



*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**

**POTENTIAL USE OF THE WEATHER IMPACT RATIO (WXIR) IN FUTURE ATM**

(Presented by Japan)

**SUMMARY**

The Air Traffic Meteorology Center (ATMetC) of the Japan Meteorological Agency supports ATM operation by the Air Traffic Management Center(ATMC) of the Japan Civil Aviation Bureau by providing tailored weather information. In particular, the ATMet Category Forecast is a key product indicating the likelihood of weather-related impacts on air traffic flow. The Weather Impact Ratio (WXIR) currently used for continuous evaluation of ATMet Category Forecasts has potential as a future standard index to measure the degree of weather impact on ATM for the establishment of advanced weather information supporting such management as described in ASBU Module B1-AMET.

**1. Introduction**

1.1 In response to a significant increase in the amount of air traffic in the Fukuoka flight information region (FIR) in recent decades, the Japan Civil Aviation Bureau (JCAB) established the Air Traffic Management Center (ATMC) in Fukuoka in October 2005. In line with ICAO's global concept for air traffic management (ATM), ATMC facilitates safe and efficient flight operations through ATM in close cooperation with airspace management, air traffic flow management (ATFM) and oceanic ATM. To support the accomplishment of its goals, ATMC asked the Japan Meteorological Agency (JMA) to develop dedicated meteorological information and services in support of ATM.

1.2 In line with the relevant requirements, JMA established the Air Traffic Meteorology Center (ATMetC) in the same location as the ATMC to support ATM operation. ATMetC forecasters work in the ATMC operation room with ATM officers, collect various kinds of meteorological information relating to airspace and airports, and provide valuable support to ATMC for ATM concerning airlines and other organizations (see ICAO APAC CNS/MET SG/10 IP11 and CNS/MET SG/13 IP31).

1.3 ATMetC developed an ATM-tailored weather information product called the ATMet Category Forecast, which indicates the likelihood of weather-related impacts on air traffic flow. This

1.4 The ATMet Category Forecast highlights the potential for meteorological impacts on air traffic flow around air traffic control (ATC) sectors and major aerodromes with four color-coded categories (red, yellow, blue and white). The information is shown on a large display in the ATMC operations room and provided online to airlines and other relevant parties. (See appendix, Figure 1.)

1.5 The color-coded categories of ATMet Category Forecasts indicate the probability of impacts as shown below with criteria based on the verification of relationships between weather

conditions and air traffic flow delays.

Red: very high ( $\geq 50\%$ )

Yellow: high ( $\geq 25\%$ ,  $< 50\%$ )

Blue: slightly elevated ( $\geq 15\%$ ,  $< 25\%$ )

White: low ( $< 15\%$ )

## 2. VERIFICATION OF ATMET CATEGORY FORECAST CRITERIA

2.1 ATMet category forecast criteria are weather conditions (or sometimes a combination thereof) defined through verification processes carried out by ATMetC in coordination with ATMC. (See appendix, Figure 2.) This process involves three main steps:

- a) investigation of impacts on ATM in previous significant cases;
- b) confirmation of operational rules and conditions with reference to aircraft operation manuals and flight operations manuals; and
- c) checking of the latest requirements from ATM officers, such as high-priority airways and altitude, and important air navigation facilities (waypoints or typical holding areas).

2.2 Each criterion is verified by calculating the Weather Impact Ratio (WXIR), which is the ratio of the frequency of cases in which a weather condition has influenced air traffic flow to all cases of the weather condition concerned. When the WXIR value is within a certain range of probability for the relevant rank, the criterion applies.

$$\frac{\text{Number of occurrence of air traffic controls}}{\text{Number of occurrence of WX conditions}} = \text{WXIR}(\%)$$

2.3 To determine whether meteorological conditions meet certain criteria, ATMetC forecasters generally use aerodrome observation reports (METAR/SPECI), radar data (for the presence of cumulonimbi, or CBs), wind profiler observation data and aircraft reports on upper-air wind speed/direction. Meanwhile, air traffic flow impacts are determined based on the occurrence of deviations in ATC sector ATC conditions such as expected departure clearance time at aerodromes.

### 3. EFFECTIVENESS OF CONTINUOUS VERIFICATION USING WXIR

3.1 WXIR is seen as an index that can be used to directly measure the degree of weather-related impact on ATM. It is also useful for checking whether criteria meet operational requirements in such management.

3.2 Meteorological services provided to support ATM need to be flexibly applicable to the various operational variables of such management, including ATC procedures, airways and aircraft types, which are also developed in parallel. It is therefore highly important to ensure close and continuous coordination with ATM officers in order to revise criteria appropriately based on the results of verification using WXIR in consideration of operational requirements. Through such continuous improvement, the gap between ATM operational requirements and MET capability can finally be closed. (See appendix, Figure 3.)

### 4. DISCUSSION

4.1 As stated in ASBU Module B1-AMET, meteorological information and services should be improved to support ATM decision-making. In order to achieve such improvement, it is important to provide meteorological information representing the specific likelihood of influence on air traffic flow with careful consideration of flight operations and ATC procedures.

4.2 For the successful provision of advanced weather information in support of ATM, it is very important to accumulate information on actual cases of air traffic disturbance in order to clarify the relationship between severe weather conditions and their impacts on ATM. Continuous verification of such information is also essential to ensure that the operational requirements of ATM officers are met in

4.3 At the ICAO MET Divisional Meeting, it was agreed that information on possible weather impact on air traffic flow was very effective and continuous improvement of those information through verification in close coordination with ATM users was essential. The Meeting finally endorsed draft recommendation 2/10 c) as below which tasked ICAO to develop a guidance on verification methodology toward the continuous improvement of meteorological information to ATM, as indicated in this paper.

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

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

- a) Include... (*Omitted*)
- b) ... (*Omitted*)
- c) develop a guidance on verification methodology toward the continuous improvement of meteorological information to ATM; and
- d) ... (*Omitted*)

**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

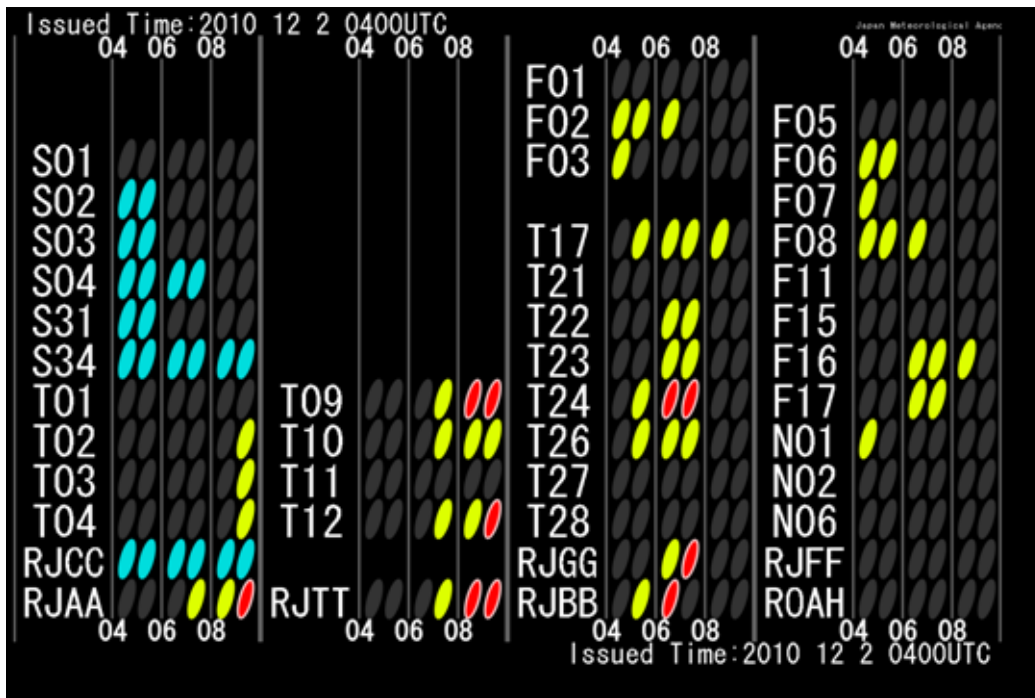
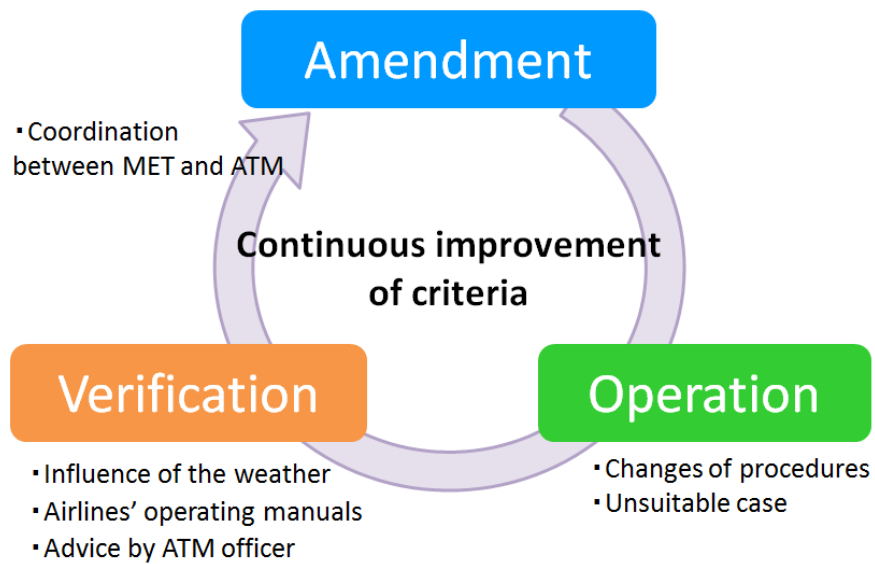


Figure 1. ATMet Category Forecast

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 $030\sim 060^\circ$ or $210\sim 240^\circ$ and gust $\geq 30kt$					visibility $< 800m$ with snow	
	ceiling $< 300ft$	visibility $< 400m$					ceiling $< 400ft$ with snow	
	TS OHD							
	wind speed at surface $\geq 30kt$ and wind speed below 5000ft $\geq 60kt$	wind speed below 3000ft $\geq 60kt$					visibility $< 1000$ with blowing snow	
YELLOW	snow fall rate $\geq 1cm/1h$							CB exists on selected airway or on selected area
	snow fall rate $\geq 5cm/3h$							
	wind speed $\geq 34kt$ with gust $\geq 50kt$							the proportion occupied with CB (top $\geq FL300$ ) in the sector $\geq 20\%$
	cross wind component to runway $\geq 25kt$ with moderate or heavy precipitation							
	cross wind component to runway $\geq 20kt$ with moderate or heavy precipitation							
	CB in HANEDA sector	CB in NARITA sector					visibility $< 400m$	
TS							visibility $< 1600m$ with snow	
ceiling $< 200ft$							ceiling $< 600ft$ with snow	
wind speed at surface $\geq 30kt$ and wind speed below 5000ft $\geq 50kt$	wind speed below 3000ft $\geq 50kt$					ceiling $< 200ft$	visibility $< 600ft$ with snow	
moderate or heavy snow							ceiling $< 200ft$	
snow fall rate $\geq 3cm/3h$ when wind direction $250\sim 110^\circ$							ceiling $< 200ft$	
BLUE	TS in TAF but CB doesn't exist in the aerodrome							the proportion occupied with CB (top $\geq FL300$ ) in the sector $\geq 10\%$
						wind speed $\geq 20kt$ with snow	ceiling $< 200ft$	

Figure 2. ATMet category forecast criteria



**Figure 3. Continuous improvement of criteria**