International Civil Aviation Organization

INFORMATION PAPER

Tenth Meeting of the Asia/Pacific Meteorological Requirements Working Group (MET/R WG/10)

Virtual Meeting (Online), 24 – 28 May 2021

Agenda Item 5: Coordination between MET and ATM services

DEVELOPMENT AND UPDATING OF ATM TAILORED METEOROLOGICAL INFORMATION

(Presented by Japan)

SUMMARY

This paper presents the development and updating of ATM tailored products from the Japan Meteorological Agency (JMA). The product specifications are updated in line with changes in ATC operations based on aircraft operation and verification/research in the wake of adverse weather conditions seriously affecting air traffic flow. Effective support for ATFM operations requires appropriate updating of information specifications based on consideration of events in actual operation.

1. INTRODUCTION

1.1 The Japan Meteorological Agency (JMA) set up the Air Traffic Meteorology Center (ATMetC) in Fukuoka and commenced its operation in 2006 to provide the Air Traffic Management Center (ATMC) of the Japan Civil Aviation Bureau (JCAB), the core organization for ATM in Fukuoka FIR, with ATM-tailored meteorological information (see MET/ATM Seminar 2013 IP/3). JMA has also run the Tokyo Metropolitan Area Team (TMAT) as a branch of ATMetC since 2014 and the New Chitose Area Team (NCAT) since 2018 to support the operations of Traffic Management Units (TMUs) as ATMC branches conducting tactical and flexible ATFM related to airports and airspace in and around the Tokyo metropolitan area and New Chitose airport. TMAT and NCAT provide more detailed meteorological information to TMUs (see MET/ATM Seminar 2015 IP/7, MET/R WG/8 IP/12).

1.2 ATMetC provides the sequential ATMet Category Forecast, which highlights the impacts of significant weather on ATFM based on four color-coded categories. TMAT also provides the similar product, ATM CIEL, whose temporal and spatial resolutions are more precise than those of ATMet Category Forecast (Fig. 1; see MET/ATM Seminar 2011 WP/9, MET/ATM Seminar 2015 IP/7). JMA's development and updating of these products are outlined below.

2. DISCUSSION

Product development

2.1 JMA spent three years developing and testing the ATMet Category Forecast before the commencement of ATMetC operation as follows:

- JMA officers observed 24-hour activity in the ATM operation room and inspected the tools used there. Focus was placed on understanding weather phenomena/conditions affecting air traffic flow and requirements for meteorological information to support ATFM, such as related time resolution.
- The product was designed as a time-series color-coded categorized forecast with a look and feel similar to those of the screen showing ATMC Air Traffic Volume forecasts (Fig. 2).
- MET officers including developers and operational forecasters provided sample products to ATM officers for discussion. Target phenomena, related category criteria and target areas were fixed in consideration of results from research involving case studies on adverse weather conditions that affect air traffic flow and on requests from ATM officers.
- JMA spent approximately two years developing the category forecast and commenced provision after a trial period of around a year to build familiarity with the software, test the production system and review the product specifications.

Product specification updating

2.2 Since the product launch, JMA has updated the information specifications and developed extra information based on newly launched ATC operations, newly identified impacts of weather phenomena on ATFM and requests from ATM officers on duty.

Verification in relation to actual adverse weather events

2.2.1 JMA's ATMetC and TMAT officers have reviewed and verified MET information for ATM as follows:

- Research regarding previous significant weather-related impacts on air traffic flow with coordination between MET and ATM officers (with research criteria set in advance)
- Numerical verification (see IP/5, SP/14 MET/ATM Seminar 2013)
- Monthly technical meetings (and at other times as needed) for sharing technical information on meteorology/ATFM and review of weather phenomena impacts on air traffic flow as needed

In this research, ATM officers share ATM data on delays, flow control, causes of delays and other matters, and MET officers examine correlations between air traffic flow and weather conditions. This work serves to highlight issues not identified during the product development phase.

2.2.2 For TMAT's ATM CIEL, TMAT experienced the case that low visibility near the touchdown zone heavily impact on the air traffic flow, even if prevailing visibility does not meet the criteria used for the color-codes. Therefore, TMAT proposed additional criteria such partial fog case, and set the criteria in collaboration with TMUs. In the technical meeting, TMUs asked TMAT to change the criteria so that the categories would fit better to TMU officers' operational decision-making (e.g., using weather minimum values rather than statistically set values). In addition, TMAT conducted a survey on aircraft operations in particular weather conditions via interaction at meetings with airlines to identify appropriate criteria for ATM operations. It took about one year and a half since TMAT started to coordinate with TMUs to consolidate the new criteria. (see IP/4 MET/R WG/7)

ATC operation changes associated with increased air traffic volumes

2.2.3 In 2019 and 2020, JCAB updated the airspace configuration around the Tokyo metropolitan area and expanded the Tokyo approach control area's airspace along with new ATC procedures (Fig. 3). Gradual airspace redesign (with the division of airspace by altitude as upper and lower sectors) remains ongoing for all of Japan's domestic airspace (Fig. 5). In line with these changes, the specifications of the ATMet category forecast and ATM CIEL were modified to target the redesigned airspace (Figs. 4 and 6).

2.2.4 The high-precision capacity management required due to increasing air traffic volumes in and around the Tokyo metropolitan area necessitates highly detailed local meteorological information to support ATM, with particular focus on information regarding weather conditions along individual air routes. TMAT also developed ECLAIR as a new product indicating levels of expected impacts from convective clouds on individual air routes in the Tokyo Approach Control Area. The information helps ATM officers understand the air traffic impacts of weather conditions more in detail than with ATM CIEL. (Fig. 8, see IP/1 MET/R WG/9)

2.2.5 Product specifications were changed in relation both to permanent changes in ATC operations above mentioned and to temporary changes. For example, when construction work was carried out near the runway at Tokyo International Airport, restrictions were imposed on the use of the ILS approach for southerly wind operation. Accordingly, new criteria for ATMet category forecasts for southerly winds and IMC were established and applied exclusively during this period.

2.2.6 Information on changes in ATC operations is shared by ATM officers on various occasions, including annual meetings held by ATMC as a platform for discussions on ATM operational policy. The meetings are attended by representatives of ATMetC, Area Control Centers (ACCs), major airport controls and airlines.

2.3 JMA verifies products with new specifications using actual meteorological data, and discuss the results with ATM officers for feedback. The criteria table is then updated and shared with ATM officers before the product becomes operational.

2.4 The following issues are experienced with specification updates:

- Difficulties are experienced in numerical verification of criteria and procuration of reliable statistical results due to a data shortage arising from frequent changes in ATC operations and traffic volumes.
- The increasing complexity of ATC operations and airspace structure makes manual production of forecast information challenging. Accordingly, more efficient procedures for forecast production are required.
- Manipulation of NWP-based automated forecasts is still needed to compensate for NWP forecast weaknesses. By way of example, prediction of sudden meteorological changes over the next few hours in NWP models remains challenging.

3. CONCLUSION

3.1 JMA continues to update the specifications of ATM-tailored MET information after product launch.

3.2 Due to increased air traffic volumes, weather phenomena that had previously not affected air traffic flow now influence ATFM, and ATC operations have been updated. MET officers need to consider these new challenges and update their product specification accordingly.

3.3 Effective ATFM operational support requires MET officers to identify requirements from ATM officers, understand changes in ATC operations and appropriately update product specifications based on reviews once every few years, along with other efforts.

4. ACTION BY THE MEETING

4.1 Note the information contained in this paper.

Appendix

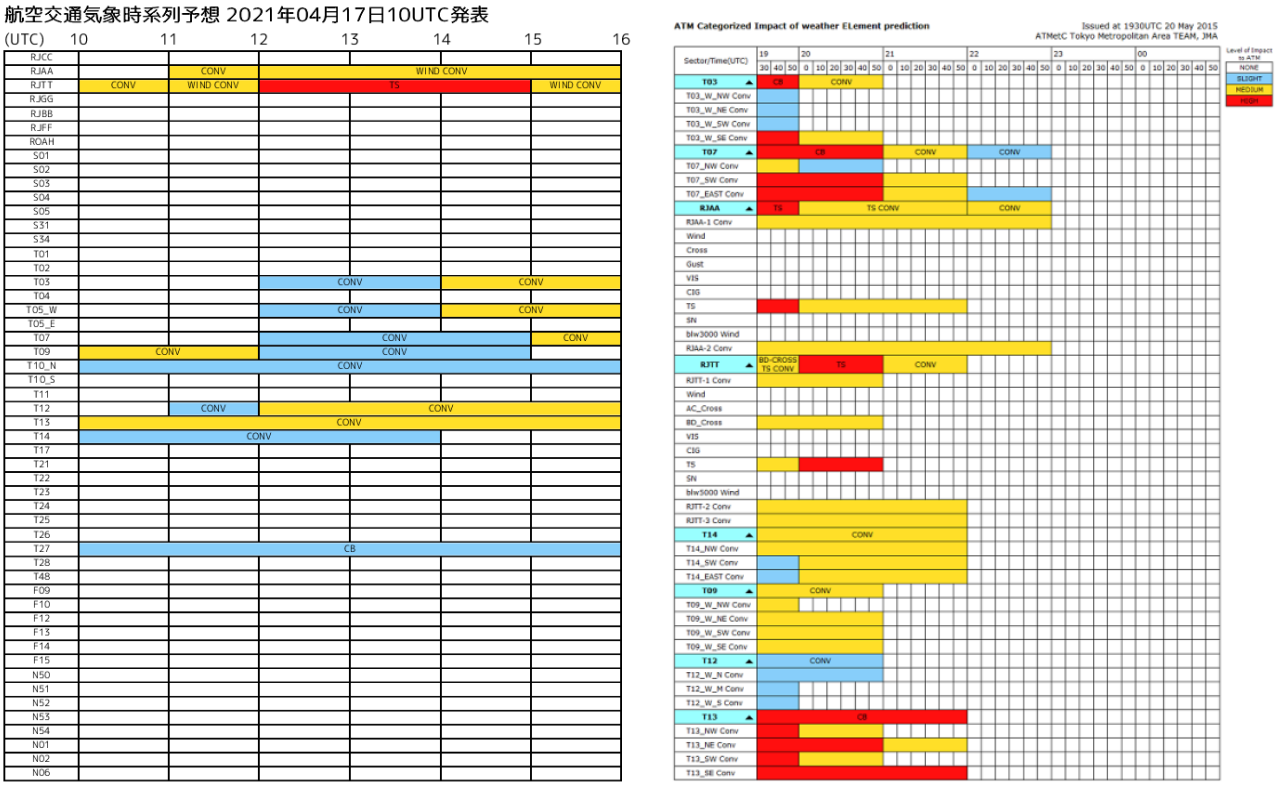

Fig.1 ATMet category forecast (left) and ATM CIEL (right)

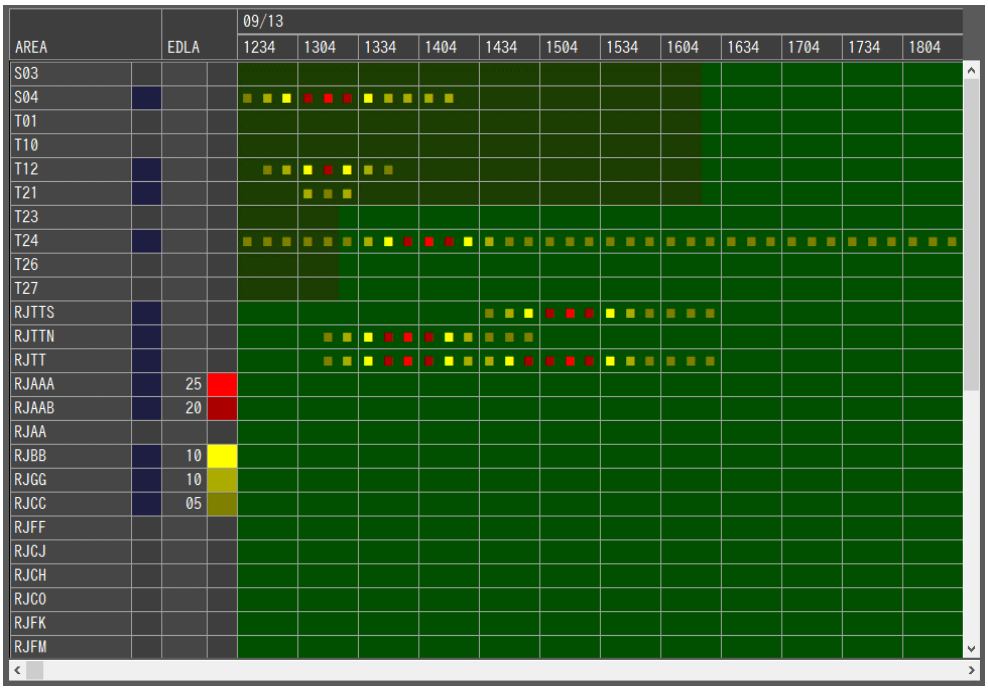

Fig.2 The screen showing ATMC Air Traffic Volume forecast (current system)

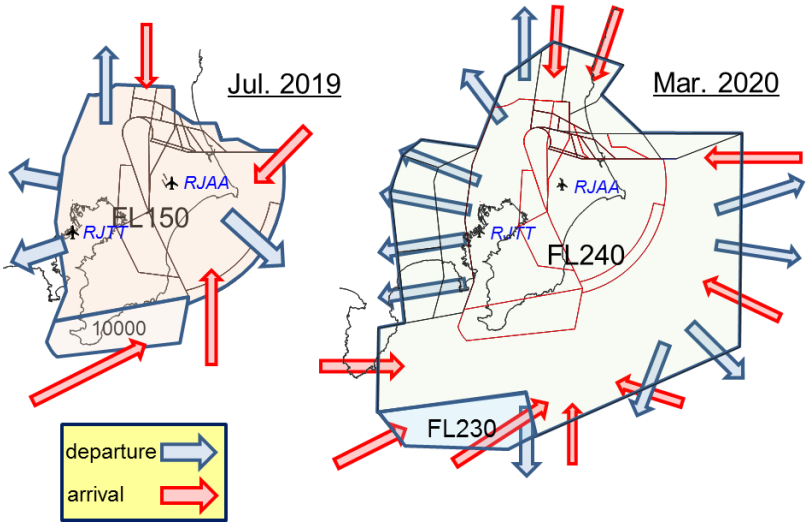

Fig.3 Expansion of the Tokyo approach control area airspace

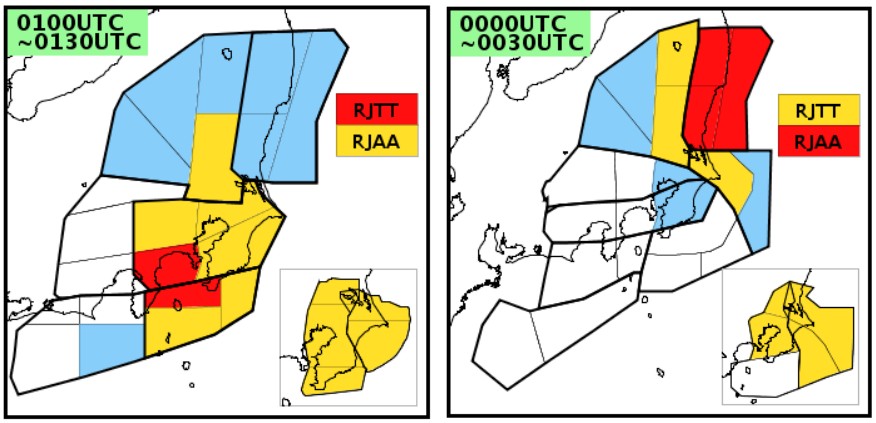

Fig. 4 ATM CIEL target area changes (left: pre-change; right: post-change)

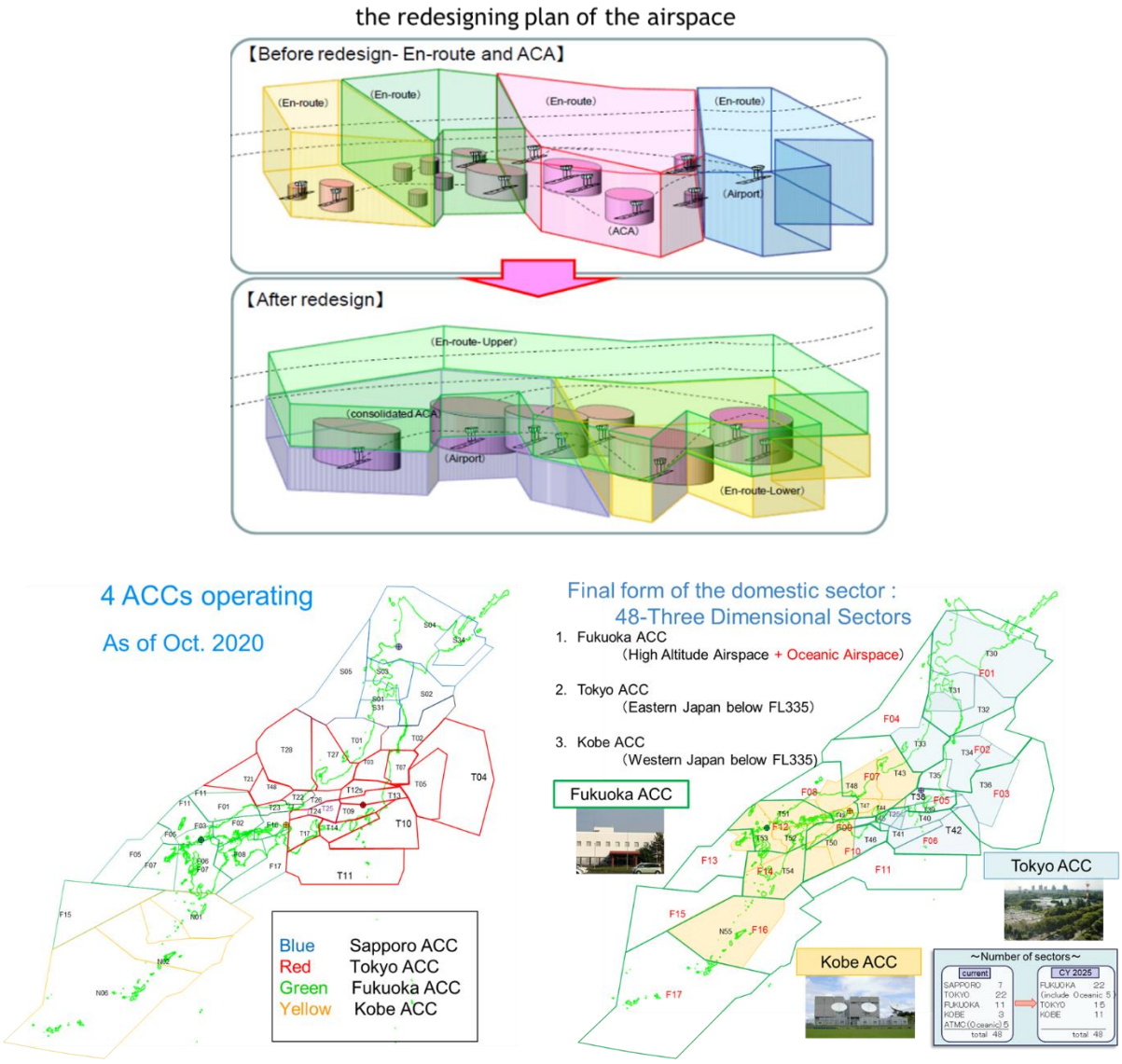

Fig. 5 Redesign of domestic airspace in Japan with division of upper and lower sectors (top: redesign; bottom: actual sector shapes before (left) and after (right) redesign)

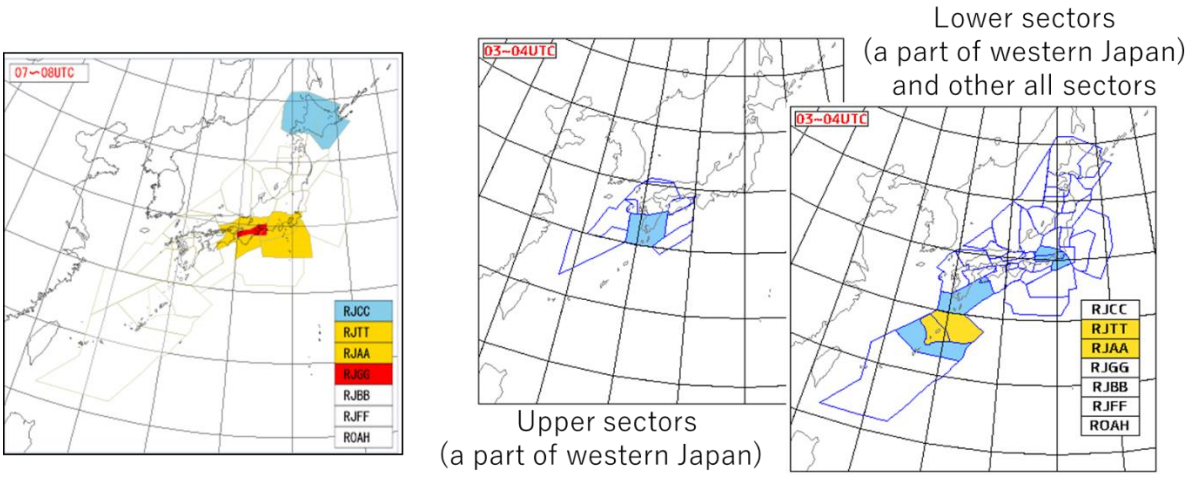

Fig.6 ATMet Category Forecast target area changes (left: pre-change; right: post-change)

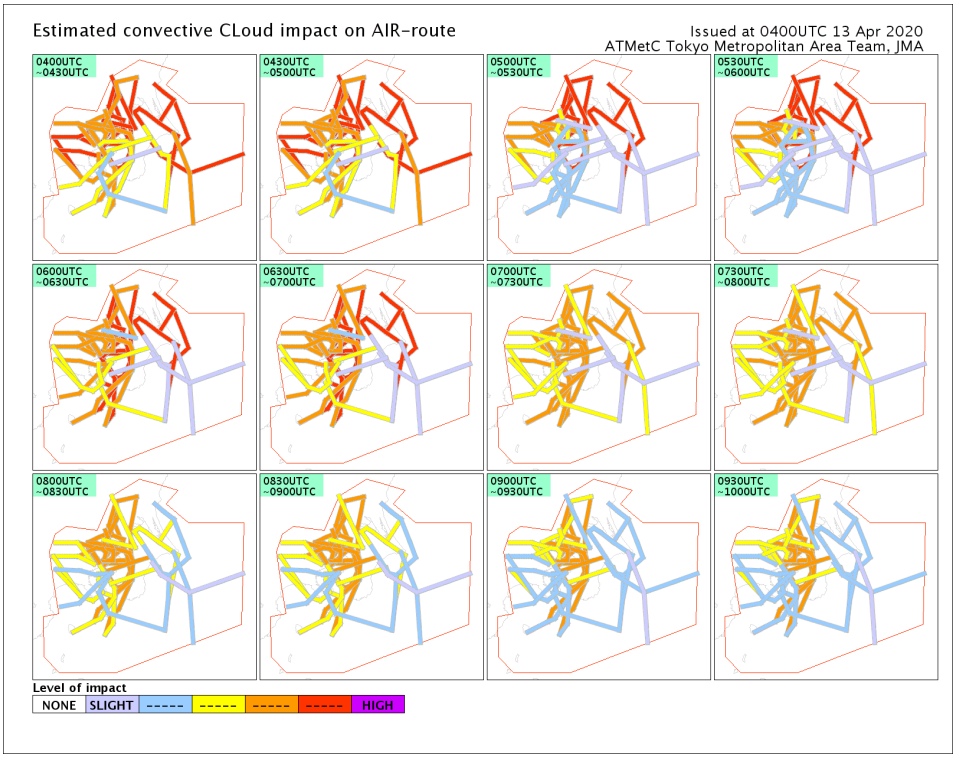

Fig.7 ECLAIR (Estimated convective CLoud impact on AIR-routes)