridors¹

¹ The box to the west has changed to red, indicating that intense convection is affecting or forecast to affect the arrival (departure) area for runway 07(25). The box to the north has changed to amber, indicating that less intense convection is affecting or to forecast to affect the miss-approach area for the northern runway

UTC	15	16	17	18	19	20	21	22	23	
Overall	Yellow									
<u>07 Headwind</u>	Grey									
<u>25 Headwind</u>	Yellow									
<u>Crosswind</u>	Green			Yellow	Green					
<u>Visibility</u>	Green									
<u>Ceiling</u>	Green									
Prepared at 1434UTC 22 Sep										

Figure 19: 9-hr performance-based weather forecast for the aerodrome (HKIA)

Level	Head wind	Cross wind	Visibility	Ceiling
1	=< 20 kt	< 30 kt	> 1000 m	> 400 ft
2	21 - 40 kt	30 - 35 kt	600 – 1000 m	200 – 400 ft
3	> 40 kt	> 35 kt	< 600 m	< 200 ft
-	< -5 kt	-	-	obscured sky

Figure 20: Thresholds for the 9-hr performance-based weather forecast²

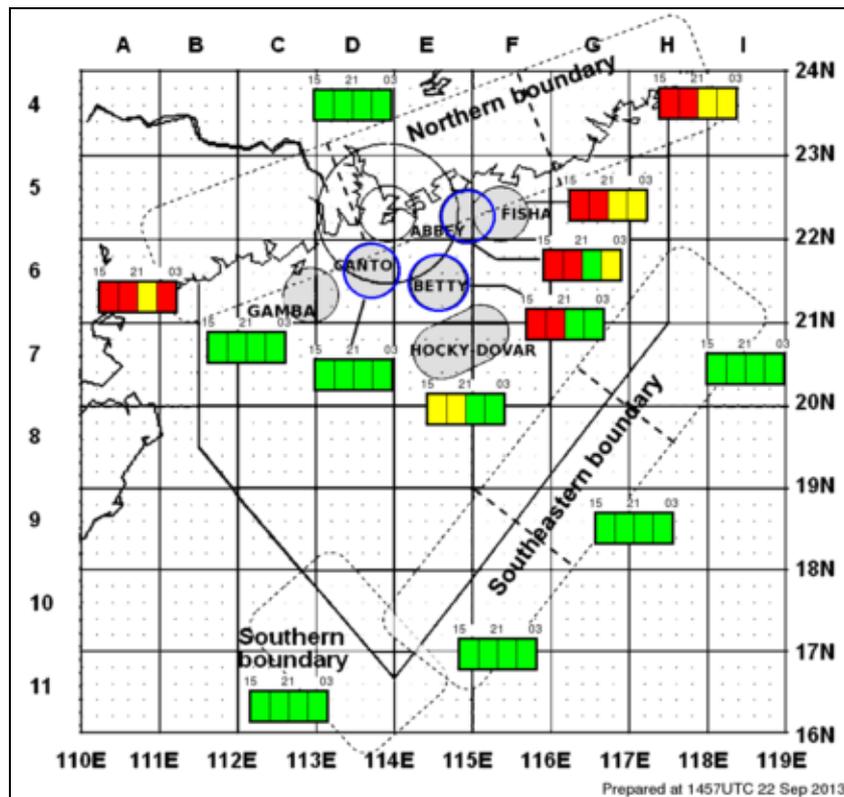


Figure 21: 12-hr significant forecast time series for key ATC areas³

(07L/25R). The box to the east remains green, suggesting that no significant convection will affect the arrival (departure) corridor for runway 25(07).

² The headwind condition is related to the aircraft separation, the crosswind condition is related to the operation threshold of aircraft, while the visibility and ceiling thresholds are associated with the Low Visibility Procedures of HKIA.

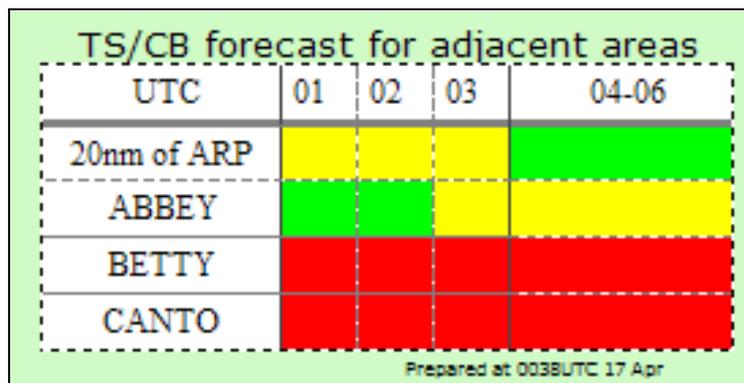


Figure 22: 6-hr forecast for thunderstorm/cumulonimbus cloud (for the aerodrome area and critical holding areas for HKIA)

A-TITLE		D-TITLE	
HONG KONG ARRIVAL INFORMATION		HONG KONG DEPARTURE INFORMATION	
A-IDENT	J	D-IDENT	S
A-TIME	0335	D-TIME	0337
A-INFO-D1		D-INFO-D1	
A-RUNWAY	07L	D-RUNWAY	07R
A-INFO-D2		D-WS/TURB	
A-WS/TURB	WS AND TURB FCST	D-SUPPL1	RWY SFC WET
A-SUPPL1		D-WIND	130
A-WIND	120	D-SPEED	15
A-SPEED	15	D-VRB-BTN	
A-VRB-BTN		D-AND	
A-AND		D-MAX	
A-MAX		D-MNM	
A-MNM		D-VIS	5000M
A-VIS	10 KM	D-RVR	
A-RVR		D-PRESENT-WX	PASSING SHOWERS
A-PRESENT-WX	PASSING SHOWERS	D-CLOUD	FEW 1000FT SCT 3500FT
A-CLOUD	FEW 1000FT SCT 3500FT	D-WXCHG	
A-WXCHG		D-TEMP	27
A-TEMP	27	D-DEWPOINT	25
A-DEWPOINT	25	D-QNH	1007
A-QNH	1007	D-METINFO	TS 15 NM SW MOV NE
A-METINFO	TS 15 NM SW MOV NE	D-TREND	
A-TREND		D-SUPPL2	
A-SUPPL2		D-ACK	ACK INFO S
A-ACK	ACK INFO J	D-CDCGMC	DELIVERY

Figure 23: Thunderstorm/weather cell message shown on ATIS (highlighted in red boxes)

³ Shaded areas are the location of key holding patterns with a 20NM radius. Dotted lines mark the other important air spaces which cover busy air routes at the southern and northern boundaries of the HKFIR.

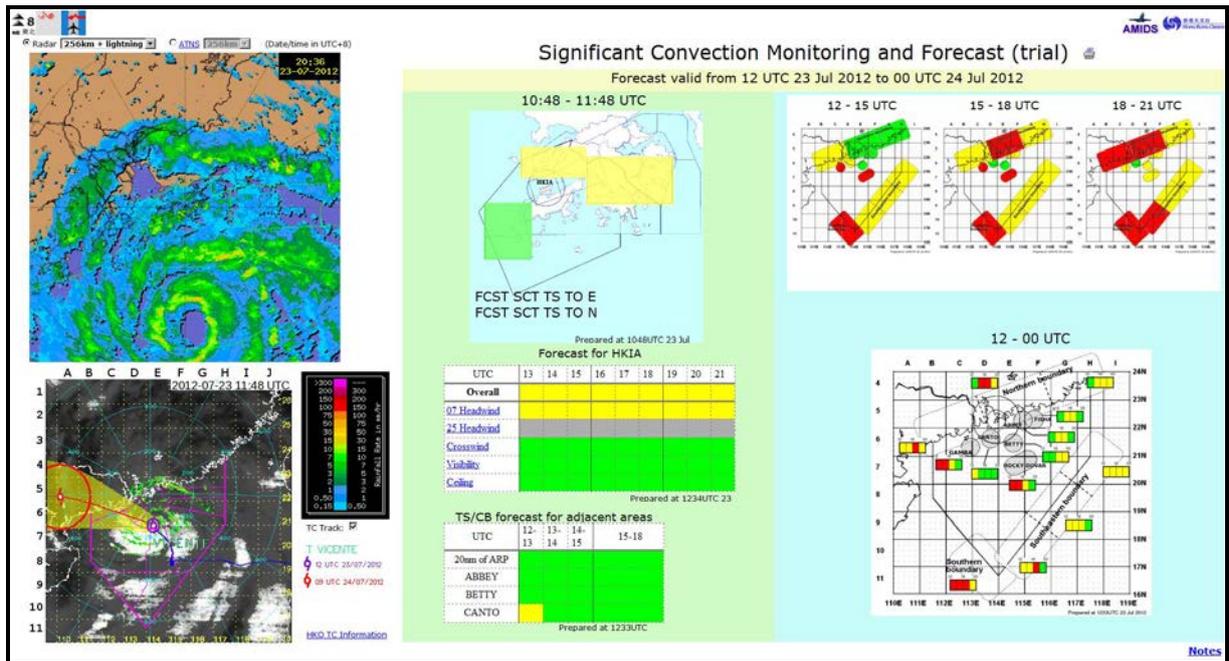


Figure 24: Integrated web display of the forecast suite
(captured during the passage of Severe Typhoon Vicente in July 2012)