

Japan

1. ATM-tailored MET information and Services

1.1 ATMetC, TMAT, NCAT (Figure 1)

The Japan Civil Aviation Bureau (JCAB) established the Air Traffic Management Center (ATMC) in Fukuoka in 2005 as a core organization for ATM in Fukuoka FIR. In line with ICAO's global concept for ATM, ATMC facilitates safe and efficient flight operation through ATM 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, and started their operation in 2006. ATMetC forecasters work in the same operation room as ATM officers to directly provide weather information and briefings tailored to ATM officers' needs. ATMetC preparations were carried out over a period of three years (see MET/ATM Seminar 2013 IP/3).

For tactical and flexible ATFM to deal with increased air traffic, JCAB subsequently organized Traffic Management Units (TMUs) operating as ATMC branches – two in the Tokyo metropolitan area and one at New Chitose airport (a local major hub where aircraft operation is significantly affected by snowstorm). To support TMU operation with detailed ATM-tailored meteorological information on related airports and air space, JMA organized two teams operating as branches of ATMetC – the Tokyo Metropolitan Area Team (TMAT) at Tokyo International airport and New Chitose Area Team (NCAT) – in different offices at the same location to operate as TMUs. (See MET/R WG/5 IP/10, MET/R WG/8 IP/18).

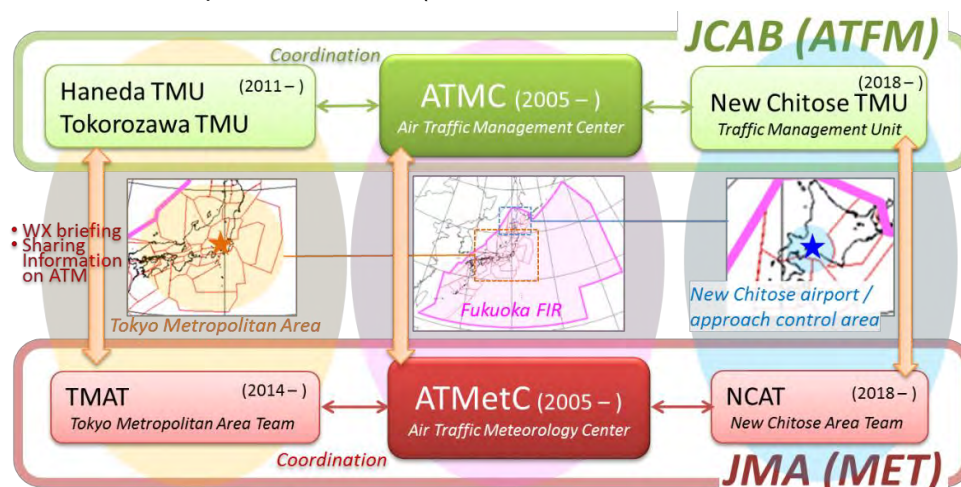


Figure 1 MET organization and target areas for supporting ATM in Japan

MET information and services specifically tailored for ATM requirements are as follows.

1.2 CDM conferences

Daily online ATMC conferences held at 0620 and 2345 UTC for collaborative decision making (CDM) are attended by ATM, ATC and airline officers, with an ATMetC officer providing MET information targeted at Fukuoka FIR and neighboring FIRs. TMAT and NCAT officers in attendance also contribute MET information. Additional conferences are also held as necessary except midnight.

1.3 Briefings (regular/extra)

ATMetC, TMAT and NCAT officers provide weather briefings to ATM officers based on the ATMC and TMU areas of responsibility (e.g., the Fukuoka FIR for ATMetC, Tokyo ACC areas of responsibility and Tokyo approach control area for TMAT) as detailed in Section 2. Briefings are provided regularly before ATM officers start work or before traffic

congestion begins (e.g., 4 times/day by TMAT), with additional briefings as necessary in line with changing weather conditions.

1.4 Wx Bulletins (Figure 2)

TMAT and NCAT provide at-a-glance meteorological information for ATM officers during work shifts and periods of traffic congestion. The bulletins contain brief comments on phenomena expected to affect air traffic flow and imagery highlighting weather conditions and forecasts for the next 6 hours (see MET/R WG/5 IP/10, MET/R WG/8 IP/18 and MET/R WG/9 IP/1)

1.5 Impact-based category forecasts for supporting ATM

ATMetC and TMAT provide sequential category forecasts indicating expected impacts of weather conditions on air traffic flow in color-coded categories.

Forecasts are issued hourly outside the nighttime hours of 14 to 16 UTC when air traffic volumes are low. The forecast period of up to six hours supports ATM officers with ATFM operations.

Target weather phenomena are followings:

- Airports: Thunderstorm, Visibility, Ceiling, Wind, etc.
- Approach control area: CBs, Convective clouds and Wind
- ATC sectors: CBs, Convective clouds

Product specifications are outlined below.

1.5.1 ATMet Category Forecast (Air Traffic Meteorological Category Forecast)

(Figure 3)

- Target areas: major airports and ATC sectors in Japan
- Contents: the potential for meteorological impact on air traffic flow with four color-coded categories (red, yellow, blue and white)
- Temporal resolution: 1 hour
(see MET/ATM Seminar 2011 WP/9*)

1.5.2 ATM CIEL (ATM Categorized Impact of weather Elements prediction) (Figure 4)

- Target areas: Tokyo/Narita international airport, Tokyo approach control area and ATC sectors around the Tokyo metropolitan area

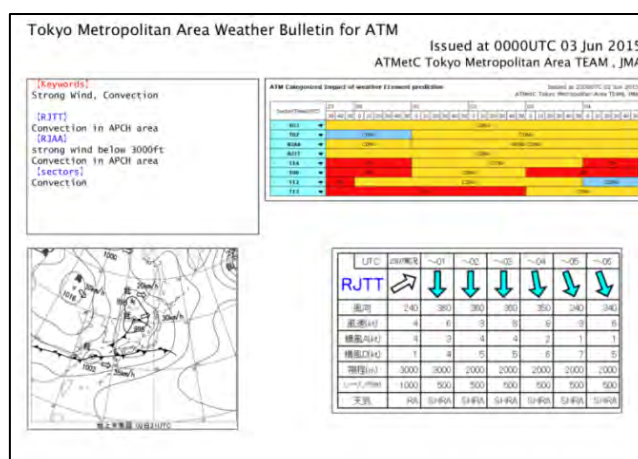


Figure 2 WX Bulletin



Figure 3 ATMet Category Forecast



Figure 4 ATM CIEL

- Contents: level of expected impact of significant weather on ATC operations
 - ✧ High : Need to reduce capacity value (CAPA) significantly
 - ✧ Medium : Need to reduce CAPA
 - ✧ Slight : Need to reduce CAPA slightly
 - ✧ None : Not need to reduce CAPA
- Temporal resolution: 10 minutes to 1 hour
(see MET/ATM Seminar 2015 IP/7*)

1.5.3 ECLAIR (Estimated convective Cloud impact on AIR-routes) (Figure 5)

The ECLAIR provides route-based information. It is semi-automated NWP-based product incorporates the level of expected impact of convective cloud forecasted in ATM CIEL which is manually produced by TMAT forecasters (see MET/R WG/9 IP/1). Product specifications are as follows:

- Target air routes: main RJTT/RJAA arrival/departure routes
- Content: levels of expected impact of convective cloud on individual air routes with more precise categorization than ATM CIEL
- Issuance: hourly (except 14 - 16 UTC)
- Forecast period: up to 6 hours (temporal resolution: 10 minutes to 1 hour)

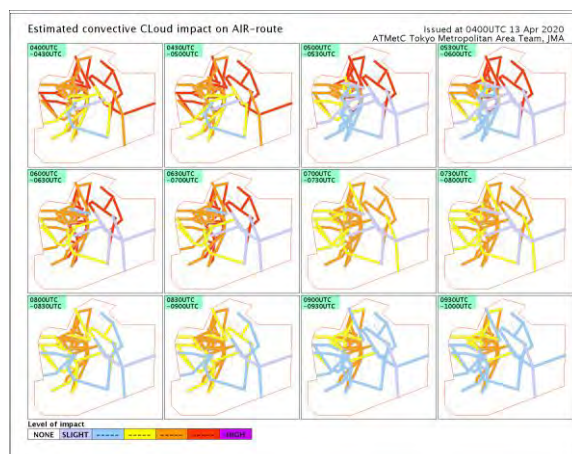


Figure 5 ECLAIR

1.6 Other information

JMA automatically provides the following information in addition to the OPMET data via ATMets described in Section 2.1.

- Analysis and hourly forecasts of upper-wind speed/direction on major air-routes (updated hourly; figure 6)
- Observation data including weather radar (three-dimensional vertical/horizontal sectional viewing), Doppler radar for airport weather, lidar and 6-second aerodrome observations
- Seismic intensity for quakes at major airports, along with tsunami warnings where necessary (ASAP post-earthquake)
- NWP model output provided via Adverse Weather Forecast for Tokyo Metropolitan Area (see ICAO APAC MET/R WG/9 IP1)

東京から関東上空の風予想表

地点名	ALT/UTC	19日07時	19日09時	19日12時	19日15時	19日18時
河和 (KOHWA)	FL350	260 61	270 57	280 62	290 71	290 75
	FL250	270 32	280 35	280 37	290 40	290 40
逸州 (ENSYU)	FL310	260 49	270 46	270 46	280 52	280 60
	FL190	280 39	280 40	290 38	300 31	300 28
大島 (XAC)	FL230	270 42	270 39	280 36	280 32	280 33
	13000FT	290 29	290 30	290 26	300 19	330 20
館山 (UTIBO)	10000FT	300 25	300 23	290 18	300 19	330 20
	5000FT	030 04	360 05	290 04	260 05	280 12
木更津 (KZT)	10000FT	300 26	300 24	300 22	310 23	320 22
	5000FT	210 01	340 05	020 02	240 08	270 17
羽田 RJTT	SFC	180 08	190 10	200 06	240 04	300 05

Figure 6 Upper-wind analysis/forecast

2. Means of Information and Service Provision

ATMetC and NCAT provide information and services via direct interaction, as ATMetC and NCAT officers work in close proximity to ATM officers. (i.e. ATMetC officers share the operations room with ATM officers, and NCAT officers are able to visit ATM officers' operation room.) TMAT provides information via telephone and TV conferencing due to limited proximity. The JMA systems outlined below also allow sharing of MET information to support ATM.

2.1 ATMetS

The ATMetS information sharing system for ATM officers provides the products described in Section 1 via terminals on each ATM officer's desk.

2.2 MetAir

The MetAir weather information system allows not only ATM officers but also aviation users to obtain MET products for airspace and aerodrome on a real time basis. Airlines can receive them through MetAir.

2.3 Web chat system

To support the need for prompt decision making in ATM within terminal areas, speedy and appropriate information sharing is necessary even if ATM and MET officers are unable to share their operations room. For weather briefing services in particular, TMAT and NCAT coordinate with TMUs as needed via online chat for live interaction in addition to video conferencing and telephone communication. As text information remains in the chat tool, TMU officers can reaffirm the contents of briefings at any time. Also, graphical information can be posted on the tool (Figure 7). This function helps TMU officers to easily understand the weather condition which is sometimes difficult to grasp only by the explanation on the telephone.

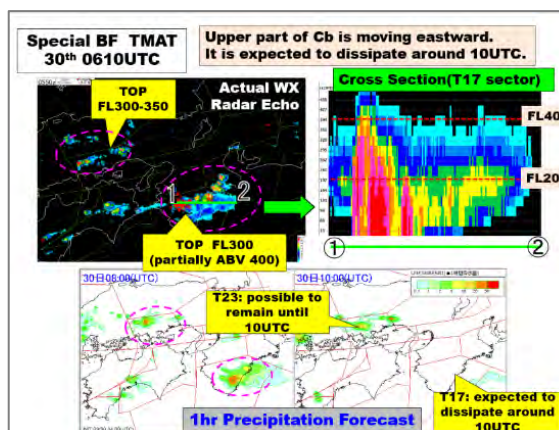


Figure 7 Graphical info on online chat tool

3. Continuous improvement of services

3.1 Verification

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

- Investigation of impacts on ATM in previous significant cases;
- Confirmation of operational rules and conditions with reference to aircraft operation manuals and flight operations manuals; and
- 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).

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.

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

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 (Figure 8).

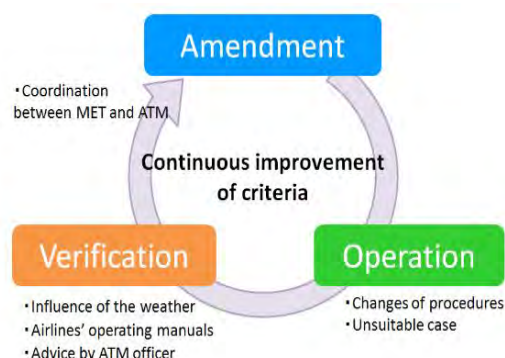


Figure 8 Continuous improvement of criteria
 (As of October 2021)

* The product specifications have been updated from those described in this paper.