

**INTERNATIONAL CIVIL AVIATION ORGANIZATION
ASIA AND PACIFIC OFFICE**



**REPORT OF THE METEOROLOGY/
AIRTRAFFIC MANAGEMENT SEMINAR**

AND

**REPORT OF THE THIRD MEETING OF THE METEOROLOGICAL
REQUIREMENTS TASK FORCE (MET/R TF/3)**

BANGKOK, THAILAND, 26 – 29 NOVEMBER 2013

The views expressed in this Report should be taken as those of the
Meeting and not the Organization

Approved by the Meeting
and published by the ICAO Asia and Pacific Office, Bangkok

MET/R TF/3
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1. INTRODUCTION

Seminar and Meeting

1.1 The Meteorology/Air Traffic Management (MET/ATM) Seminar and the Third Meeting of the Meteorological Requirements Task Force (MET/R TF/3), of the Meteorology Sub-Group (MET SG) of the Asia and Pacific (APAC) Air Navigation Planning and Implementation Regional Group (APANPIRG), were held back-to-back at the International Civil Aviation Organization (ICAO) APAC Office, Bangkok, Thailand, from 26 to 29 November 2013.

1.2 The MET/ATM Seminar was conducted from 26 November 2013 until the morning of 28 November 2013, while the MET/R TF/3 Meeting commenced on the morning of 28 November 2013 and closed on 29 November 2013.

2. ATTENDANCE

2.1 The Seminar and Meeting were attended by 49 participants from Australia, Bangladesh, China, Hong Kong China, Indonesia, India, Japan, Malaysia, New Zealand, Philippines, Republic of Korea, Singapore, Russian Federation, Thailand, USA, Viet Nam, IATA and IFATCA. The list of participants is attached at **Appendix A** to this Report.

3. OFFICER AND SECRETARIAT

3.1 Mr. Jun Ryuzaki, Senior Scientific Officer, Aeronautical Meteorology Division of the Japan Meteorological Agency, acted as moderator for the Seminar and Chairman for the Meeting.

3.2 Mr. Peter Dunda, Regional Officer Aeronautical Meteorology, of the ICAO APAC Office, acted as the Secretary for the Meeting and was assisted by Mr Shane Sumner, Regional Officer Air Traffic Management.

4. OPENING OF THE MEETING

4.1 On behalf of Mr Mokhtar A. Awan, Regional Director of the ICAO APAC Office, Mr. Peter Dunda provided opening remarks and welcomed all participants to the Meeting.

4.2 Mr Jun Ryuzaki also welcomed all participants to the Meeting.

5. DOCUMENTATION AND WORKING LANGUAGE

5.1 All discussions were conducted in English. Documentation was issued in English with a total of 20 presentations made to the Seminar and 8 working papers and 4 information papers considered by the Task Force Meeting. The list of presentations and papers is attached at **Appendix B** to this Report.

6. DRAFT CONCLUSIONS, DRAFT DECISIONS AND DECISIONS – DEFINITION

6.1 The MET/R TF recorded its actions in the form of Draft Conclusions, Draft Decisions and Decisions within the following definitions:

- a) **Draft Conclusions** deal with matters that, according to APANPIRG terms of reference, require the attention of States, or action by the ICAO in accordance with established procedures;
- b) **Draft Decisions** deal with the matters of concern only to APANPIRG and its contributory bodies; and
- c) **Decisions** deal with matters that relate solely to the internal working arrangements of the MET/R TF.

7. LIST OF DECISIONS AND DRAFT CONCLUSIONS/DECISIONS

7.1 List of Draft Conclusions

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).

7.2 List of Draft Decisions

Draft Decision 3/1 – Revised Terms of Reference

That, the revised Terms of Reference for the MET/R TF provided in **Appendix C** to this Report be adopted.

7.3 List of Decisions

Decision 3/2 – Revised ATFM/SG Terms of Reference

That, the Secretariat reports the revised MET/R TF Terms of Reference and the rationale behind them to ATFM/SG/3 and proposes a corresponding revision of ATFM/SG Terms of Reference for consideration by ATM/SG.

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.

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.*

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.

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 Meteorological Hazards Task Force (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.

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.

REPORT ON OUTCOMES OF THE MET/ATM SEMINAR 2013

1.1 The MET/ATM Seminar 2013 was held in Bangkok, Thailand, from 26 to 28 November 2013 and attended by 50 experts from 15 States, IATA, IFATCA and ICAO.

1.2 There were 20 presentations and information papers presented to the Seminar by Australia, Hong Kong, China, Japan, United States, IFATCA and ICAO; these are listed individually below. Further discussion on outcomes from the Seminar is contained in paragraphs 2.21 to 2.45 of the **Report on Agenda Items**.

1.3 *Introduction to MET/ATM Seminar (SP/1)*: discussed the purpose, objective, outline and the expected outcomes of the Seminar.

1.4 *Background of MET Services for ATM (SP/2)*: summarized the international requirements and regional operational requirements for the provision of aeronautical meteorological information in support of international air navigation.

1.5 *Australian Aviation Weather Services for ATM (SP/3)*: discussed the comprehensive list of the aeronautical meteorological services and products provided to support air traffic management in Australia.

1.6 *WMO Activities for MET Services Supporting ATM (SP/4)*: summarized the work done by the World Meteorological Organization's Expert Team on Meteorological Services to Air Traffic Management and Meteorological Information Exchange (WMO ET-M&M).

1.7 *Overview of ATMRPP and MARIE-PT activities (SP/5)*: summarized activities of the Meteorological Aeronautical Requirements and Information Exchange Project Team and the Air Traffic Management Requirements and Performance Panel to support the development of ICAO provisions for aeronautical meteorological information.

1.8 *Aviation XML (SP/6)*: summarized activities of the WMO in coordination with the ICAO that supported development of aeronautical meteorological information exchange.

1.9 *MET in the GANP and ASBU Initiative (SP/7)*: summarized development of the ICAO provisions for aeronautical meteorological information, current and future, within the framework of the global air navigation plan and the aviation system block upgrades methodology.

1.10 *Overview of APAC Seamless ATM Planning Group (SP/8)*: discussed the development and purpose of the APAC Seamless Air Traffic Management Plan and outcomes with respect to implementation of the ICAO provisions for aeronautical meteorological information.

1.11 *Overview of the MET/R TF and MET/ATM Seminars (SP/9)*: summarized the establishment and purpose of the Meteorological Requirements Task Force and Meteorology/Air Traffic Management Seminars in the Asia and Pacific Region.

1.12 *Changes in Meteorological Services in Support of International Air Navigation (SP/10)*: discussed developments in the provision of meteorological services to support air traffic management within the (United States/Federal Aviation Administration) NextGen project.

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- 1.13 *Enhancing MET Support to ATM (SP/11)*: discussed enhanced provision of meteorological services in support of air traffic management from an air traffic controller's perspective.
- 1.14 *Strategic Radar Enhancement Project (SP/12)*: summarized developments to the weather-watch radar network in Australia that enhanced numerical weather prediction and detection and resulted in potential benefits to the provision of aeronautical meteorological services.
- 1.15 *The Outline and the Benefit of VOLKAM from the Point of View of ATM (SP/13)*: discussed the lessons learnt and the benefits, from an air traffic management perspective, of the volcanic ash exercise conducted in Kamchatka, Russian Federation, in 2013.
- 1.16 *Verification of ATM Category Forecast (SP/14)*: summarized the provision and verification of the ATM Category Forecast in Japan, which supported air traffic management decision making through probability forecasts of the impact of meteorological conditions on air traffic flow.
- 1.17 *Practical Use of Weather Information to Air Traffic Management (SP/15)*: discussed a case study of the impact of convective clouds on air traffic approaching Japan's Tokyo, Narita, international airport, including the use of aeronautical meteorological information to support air traffic management.
- 1.18 *ATM measures by using the weather information (SP/16)*: discussed the role of aeronautical meteorological information in collaborative decision making that supported the air traffic management system in Japan.
- 1.19 *Next steps (SP/17)*: discussed future MET/ATM Seminars and the Meteorological Requirements Task Force in the APAC Region, amendments to Annex 3 with respect to meteorological information exchange, and the upcoming ICAO Meteorology Divisional Meeting in July 2014.
- 1.20 *Objective Quantification of Weather Impact on Aircraft Operations due to Significant Convection Using Weather Radar Parameters (SP/18)*: discussed a Hong Kong, China, study that objectively quantified the impact of convective clouds on air traffic operations with a view to improve forecasts of the impact of meteorological phenomena on aerodrome/airspace capacity.
- 1.21 *Meteorology in the Japan's CARATS Project (IP/2)*: discussed the current and future development of aeronautical meteorological services to support Japan's long-term vision for the future air transportation system.
- 1.22 *Establishment of MET Services in Support of ATM (IP/3)*: summarized the establishment and operation of the Air Traffic Meteorology Center in Japan to support air traffic management.

REPORT ON AGENDA ITEMS

Agenda Item 1: Adoption of agenda and working arrangements; review of the ToR and composition of the group

Adoption of provisional agenda and working arrangements for the Meeting

Provisional agenda (WP/01)

1.1 The provisional agenda was adopted by the Meeting.

Review of the ToR and composition of the group

Review of the MET/R TF and composition of the group (WP/02)

1.2 The Secretariat presented the Terms of Reference (ToR) and composition of the Meteorological Requirements Task Force (MET/R TF) and reminded the Meeting that a review of the ToR and composition of the group was necessary in order to ensure the current operational needs of the air traffic management (ATM) community were met and a balanced representation of stakeholders achieved.

1.3 The Meeting reviewed the history of the MET/R TF noting that a MET/ATM TF was originally established as a result of the Fifth Meeting of the Communications, Navigation and Surveillance/Meteorology Sub-group (CNS/MET SG/5 Decision 5/30 refers), updates to the ToR and composition of the MET/ATM TF were adopted by subsequent CNS/MET SG meetings and the MET/ATM TF was eventually reformed into the MET/R TF as a result of a review of the structure of all the contributory bodies under the MET component of the CNS/MET SG (CNS/MET SG/16 Decision 16/34 refers).

1.4 The latest ToR and composition of the MET/R TF, adopted by the Seventeenth Meeting of the Meteorology Sub-Group (MET SG/17) in May 2013, include regional considerations for space weather information required to support ATM and confirmation of Mr Jun Ryuzaki, from Japan, as the Chairman.

1.5 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 APAC Region. Furthermore, in accordance with the outcomes from CNS/MET SG/16, the MET/R TF should be focused on supporting ATM and flight operations in the APAC Region through:

- a) recommendation of improvements to enable integration of aeronautical meteorological information into decision support tools; and
- b) establishment of detailed user requirements for volcanic ash information.

1.6 Following more detailed discussion related to this matter under WP/09 and WP/05 the Meeting adopted the following Draft Decision for consideration by the MET SG:

Draft Decision 3/1 - Revised Terms of Reference

That, the revised Terms of Reference for the MET/R TF provided in **Appendix C** to this Report be adopted.

1.7 The contact information for members of the MET/R TF was updated, and is provided at **Appendix C** to this Report.

Agenda Item 2: Review of: MET/ATM TF/2 Meeting; other relevant meetings; and MET/ATM Seminar 2013

MET/ATM TF/2 Meeting

Review of MET/ATM TF/2 (WP/03)

2.1 The Secretariat presented a summary of the Second Meeting of the Meteorology/Air Traffic Management Task Force (MET/ATM TF/2) held in Fukuoka, Japan, from 27 to 28 January 2011, back-to-back with the MET/ATM Seminar 2011 from 24 to 26 January 2011.

2.2 The full report of MET/ATM TF/2 and supporting documentation can be found at the following website: <http://www.icao.int/APAC/Meetings/Pages/2011-metatm-tf2.aspx>. A combined executive summary of the MET/ATM Seminar 2011 and MET/ATM TF/2 Meeting is provided in **Appendix D** to this Report.

2.3 The Meeting reviewed six action items formulated by MET/ATM TF/2. The consolidated list of action items from MET/ATM TF/2 (reviewed) and MET/R TF/3 is appended at **Appendix E** to this Report.

Other relevant meetings

Review of other relevant meetings (WP/04)

- 2.4 The Meeting reviewed outcomes from other relevant meetings including the:
- a) Second Meeting of the Meteorological Aeronautical Requirements and Information Exchange Project Team (MARIE-PT/2);
 - b) Air Traffic Management Requirements and Performance Panel, Working Group of the Whole Seventeenth Meeting (ATMRPP WG/WHL/17);
 - c) Seventh Meeting of the International Airways Volcano Watch Operations Group (IAVWOPSG/7);
 - d) Eighteenth Meeting of the Satellite Distribution System Operations Group (SADISOPSG/18);
 - e) Fifth Meeting of the Meteorological Warnings Study Group (METWSG/5); and
 - f) Eighth Meeting of the World Area Forecast System Operations Group (WAFSOPSG/8).

2.5 The Meeting also reviewed the agenda for the ICAO Meteorology (MET) Divisional Meeting, which will be held in Montréal, Canada, between 7 and 18 July 2014, in part conjointly with the Fifteenth Session of the World Meteorological Organization Commission for Aeronautical Meteorology (WMO CAeM-XV). Further discussion related to the MET Divisional Meeting was recorded in paragraphs 2.45 and 3.4 of the **Report on Agenda Items**.

2.6 The Meeting discussed the development of various proposals, by the MARIE-PT, ATMRPP, WAFSOPSG, IAVWOPSG, SADISOPSG and METWSG, related to the provisions for aeronautical meteorological information and noted that any recommendations based on the proposals that may be adopted by the MET Divisional Meeting would be important to the regional determination of requirements for aeronautical meteorological information to support ATM.

MET requirements arising from ICAO Asia/Pacific ATM meetings (WP/09)

2.7 The Secretariat presented information on outcomes related to future requirements for meteorological information and products supporting air traffic management (ATM) that had arisen from various ICAO APAC Region ATM meetings. The Meeting noted that a number of ATM initiatives, which had either developed or were 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 and ATM contingency operations.

2.8 The APAC Seamless ATM Plan (located at the following website: <http://www.icao.int/APAC/Pages/edocs.aspx>), adopted by APANPIRG/24, Bangkok, Thailand, 24 – 26 June 2013, specified a number of elements of MET information required to support the Preferred ATM Service Levels (PASL), which were planned to be implemented in 2 phases; Phase I by 12 November 2015, and Phase II by 8 November 2018. Potential MET/ATM work areas arising from the Seamless ATM Plan included identification of the meteorological data required to support airport capacity analysis and aircraft climb, descent and approach operations, Air Traffic Flow Management/Collaborative Decision Making (ATFM/CDM) processes and the determination of nominal aircraft capacity for terminal Air Traffic Control (ATC) sectors, as well as the integration of MET information in ATC Air Situation Displays.

2.9 APANPIRG/24 adopted several ATFM related conclusions that would require supporting MET services, including the re-convening of the Asia/Pacific Air Traffic Flow Management Steering Group (ATFM/SG), tasked with developing a regional framework for collaborative ATFM.

2.10 Outcomes from ATFM/SG/2 (Hong Kong, China, 1 – 4 October 2013) included revised ToR for consideration by ATM Sub-Group and APANPIRG, and the draft principles, basic plan elements and ATFM capability elements that would define the framework.

2.11 The revised ToR (of ATFM/SG) included the task of identifying, researching and recommending appropriate guidance regarding *inter alia* capacity assessment and adjustment mechanisms, and mechanisms for ATFM data gathering, collation and sharing which may include capacity assessments, including factors affecting capacity such weather information.

2.12 The ATFM framework was expected to be finalized for adoption by APANPIRG/26 in September 2015. The ongoing development of the draft principles, basic plan elements and ATFM capability elements could be expected to include specific requirements for meteorological information and services supporting sub-Regional ATFM solutions. The early draft material included a number of elements that would require supporting MET information:

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- prediction and monitoring tools including weather prediction;
- CDM tools including information exchange;
- analysis tools for data analysis and reporting; and
- terminal and aerodrome operations including wind monitoring.

2.13 The Meeting was advised that Regional collaborative ATFM system capability was foreseen to consist of a number of sub-Regional distributed or “virtual” ATFM networks, which required the definition of standardized ATFM message formats and communications protocols to ensure interoperability within and between sub-Regional networks. The meeting was of the view that current and future developments in the provisions for aeronautical meteorological information exchange should support interoperability and noted that any future exchange of meteorological information in addition to OPMET defined in Annex 3 and yet to be defined within the Regional Framework for Collaborative ATFM would also need standardization to support interoperability.

2.14 It was proposed that the Meeting consider the benefits of establishing a link between MET/R TF and ATFM/SG to ensure the timely coordination of meeting outcomes, and a shared understanding of the MET products and information currently available and those that may be required as ATFM/SG continues development of the Regional ATFM framework.

2.15 The Meeting agreed that there was considerable benefit in formalizing a link between MET/R TF and ATFM/SG, and that the possibility of joint meetings should be explored. It was noted that meteorological information and services were only a part, albeit a significant one, of the work of ATFM/SG, and that the aggressive schedule of ATFM/SG required meeting intervals of 6 months which MET/R TF would be unlikely to justify.

2.16 The benefits of a link between MET/R TF and ATFM/SG were further discussed and agreed under WP/05, and the Meeting agreed to propose that the ToR of both the MET/R TF and the ATFM/SG should be revised accordingly. *Draft Decision TF 3/1: Revised Terms of Reference* as recorded under Agenda Item 1 of this Report was proposed for further consideration by the MET SG.

2.17 The Meeting proposed that the ATFM/SG/3, scheduled to be held in March 2014, should discuss the corresponding proposed revision of ToR for ATFM/SG for further consideration by the Air Traffic Management Sub-Group (ATM/SG) and adopted the following Decision:

Decision 3/2 - Revised ATFM/SG Terms of Reference

That, the Secretariat reports the revised MET/R TF Terms of Reference and the rationale behind them to ATFM/SG/3 and propose a corresponding revision of ATFM/SG Terms of Reference for consideration by ATM/SG.

2.18 The Meeting discussed the development of (digital) meteorological information exchange, in the context of Regional implementation issues, which was further discussed in paragraphs 2.42 to 2.44 of the Report on Agenda Items, 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.

2.19 The Meeting noted that the Third Meeting of the Regional ATM Contingency Plan Task Force (RACP/TF/3) was held in Bangkok, Thailand, from 12 to 15 November 2013, and was informed that the objective of RACP/TF was to develop and implement a Regional ATM Contingency Plan that *inter alia* recommended Regional contingency practices to events such as severe meteorological phenomena. The Meeting noted that initial drafting of the Regional ATM Contingency Plan included consideration of phenomena such as volcanic ash cloud, inundation, nuclear emergency and tropical cyclones. Furthermore, the Meeting was informed that reassignment to adjacent States of responsibilities for the provision of *inter alia* meteorological information was one of the basic plan elements contained in the draft Asia/Pacific ATM Contingency Plan.

2.20 The Meeting noted that the ToR of the RACP/TF included a link to the Meteorological Hazards Task Force (MET/H TF) and was invited to consider whether this link was sufficient for the effective communication of Regional ATM requirements for MET support in contingency situations, or if there was a need for a link, either informal or formal, between MET/R TF and RACP/TF. The Meeting considered that there was no need for an extra link to RACP/TF.

MET/ATM Seminar 2013

Review of MET/ATM Seminar 2013 (WP/05)

2.21 Outcomes from the Meeting's review of discussions at the MET/ATM Seminar 2013 are detailed in the paragraphs below.

Background of MET services for ATM

2.22 The Meeting noted the Seminar had recalled that the provision of aeronautical meteorological information to civil aviation was determined by internationally-agreed Standards and recommended practices contained in ICAO Annex 3 – *Meteorological Service for International Air Navigation* and other Annexes to the Convention on International Civil Aviation, and supplemented by Regional Air Navigation Plans and other ICAO provisions. The Meeting noted that few of the (non-ATM and ATM) Seminar participants were familiar with the ICAO *Global Air Traffic Management Operational Concept* (Doc 9854), though IFATCA noted cross-reference between Doc 9854 (2.9.17 to 2.9.19) and the ICAO *Manual on Coordination between Air Traffic Services, Aeronautical Information Services and Aeronautical Meteorological Services* (Doc 9377).

2.23 The Meeting noted that Australia had implemented a graphical SIGMET (as recommended by Annex 3) in trial mode and that New Zealand would do so in 2014. Seminar discussions had highlighted the need for cross-boundary alignment of graphical SIGMET information so as to ensure harmonization. An example of the graphical SIGMET produced by Australia is provided in Figure 1 of **Appendix G** to this Report.

2.24 The Meeting noted New Zealand had advised that long haul flights could incur a material fuel penalty due to misalignment of the (meteorological) phenomena described in SIGMETs at flight information region (FIR) boundaries and the Seminar had considered that accuracy and alignment of SIGMET information were vital to the management of global air traffic, as pilots and air traffic control based operational decisions on the SIGMET information provided by meteorological watch offices (MWOs). The Meeting also considered the need for sharing of real-time meteorological data between neighbouring MWOs, which could contribute to improved MET support for ATM across FIR boundaries.

2.25 The Meeting discussed the challenges that meteorological watch offices may have in aligning phenomena across FIR boundaries due to differences in forecasting personnel and timeframes, and difficulty in fully coordinating and consulting with neighbouring offices. The Meeting was informed that the challenges in providing seamless MET information were not insurmountable, and work was already being done between APAC States (e.g., Australia and New Zealand) to ensure the alignment of information. The meeting agreed that States should liaise with one another to find mutually beneficial solutions such as implementation of compatible systems/software.

2.26 The Meeting noted that cross-boundary alignment issues such as those noted above would likely be addressed in the work of the METWSG that related to potential future provisions for information on hazardous meteorological conditions.

2.27 In view of the discussion above on cross-boundary alignment of graphical SIGMET information, the Meeting adopted the following Draft Conclusion:

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).

Requirements for MET support to ATM

2.28 The Meeting noted the Seminar discussion on the work being undertaken within the SESAR and NextGen air transport modernization programmes in Europe and North America (*note: NextGen is also discussed in paragraph 2.37*). Whilst welcoming the need for global interoperability, the Seminar had considered that the programmes themselves may not be entirely suitable for or adaptable to the APAC region, owing to the different air traffic needs in the regions. Japan advised the Meeting that it had referred to the Global Air Navigation Plan (GANP) (Doc 9750), and the Aviation System Block Upgrades (ASBU) methodology contained therein, as a basis for its air transport infrastructure modernization (i.e., CARATS), which should facilitate suitability and adaptability for the region and inter-regionally.

2.29 The Meeting noted that harmonization and interoperability of aeronautical information was a key objective of the APAC Seamless ATM Plan (located at the following website: <http://www.icao.int/APAC/Pages/edocs.aspx>; under ‘ATM’, ‘Seamless ATM Plan’). Furthermore, the Meeting noted that the Seamless ATM Plan not only contained elements compatible with the ASBU methodology and the GANP framework, e.g., ASBU module B0-AMET was mapped directly to element 300 – *Meteorological Information*, in the first phase of the Seamless ATM Plan recommended for full implementation by 2015, but it necessarily included additional regional implementation priorities not specifically captured in the ASBU framework. The Meeting was advised that implementation of a number of the (forty-two) individual elements contained in the Seamless ATM Plan would also necessitate the implementation of specific supporting MET information services, which could be determined on a State basis. The Meeting considered that effective relationships between Air Navigation Service Providers (ANSPs) and MET Service Providers would be essential in this process and, preferably, should be backed up by formal agreements. The Meeting noted that elements of the Seamless ATM Plan included the requirements for reporting and relay of aircraft (MET) reports.

2.30 In view of the discussion above on the requirements for MET in the APAC Seamless ATM Plan, the Meeting adopted 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.*

2.31 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 **Appendix G** to this Report, including the Automated Thunderstorm Alert Service (ATSAS) and Area QNH Forecast provided by Australia in Figures 2 to 3.

2.32 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 Meeting and Seminar 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.

2.33 The Meeting considered that, to facilitate States in the alignment of systems, any survey should also seek information on the product formats used. The Meeting agreed on 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.

Enhancing MET support to ATM

2.34 The Meeting agreed with the Seminar's consideration that there was a need for a 'common language' between ATM/MET to ensure clarity of understanding of ATM operational requirements and MET capabilities when developing tailored services. The meeting noted that, when presented in graphical form, the utility of tailored MET information may be enhanced by presentation on an Air Traffic Service (ATS) route map.

2.35 The Meeting agreed that the provision of tailored MET information was not only important to ATM, but also to aircraft operators who used it for fuel and alternate planning. In this respect, the Meeting noted that the depiction of real-time weather conditions at major airports was considered useful and that 12- to 24-hour forecasts were used by ATM to determine the following day's airport/airspace capacity.

2.36 The Meeting noted that feedback from pilots, ATC and airlines to providers of MET information assisted in the improvement of MET services and that the provision of oral briefings between MET and ATM also facilitated better understanding of existing and/or expected MET conditions. While the Meeting noted that improved accuracy of forecasts was frequently mentioned as an identified user need, it also noted the necessity to identify which elements of forecasting most needed improvement when considering ATM and ATC operational measures. The Meeting noted that in some States, embedded MET personnel in ATM operations had provided significant improvements, but not all States had adequate resources to do this.

2.37 The Meeting noted the discussion in the Seminar, which was initiated by the United States, concerning integration of MET information into ATM decision-making and examples provided of MET integration within the Next Generation Air Transport System (NextGen). The United States had pointed out that it was not attempting to present the NextGen as a regional solution but rather as a system that supports the ASBUs as a mechanism for MET modernization and that the MET integration initiatives within NextGen were categorized into 4 levels where MET information was: visualized (level 1), translated into thresholds (level 2), converted into ATM impacts (level 3) and fully integrated into ATM decision support tools (level 4). Examples of MET integration within NextGen, i.e., the Corridor Integrated Weather System (CIWS) and Route Availability Planning Tool (RAPT), are provided in Figures 4 to 5 of **Appendix G** to this Report.

2.38 The Meeting noted Seminar discussions on a case study of the impact of convective weather on air traffic in the approach control area of Tokyo International Airport (RJTT). In this case, convective clouds occurred along the final approach path and, although relatively small-scale in areal extent and intensity, the presence of convective weather in the approach path triggered the suspending of landing operations for 20 minutes with many aircraft directed by ATC to either hold in and around the approach control area or to delay departure for RJTT, which had a significant downstream impact on air traffic flow nationwide. The case study illustrated that the impact of convective weather on air traffic systems was not always a direct relationship between the intensity or extent of the weather conditions and the impact on air traffic flow. Rather, the relationship was more complex and required consideration of the location and time of convective weather relative to air traffic movements. Based on

such experience, and with close consideration of ATC/ATM operational procedures, Japan's Air Traffic Meteorology Center (ATMetC) provided tailored meteorological information that indicated the possible impact of convective weather on air traffic flow and, therefore, supported ATC to mitigate the impact of convective weather on the air traffic system.

2.39 The Meeting also noted Seminar discussions on the details and the validation of ATM-tailored meteorological information contained in the ATMet Category Forecast provided by the ATMetC in Japan. The ATMet Category Forecast provided ATM with information on the probability of weather-induced impacts on air traffic flow in each area control centre (ACC) sector and major aerodrome up to 6 hours ahead. The information was intended to support ATC decision-making such as in the activation of expected departure control time (EDCT) procedures. Meteorological criteria were developed based on the relationship between recorded air traffic delays and the concurrent meteorological conditions; the criteria were verified regularly using a weather impact ratio (WXIR) – which compared the rate of air traffic delays against all occurrences of the meteorological criteria – and then validated against operational outcomes through consultation with the Air Traffic Management Center (ATMC). The Seminar had noted that such collaborative, continuous improvement processes were important in the enhancement of MET support to ATM. Examples of the ATMet Category Forecast are provided in Figures 6 to 8 of **Appendix G** to this Report.

2.40 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.

2.41 In view of the discussion above, the Meeting agreed that there would be considerable value in conducting such an exercise in the APAC Region taking into account the experience of VOLKAM13 and other exercises conducted in other regions, and 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.

Next steps

2.42 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. The Meeting noted strong support for this type of interaction from both the MET and ATM communities and considered that the frequency and objectives of future MET/ATM Seminars would depend on the regional level of demand and requirement for updated information. Furthermore, the Meeting considered that practical examples of how MET was used successfully by ATM in collaborative decision making (CDM) were useful in such forums, as was the provision of guidance and information supporting a shared understanding of

technical and practical aspects of the MET information exchange formats that were under development. In view of the discussion above, the Meeting agreed to the following Decision:

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.

2.43 The Meeting recalled that Amendment 76 to Annex 3, applicable on 14 November 2013, introduced enabling clauses to allow States in a position to do so to exchange OPMET information (specifically METAR/SPECI, TAF and SIGMET) in a digital format in accordance with a globally interoperable information exchange model. The Meeting was informed that these initial provisions for digital exchange were expected to be enhanced and extended through at least Amendments 77 and 78 to Annex 3 to ensure that the broad spectrum of the aeronautical meteorological services can fulfil the requirements of the future globally interoperable ATM system through system-wide information management. The Meeting noted that discussion in the Seminar highlighted that the current knowledge and capability required to begin implementing the provisions for digital exchange of MET information was not widespread in the region.

2.44 The Meeting noted that the Regional OPMET Bulletins Exchange Working Group (ROBEX WG) had some responsibility in the area of digital exchange and should therefore be closely included in any coordination. The Meeting also noted that no such testing and implementation work had been done in the region on digital meteorological information exchange and that some States may not be ready. Following the discussions above, the Meeting adopted *Decision 3/3: Capacity building for (digital) MET information exchange*, which is recorded in paragraph 2.18 of the Report on Agenda Items (under WP/09).

2.45 The Meeting recalled that the MET Divisional Meeting (in July 2014) will provide the international civil aviation community the opportunity to address issues vital to the current and future provision of MET services, particularly as they relate to GANP, and that details on the MET Divisional Meeting had been sent to States and concerned international organizations under State letter reference SD 40/1-13/68 of 4 October 2013. The Meeting noted that several transitional roadmaps and concepts of operations had emerged from global ICAO MET expert groups (including the WAFSOPSG and IAVWOPSG) that would be tabled for the consideration and/or information of the MET Divisional Meeting.

Agenda Item 3: MET and ATM Requirements and Information Exchange

Current and future requirements for MET information in support of ATM

MET Information in Support of ATM (WP/06)

3.1 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.

3.2 The Meeting was reminded that global provisions and regional operational MET requirements were subject to periodical amendment to keep pace with evolving global and regional requirements. The overall strategic direction for development and implementation of ICAO provisions for MET information was provided by the *Global Air Traffic Management Operational Concept* (Doc 9854) and the *2013-2028 Global Air Navigation Plan* (GANP) (Doc 9750), ensuring MET information and services were developed and implemented to support the transition to an integrated and collaborative ATM system.

3.3 The Meeting discussed the development and implementation of provisions for MET information in the near- and longer-term with respect to the ASBU methodology, and the region-specific issues concerning implementation of MET arising from the APAC Seamless ATM Plan.

3.4 The Meeting also considered the future application of MET information in CDM/ATFM in the APAC Region. In this regard, 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 and would be intended to include the necessary procedural components of the provisions for MET information that would support transition to the future global ATM system.

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

3.5 China provided the Meeting with information on the development of meteorological services for the terminal area in China.

3.6 The Meeting was informed that, with increasing air traffic density, operations in terminal areas in China were impacted tremendously by adverse weather and the current aerodrome forecast (TAF) products were unable to meet all the operational requirements in the terminal area. The Meeting noted that in response to users' requirements the Air Traffic Management Bureau of the Civil Aviation Authority of China (ATMB of CAAC) launched its meteorological services for the terminal area program in 2010.

3.7 The Meeting was informed that a workgroup on meteorological services for the terminal area was set up including forecasters from the three regional aviation meteorological centres that provide weather services for the three busiest airports in China: Beijing, Shanghai and Guangzhou; and experts from Hong Kong Observatory were invited to join the workgroup.

3.8 The Meeting was informed that the workgroup agreed the services required were terminal-area specific; primarily based on local-area data derived from Doppler weather radar and numerical prediction models, and that the meteorological services for the terminal area be developed in stages with the highest priority being the provision of information on convective weather, wind and icing potential.

3.9 The Meeting noted that the meteorological services for the terminal area would be tailored and provided in graphical, tabular, text or coded format to facilitate use and transmission by users including ATC, pilots and dispatchers. Furthermore, the Meeting was informed that the period of validity of the meteorological services for the terminal area would be very-short-term or now-cast (i.e., less than 6 hours) for convective weather and short-term (i.e., less than 24 hours) for the other elements and that accuracy specifications of the services would be determined by agreement between the meteorological authority and user community based on capability of the provider and requirements of the users.

3.10 The Meeting was informed that trial convective weather now-cast products, valid for 1-hour and with 6-minute updates, were provided from July 2013 to the ACC, Terminal Control Center, Flight Service Center and Operations Control Center for the Guangzhou terminal area, and that, while user feedback was positive, the trial indicated further improvement was required for the algorithm that provided an indication of impact of convective weather for ATM. The Meeting also noted additional information provided by China on icing and wind shear forecasting.

3.11 The Meeting was informed that, in the future, the meteorological services for the terminal area may be provided to additional users – to solicit more feedback and facilitate further improvements – and research and development would be carried out to include additional meteorological elements.

3.12 Examples of China’s meteorological services for the terminal area are provided in Figures 9 to 14 of **Appendix G** to this Report.

Australian Aviation Weather Services for Air Traffic Management (IP/02)

3.13 Australia provided the Meeting with information on the aeronautical meteorological information provided, which included:

- *Meteorological observations and reports* – routine and special observations and reports (METAR/SPECI), based on information from automatic weather stations (AWS) and supplemented by manual observations at some aerodromes; observations for take-off and landing provided by tower controllers, which included information from AWS broadcasted on the Aerodrome Terminal Information Service (ATIS); Aerodrome Weather Information Service (AWIS), which provided real-time access to meteorological observations from AWS by phone or radio transmissions;
- *Aircraft observations and reports* – air-reports augmented meteorological observations available from other sources, particularly over data sparse areas;
- *Forecasts* – aerodrome forecasts (TAF), based on the ICAO standards but also included additional fields such as INTER to represent significant variations in prevailing conditions of less than 30 minutes duration and temperature and QNH for times HH, HH+3, HH+6 and HH+9; trend forecasts (TTF), not compliant with the ICAO standards for landing forecasts and offered operational benefits to pilots in that it could be used for flight (fuel) planning purposes for very short flights; airport weather briefings; ‘Code Grey’ special forecast service, which supplemented the TAF and reduced the impact of later TAF amendments on long haul flights; area forecasts (ARFOR) to meet the needs of general aviation operations below F185; local area forecasts; flight and route forecasts; area QNH forecasts;
- *Warnings* – SIGMET and AIRMET information, aerodrome warnings and wind shear warnings; marked temperature inversion advice;

- *Service for operators and flight crew members* – Antarctic weather briefing, which was tailored to expected flying programs; thunderstorm alert for aviation ground staff (TAAGS) and automated thunderstorm alert service (ATSAS); Aviation Weather Centre provided forecasts for operations above 20,000 feet including upper wind, upper-air temperature and SIGWX phenomena;
- *Information for search and rescue services* – search and rescue forecasts to support air search operations conducted by the Rescue Coordination Centre (RCC); ditching reports, included a now-cast of conditions at a location where an aircraft in difficulty would attempt a forced landing; and
- *Advisory information* – tropical cyclone advisory information and volcanic ash advisory information.

3.14 The Meeting was informed that future services under development included the graphical presentation of SIGMET, ARFOR and other complex weather descriptions, and that planning for the implementation of meteorological information exchange models was also under way.

Integration of MET information in ATM, airspace user systems and decision support tools

Aerodrome Weather Briefing and Code Grey (IP/03)

3.15 Australia informed the Meeting on specialized products, including the airport weather briefing (AWB) and ‘Code Grey’ forecast, which provided additional information not normally included in the standard aerodrome or landing forecasts (TAF or TTF).

3.16 The Meeting noted that the AWB was provided for Australian capital city airports and expanded on information provided in the TAF; it was issued twice- to four-times per day, depending on location, but was not usually updated except for the ‘Code Grey’ component of the briefing. An example of the AWB, provided by Australia, is included in Figure 15 of **Appendix G** to this Report.

3.17 The Meeting was informed that the ‘Code Grey’ forecast was provided to supplement the routine TAF; as a component of the AWB and as a stand-alone product. The Meeting noted that the ‘Code Grey’ was used to reduce the operational impact, particularly on long-haul flights arriving the following morning, of later amendments to the TAF by providing flight planners some insight into alternative weather scenarios being considered by the forecaster and, as such, early advice of a possible later TAF amendment. The Meeting noted the ‘Code Grey’ was issued when there was a small but realistic chance of fog, thunderstorms, or visibility/ceiling below special alternate minima and, when applicable, it indicated the probability of occurrence of those elements as 5%, 10% or 20%.

3.18 Examples of ‘Code Grey’ forecasts were provided by Australia as follows:

PROB05 1919/1923 0500 FG
PROB20 1614/1624 1500 BR
PROB10 INTER 0120/0124 TS
PROB10 0514/0524 BKN005
PROB10 1218/1223 2000 FU
PROB20 2518/2522 1500 BLDU

3.19 The Meeting was informed that the ‘Code Grey’ forecast was used only by some international airlines and that it and the AWB were together under review by the aviation industry in Australia to establish the user requirements for future service improvements.

Collaborative decision making (IP/04)

3.20 The Meeting was provided with an overview of a trial of collaborative decision making (CDM) in Australia.

3.21 The Meeting was informed that air traffic movements in Australia had increased at about 4% per annum and that at peak times and during periods of marginal or poor weather there were more aircraft scheduled than there were landing slots available, which sometimes resulted in significant delays and flight cancellations. The Meeting was further informed that the ANSP primarily managed the situation utilizing airline schedules to produce a ground delay program, which used software that enabled the ANSP to monitor demand and capacity across the network and to implement traffic management initiatives (TMIs) when demand exceeded capacity.

3.22 The Meeting noted that landing rates for each airport were decided the previous day by a collaborative process taking into account meteorological information (including forecast wind and weather) and other factors that were likely to influence traffic flow, and that any subsequent changes in the forecast of wind or weather may have necessitated the implementation of revised or new TMIs.

3.23 The Meeting was informed that although the meteorological information used for deciding landing rates was principally provided by the TAF, this forecast did not provide information on all weather phenomena likely to affect traffic flow into the airport, e.g., thunderstorms in the terminal movement area (TMA) that were not also in the TAF area, which was limited to approximately 8 km radius from the aerodrome reference point.

3.24 To address the above scenario, the Meeting was informed of a trial CDM product used in Australia, which combined the TAF information with supplementary information that included both the probability of alternative weather scenarios occurring at the aerodrome and the probability of significant meteorological phenomena occurring outside the immediate aerodrome vicinity but within the TMA. The Meeting noted that the trial CDM product, which represented meteorological information as a matrix of forecast probability and confidence, contained significantly more information than the standard TAF. An example of the trial CDM product is provided in Figure 16 of **Appendix G** to this Report.

3.25 The Meeting was informed that the trial CDM product was used in routine daily teleconferences conducted between operational staff from the ANSP, meteorological service provider and airline meteorological units to facilitate CDM processes.

3.26 The Meeting noted that the initial trial of the CDM product had been positive in that it provided valuable additional information to support decisions, and issues were identified that needed to be addressed including:

- better defined user requirements in order to provide specialized products and services for CDM;
- identification of other meteorological information for use in CDM;

- allocation of additional resources to support CDM initiatives;
- verification of meteorological forecasts used in CDM;
- education/training supporting the roles of stakeholders in CDM;
- guidance supporting common understanding of ‘probability’ and ‘confidence’ used in meteorological forecasts used in CDM; and
- guidance supporting users’ understanding that the probability matrix is provided as supplementary and complimentary to the TAF.

Sub-regional exchange of MET information that facilitates ATM operations

3.27 The Meeting discussed possibilities for sub-regional exchange of MET information and associated agreements that facilitate ATM operations, particularly over busy routes that overlap different FIRs, and noted that in this region some States had discussed sharing of aircraft reports.

The Role of MET Information in the Development of CDM/ATFM

Development of Meteorological Products to Support ATFM (WP/07)

3.28 Hong Kong, China informed the Meeting on a number of tailor-made meteorological products and services, referred to as Meteorological Services to ATM (MSTA), developed by the Hong Kong Observatory (HKO) to support the Hong Kong Civil Aviation Department in ATFM operations.

3.29 The Meeting was informed that maximum runway throughput for landing traffic could only be achieved with optimum inter-arrival spacing and that the effects of convective weather, which occurred over the airport, final approaches or the base area, would significantly reduce the runway capacity. In view of the above, the Meeting was informed that existing meteorological products such as TAF, which focused mainly on the control zone, did not represent the whole terminal area airspace, including the approaches, required.

3.30 The Meeting was also informed that targeted meteorological information that supported decisions on the mode of the runway operation would also facilitate ATFM operations.

3.31 The Meeting noted that, in Hong Kong, major airborne delays for arriving aircraft were absorbed in 3 primary holding patterns in the terminal airspace and that inclement weather in these holding areas reduced airspace capacity significantly. To handle the issue tactically, the Meeting was informed that Hong Kong had established contingency holding patterns, but these measures were not adequate in extensive poor weather and meteorological product was required to assess the availability of holding patterns and determine necessary ATFM measures.

3.32 The Meeting was informed that, when ATFM measures were required it was preferable that aircraft be held on the ground at the departure aerodrome and, with a catchment area of 1,500NM from Hong Kong International Airport, the Hong Kong ATFM Unit endeavoured to provide 4-hours advance notice of ATFM measures to upstream ACCs – which required supporting

meteorological forecasts with similar lead time.

3.33 The Meeting noted that MSTA products developed by HKO to support capacity estimation included:

- Aviation Thunderstorm Now-casting System (ATNS); to track the past movement and forecast the future location of weather cells that may block the intended flight path or significant points in the air space;
- 1-hour convection now-cast for arrival/departure corridors; updated every 6 minutes or as manually adjusted;
- 9-hour performance-based weather forecasts for the aerodrome; including significant convection, headwind, crosswind, visibility and cloud ceiling, which provided information in addition to the TAF or trend forecast (TTF) and facilitated fine tuning of the expected airport arrival rate; and
- 12-hour and 6-hour forecasts of significant convection; for key areas of the Hong Kong FIR, including holding areas and busy air routes.

3.34 The Meeting was informed that a web-based integrated display, known as the ‘Significant Convection Monitoring and Forecast’, was developed to provide a ‘one-stop-shop’ to the ATFM Unit and ATC and that weather briefings were conducted twice per day between aviation weather forecasters and the ATMF Unit.

3.35 The Meeting noted that information on thunderstorms or significant weather that affected approach and departure areas, which may not have been reported by the METAR, including information on the position and movement of thunderstorms, was provided on the ATIS broadcast to heighten pilots’ situational awareness.

3.36 The Meeting was informed that users were involved in the development of MSTA products, regular meetings were held to review operational and coordination issues and joint workshops were organized for aviation weather forecasters and air traffic controllers to improve mutual understanding of MSTA products and to exchange views on future development and application of MSTA products.

3.37 Examples of Hong Kong China’s MSTA products and their presentation are provided in Figures 17 to 24 of **Appendix G** to this Report.

MET Information Supporting ATM Contingency Planning

3.38 The Meeting was reminded of the requirement for the MET/R TF to coordinate with the Meteorological Hazards Task Force (MET/H TF) on a framework for ATM contingency plans for specific phenomena including volcanic ash, radioactive cloud, tropical cyclone and tsunami. This item was discussed further in paragraphs 2.19 to 2.20 of the Report on Agenda Items.

Current and Future Requirements for ATM in Support of MET Services

3.39 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. The Meeting 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. Requirements for aircraft reporting were referred to in the *Decision 3/5 – MET in the APAC Seamless ATM Plan*, adopted by the Meeting in paragraph 2.30 of the Report on Agenda Items.

Agenda Item 4: Future Work Programme

Future Work Programme of the MET/R TF (WP/08)

4.1 The Meeting reviewed the work programme of the MET/R TF, which included the communication strategies, performance framework, milestones and work plan. The work programme as reviewed and updated by the Meeting is appended at **Appendix F** to this Report.

Agenda Item 5: Any Other Business

5.1 India raised the issue of assessment of prevailing visibility and its effect on aircraft operations, and requested information on the availability of visibility measurement technology.

5.2 India noted cases where visibility was assessed by visual observation with reference to specified landmarks and the minimum permissible visibility for a particular flight was a distance between two landmarks used in visibility observations. In such cases, when the observed visibility had not yet increased to the distance of the further landmark ATC would not permit the operation. This caused congestion on airports, delays in the air, and pilot complaints when their own assessment was that the visibility was suitable for their operation.

5.3 The chair suggested that this item could be discussed further outside the meeting and several States offered to provide further information to assist India.

Date and Venue for the Next Meeting

5.4 The Meeting agreed tentatively that the next meeting (MET/R TF/4) should be conducted in Bangkok in 2014 and that the Secretariat and Chairman should make further consideration of possible suitable dates for the meeting, which could be held back-to-back with another related forum or event.

Closing of the Meeting

5.5 The Chairman thanked the meeting participants for their contributions.

**METEOROLOGY/AIR TRAFFIC MANAGEMENT (MET/ATM) SEMINAR
AND
3RD MEETING OF METEOROLOGICAL REQUIREMENTS TASK FORCE (MET/R TF/3)**

(Bangkok, Thailand, 26 – 29 November 2013)

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INTERNATIONAL CIVIL AVIATION ORGANIZATION

**ICAO ASIA/PAC METEOROLOGY /
AIR TRAFFIC MANAGEMENT (MET/ATM) SEMINAR**

Bangkok, Thailand, 26 – 28 November 2013

LIST OF WORKING/INFORMATION PAPERS AND PRESENTATIONS

WP/SP/IP No.	Discussion Topic	Subject	Presented by
WP/1	-	Provisional Seminar Programme	Secretariat
PRESENTATIONS			
SP/1		Introduction to MET/ATM Seminar	Secretariat
SP/2		Background of MET Services for ATM	Secretariat
SP/3		Australian Aviation Weather Services for ATM	Australia
SP/4		WMO Activities for MET Services Supporting ATM	Australia
SP/5		Overview of ATMRPP and MARIE-PT activities	Secretary
SP/6		Aviation XML	Australia
SP/7		MET in the GANP and ASBU Initiative	Secretary
SP/8		Overview of APAC Seamless ATM Planning Group	Secretariat
SP/9		Overview of MET/R TF and MET/ATM Seminar	Secretariat
SP/10		Changes in Meteorological Services in Support of International Air Navigation	USA
SP/11		Enhancing MET Support to ATM	IFATCA
SP/12		Strategic Radar Enhancement Project	Australia
SP/13		The Outline and the Benefit of VOLKAM from the Point of View of ATM	Japan
SP/14		Verification of ATM Category Forecast	Japan
SP/15		Practical Use of Weather Information to Air Traffic Management	Japan
SP/16		ATM Measures by Using the Weather Information	Japan

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WP/SP/IP No.	Discussion Topic	Subject	Presented by
SP/17		Next Steps	Secretariat
SP18		Objective Quantification of Weather Impact on Aircraft Operations due to Significant Convection Using Weather Radar Parameters	Hong Kong, China

INFORMATION PAPERS

IP/1	-	Meeting Bulletin	Secretariat
IP/2	2	Meteorology in the Japan's CARATS Project	Japan
IP/3	1	Establishment of MET Services in Support of ATM	Japan
IP/4	3 (2)	Benefit of VOLKAM for ATM	Japan
IP/5	3 (2)	Verification of ATM Category Forecast	Japan
IP/6	2 (1a)	Practical Use of MET Information for ATM	Japan
IP/7	3 (2)	ATM Measures Using MET Information	Japan
IP/8	3 (2)	Objective Quantification of Weather Impact on Aircraft Operations due to Significant Convection Using Weather Radar Parameters	Hong Kong, China



INTERNATIONAL CIVIL AVIATION ORGANIZATION

**THIRD MEETING OF ASIA/PACIFIC METEOROLOGICAL
REQUIREMENTS TASK FORCE (MET/R TF/3) OF MET
SUB-GROUP OF APANPIRG**

Bangkok, Thailand, 28 – 29 November 2013

LIST OF WORKING AND INFORMATION PAPERS

WP/IP No.	Agenda	Subject	Presented by
WP/1	-	Provisional Agenda	Secretariat
WP/2	1 (b)	Review of the MET/R TF and Composition of the Group	Secretariat
WP/3	2 (a)	Review of MET/ATM TF/2 Meeting	Secretariat
WP/4	2 (a)	Review of other relevant Meetings	Secretariat
WP/5	2 (c)	Review of MET/ATM Seminar 2013	Secretariat
WP/6	3	MET Information in Support of ATM	Secretariat
WP/7	3 (a)	Development of MET Products to Support ATFM	Hong Kong, China
WP/8	4	Future Work Programme of the MET/R TF	Secretariat
WP/9	2	MET Requirements Arising from ICAO Asia/Pacific ATM Meetings	Secretariat

INFORMATION PAPERS

IP/1		Meeting Bulletin	Secretariat
IP/2	3 (a)	MET Services for ATM	Australia
IP/3	3 (a)	Aerodrome Weather Briefing and Code Grey	Australia
IP/4	4 (b)	Collaborative Decision Making	Australia
IP/5	3	Development of Meteorological Services for the Terminal Area in China	China

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2. DESCRIPTION	
Objective	Improve safety, efficiency and sustainability of ATM and operators by providing MET information needed to meet current and future requirements.
Benefits	Increase efficiency – save time and fuel as well as reduce carbon emissions
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>

ICAO/WMO APAC MET/ATM Seminar and TF/2 meeting – Executive Summary
Fukuoka, Japan
24-26 and 27-28 January 2011

Annex 3, *Meteorological Provisions for International Civil Aviation*; provides standards and recommended practices on services for flight planning and tactical decision-making. Air traffic in some places, particularly North America and Europe, require additional meteorological products and services to those in Annex 3 for strategic planning by Air Traffic Management (ATM). The Asia and Pacific Regions currently have significant growth, which is forecasted to continue such that enhanced MET services and products are required to meet the needs of ATM in optimizing traffic flow. The ICAO/WMO APAC MET/ATM Seminar held in Fukuoka, Japan from 24-26 January 2011 (APANPIRG Conclusions 19/53 and 21/50 refer) allowed States to discuss their progress on MET products and services that better serve ATM. In addition, some issues were further considered by the APAC MET/ATM TF/2 meeting which resulted in six action items.

The seminar was attended by 76 experts from 14 States, 2 Special Administrative Regions, IATA, IFALPA, IFATCA, WMO and ICAO. The task force meeting was attended by 43 experts from 11 States, 1 Special Administrative Region, IFATCA, WMO and ICAO. The full reports of each can be found at the following website <http://www.icao.int/APAC/Meetings/Pages/default.aspx>. A brief summary of items discussed and resulting six actions are provided here within.

State arrangements between MET and ATM

Many States at the seminar have arrangements between MET and ATM. The host State, Japan, detailed steps in developing a MET service for ATM called the Air Traffic Meteorology Centre (ATMetC) located at the Air Traffic Management Centre (ATMC). These steps may be useful for emerging States that plan to provide such services in the future. The Republic of Korea noted that due to constraints in resources, visits to the nearby Area Control Centre (ACC) are conducted to provide briefings of weather impacts on ATM for each shift. The Russian Federation provides a mechanism for former Soviet Union States to improve MET services for aviation in the form of a working group. Most States with MET services for ATM provide briefings catered to ATM, in addition to teleconferences and mutual training (ATM for MET, MET for ATM) as described by Hong Kong China. The United States described the use of the Central Weather Service Unit at the En-route Centres in serving ATM needs in addition to products being used for strategic planning (greater than 4 hours in advance) at the Central Flow Control Unit. Collaborative decision making includes the airline operators which has proven successful in that they often cancel flights in advance resulting in less ATM workload to manage a particular weather event. Decision support tools include when aircraft are expected to be in convective weather, based on forecasts of convection overlaid on historic air traffic data at one hour intervals. Capacity impacts are forecasted using a combination of airport/terminal/en-route impacts due to weather, which allows for a prediction of how many flights should be cancelled to reduce delays to an acceptable level. Furthermore, operators are provided with choices (cancellation, delay, reroutes) which allow the operator to make the decision that best suits them. When an operator chooses a cancellation or delay, that time slot becomes available for another operator to use. Lastly, the seminar noted that the knowledge of other States air traffic impacts due to weather also assists neighboring States or States where operations are numerous to the other State in ATM planning.

Given the importance of collaborative decision-making, the MET/ATM TF/2 meeting agreed that terms of reference of the task force include “study the successful involvement of MET in the development of CDM in other regions with a view to future application in ASIA/PAC” (TF/2 meeting **Action 2/1** refers).

Meteorological impacts on ATM

Various types of weather have significant impact on all phases of flight (en-route, terminal and aerodrome).

Volcanic Ash

States discussed various volcanic ash impacts on en-route and aerodrome operations. Japan noted the disruption to trans-Pacific flights that utilize one of the five Northern Pacific (NOPAC) routes as a result of the volcanic eruption of Mt. Sarychev in the Russian Federation on June 12, 2009. Many flights were en-route several hours before turning back to their point of origin and due to the operators not having the same information as the Japan Civil Aviation Bureau (JCAB) and city-pair restrictions. This has been partly resolved by sharing of information, but city-pair restrictions are only done on a case by case basis with an investigation on relaxing this constraint in such events before the aircraft departs. The use of Pacific Organized Track System (PACOTS), which are optimized routes determined by Japan and the United States each day based on the jet-stream. These routes are typically south of the volcanic ash cloud, however, adjustments to tracks based on new information are not currently made. Improvements being considered at the Informal Pacific ATC Coordination Group (IPACG) include coordination between the Russian Federation and Japan in terms of alternate routes. Another improvement is having accurate volcanic ash information for users. The Russian Federation has designated the Institute of Volcanic Geology and Geochemistry of FED Russian Academy of Sciences (IVGG FED RAS) as the State Volcano Observatory to continuously monitor active volcanoes in the Russian Far East, which includes the Sakhalin and Kuril Islands.

Indonesia informed the seminar of the significant air traffic impacts, which included 400 cancelled flights at Jogjakarta Airport due to the eruption of Mount Merapi on Java Island that began on October 26, 2010. The impact of ash was probably reduced due to the ATS contingency plan in place (est. 2007), which involves collaboration between the civil aviation authority, MET authority, air navigation service provider, and the military. Further developments include bilateral ATM coordination for volcanic ash events between Indonesia and Singapore (TF/2 meeting **Action 2/4**). Specifically, a plan to develop contingency routes and FIR to FIR coordination in case of volcanic ash events is expected. A working paper on this subject will be submitted to the METWARN/I TF/1 meeting of the APANPIRG in March 2011.

Indonesia CAA and operators desire volcanic ash maps that contain thresholds of ash concentration. The seminar was briefed that volcanic ash thresholds are being investigated by the International Volcanic Ash Task Force (IVATF) airworthiness sub group which plans to use information provided by engine manufacturers. In addition, the IVATF ATM sub group is investigating a template on regional contingency plans for volcanic ash. This outcome would affect the development of the APAC regional contingency plan for volcanic ash. In the meantime, points of contact for operational purposes during a volcanic ash event have been provided by 13 States and one Special Administrative Region and posted on the APAC website (APANPIRG D21/9 refers). States who have not provided this information will be reminded by the APAC RO (TF/2 meeting **Action 2/3 refers**) for updating by 1 April 2011.

Other improvements of volcanic ash information services were provided to the seminar, such as the stakeholder meeting outcome conducted by the Federation Aviation Administration of the United States to improve volcanic ash information from the Volcanic Ash Advisory Centres (VAACs) Anchorage and Washington.

Tropical Cyclone

As volcanic ash events impact mainly en-route and aerodrome operations in the cases described, a tropical cyclone event in Japan on 7 and 8 October affected airport capacity at the Tokyo International Airport mainly due to operational requirements related to wind and visibility. The forecast for significant reduction in airport capacity was accurate and assisted in limiting the number of in air holds, saving costs to the airlines.

Intertropical Convergence Zone

Accurate convective forecasts in graphical and tabular form for air traffic focal points such as holding areas assists planning for the Hong Kong China ATM in determining proactive measures to avoid significant diversions caused by convective weather. Furthermore, ATM utilizes different flight levels in the Hong Kong FIR to avoid aircraft conflicts with the anticipation of deviations. These meteorological products are useful to air traffic planning for several months of the year when the Intertropical Convergence Zone results in large areas of significant convection.

Dust Storms

Airport arrival rates (AAR) were significantly reduced due to low visibility operations at Sydney International Airport as a large part of eastern Australia was affected by dust storms from 21-27 September 2009. The forecast for high winds provided anticipation of AAR reductions, but low visibility was not forecasted in time to assist AAR planning. The seminar noted that clarification on criteria and reporting of dust storms is being developed by the World Meteorological Organization (WMO) Sand and Dust Storm (SDS) Warning Advisory Assessment System (WAS) in conjunction with ICAO at the global study groups (AMOFSG and METWSG). Australia has taken an initiative in training and improved forecasting documentation guidance in the Bureau of Meteorology's Aeronautical Forecasters Handbook.

Use of Meteorological information by ATM

The seminar noted the 1,000 feet vertical spacing where Reduced Vertical Minimum Spacing (RVSM) is utilized is increased to 2,000 feet vertical spacing when severe turbulence is reported as per the RVSM Manual. WMO noted that the theoretical altimeter errors associated with vertical motion in situations such as turbulence and gravity waves should be investigated further. As a result, the MET/ATM TF/2 meeting invited WMO to request the ICAO Separation and Airspace Safety Panel (SASP) to investigate these theoretical errors, which could be done by comparing GPS readings with altimeter readings (TF/2 meeting **Action 2/5 refers**).

IFATCA noted their input could have been of use at the global study groups (AMOFSG, METWSG) when developing standards and guidance material related to visibility reporting and spatial area of TAF and METAR to name examples. IFATCA was invited to request membership of the global study groups to request membership. IFATCA also noted the importance of ATC to be involved in the development of ATM products since ATC is a tactical phase, while ATM is a strategic phase and a link is needed in the timeline of 0-4 hours in the operational planning phase. In addition, ATC desires products that are in graphic or tabular form whereas the strategic phase may have different product representation.

ATM developments requiring additional/new MET information

The seminar noted that future MET requirements for ATM will likely have high level enabling clauses in Annex 3 with more dynamic information in a WMO/ICAO Manual (TF/2 meeting action **2/6 refers**). These new requirements should assist in maximizing the benefits of performance based navigation (PBN). The World Area Forecast System in its current form does not meet the demands of PBN due to the coarse spatial and temporal resolutions. Some locations utilize greater spatial and temporal resolutions of upper level wind to assist in arrival metering and sequencing, such as Hong Kong China.

Meteorological Services in the Terminal Area (MSTA)

To close the gap between current Annex 3 provisions and ATM needs, the Meteorological Services in the Terminal Area (MSTA) initiative is being developed by WMO in collaboration with ICAO. The prototype MSTA is expected to assist ICAO in developing requirements on MET products and services (forecasts and probabilities of convection, winds, low ceiling/visibility, winter weather and dust/sand storms) for a wider terminal area not currently prescribed in Annex 3. These services are subject to endorsement at the ICAO MET/AIM Divisional Meeting / WMO CAeM XV Session in 2014. User input is provided to WMO, which is linked to an ICAO user group in the development of requirements. User input at the regional level was provided at the task force meeting, which addressed the following points: **development of probabilistic forecasts, verification and validation of forecast accuracy, translating weather products to user impacts and standards and guidance material for MSTA**. The seminar consensus to these points will be incorporated in the AMOFSG ad-hoc group and WMO encouraged sharing its feedback at forthcoming MET/ATM meetings in other ICAO regions (TF/2 meeting **Action 2/6** refers).

Future data delivery

The delivery of weather information to ATM and other AT sectors will change from alphanumeric code to extensible markup language (subject to endorsement by the ICAO MET/AIM Divisional Meeting / WMO CAeM XV Session in 2014). The reason for the change is to enable automated systems, reduce coding errors and improve quality control.

Other

The only subject exclusively raised in the MET/ATM TF/2 meeting was the review of the Air Traffic Flow Management (ATFM) Survey 2010. Several States noted the MET information provided was incomplete, misleading or missing. As a result, the meeting requested the survey be checked for validation by those States as described in **Action 2/2**.

Next MET/ATM event

The meeting agreed that the CNS/MET SG/15 meeting will have the most insight in determining the time frame of the next MET/ATM event, which may not be required each year, but should be tied in with global developments such as Annex 3 amendments and WMO meetings.

Follow-up of APAC MET/ATM TF/2
ACTION AGREED

✔ = completed

No.	Title/Action	Follow-up action (target/completion dates in brackets)
2/1	<p>Proposed updates to TORs</p> <p>That, the Secretariat will draft a working paper with the proposed changes to the TORs:</p> <ul style="list-style-type: none"> • membership to include Singapore and Russian Federation • removal of ATFM in (a) since it is covered in ATM • include new TOR <i>“study the successful involvement of MET in the development of CDM in other regions with a view to future application in ASIA/PAC”</i> • include IAVW in section (f) (now g) • modify WMO reference to WMO IVGG scientific advisory group in section (f) (now g) • the inclusion of ATM/AIS/SAR/SG in section (g) to be coordinated with the Secretariat (now h) <p>for further consideration by the CNS/MET SG/15 meeting</p>	<p>✔</p> <p>Secretariat</p> <p>WP for CNS/MET SG/15</p> <p>(31 May 2011)</p>
2/2	<p>Check the validity of the ATFM survey by States for more accurate depiction of MET elements used for ATFM</p> <p>That, States check the validity of the ATFM survey to obtain more accurate contributions from MET for ATFM.</p> <p>Update survey and draft WP for ATM/AIS/SAR/SG/22 and CNS/MET SG/15 meetings.</p>	<p>✔</p> <p>Secretariat</p> <p>Email original survey to TF members of the following States: Brunei Darussalam, China, Malaysia and United States (15 February 2011)</p> <p>Collect responses</p> <p>Secretariat</p> <p>Update survey results for consideration by ATM/AIS/SAR/SG/22 and CNS/MET SG/15 (30 April 2011)</p>

MET/R TF/3
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2/3	<p>Operational point of contact for volcanic ash events</p> <p>That, the Secretariat remind States to provide an operational point of contact in case of a volcanic ash event (APANPIRG Decision 21/9 refers)</p>	<p>✓</p> <p>Secretariat</p> <p>State letter (reminder)</p> <p>(15 February 2011)</p> <p>States to respond to SL</p> <p>Secretariat update website</p> <p>(1 April 2011)</p>
2/4	<p>Bilateral ATM coordination for volcanic ash events</p> <p>That, ATM of Indonesia and Singapore prepare a working paper for the METWARN/I TF/1 meeting on a plan to develop contingency routes and FIR to FIR coordination in case of volcanic ash events</p>	<p>✓</p> <p>States: Indonesia and Singapore</p> <p>WP</p> <p>(1 March 2011)</p>
2/5	<p>Altimeter reading study when vertical motion is present</p> <p>That, WMO considers requesting ICAO Separation and Airspace Safety Panel (SASP) to investigate theoretical errors associated with altimeter readings when vertical motion is present (in such situations as turbulence and gravity waves). This could be done by operators in comparing GPS readings with altimeter readings.</p>	<p>WMO</p> <p>letter</p> <p>(1 May 2011)</p>
2/6	<p>APAC ATM input to MSTA questions for further development for AMOGSG</p> <p>That, the feedback from the APAC MET/ATM TF/2 meeting to MSTA Expert Team be incorporated in the AMOFSG ad-hoc group and WMO be encouraged to share its feedback at forthcoming MET-ATM meetings in other ICAO regions.</p>	<p>✓</p> <p>WMO input to ad-hoc study group</p> <p>Study note</p> <p>(1 June 2011)</p> <p>[AMOFSG/9-SN No. 34]</p>

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Follow-up of APAC MET/ATM TF/2 and MET/R TF/3
ACTION AGREED

✔ = completed

MET/R TF/3		
No.	Title/Action	Follow-up action (target/completion dates in brackets)
3/1	<p>Draft Decision 3/1: Revised Terms of Reference</p> <p>That, the revised Terms of Reference for the MET/R TF provided in Appendix C to this Report be adopted.</p>	<p>Secretariat</p> <p>WP for MET SG/18 (2 June 2014)</p>
3/2	<p>Decision 3/2: Revised ATFM/SG Terms of Reference</p> <p>That, the Secretariat report the revised MET/R TF Terms of Reference and the rationale behind them to ATFM/SG/3 and propose a corresponding revision of ATFM/SG Terms of Reference for consideration by ATM/SG.</p>	<p>Secretariat</p> <p>WP for ATFM SG/3 (10 March 2014)</p>
3/3	<p>Decision 3/3: Capacity building for (digital) MET information exchange</p> <p>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, develop a proposal for capacity building activities in the APAC Region to foster the implementation of (digital) aeronautical meteorological information exchange, and report to MET SG/18.</p>	<p>Ad-hoc group and Secretariat</p> <p>WP for MET SG/18 (2 June 2014)</p>
3/4	<p>Draft Conclusion 3/4: Cross-boundary alignment of graphical SIGMET information</p> <p>That, ICAO be invited to:</p> <p>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</p> <p>b) consider providing guidance to assist States in meeting the end users' requirement in a).</p>	<p>Secretariat</p> <p>WP for MET SG/18 (2 June 2014)</p>
3/5	<p>Decision 3/5: MET in the APAC Seamless ATM Plan</p> <p>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 report to the next meeting of the</p>	<p>Ad-hoc group and Secretariat</p> <p>IP for ATFM SG/3 and MET SG/18 (10 March 2014 and 2 June 2014)</p> <p>WP for MET/R TF/3 (TBD 2014)</p>

MET/R TF/3
Appendix E to the Report

MET/R TF/3		
No.	Title/Action	Follow-up action (target/completion dates in brackets)
	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.	
3/6	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.	Secretariat Survey; WP for ATFM SG/3 and MET/R TF/3 (10 March 2014 and TBD 2014)
3/7	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 Meteorological Hazards Task Force (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.	Secretariat WP for MET/H TF/4 (19 March 2014)
3/8	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 report to MET SG/18.	Japan and Secretariat WP for MET SG/18 (2 June 2014)

MET/ATM TF/2		
No.	Title/Action	Follow-up action (target/completion dates in brackets)
2/1	Proposed updates to TORs That, the Secretariat will draft a working paper with the proposed changes to the TORs: <ul style="list-style-type: none"> • membership to include Singapore and Russian Federation • removal of ATFM in (a) since it is covered in ATM • include new TOR "<i>study the successful involvement of MET in the development of CDM in other regions with a view to future application in ASIA/PAC</i>" • include IAVW in section (f) (now g) • modify WMO reference to WMO IVGG scientific advisory group in section (f) (now g) • the inclusion of ATM/AIS/SAR/SG in section (g) to be coordinated with the Secretariat (now h) 	✓ Secretariat WP for CNS/MET SG/15 (31 May 2011)

MET/ATM TF/2		
No.	Title/Action	Follow-up action (target/completion dates in brackets)
	for further consideration by the CNS/MET SG/15 meeting	
2/2	<p>Check the validity of the ATFM survey by States for more accurate depiction of MET elements used for ATFM</p> <p>That, States check the validity of the ATFM survey to obtain more accurate contributions from MET for ATFM.</p> <p>Update survey and draft WP for ATM/AIS/SAR/SG/22 and CNS/MET SG/15 meetings.</p>	<p>✓</p> <p>Secretariat Email original survey to TF members of the following States: Brunei Darussalam, China, Malaysia and United States (15 February 2011)</p> <p>Collect responses</p> <p>Secretariat Update survey results for consideration by ATM/AIS/SAR/SG/22 and CNS/MET SG/15 (30 April 2011)</p>
2/3	<p>Operational point of contact for volcanic ash events</p> <p>That, the Secretariat remind States to provide an operational point of contact in case of a volcanic ash event (APANPIRG Decision 21/9 refers)</p>	<p>✓</p> <p>Secretariat</p> <p>State letter (reminder) (15 February 2011)</p> <p>States to respond to SL</p> <p>Secretariat update website (1 April 2011)</p>
2/4	<p>Bilateral ATM coordination for volcanic ash events</p> <p>That, ATM of Indonesia and Singapore prepare a working paper for the METWARN/I TF/1 meeting on a plan to develop contingency routes and FIR to FIR coordination in case of volcanic ash events</p>	<p>✓</p> <p>States: Indonesia and Singapore</p> <p>WP (1 March 2011)</p>
2/5	<p>Altimeter reading study when vertical motion is present</p> <p>That, WMO considers requesting ICAO Separation and Airspace Safety Panel (SASP) to investigate theoretical errors associated with altimeter readings when vertical motion is present (in such situations as turbulence and gravity waves). This could be done by operators in comparing GPS readings with altimeter readings.</p>	<p>WMO</p> <p>letter (1 May 2011)</p>

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MET/ATM TF/2		
No.	Title/Action	Follow-up action (target/completion dates in brackets)
2/6	<p>APAC ATM input to MSTA questions for further development for AMOGSG</p> <p>That, the feedback from the APAC MET/ATM TF/2 meeting to MSTA Expert Team be incorporated in the AMOFSG ad-hoc group and WMO be encouraged to share its feedback at forthcoming MET-ATM meetings in other ICAO regions.</p>	<p style="text-align: center;">✓</p> <p>WMO input to ad-hoc study group</p> <p>Study note</p> <p>(1 June 2011)</p> <p>[AMOFSG/9-SN No. 34]</p>

WORK PROGRAMME OF THE METEOROLOGICAL REQUIREMENTS TASK FORCE

3. COMMUNICATION STRATEGIES				
Description	Target Audience	Delivery Method	Frequency / Date	Responsibility
Work Plan	Task Force Members	Document via email	As required but reviewed at least quarterly	Chair
General correspondence	Task Force Members	Email	As required	Task Force Members
Task Force Meeting	Task Team Members	Meeting	As required, supplemented by teleconference	Chair
Status & Milestone Reports	ICAO Secretariat and Task Team Members	Report via email	At least half-yearly	Chair
Task Force Report	MET SG	Working Paper	Yearly	Chair

4. PERFORMANCE FRAMEWORK FORM (PFF)				
Tasks	Time Frame	Responsibility	Status	Milestone
Task 1: Conduct MET/R TF meeting to obtain regional MET requirements to support ATM	2013 (Nov)	MET/R TF	✓	1
Task 2: Conduct survey on regional ATM requirements for MET information	2013 2014	MET/R TF secretariat	In time for next MET/ATM seminar to commence	1
Task 3: Conduct MET/ATM seminar in coordination with WMO in 2013 to further develop list of possible regional MET requirements to support ATM	2013 (Nov)	MET/R TF	to commence ✓	1
Task 4: Assess aviation meteorological services, systems and architecture in the region and how they can integrate weather information into ATS/aircraft operator decision support tools	2013-2016	MET/R TF	In progress	2
Task 5: Investigate sub-regional exchange of MET information and associated agreements that facilitate ATM operations particularly over busy routes that overlap different FIRs	2013-2016	MET/R TF ATFM/SG	In progress	3
Task 6: Facilitate implementation of Meteorological Services for the Terminal Area (under development by WMO)	2013-2016	MET/R TF	future	4
Task 7: Monitor global policy associated with source data and delivery of MET information for ATM	2013-2016	MET/R TF	future	5

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5. MILESTONES			
Milestone	Accountability	Dates	Status
Milestone 1: Determine regional MET requirements for ATM	MET/R TF		To begin
Milestone 2: Develop methods to use weather information in decision support tools	MET/R TF		To begin
Milestone 3: Develop sub-regional exchange of MET information to facilitate ATM operations in busy routes	MET/R TF		To begin
Milestone 4: Develop regional implementation plan for the Meteorological Services for the Terminal Area	MET/R TF		future
Milestone 5: Monitor global policies associated with source data and delivery of MET products for ATM	MET/R TF		To begin

6. WORK PLAN				
Activity / Milestone	Accountability	Predecessors	Date	Status
Activity 1: Develop regional MET requirements for ATM				
Activity 1.1: Conduct MET/R TF meetings and MET/ATM seminars to contribute in developing MET requirements for ATM	MET/R TF	-	Jan 14 Nov 13-completed (at least every 18 months)	In progress
Activity 1.2: Analyse existing surveys (e.g. ATFM survey) and develop new surveys, when necessary, to determine regional ATM requirements for MET	MET/R TF	-	?? 14	To begin In progress
Activity 1.3: Develop a list to guide States on the MET information or services necessary to support implementation of each element of the APAC Seamless ATM Plan, and report to the next meeting of the MET/R TF. Note: this should include requirements for aircraft reporting	Ad hoc group x	-	?? 14	To begin
Activity 1.3.4: Recommend regional MET requirements for ATM to MET SG and AMOFSG (through direct membership) meetings	MET/R TF	-	Annual (AMOFSG – 18 months)	To begin
Milestone 1: Determine regional MET requirements for ATM				
Activity 2: Developing methods to use weather information in decision support tools				
Activity 2.1:	MET/R TF	-		To begin
Activity 2.2:		-		
Activity 2.3:		-		
Milestone 2: Develop methods to use weather information in decision support tools				

Activity 3: Developing sub-regional exchange of MET information to facilitate ATM operations				
Activity 3.1: develop a proposal in close collaboration with the ROBEX WG and assisted by the Secretariat, for capacity building activities in the APAC region to foster the implementation of digital MET information exchange, and report to MET SG/18	Ad hoc group x ROBEX WG	-		To begin
Activity 3.4.2: States develop agreements on the exchange of MET information that provides benefits to ATM operations on sub-regional level	States ATFM/SG	-		To begin In progress
Activity 3.2.3: States report developments to MET/R TF and MET SG meetings	States/ MET/R TF	3.4.2		To begin
Milestone 3: Develop sub-regional exchange of MET information to facilitate ATM operations in busy routes				To begin
Activity 4: Developing regional implementation plan for MSTA				
Activity 4.1: Monitor developments of MSTA (pending approval at conjoint ICAO/WMO Divisional meeting 2014)	MET/R TF	-		In progress
Activity 4.2: Monitor Annex 3 developments (requirements for MSTA)	MET/R TF	4.1		future
Activity 4.3: Develop regional implementation plan for MSTA	MET/R TF	4.2		future
Activity 4.4: Monitor regional implementation of MSTA	MET/R TF	4.3		future
Activity 4.5: Report implementation progress to MET SG	MET/R TF	4.4		future
Milestone 4: Develop regional implementation plan for Meteorological Services for the Terminal Area				future
Activity 5: Monitoring global policies associated with source data and delivery of MET products for ATM				
Activity 5.1: monitor global policies associated with source data and delivery of MET products for ATM	MET/R TF	-		To begin
Activity 5.2: report results to MET/R TF and MET SG meetings	MET/R TF	5.1		future
Milestone 5: Monitor global policies associated with source data and delivery of MET products for ATM				

Examples of Meteorological Information Provided to ATM

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

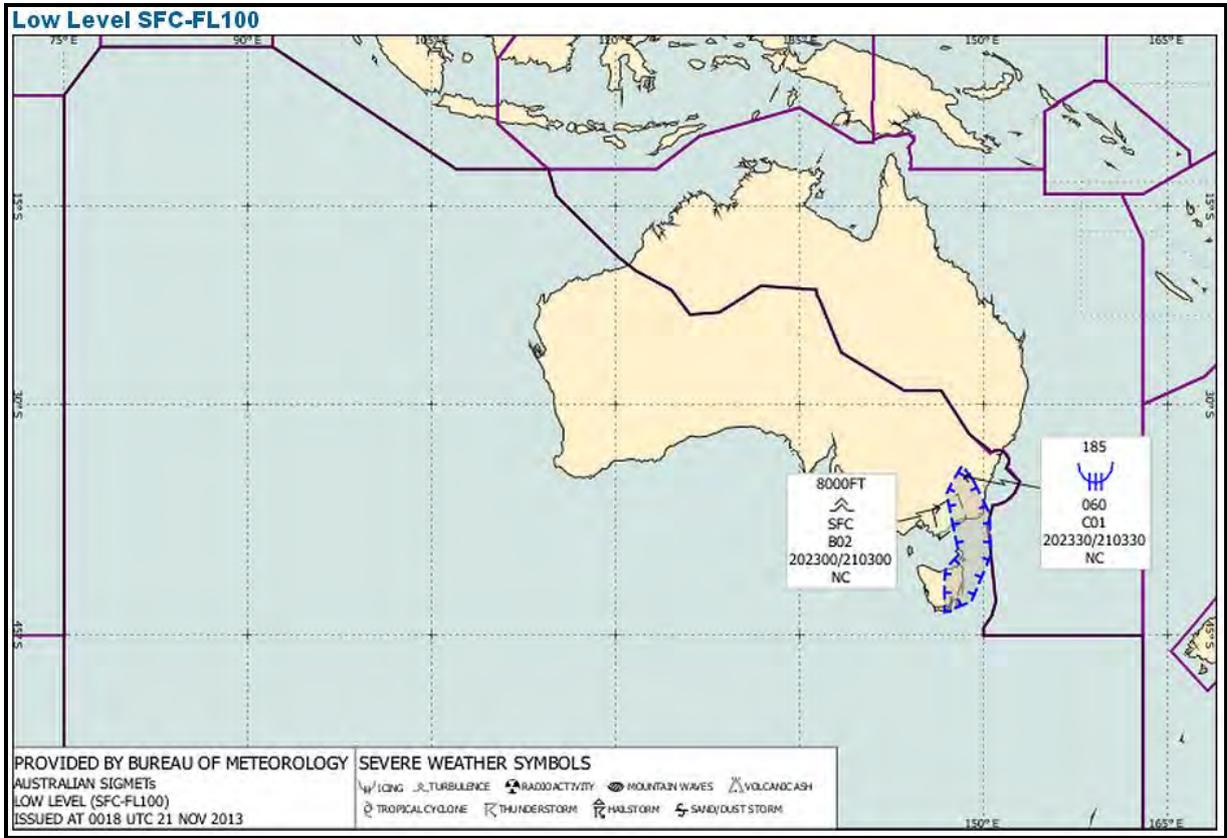


Figure 1: Graphical SIGMET (trial product)

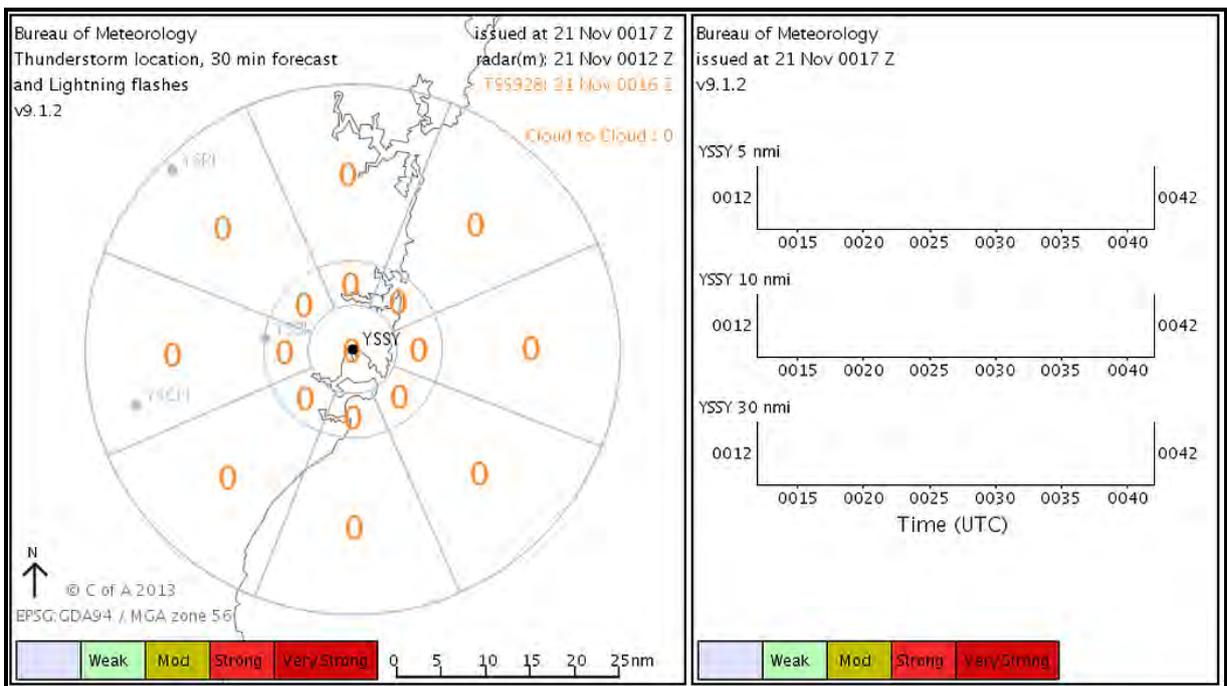


Figure 2: Automated Thunderstorm Alert Service (ATSAS)

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

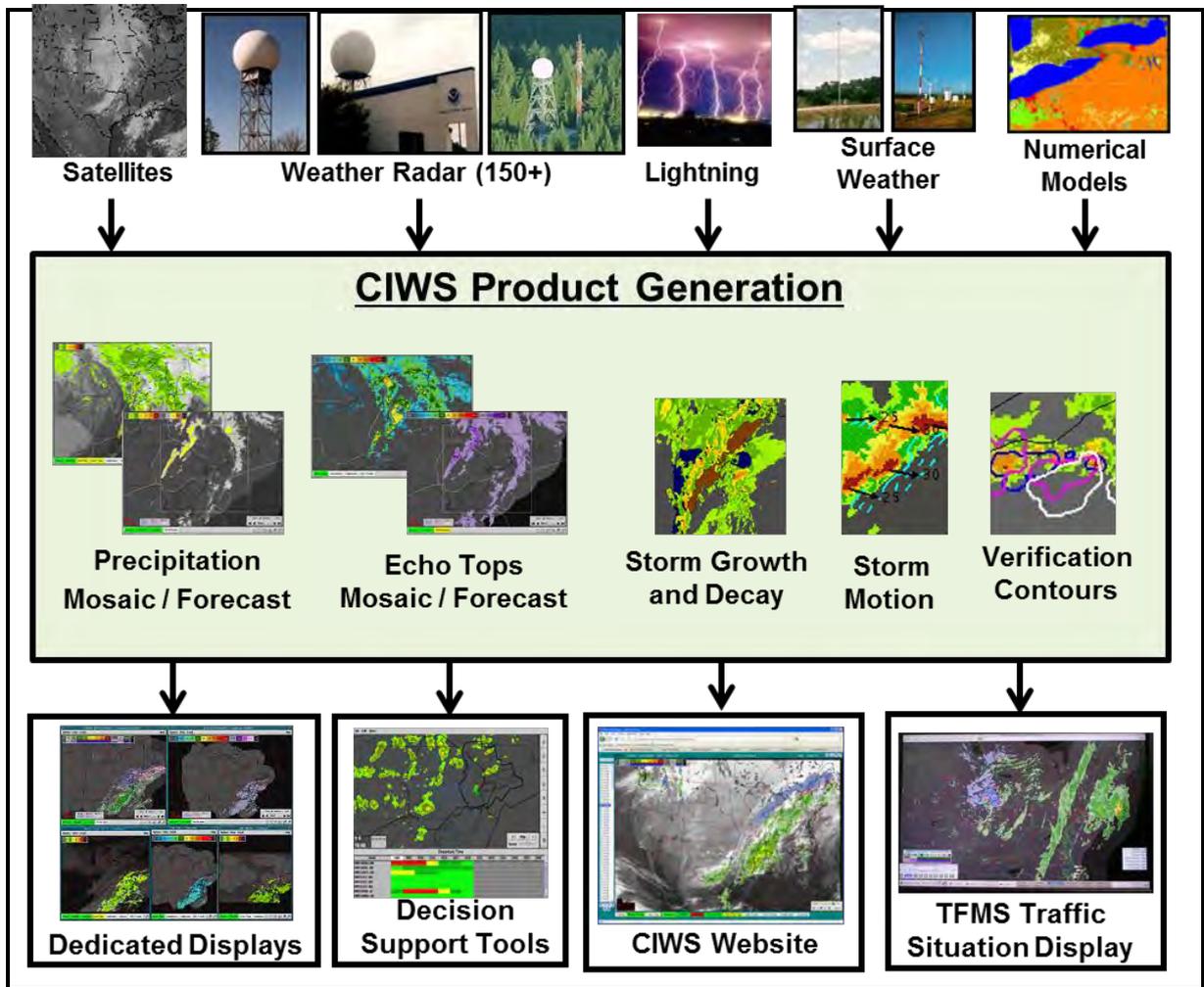


Figure 4: Corridor Integrated Weather System (CIWS)

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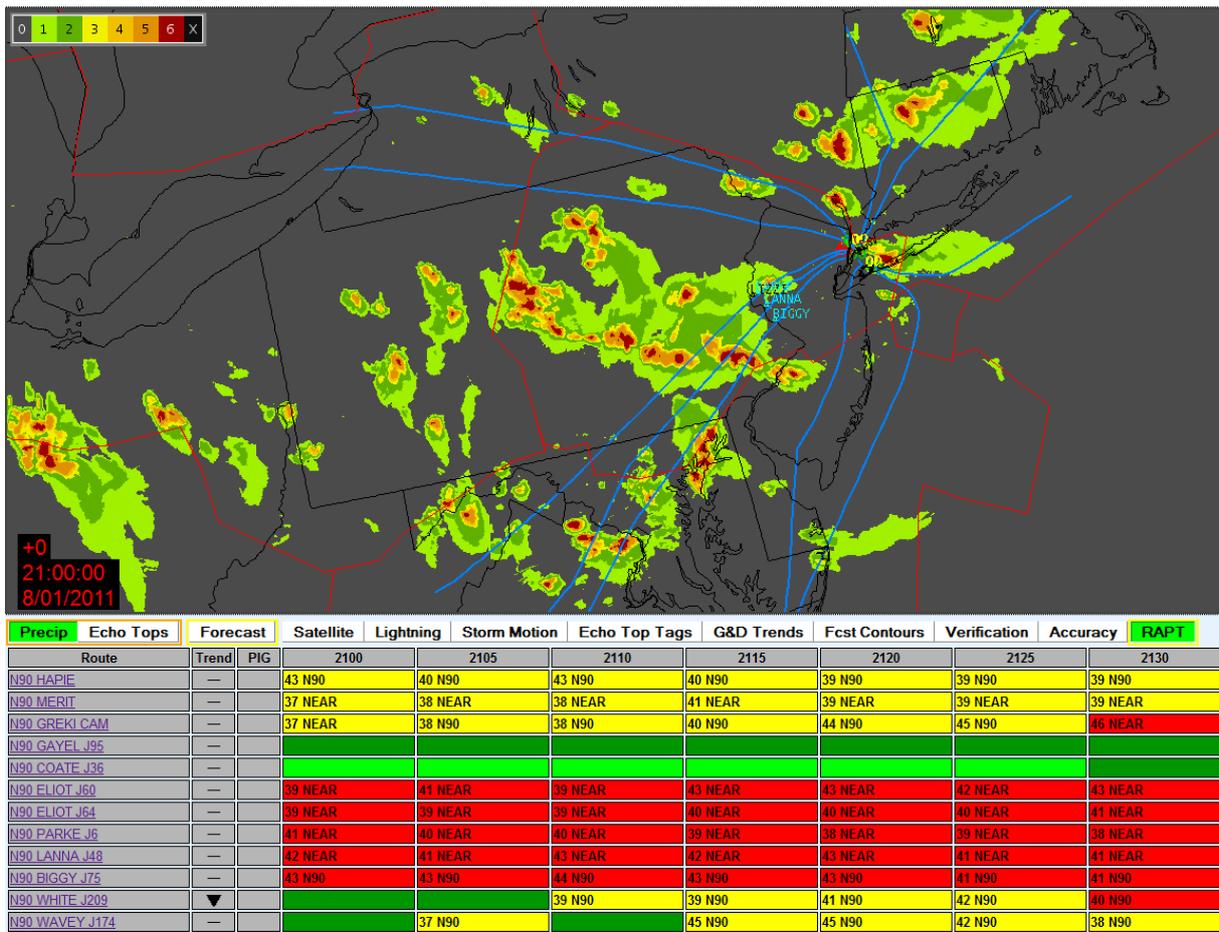


Figure 5: Route Availability Planning Tool (RAPT)

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

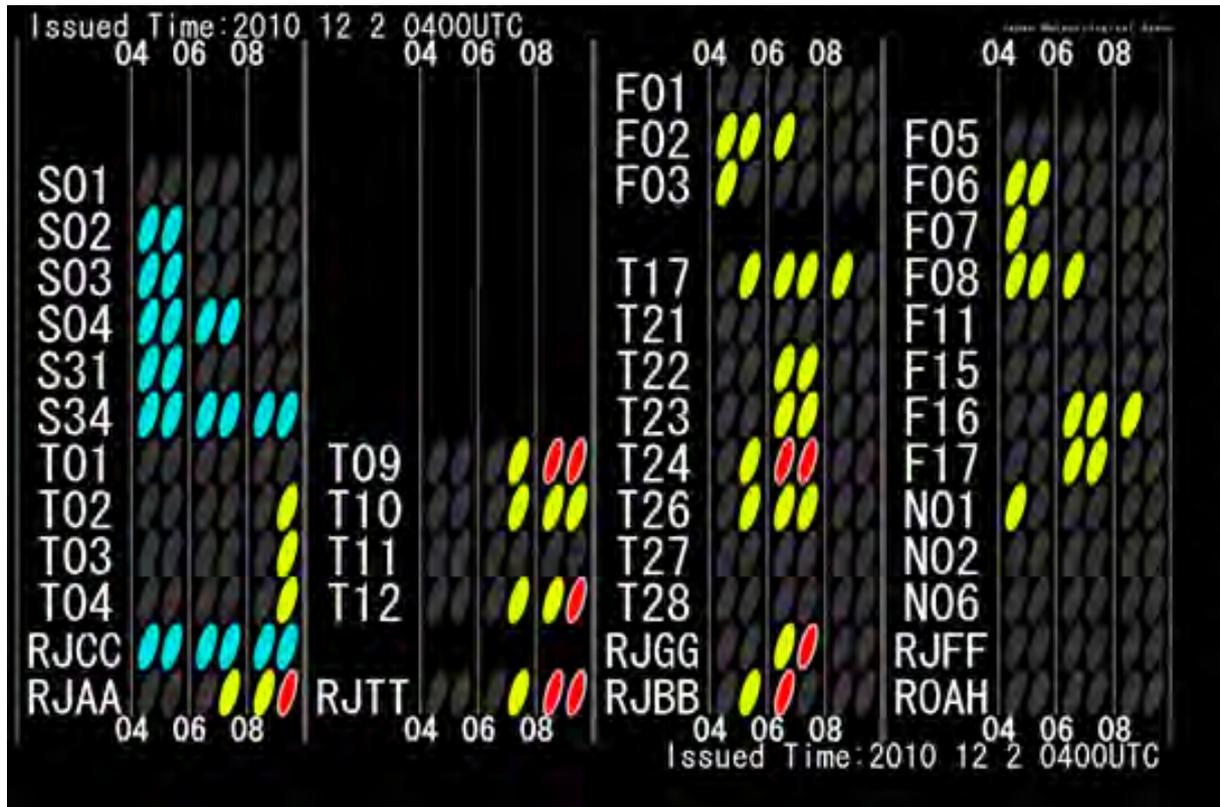


Figure 6: ATMet Category Forecast

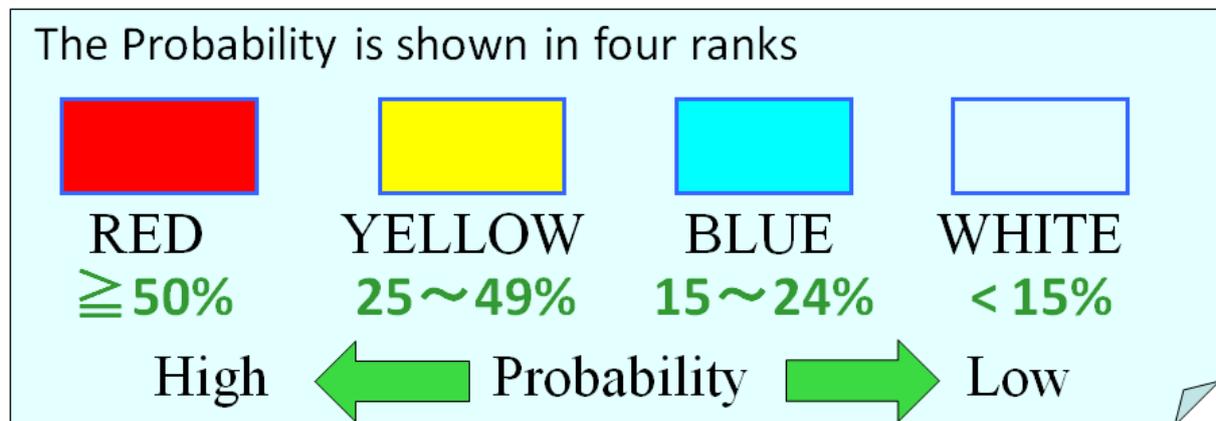


Figure 7: Legend for ATMet Category Forecast

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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%
	CB in HANEDA sector		CB in NARITA sector			visibility < 400m		
	wind speed at surface \geq 30kt and wind speed below 5000ft \geq 50kt		wind direction 090~060° or 210~240° and gust \geq 25kt			visibility < 1600m with snow		
	TS							
	wind speed at surface \geq 30kt and wind speed below 5000ft \geq 50kt		ceiling < 200ft			ceiling < 600ft with snow		
BLUE	moderate or heavy snow							the proportion occupied with CB (top \geq FL300) in the sector \geq 10%
	wind speed at surface \geq 30kt and wind speed below 5000ft \geq 50kt		wind speed below 3000ft \geq 50kt			snow fall rate \geq 3cm/3h when wind direction 250~110°		
TS in TAF but CB doesn't exist in the aerodrome							wind speed \geq 20kt with snow ceiling < 200ft	

Figure 8: Criteria for ATMet Category Forecast

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

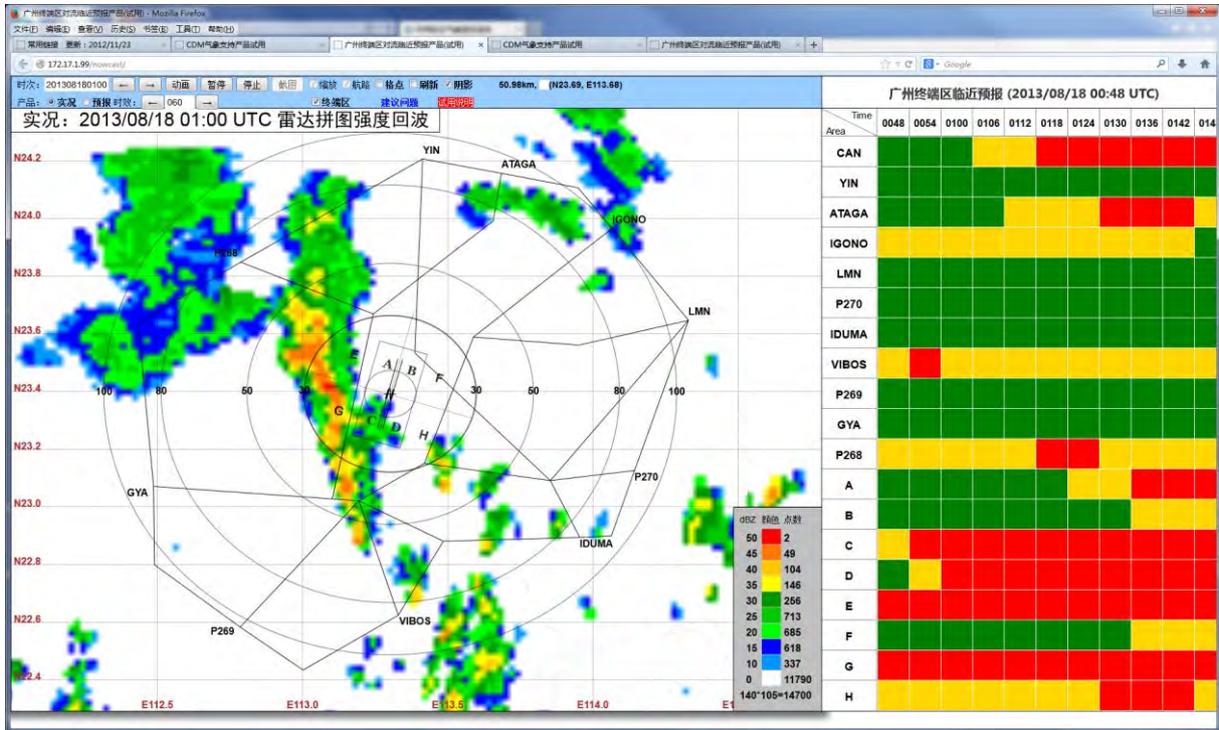


Figure 9: Observation of convection and its impact at Key ATC points

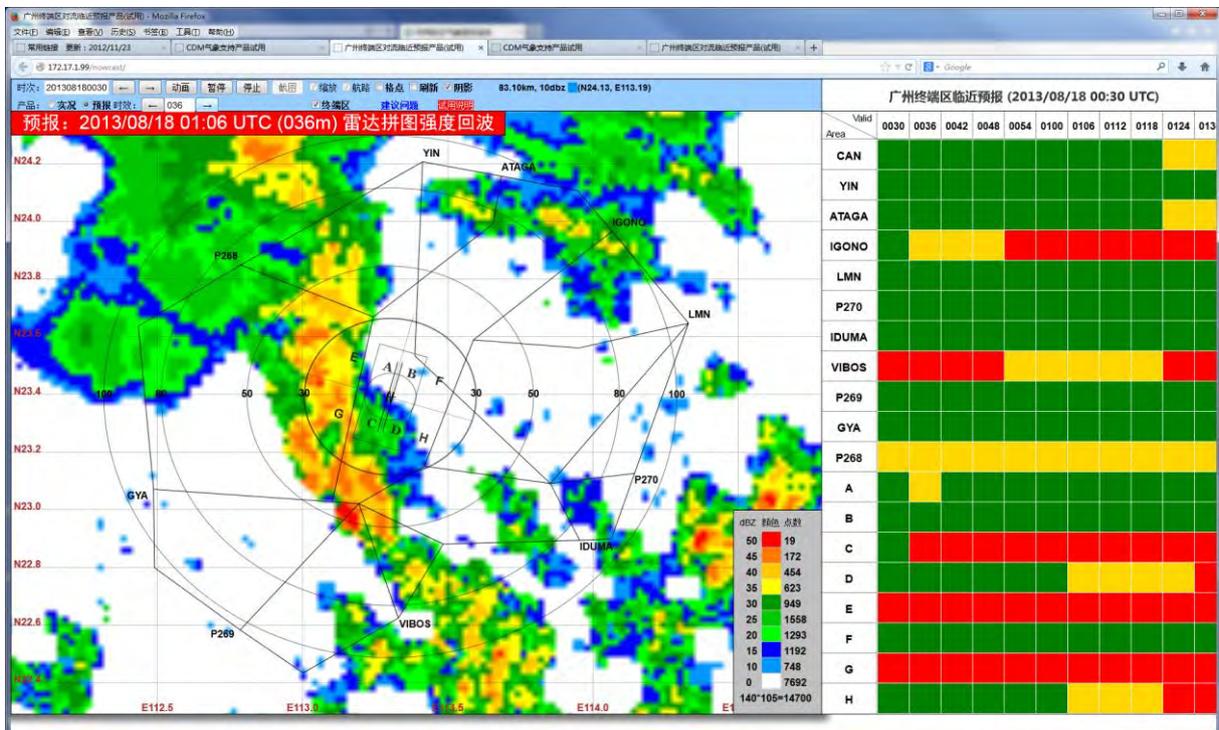


Figure 10: Forecast of convection and its impact at Key ATC points

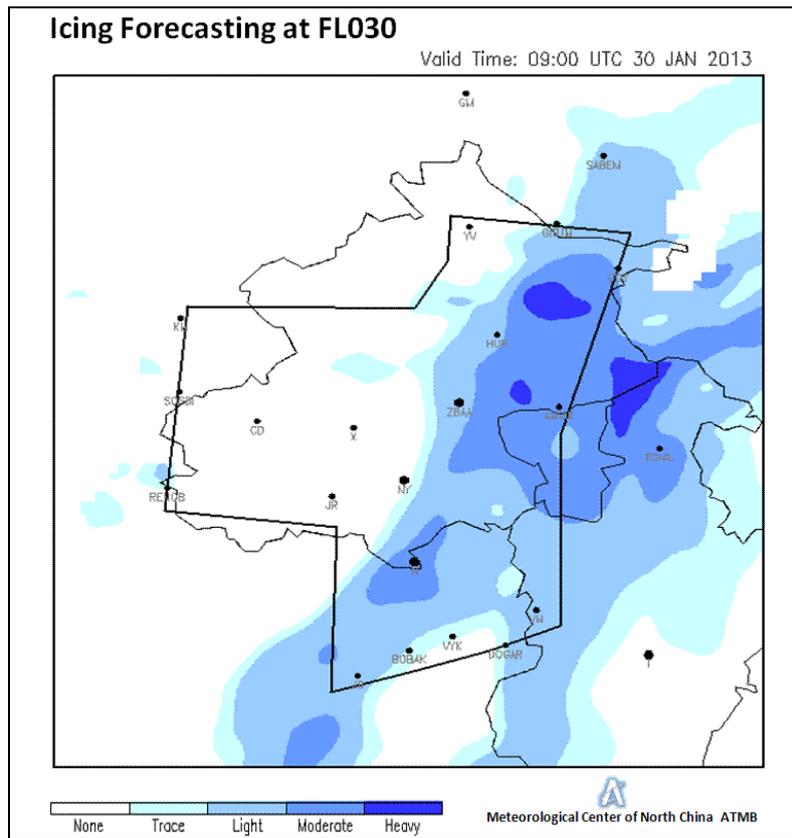


Figure 11: Icing forecast

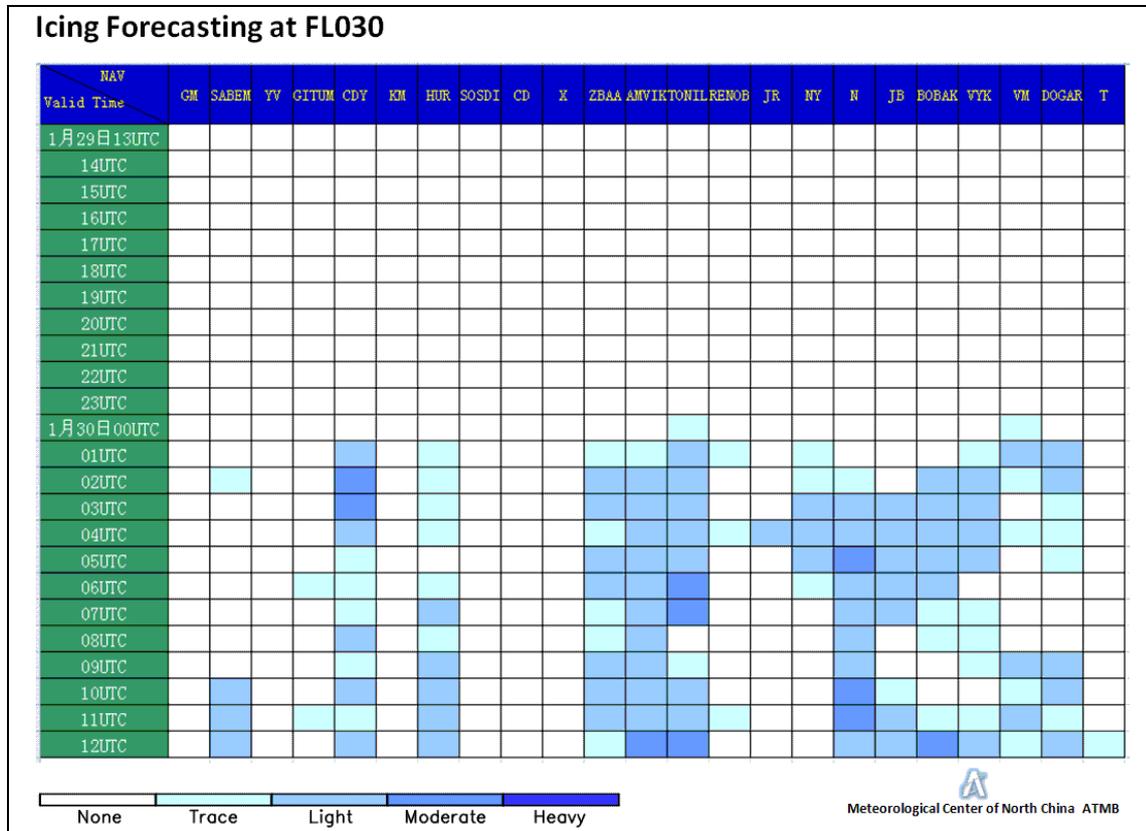


Figure 12: Icing forecast

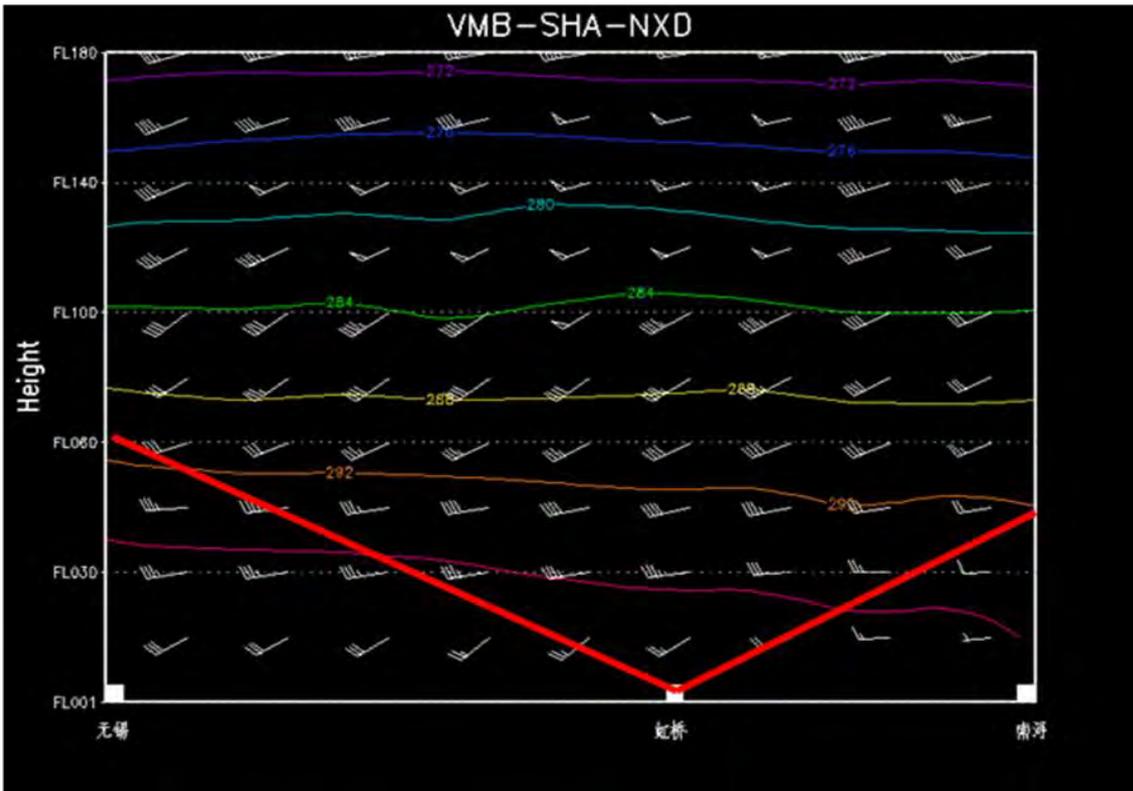


Figure 13: En-route wind and temperature

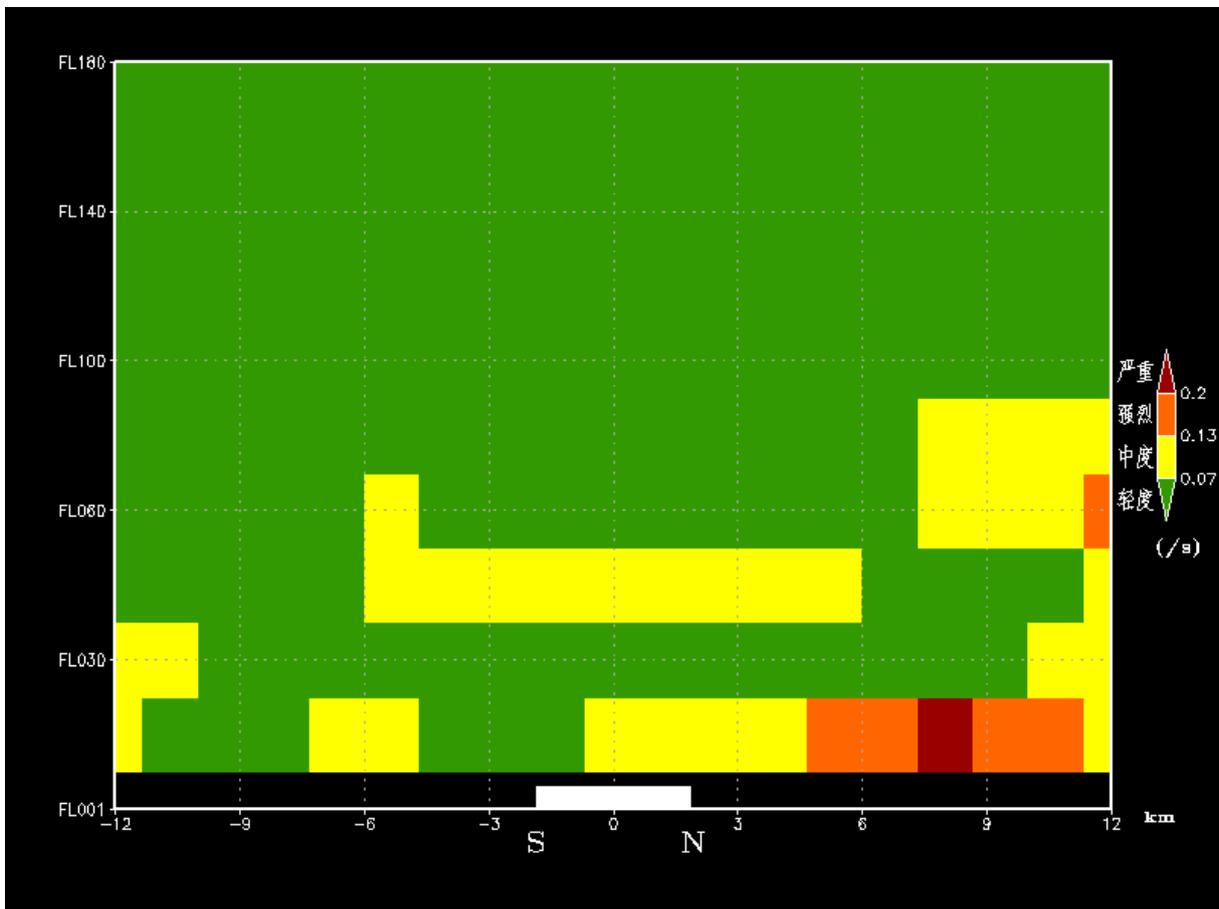


Figure 14: Wind shear along the runway

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

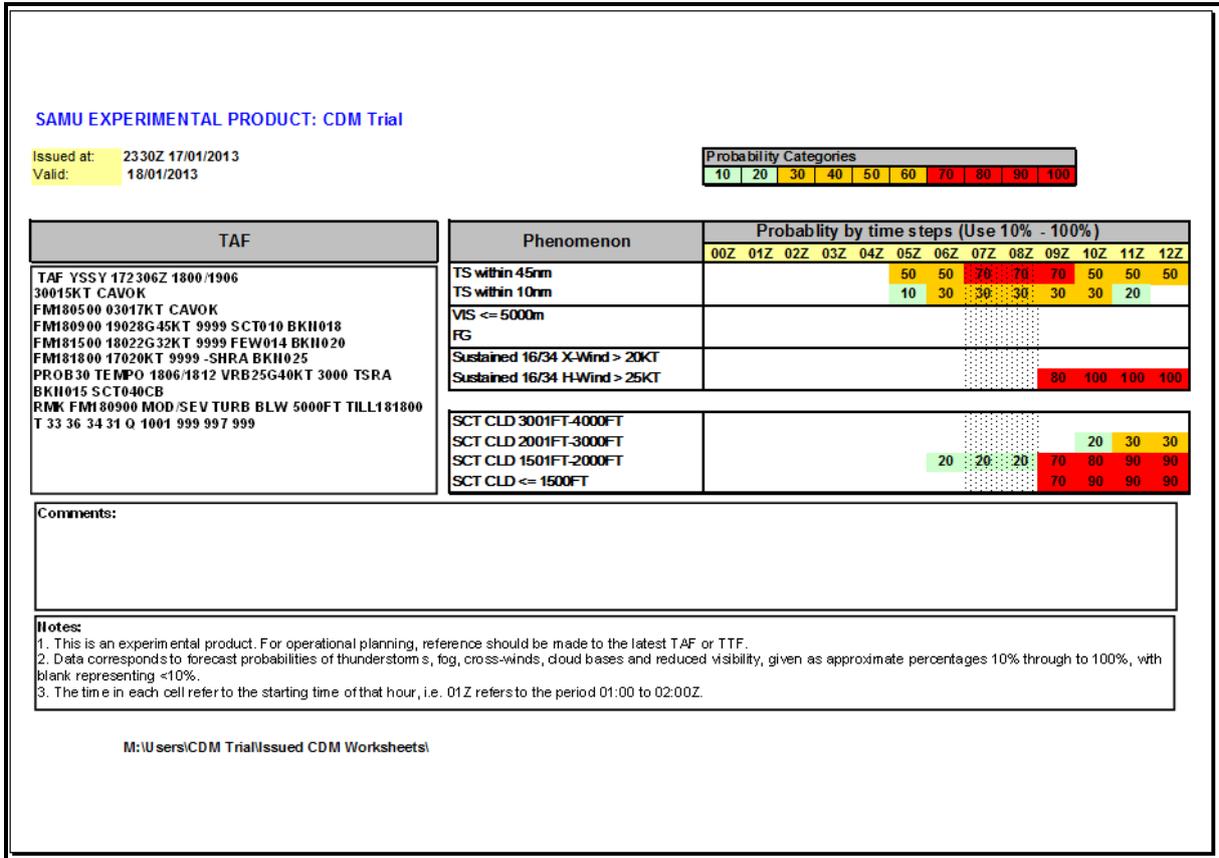


Figure 16: Example of a probability matrix for Sydney (which contains additional information to the TAF)

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

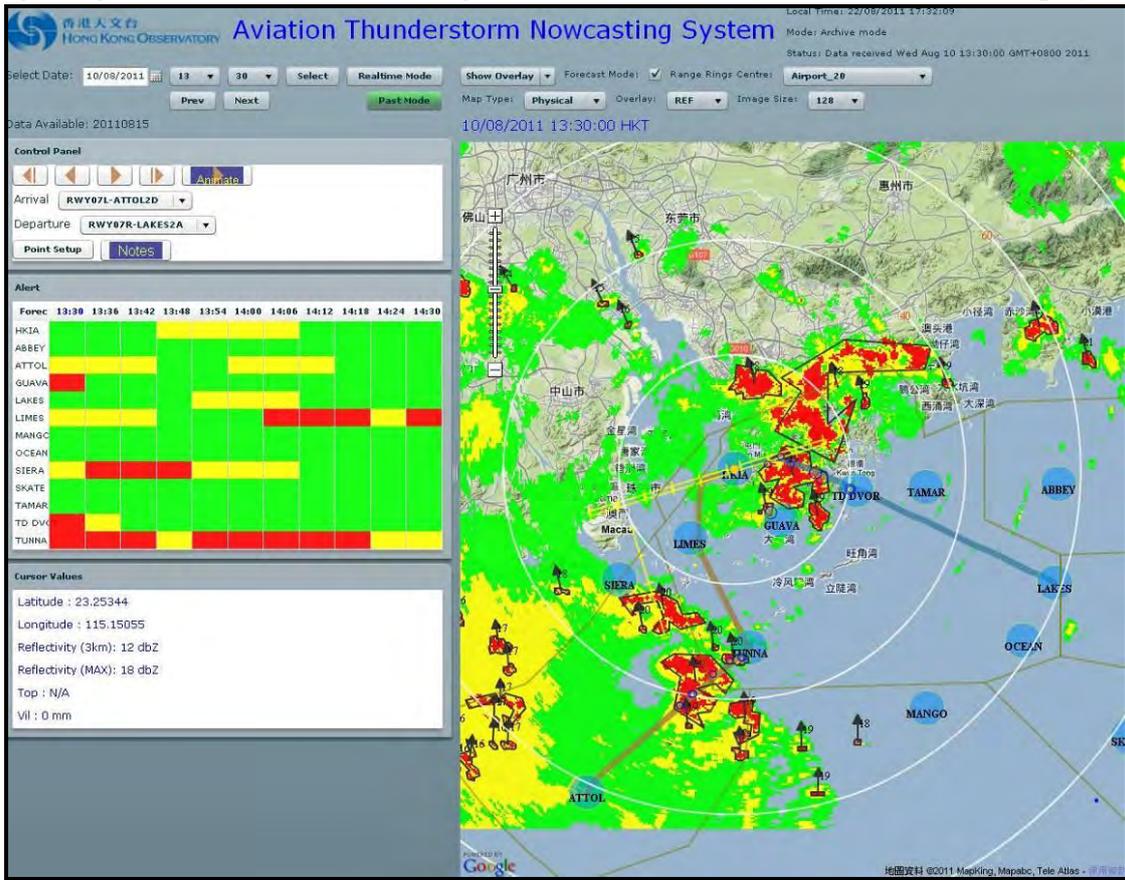


Figure 17: The display panel of the Aviation Thunderstorm Nowcasting System (ATNS)

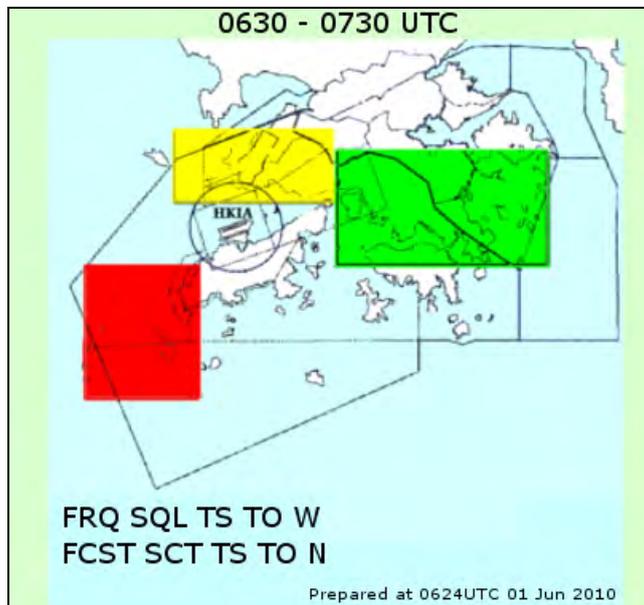


Figure 18: 1-hr now-cast for convective weather in the arrival/departure corridors¹

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

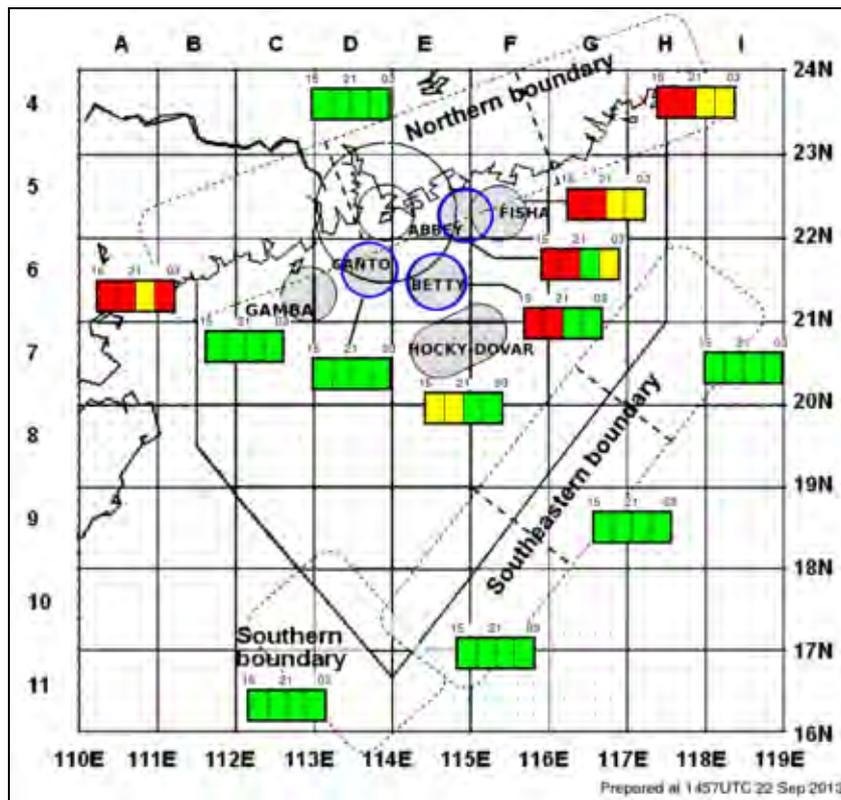


Figure 21: 12-hr significant forecast time series for key ATC areas³

(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.

TS/CB forecast for adjacent areas				
UTC	01	02	03	04-06
20nm of ARP	Yellow	Yellow	Yellow	Green
ABBEY	Green	Green	Yellow	Yellow
BETTY	Red	Red	Red	Red
CANTO	Red	Red	Red	Red

Prepared at 0038UTC 17 Apr

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.

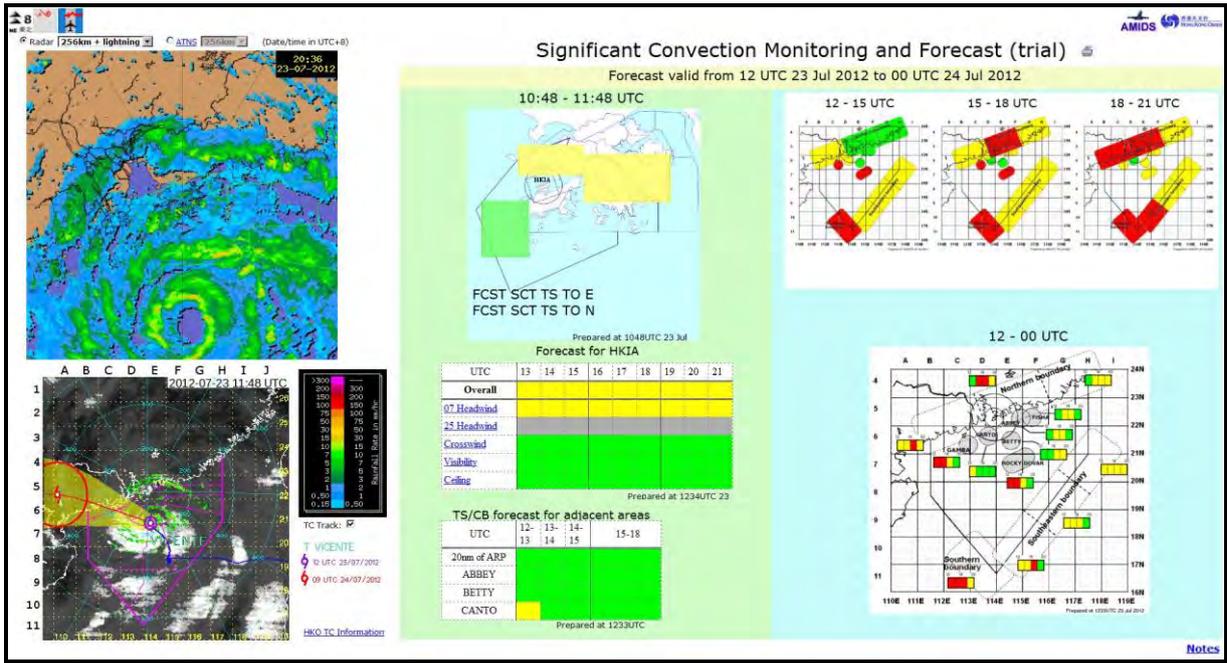


Figure 24: Integrated web display of the forecast suite
(captured during the passage of Severe Typhoon Vicente in July 2012)