International Civil Aviation Organization

INFORMATION PAPER

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Agenda Item 6: Research, development and other initiatives

THE IMPLEMENTATION AND NEW DEVELOPMENTS OF MET-ATM INTEGRATION IN THE MIDDLE-SOUTH REGION OF CHINA

(Presented by China)

SUMMARY

This paper presents the implementation and new developments of MET and ATM integration in the middle-south region of China. A variety of meteorological service and products for different operational stages are provided, and a full time series of aviation meteorological services are developed step by step in the region.

1. INTRODUCTION

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

1.2 A full time series (Figure 1) of aviation meteorological services from one week in advance to real-time are formed. This paper mainly introduces the tailored meteorological information and the MET-ATM integration in the Middle-south region of China in five different periods (strategic, pre-tactical, tactical, command and post-operational stages).

2. DISCUSSION

Strategic Stage (3-7days in advance)

2.1 In recent years, under the promotion of the ATMB of CAAC, the Middle-south Regional Meteorological Center (hereinafter referred to the Mid-south MET Center) and the other six regional meteorological centers have produced the one-week aviation weather outlooks during the thunderstorm season (mainly from June to September in China) on a daily basis (whereas once a week in non-thunderstorm season). The outlook allows ATM controllers or air traffic flow managers to have a clearer understanding of the important weather processes and trends of the weather variation in the coming week.

2.2 Furthermore, a special forecasting working mechanism focusing on critical weather processes or important activities is established and led by the senior forecasters. When adverse weather (such as typhoons, heavy rains, large-scale snow and ice, etc.) or special concerned activities are expected, the senior forecasters will arrange weather consultations and generate tailored forecasts at least 3 days in advance (as shown in Figure 2). The special forecast can provide more comprehensive and refined meteorological information for important events, and has a strong warning effect on hazardous weather with high influence. During the construction of the instrument landing systems at Guangzhou Baiyun International Airport in 2023, tailored forecasts were issued by the Middle-south MET Center every day to provide hourly predictions of wind direction, wind speed, weather phenomenon and other elements for the next 30 hours, which had strongly supported the decision of ATFM controllers to apply flow management measures.

Pre-tactical Stage (6-24hours in advance)

2.3 During the pre-tactical stage, the ATM department needs weather forecasts with a lead time of 6-24h or more to support the operational decisions for the initiation of Massive Delay Response System (MDRS) or the application of Ground Delay Program (GDP). ATM or ATFM controllers mainly focus on adverse weather like thunderstorms, typhoons, low clouds and low visibility, etc.

2.4 In order to reduce flight delays and improve the efficiency of flight operation, 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). The ATFM controller will determine the flow management measures for the next day according to the time and the scope of critical weather located in aerodromes, terminal areas or air routes.

Tactical Stage (2-6hours in advance)

2.5 During the tactical phase, ATM or ATFM controllers need to adjust traffic management measures based on the latest forecasts. The meteorological products provided by the Middle-south MET Center for controllers in the tactical stage include 3-6-9 hour convection weather forecasts and tailored forecasts for the morning departure peak.

2.6 A joint MET and ATM Working Group was set up in 2020 by the Air Traffic Control Center and the Meteorological Center of the Middle-south Regional ATMB. For improving the consistent situational awareness, weather forecasters and air traffic controllers hold regular face-to-face meetings for adverse weather consultation at least every 2 hours (Figure 3).

2.7 Frequent thunderstorms occur in the warm and moist area of South China and the prediction effect of CCFP products based on numerical prediction model is unstable. At present, convective weather forecast products (Figure 4) of the Middle-south MET Center are generated through the combination of numerical weather prediction and artificial correction. The product is updated three times a day (00:00, 03:00 and 09:00UTC) with forecast validity of 3, 6, 9 hours. In the future, CCFP products with high temporal and spatial resolution will be developed, aiming to provide higher quality decision-making products for air traffic management.

Command Stage (0-2hours in advance)

2.8 In accordance with Annex 3, aerodrome warnings shall give concise information of meteorological conditions which could adversely affect aircraft on the ground, including parked aircraft, and the aerodrome facilities and services. In practice, aerodrome warnings can not only provide early warning of dangerous weather for airports, airlines or other users, but also provide important

meteorological information for tower and terminal controllers to support operational decision-making in the command stage. Evaluations and optimizations on aerodrome warnings have been carried out in the recent years, focusing on improving the forecast lead time and resolution of aerodrome warnings. From 2020 to 2022, the average forecast lead of Guangzhou Baiyun Airport has increased from 30-40 minutes to about 60-70 minutes, which can support ATM controllers to make flight flow planning, hover waiting strategy, operation direction switching scheme, etc.

2.9 In terms of convective weather forecast, the Middle-south MET Center has developed the Guangzhou approach area and Middle-south region convection nowcast system based on the multi-scale cross-correlation tracking algorithm, which can forecast the position and intensity of convective echoes in the next 2 hours. The Guangzhou approach area convection nowcast system can also indicate the degree of influence on navigation points in the form of traffic lights (as shown in Figure 5). At present, the system can accurately predict the direction and speed of radar echoes, but is not skilled in predicting the convection intensity. The application of deep learning methods and the establishment of rapid update cycle (RUC) models have been carried out to improve the accuracy of convection prediction recently.

2.10 A new service mode of the website visual display of weather observation data is in trial operation in Guangzhou Baiyun Airport, intended to replace the telephone weather report service. Since July 2023, the trial operation of the Refined Real-time Weather Display System (Figure 6) has been conducted. The new system can display automatic weather observation data in real time on the tower and approach controllers' computer screens. When the key meteorological parameters exceed the specified threshold, the system will automatically synchronize the corresponding meteorological elements to the service interface after the observer edit the data. The transformation from traditional telephone services to convenient website services can not only improve the efficiency of meteorological services, but also provide users with more comprehensive and refined real-time weather information.

Post-operational Stage

2.11 In recent years, the Middle-south MET Center has established a monthly weather review mechanism among aviation meteorological agencies in the region. The main content of the monthly weather review includes weather situation, forecast products and services analysis, the forecast method and deviation analysis, experience summary, etc. Besides, a quality monitoring post has been set up since December 2021, intended for monitoring the quality of meteorological products, analysing the impact of complex weather on flight operations and evaluating the effect of meteorological services.

2.12 As the air traffic capacity is constantly compromised by adverse weather, the accuracy of aviation weather forecast becomes critical to aviation users. Forecasters are invited to participate in the joint weather review with stakeholders after the high-impact weather process (Figure 7). Important experiences in improving the effectiveness of meteorological services are gained through the joint review.

3. ACTION BY THE MEETING

3.1 Note the information contained in this paper.

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APPENDIX [A]

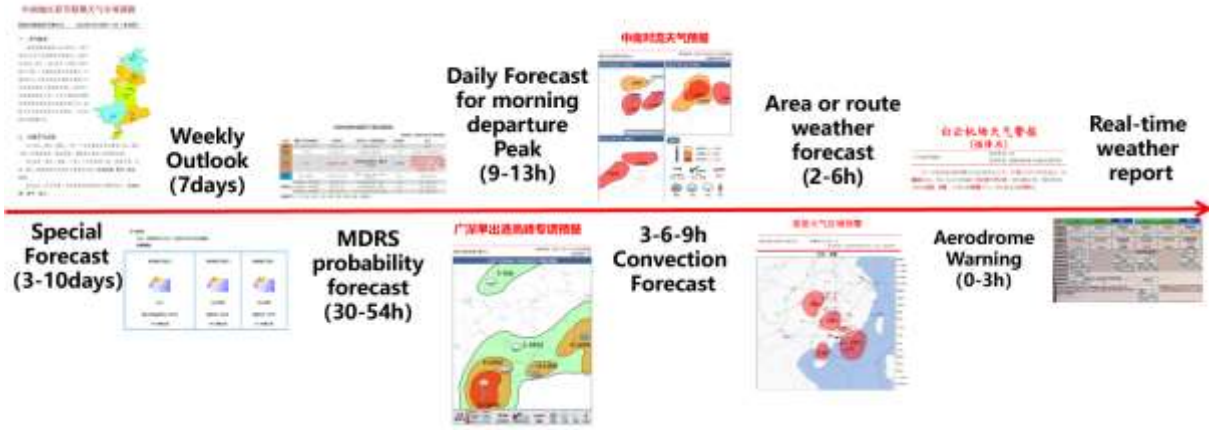
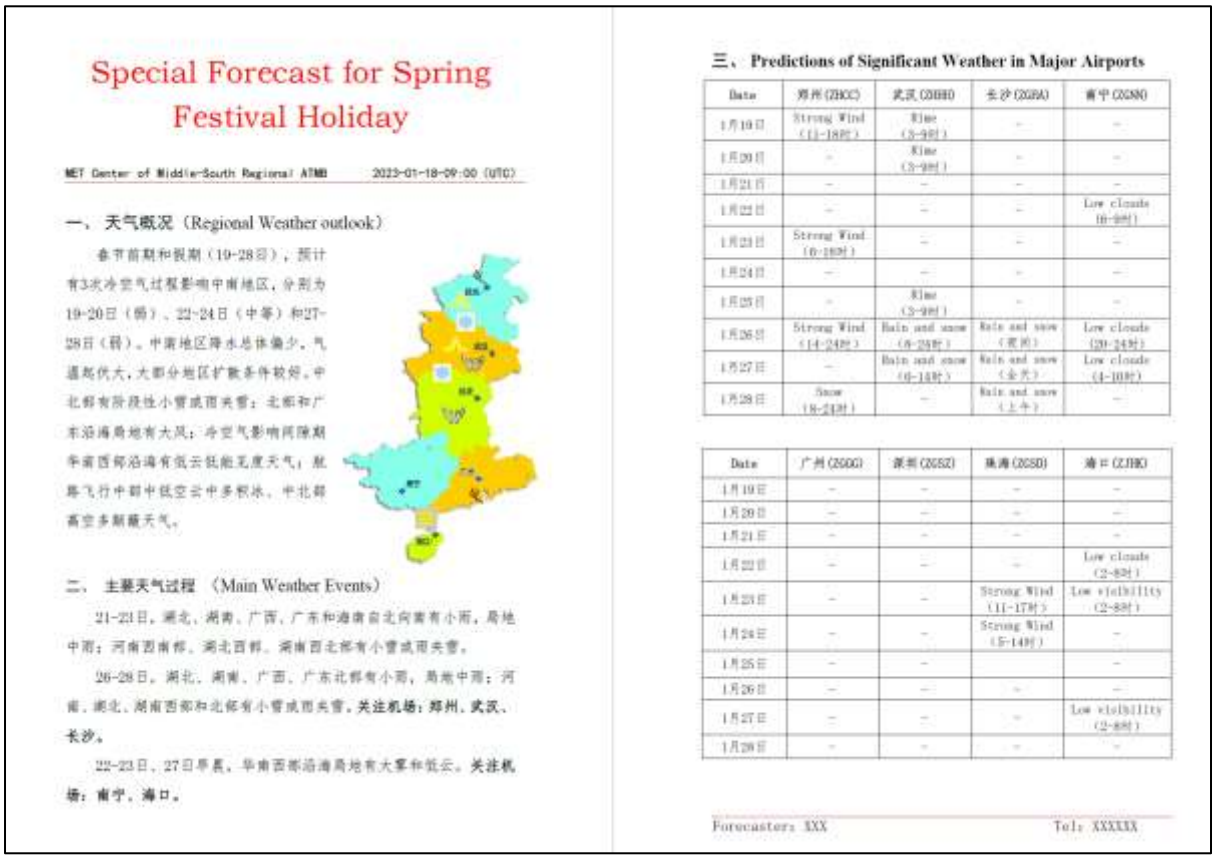


Figure 1 The time series of weather service (from weekly forecast to real-time weather report)



Special Forecast for Spring Festival Holiday

MET Center of Middle-South Regional ATMB 2023-01-18-09:00 (UTC)

一、天气概况（Regional Weather outlook）

春节前期和假期（19-28日），预计有3次冷空气过程影响中南地区，分别为19-20日（弱）、22-24日（中等）和27-28日（弱）。中南地区降水总体偏少，气温起伏大，大部分地区扩散条件较好。中北部有阶段性小雪或雨夹雪；北部和广东沿海局地有大风；冷空气影响间隙期华南西部沿海有低云低能见度天气；航路飞行中部中低空云中多积冰，中北部高空多颠簸天气。

二、主要天气过程 （Main Weather Events）

21-23日，湖北、湖南、广西、广东和海南自北向南有小雨，局地中雨；河南西南部、湖北西部、湖南西北部有小雪或雨夹雪。

26-28日，湖北、湖南、广西、广东北部有小雨，局地中雨；河南、湖北、湖南西部和北部有小雪或雨夹雪。关注机场：郑州、武汉、长沙。

22-23日，27日早晨，华南西部沿海局地有大雾和低云。关注机场：南宁、海口。

三、 Predictions of Significant Weather in Major Airports

Date	郑州 (ZHCC)	武汉 (ZHHH)	长沙 (ZGHA)	南宁 (ZGNN)
1月19日	Strong Wind (11-18时)	Rime (3-9时)	-	-
1月20日	-	Rime (3-9时)	-	-
1月21日	-	-	-	-
1月22日	-	-	-	Low clouds (6-9时)
1月23日	Strong Wind (6-10时)	-	-	-
1月24日	-	-	-	-
1月25日	-	Rime (3-9时)	-	-
1月26日	Strong Wind (14-24时)	Rain and snow (8-24时)	Rain and snow (夜间)	Low clouds (20-24时)
1月27日	-	Rain and snow (0-14时)	Rain and snow (全天)	Low clouds (4-10时)
1月28日	Snow (8-24时)	-	Rain and snow (上午)	-

Date	广州 (ZGGG)	深圳 (ZGSZ)	珠海 (ZGSD)	海口 (ZJHK)
1月19日	-	-	-	-
1月20日	-	-	-	-
1月21日	-	-	-	-
1月22日	-	-	-	Low clouds (2-8时)
1月23日	-	-	Strong Wind (11-17时)	Low visibility (2-8时)
1月24日	-	-	Strong Wind (5-14时)	-
1月25日	-	-		-
1月26日	-	-	-	-
1月27日	-	-	-	Low visibility (2-8时)
1月28日	-	-	-	-

Forecasters: XXX Tel: XXXXXX

Figure 2 The special forecast of the Middle-south MET Center

Figure 3 A joint MET and ATM consultation

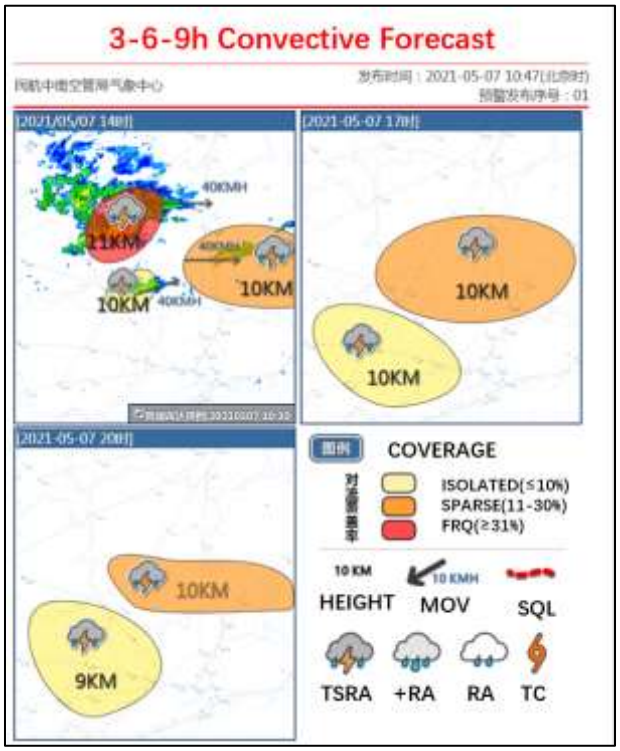


Figure 4 The 3-6-9 hour convective forecast

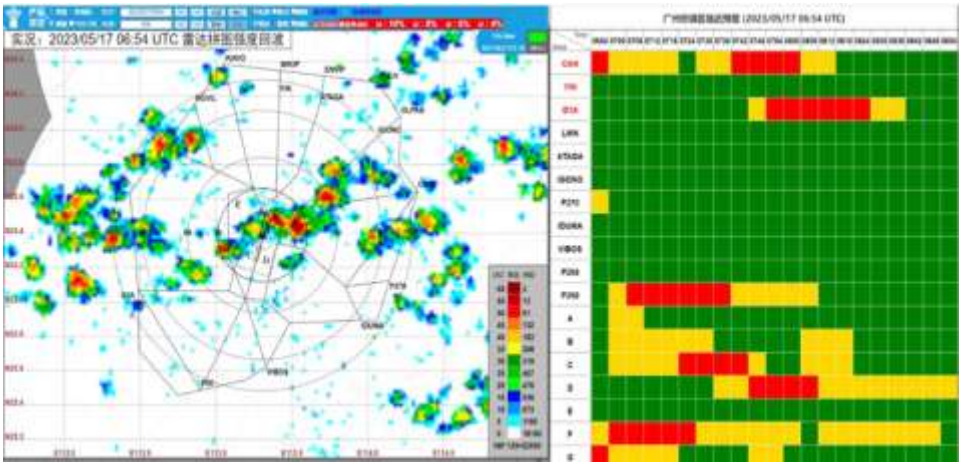


Figure 5 The Guangzhou Approach Area Convection Nowcast System

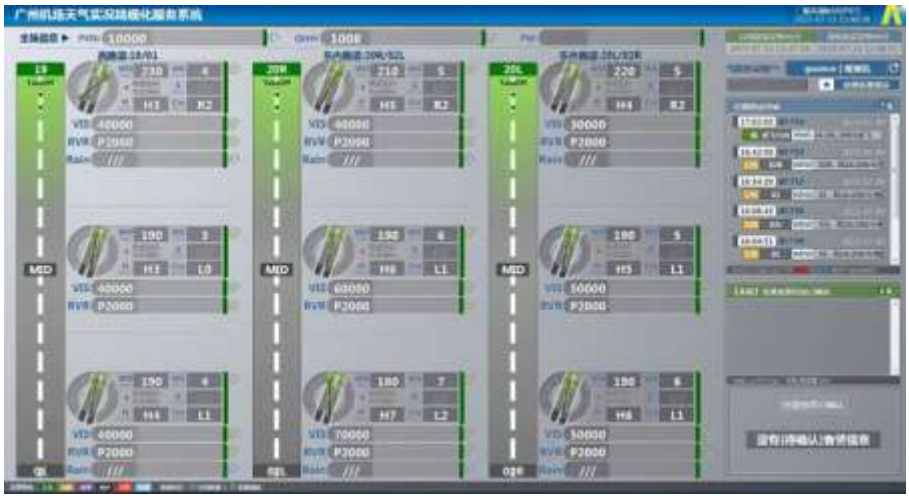


Figure 6 The Refined Real-time Weather Display System in Guangzhou Airport

Figure 7 The joint weather review with stakeholders