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International Civil Aviation Organization

INFORMATION PAPER

**Asia and Pacific (APAC)
Thirteenth Meeting of the Meteorological
Requirements Working Group (MET/R WG/13)**

Bangkok, Thailand, 22 to 26 April 2024

Agenda Item 3: Collaboration between MET and ATM stakeholders

**THE NEW IMPLEMENTATION OF TAILORED MET INFORMATION AND SERVICES TO
SUPPORT ATM OPERATIONS**

(Presented by China)

SUMMARY

This paper presents the new implementation of tailored MET information and services to support ATM operations. The implementation of CAAC MET service to support ATM operations has been prepared for the proposals for updating to the APAC regional guidance.

1. INTRODUCTION

1.1 With the development of aviation industry and the rapid growth of traffic volume, the demand of safe and efficient air traffic management (ATM) have increased. In order to improve the ATM and air traffic flow management (ATFM) efficiency, aeronautical meteorological information plays an increasingly important role in collaborative decision-making process.

1.2 A full time series of aviation MET services from one week in advance to real-time are formed in China, supporting the collaboration between meteorological (MET) and ATM in five different periods (strategic, pre-tactical, tactical, command and post-operational stages) (Figure 1) (Detailed information refers to MET SG/27-IP/12). This paper mainly introduces the new implementation of tailored MET information and services in recent years, providing Chinese action for the APAC regional guidance for MET information and services to support ATM operations.

2. DISCUSSION

Weather briefing at the national CDM meeting of CAAC

2.1 The MET departments in air traffic management bureau (ATMB) are under the unified management of the civil aviation administration of China (CAAC), which is conducive to the establishment of situational awareness between MET and ATM stakeholders. The national collaborative decision-making (CDM) meeting of CAAC is held 3 times (10am, 02pm and 06pm) a day through video conference. Civil aviation stakeholders, including national ATFM centre, regional ATFM Centre, major airport operations centre (APOC) and airlines, attend the meeting. Aviation meteorological centre (AMC) provides weather briefings for the next 24 and 48 hours (increasing to 54 hours in the

thunderstorm season) to aviation users, especially highlighting weather forecasts for aerodromes, terminal areas and air routes where the airspace capacity and flight operations may be affected by the adverse weather. Based on the weather information provided by AMC, the national ATFM Centre determines the level of the ground delay program (GDP) measures and time of initiation after consulting with ATC units and regional ATMBs. Further consultations among the regional aviation meteorological centers (RAMC), regional ATFM centre, APOC and airlines are conducted to adjust flight plans if deemed necessary.

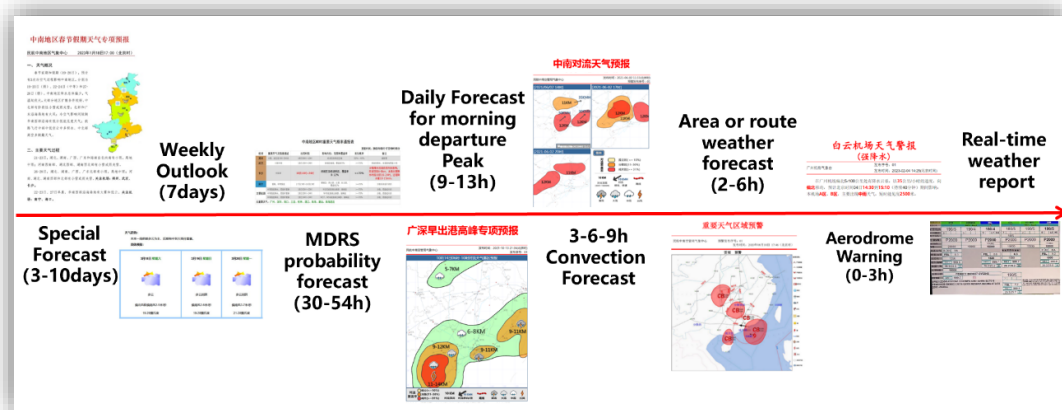


Figure 1 Customized full-time sequence of aviation weather information service

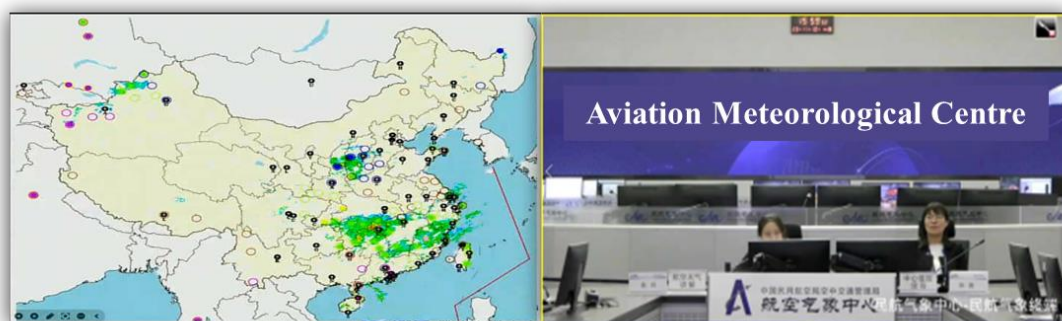


Figure 2 Weather briefing at the national CDM meeting of CAAC

MET Products and Services Quality Assessment

2.2 In order to evaluate the effectiveness of MET products and improve MET services, the MET quality management post has been set up in central and southern RAMC. MET products such as TAFs, trends, thunderstorm aerodrome warnings and MDRS probability forecasts are verified objectively based on METAR/SPECI reports and aerodrome weather radar data. MET forecasters collect and analyse the impact of weather on ATM operation in the past 24 hours, publish the 《Morning MET Operational Report》, 《MET Operation Daily》. At the same time, 《Weekly MET Operational Statistics Report》, 《Monthly MET Operational Statistics Report》 and 《Annual MET Operational Statistics Report》 were prepared through statistical analysis of weekly, monthly and annual MET operation situation (Figure 2) to provide decision-making supports for ATM stakeholders.



Figure 3 MET products and services quality assessment

Joint review of MET-ATM of weather processes

2.3 In recent years, joint reviews of MET-ATM have been conducted in different ATMBs. The objective of the joint review is to share information on forecast products and services analysis, the forecast deviation and the integration of MET-ATM operations, etc. For a wide range of weather processes, joint weather reviews are held among AMC, RAMCs and regional ATM Centres to analyse the flow management and meteorological service process.

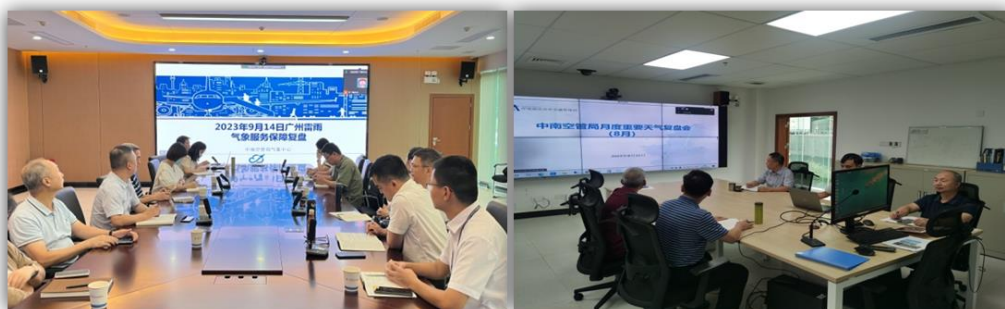


Figure 4 Joint review of MET-ATM

2.4 The increasing flights drive the development of the further integration of collaboration between MET and ATM stakeholders. The implementation of CAAC MET service system to support ATM operations has been prepared in Appendix A, which is considered proposed updated to the APAC regional guidance for MET information and services to support ATM operations.

3. ACTION BY THE MEETING

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

APPENDIX [A]

China

1. ATM-tailored MET Information and Services

To improve the safety of air navigation and the efficiency of ATM, ATM departments in China operate in three levels with its organizational structure divided into ATC units, regional ATMBs and the national ATFM Center (Figure 1). Correspondingly, MET departments in ATMB provide MET information and service in three levels, including Aerodrome Meteorological Offices (AMO), Regional Aviation Meteorological Centers (RAMC) and the national Aviation Meteorological Center (AMC).

260 AMOs and 7 RAMCs provide basic meteorological services in accordance with Annex 3 and tailored aviation meteorological services for ATMBs in China. AMC is responsible for providing support of organizing national aviation weather consultation, issuing guidance products for national aviation weather forecast and conducting aviation MET information dissemination, etc.

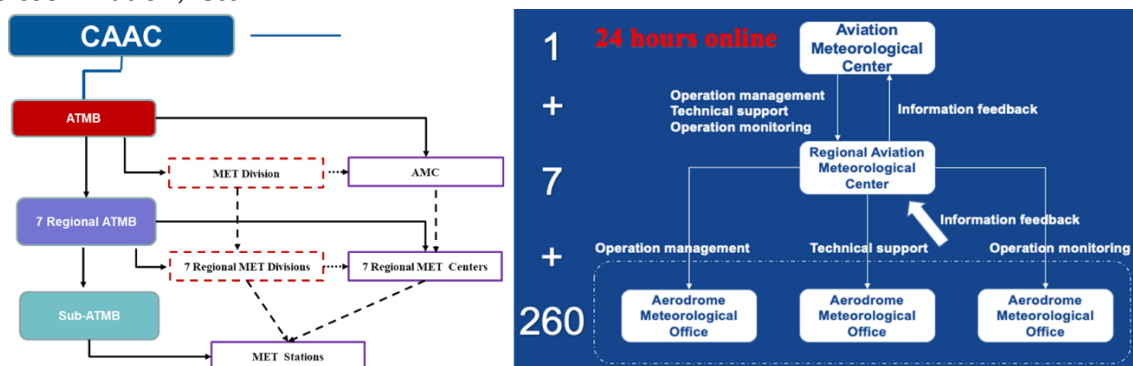


Figure 1 Organization of aviation MET Services

1.1 MET Service and products supporting ATM operation for different periods

1.1.1 Tailored aviation weather forecasts for Strategic Stage (3-7days in advance)

- Provision of a 1-week aviation weather outlook with a focus on prediction of major weather events likely to cause low efficiency in airport operation or reductions to airport capacity.
- Tailored forecasts of major weather events or highly-concerned activities are issued at least 3 days in advance to provide more comprehensive and refined weather information in support of strategic ATFM decision. When adverse weather (such as typhoons, heavy rains, large-scale snow and ice, etc.) or special concerned activities are expected, MET experts will arrange weather consultations and generate tailored forecasts for ATM or ATFM managers.

1.1.2 Probability forecasts for Pre-tactical Stage (6-24hours in advance)

In order to reduce flight delays and improve the efficiency of the flight operation, a Massive Delay Response System (MDRS) has been established and implemented by ATMB of CAAC since 2014. With the continuous development of MDRS meteorological services, a product named the MDRS significant weather probability forecast has gradually become an important decision support in the pre-tactical stage of ATFM. This product provides users with a

probabilistic forecast of significant weather at airports, terminal areas and major air routes for the next 30 hours (extended to 54 hours in the thunderstorm season) (Table 1). The ATFM controllers will determine the flow management measures for the next day according to the probability forecast. (Detailed information refers to MET SG/20--IP/20)

Table 1 An example of MDRS significant weather probability forecast

Time of issuance: 04pm of 4 March 2024					
Airports	Major Weather Events	Forecast Period	Forecast Areas	Probability	Remarks
ZBAD	Heavy fog	05-09am	Airport	30%-40%	Prevailing visibility: 600-900m RVR: 500-800m
ZGGG	Heavy rain with thunderstorms	02-08pm	Guangzhou Terminal area	≥70%	Occur at ZGGG during 03-05pm with gusts of 16-18m/s

1.1.3 Convective weather forecasts for Tactical Stage (2-6hours in advance)

- a) Convective weather forecast products of the middle-south MET center are generated through the combination of numerical weather prediction and artificial correction. The product is updated 3 times a day (08am, 11am and 05pm) with forecast validity of 3, 6, 9 hours (like CCFP). (Detailed information refers to MET/S WG/11--IP/02)
- b) Tailored forecasts for the morning departure peak are issued at 09pm focusing on prediction of weather that might cause air traffic capacity loss during the departure peak of the next morning.

1.1.4 Tailored weather services and forecasts for Command Stage (0-2hours in advance)

- a) Terminal area or aerodrome warnings are issued once the weather reaches certain threshold and are updated every 2 hours until the adverse weather ends.
- b) Aerodrome weather observation data visual website which can display real-time weather observation data along the runway (including wind directions and speed, visibility, RVR and weather phenomenon) is provided to ATM controllers (especially tower and approach controllers) for runway operation decision.

1.2 CDM Meeting

1.2.1 National CDM meeting of CAAC (Video Conference)

The National CDM meeting of CAAC is held 3 times (10am, 02pm and 06pm) a day through video conference. Civil aviation stakeholders, including ATMB, regional ATMBs, major airports and airlines, attend the meeting. AMC provides weather briefings for the next 24 and 48 hours (increasing to 54 hours in the thunderstorm season) to aviation users, especially highlighting weather forecasts for aerodromes, terminal areas and air routes where the airspace capacity and flight operations may be affected by the adverse weather. Based on the weather information provided by AMC, the national ATFM Center determines the level of the Ground Delay Program (GDP) measures and time of initiation after consulting with ATC units and regional ATMBs. Further consultations among the Airport Operations Center, regional ATFM, regional meteorological center and airlines are conducted to adjust flight plans if deemed necessary.

1.2.2 Face to face CDM consultation

Face-to-face CDM consultation between MET and ATM is held almost every 2 hours from 07am to 10pm in the thunderstorm season with focus on the convective weather impacts in the next 6 hours to support ATFM decision making (Table 2). Through the CDM consultation, meteorologists provide weather briefings mainly focusing on critical points for ATM operation, whereas ATM experts build consensus of weather and ensure proper traffic flow measures are made, thus promoting the degree of MET-ATM integration. (Detailed information refers to MET/S WG/10--IP/18)

Table 2 Daily Schedule of face-to-face CDM consultations

CDM meeting focus	Morning Rush hours	Daytime Operation	Next day Operation	Evening Rush hours	Next day Operation (update)	Nighttime Operation
Routine Service	07am	09am, 02pm	04pm	06pm	08pm	10pm
Temporary Service	When unexpected adverse weather happens or forecasts need to be updated, temporary meetings will be held to revise ATM decisions or even adjust the level of MDRS or GDP.					

1.3 Weather Briefing

1.3.1 Daily aviation weather briefing (AMC)

The AMC forecasters provide weather briefing in the National CDM meeting of CAAC and the National ATFM CDM meeting. In recent years, weather briefings in video (Figure 2) form have been generated by AMC to broadcast on the internet for stakeholders and the public.



Figure 2 Weather briefings in video

1.3.2 Weather briefing for ATM controllers (Regional AMC)

RAMC Forecasters provide weather briefings for regional ATM controllers 3 times (08am, 11am, 05pm) a day (Figure 3). The weather briefing is provided during shifts of air traffic controllers, describing the expected weather conditions (such as precipitation, convective clouds, turbulence and icing etc.) at domestic airports or air-route in the next 6 hours.

2. Means of Information and Service Provision

2.1 Aviation Meteorological Service Website

The Aviation Meteorological Service Website is developed by AMC. In addition to OPMET information, real-time weather information and tailored forecast products (such as terminal area warnings, regional significant weather forecasts, 1-week weather outlooks etc.) are provided on the website.

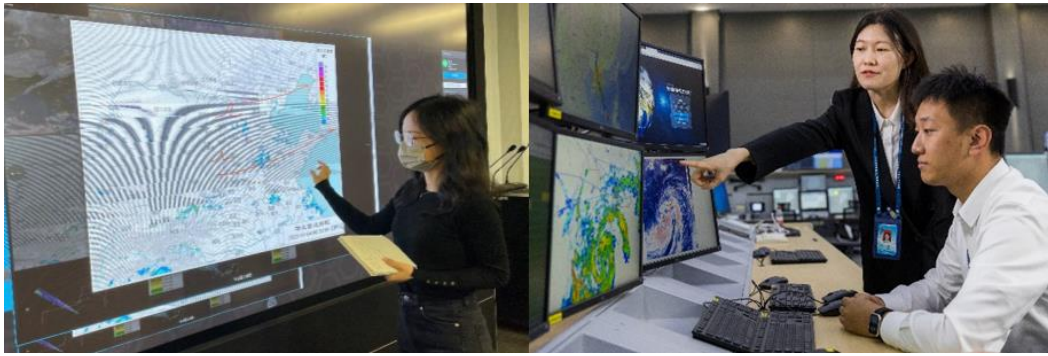


Figure 3 Weather briefings for regional ATM controllers

2.2 Aviation Multi-data Fusion System

The Aviation Multi-data Fusion System (Figure 4) is a MET and ATM integrated system. Real-time flight data and different kinds of meteorological data (such as radar images, satellite images, cloud top height information, lightning positions, convection nowcasts and CCFP etc.) can be displayed on the integrated visual interface. The system benefits meteorologists and ATM controllers in understanding the weather situation, analyzing weather impacts on flight operations and developing common situational awarenesses. Based on its multi-data visualization function, the system can be also used for weather briefing and consultation. (Detailed information refers to MET/R WG/10--IP/08)

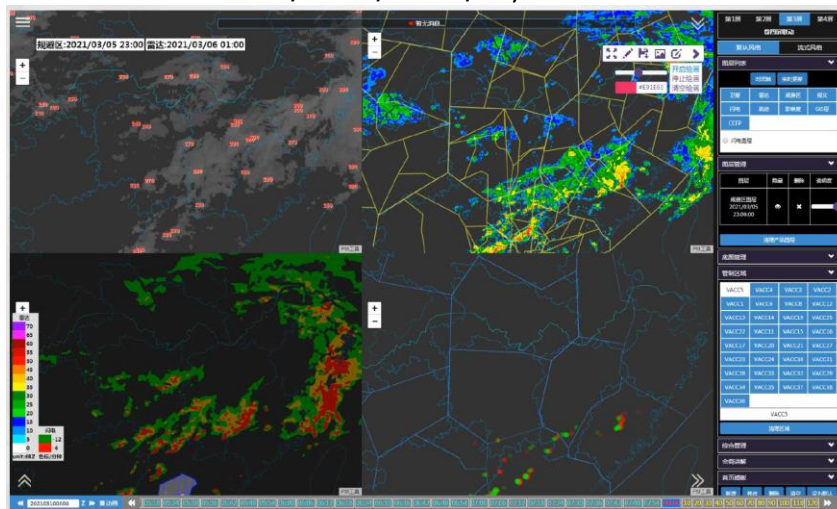


Figure 4 Aviation multi-data fusion System

2.3 Convection Nowcasting and Forecast System

2.3.1 Radar echo extrapolation nowcasting system

Based on multiscale cross correlation tracking algorithm, the system can provide forecasts of convection echo in the terminal area for the next 2 hours with an interval of 6 minutes. Colored categories (including red, yellow or green) are used to indicate the impact of key navigation points (Figure 5).

2.3.2 The North China Meteorological Centre Rapid Refresh Predict System (NCM-RAP)

The NCM-RAP has been running stably for more than 7 years since 2015 (Detailed information refers to MET/R WG/11---IP/06). The system interface integrates data of 26 radars in North China and the real-time flight track information. It can not only be updated hourly with a forecast period of 0-9 hours by 6 minutes interval, but also can calculate the coverage rate of

echoes with intensity greater than 35dBz. The results of system are derived from numerical model.

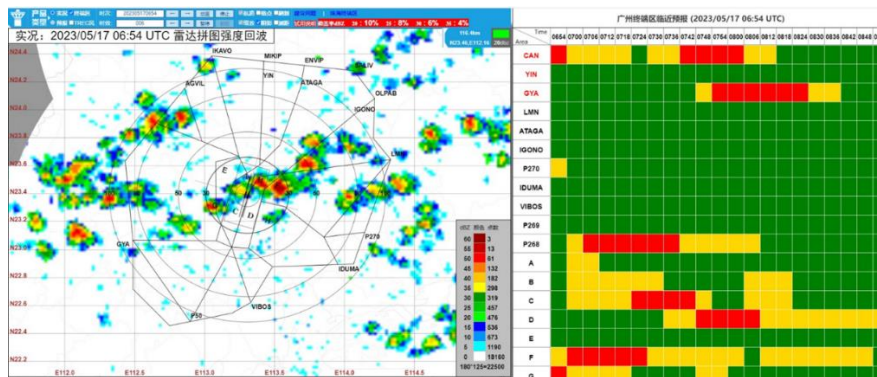


Figure 5 Convection nowcasting and forecast system

2.3.3 Deep learning nowcasting system of convective weather

Using 3-year historical radar data, a 0-2 hours nowcasting model has been built based on the optical flow algorithm and spatial-temporal series deep learning method algorithm. The new nowcasting model is proved to be more skillful in capturing the location and intensity change of convective system compared to simple extrapolation.

2.4 Mobile applications of weather service

As mobile phones are commonly used in our daily life, Aviation Weather Service APPs are newly created for ATM users. Nearly all aviation weather products can be accessed through the APP whenever and wherever possible. Only a few clicks on the phone can the ATM controllers quickly review and catch up with the weather situation before they become on duty.

3. Continuous improvement of services

3.1 MET Products and Services Quality Assessment

3.1.1 The Objective Verification of MET products

MET products such as TAFs, trends, thunderstorm aerodrome warnings and MDRS probability forecasts are verified objectively based on METAR/SPECI reports and aerodrome weather radar data.

3.1.2 Service Quality Management

The MET service quality management post has been set up in some region to monitor and assess the quality of meteorological products, analyzing the impact of complex weather on flight operations and evaluating the effect of meteorological services.

3.2 Weather Review

In recent years, regular weather reviews have been conducted by aviation meteorological agencies in different regions. The main content of the weather review includes weather situation, forecast products and services analysis, the forecast method and deviation analysis, experience summary, etc. For typical cases (successful or failed), joint weather reviews are held among regional ATM center, the aviation meteorological service agency and airlines to analyze the flow management and meteorological service process.