International Civil Aviation Organization

EIGHTEENTH MEETING OF THE METEOROLOGY SUB-GROUP (MET SG/18) OF APANPIRG

ICAO Regional Sub-Office, Beijing, China
18 – 21 August 2014

Agenda Item 7: Research, development and implementation issues in the MET field

7.6 MET/ATM coordination

THE NEED FOR DEVELOPMENT OF ATM-TAILORED METEOROLOGICAL INFORMATION FOR APPROACH CONTROL AREAS

(Presented by Japan)

SUMMARY

Japan's Air Traffic Meteorology Center (ATMetC) provides meteorological information and services to support air traffic management (ATM). In this field, high importance needs to be placed on the understanding of procedures regarding air traffic control (ATC) and ATM and the reflection of related requirements in tailored aeronautical meteorological (MET) services to help ATC and ATM officers make timely and effective decisions.

1. INTRODUCTION

1.1 The Japan Civil Aviation Bureau (JCAB) established the Air Traffic Management Center (ATMC) in Fukuoka in October 2005 as a core organization for air traffic management (ATM) in Japan's Fukuoka flight information region (FIR). In line with ICAO's global concept for ATM, ATMC facilitates safe and efficient flight operation through air traffic management in close cooperation with airspace management (ASM), air traffic flow management (ATFM) and oceanic ATM. At the same time as ATMC began operation, the Japan Meteorological Agency (JMA) established the Air Traffic Meteorology Center (ATMetC) to provide meteorological information and services in support of ATMC. ATMetC forecasters work in the same operation room as ATM officers to directly provide weather information and briefings tailored to ATM officers' needs.

1.2 At ATMC, teleconferences for collaborative decision-making are held twice daily with the attendance of relevant ATM parties, including staff from area control centers (ACCs), air traffic controllers of major aerodromes and airline representatives. At the beginning of these conferences, a forecaster from ATMetC provides a briefing on weather conditions and their possible impact on ATM as a basic provision for common situational awareness. (See appendix, Figures 1 to 4.)

1.3 To provide practically helpful weather briefings for ATM operation, it is considered important to focus on how weather conditions could impact air traffic flow in support of ATM operations. Accordingly, ATMetC forecasters emphasize weather conditions that may affect major components of the air traffic network such as crowded airports with large volumes of departures and arrivals, their approach control areas, major airways with high-density air traffic flow, and typical holding areas.

1.4 Through experience gained from eight years of operation, ATMetC is aware that certain weather conditions around major aerodromes, including their approach control areas, can affect air traffic flow in the Fukuoka FIR as a whole and cause significant disturbance regardless of their severity.

1.5 In this paper, an actual case is outlined to illustrate how cumulonimbus clouds (CBs) within the approach control area of Tokyo International Airport (RJTT) significantly impacted air traffic flow and how ATMetC's support helped ATMC conduct efficient and effective ATM. Suggestions are then made for advanced meteorological information and services corresponding to ASBU Module B1-AMET.

2. VERIFICATION OF ATMET CATEGORY FORECAST CRITERIA

Background

2.1 In the Tokyo approach control area (appendix, Figure 5 refers), radar approach control services are provided for arriving and departing aircraft both at Tokyo International Airport (RJTT) and at Narita International Airport (RJAA). As more than 1 100 flights arrive at and depart from RJTT every day (approximately 380 000 per year), the facility plays a significant role in air traffic flow over Japan.

2.2 In the Tokyo approach control area, the arrival route is set up in line with approach procedures and runway settings. A typical arrival route for south wind operation is shown in Figure 5. Air traffic controllers at RJTT coordinate with numerous aircraft approaching from the north and south to maintain safe intervals along the standard arrival course.

2.3 Air traffic controllers usually advise pilots to deviate in order to avoid CBs or other types of convective cloud present along the flight path in the approach control area. However, when such clouds move into the final approach area, controllers may keep aircraft in a holding pattern rather than allow them to start the final approach because it is difficult for an aircraft to change route once the final approach area is entered. Consequently, the ATMC may have to execute air traffic flow control for such aircraft so that appropriate spatial intervals are maintained between flights entering the RJTT approach control area.

Case study

2.4 On 3 September 2012, small CBs generated over the Boso Peninsula southeast of RJTT began to move slowly northeastward with slight development after 0300 UTC (appendix, Figure 6 refers).

2.5 At the time, RJTT was under south wind operation. The CBs moved into the final approach area at around 0400 UTC. Aircraft are generally not allowed to deviate from the standard course between the initial approach fix and the landing point, which means they were unable to approach the runway until the CBs dissipated or moved away from the final approach course. Accordingly, air traffic controllers at RJTT prohibited aircraft from entering the Tokyo approach control area after 0410 UTC.

2.6 Consequently, a large number of aircraft were kept in holding patterns just outside the approach control area in places such as airspace over the southern Boso Peninsula and southwest of the Izu Peninsula at around 0420 UTC (holding locations are indicated by the red circles in the middle image of Figure 6).

2.7 To deal with the build-up of aircraft in holding patterns, the ATMC implemented air traffic flow control at 0422 UTC to delay the departure of aircraft bound for RJTT. As a result, air traffic experienced heavy delays.

2.8 This case clearly demonstrated how even small amounts of convective cloud in the approach control area can significantly impact air traffic flow nationwide depending on ATC procedures.

3. ATM-TAILORED METEOROLOGICAL INFORMATION AND SUPPORT FOR APPROACH CONTROL AREAS

3.1 Based on experience gained from cases such as that described above, ATMetC recognizes the importance of information on weather conditions within approach control areas. However, even with state-of-the-art technology, it is difficult to accurately forecast small-scale clouds up to several hours ahead. In addition, the degree of influence on air traffic flow depends on the development, distribution and position of CBs and convective clouds. Accordingly, the following procedures are implemented:

a) ATMetC forecasters gather air traffic flow information through the ATM display system to clarify levels of airspace congestion and anticipate how weather conditions may affect air traffic flow;
b) ATMetC forecasters continuously monitor actual weather conditions and very-short-range forecasts for convective clouds using a radar network and highly precise numerical weather prediction to enable the provision of frequent weather briefings to ATM officers; and
c) based on information and briefings from ATMetC forecasters, ATM officers secure safe, smooth air traffic flow as far as possible by maintaining appropriate capacity at crowded airports and in ATC sectors.

3.2 In the current coordination scheme, it is important for ATMetC forecasters to prepare for weather-induced air traffic flow congestion by learning runway configurations and other aspects of ATC procedures well in advance, including radar approach controls and standard arrival courses. This knowledge can be used to provide practically useful briefings to ATM officers in a timely manner.

3.3 Another factor to be considered is an ATM-tailored product called Air Traffic Meteorological Forecast (ATMet Category Forecast), which helps ATM officers make decisions by highlighting the likelihood of weather-related impacts on air traffic flow. ATM officers use this product for judgment on the implementation of relevant action such as air traffic capacity changes and air traffic control application. The layout of the forecast is similar to that of the air traffic demand charts used in ATM operation systems. As ATM officers are highly familiar with these charts, the forecast can be easily understood without the need for special training. (See appendix, Figures 7 and 8.)

3.4 The ATMet Category Forecast highlights the potential for meteorological impact on air traffic flow with four color-coded categories (red, yellow, blue and white) each hour covering the period six hours ahead for all major aerodromes and ATC sectors. It is updated every hour and usually displayed on the big screen in the ATMC operation room. It is also shared online using a web-based system for airlines and other bodies related to JCAB and JMA.

3.5 In relation to weather-related impacts on the Tokyo approach control area's heavy air traffic (as described above), JMA recently developed a new ATM-tailored product called ATM Categorized Impact of weather Element Prediction (ATM-CIEL). This is an extended version of the ATMet Category Forecast in terms of both spatial and temporal resolution, providing information on potential weather-related impacts in consideration of arrival/approach courses and procedures in the area around Tokyo International Airport (appendix Figure 9, refers). The product presents categorized weather-related impact likelihood forecasts for several ATC sectors within the Tokyo approach control area. Its temporal resolution is set to just ten minutes in order to meet the requirements of airspace capacity arrangement work. The forecast also addresses weather elements such as strong wind and turbulence in addition to convective clouds.

4. DISCUSSION

4.1 Based on ATMetC operational experiences as described above, it is known that even small-scale CBs and convective clouds forming with certain timing in certain locations can significantly affect the air traffic situation as a whole in approach control areas around crowded high-density aerodromes such as RJTT and RJAA. Accordingly, more attention should be drawn to the possible impacts of CBs and convective clouds within approach control areas in order to support effective and efficient ATM.

4.2 It is therefore suggested that the development of ATM-tailored meteorological information for approach control areas in consideration of ATC procedures and other relevant operational processes should be seen as a global objective upon the establishment of the near-term advanced services described in ASBU Module B1-AMET.

4.3 At the ICAO MET Divisional Meeting, it was acknowledged that close coordination between MET and ATM should be crucial for especially tight and busy airspace like approach control area. The Meeting finally endorsed following draft recommendation 2.10 a) and b) which tasked ICAO to include meteorological services in support of ATM for the terminal area in Block1 and subsequent blocks of the ASBUs and develop ATM-tailored meteorological service for the terminal area to meet ATM requirements in the future.

Recommendation 2/10 — Development of meteorological service for the terminal area

That ICAO, in close coordination with WMO, be tasked to:

a) include meteorological service for the terminal area and other relevant operational requirements in Block 1 and subsequent blocks of the aviation system block upgrade methodology to highlight potential related impacts on air traffic flow in consideration of air traffic control and air traffic management (ATM);

b) develop ATM-tailored meteorological service for the terminal area to meet future ATM requirements identified by the Global Air Navigation Plan (Doc 9750) and reflect the appropriate functional and performance requirements in the relevant provisions, noting outcomes from ICAO expert groups on meteorology, ATM and flight operations;

c) , d)….. *(Ommited)*

5. ACTION BY THE MEETING

5.1 The meeting is invited to note the information contained in this paper; and

a) note the information contained in this paper; and

b) discuss any relevant matters as appropriate.

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APPENDIX

FIGURES

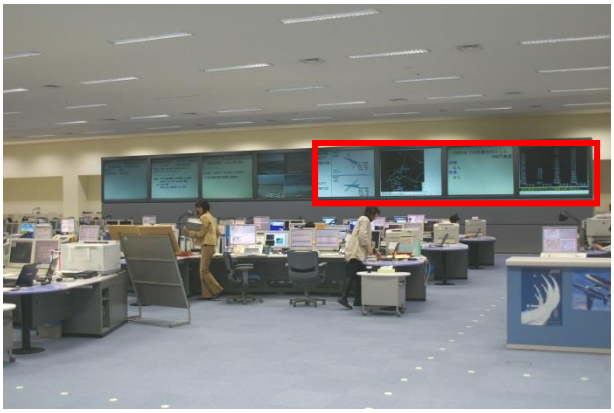

Figure 1. Weather information displayed on four large screens in the ATMC operation room

Figure 2. Additional briefing using an information-sharing terminal at an ATM officer's desk

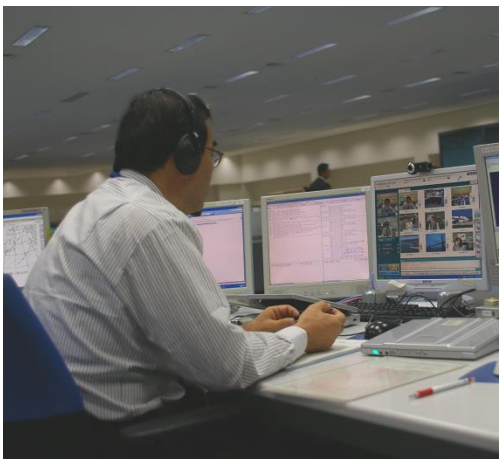

Figure 3. CDM Conference

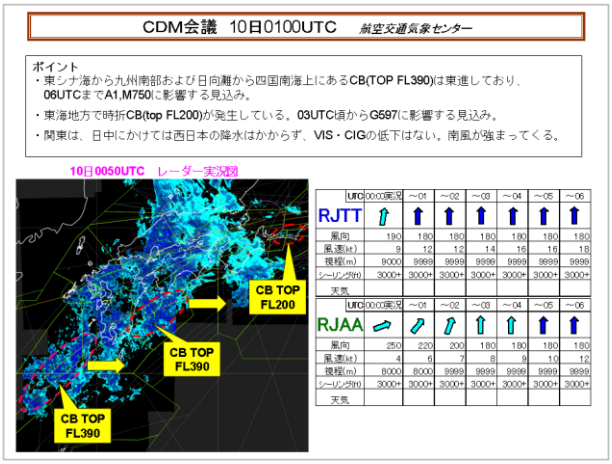

Figure 4. Example of a CDM Conference weather information sheet

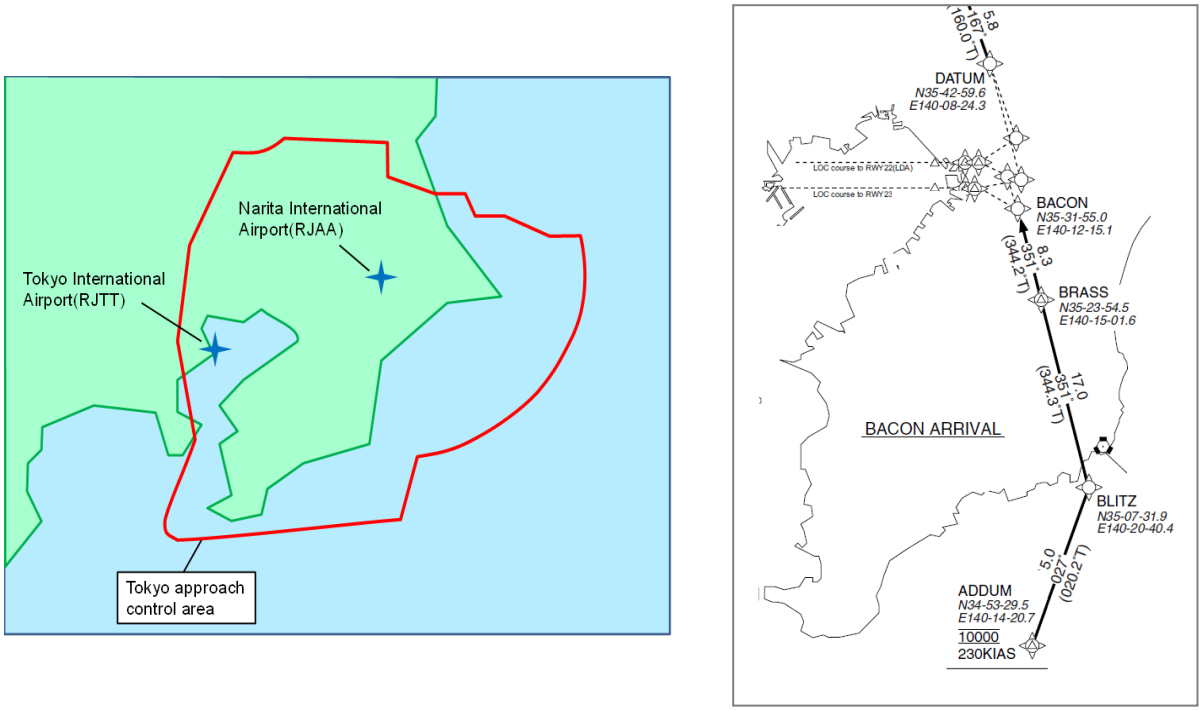

Figure 5. Tokyo approach control area (left) and a standard arrival course (south wind operation) for Tokyo International Airport (RJTT) (right)

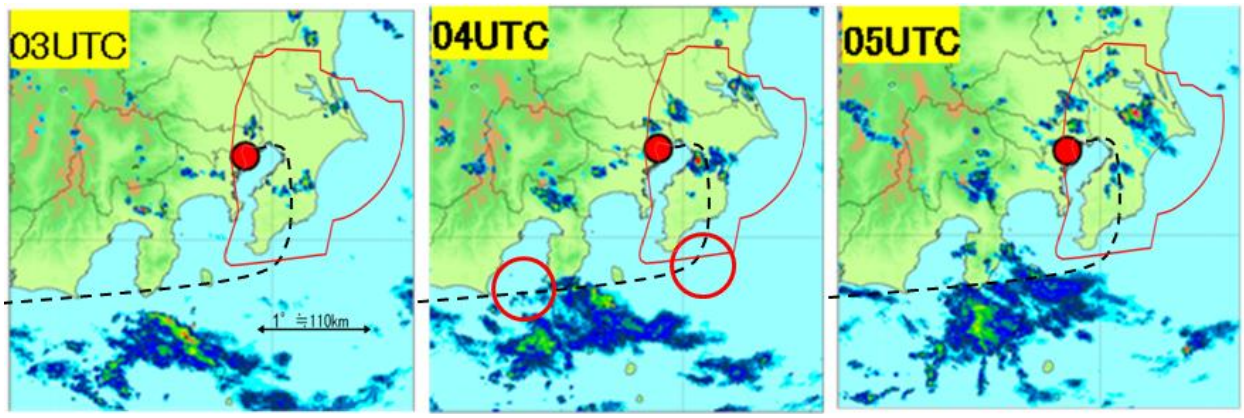

Figure 6. Rader echo (precipitation intensity) at 03, 04 and 05 UTC on 3 September 2012

The red dot indicates the location of RJTT, and the thin red line shows its approach control area. The dashed black line shows the flight path to the RJTT approach course. The two red circles in the middle image indicate typical holding locations.

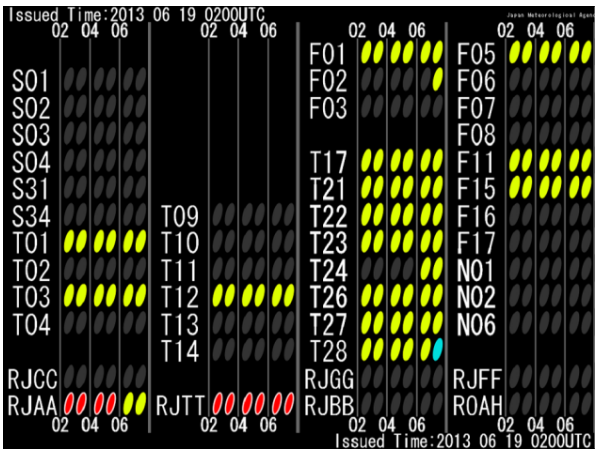

Figure 7. An ATMet category forecast displaye on the big screen in the ATMC operation room

Figure 8. An ATMet category forecast provided online to an organization outside ATMC

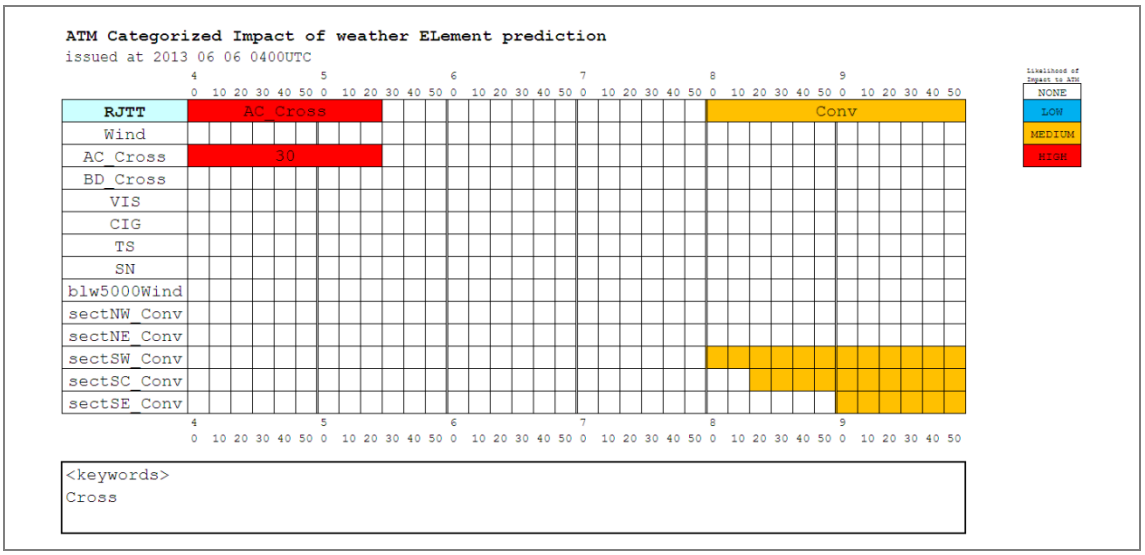

Figure 9. Forecast product for the approach control area around Tokyo