

International Civil Aviation Organization

ICAO

**NINTH MEETING OF THE ASIA AND PACIFIC
METEOROLOGICAL REQUIREMENTS WORKING
GROUP (MET/R WG/9)**

Web-conference, 07 May 2020 and 11 – 14 May 2020

Agenda Item 4: MET information required to support end-user systems**DEVELOPMENT OF METEOROLOGICAL PRODUCTS
FOR NEW ATC OPERATION IN THE TOKYO APPROACH CONTROL AREA**

(Presented by Japan)

SUMMARY

This paper presents new ATM-tailored meteorological products developed and provided by the Tokyo Metropolitan Area Team (TMAT) of the Japan Meteorological Agency (JMA). These are designed to support ATFM operation by the Traffic Management Units (TMUs) to deal with the new ATC operations launched in the Tokyo Approach Control Area during the 2019 –2020 season.

1. INTRODUCTION

1.1 The Japan Meteorological Agency (JMA) established the Tokyo Metropolitan Area Team (TMAT) as a branch of the Air Traffic Meteorology Center (ATMetC) in 2014. TMAT provides ATM-tailored meteorological information and detailed briefings to two Traffic Management Units (TMUs) of the Japan Civil Aviation Bureau (JCAB) that conduct tactical and flexible Air Traffic Flow Management (ATFM) in the Tokyo metropolitan area. One ATM-tailored product is ATM CIEL, which indicates the impacts of significant weather on ATM in the Tokyo metropolitan air space and airports via sequential forecasting in four color-coded categories. TMAT operations are detailed in MET/ATM Seminar 2015 IP/07 and MET/R WG/7 IP/4.

1.2 Due to increased air traffic volume in the Tokyo metropolitan area, JCAB increased the number of arrival/departure slots at Tokyo International Airport (RJTT) in 2020. Prior to this development, the Bureau had changed airspace configuration around the Tokyo metropolitan area, expanded the airspace of the Tokyo approach control area and added local entrance fixes, as well as launching new procedures detailed below on arrival and departure routes for RJTT and RJAA (Narita International Airport). The procedures are detailed in Appendix 1.

- Point Merge System (PMS)
- New RJTT approach/departure courses

Agenda Item 4

11-14/05/20

The new configurations and procedures were launched gradually between July 2019 and March 2020. Availability of the PMS is decided in consideration of weather conditions that significantly affect capacity management. Approach/departure course selection depends on weather conditions as well as factors such as presence of convective clouds and airport wind.

1.3 The high-precision capacity management required for these new ATC procedures and arrival/departure courses (especially for the Tokyo approach control area) necessitates highly detailed local meteorological information to support ATM, with particular importance on information regarding weather conditions along individual air routes. To meet these new ATM requirements, TMAT began providing the following ATM-tailored products for the Tokyo approach control area (which is smaller than that covered by ATM CIEL):

- Tokyo Approach Control Area Weather Bulletin for ATM
- Adverse Weather Forecast for Tokyo Metropolitan Area
- Estimated convective CLOUD impact on AIR-routes (ECLAIR)

2. NEW ATM-TAILORED METEOROLOGICAL PRODUCTS**2.1 Tokyo Approach Control Area Weather Bulletin for ATM**

2.1.1 This product (specifications: Section 1, Appendix 2) was launched by TMAT in July 2019 to provide at-a-glance information on weather phenomena expected to affect PMS, runway operation and other ATC operations in the Tokyo approach control area for periods of air traffic congestion and complex capacity management.

2.1.2 The bulletin includes description on weather phenomena that could not be presented in deterministic forecasting but may significantly impact air traffic flow, with the keyword “possible.” Sub-scenario weather forecasting adds supplementary information not covered by deterministic forecasting and supports ATM officers in prompt capacity management based on drastic changes in meteorological conditions. Such sub-scenario reporting was requested by ATM officers because air traffic is now more prone to changes in weather conditions due to complex ATC operations and increased air traffic volumes.

2.2 Adverse Weather Forecast for Tokyo Metropolitan Area

2.2.1 This product (specifications: Section 2, Appendix 2) was launched by TMAT in October 2019 to provide graphical representations of weather in the Tokyo approach control area and clarify conditions sequentially and spatially, including the presence of convective clouds, which influences PMS and setting of arrival routes, and wind speed/direction, which affect aircraft separation and runway operations.

2.2.2 Graphics are automatically generated from JMA’s high-resolution numerical weather prediction (NWP) model, LFM, enabling TMAT to provide temporally and sequentially detailed information that is difficult to create manually.

2.2.3 This online product is updated every hour, providing ATM officers with up-to-date forecast information (expressed simply as keywords in Tokyo Approach Control Area Weather Bulletin for ATM) for appropriate update of ATC capacity that they assumed. Fan-shaped PMS routes can be overlaid with weather graphics, and users can specify the display for the desired vertical level and forecast period. These functions are based on requests from ATM officers.

2.3 Estimated convective CCloud impact on AIR-routes (ECLAIR)

2.3.1 The ECLAIR is route-based information (specifications: Section 3, Appendix 2) launched by TMAT in March 2020, categorizing the impacts of convective clouds on air traffic for individual arrival/departure routes in color-coded form. This semi-automated LFM-based product incorporates forecasting decisions in consideration of ATM CIEL convective cloud forecasts manually produced by TMAT forecasters. As with Adverse Weather Forecasts for the Tokyo Metropolitan Area, ECLAIR provide precise information that is difficult to produce manually, and inaccurate NWP forecasts can be corrected with reference to ATM CIEL data. ECLAIR information helps ATM officers understand the air-traffic impacts of weather conditions more in detail than with ATM CIEL.

2.3.2 ECLAIR was developed in response to requests from ATM officers requiring information on how weather conditions affect individual air routes. ATC capacity depends on selection and coordination of arrival routes, and ATC capacity for arriving aircraft is affected by a reduction in the number of departing aircraft when the use of departure route is constrained by adverse weather in the situation of congested air traffic.

2.3.3 Impact level categorization in ECLAIR is more precise than that of ATM CIEL, because ECLAIR is depending more on NWP. NWP prediction errors impair impact level identification with an effect inversely proportional to the number of categories and can cause ATM officers' misunderstanding of the weather situation. To reduce adverse influence from NWP errors, ECLAIR has basically two categories for each ATM CIEL category.

2.4 All of the above three products are provided online via a meteorological information sharing system designed for support for ATM officers. TMAT forecasters can provide ATM officers with supplementary comments on inaccuracies in automatically processed NWP-based products via weather briefings.

2.5 In the development of these products, TMAT collected information on new ATC procedures and related requirements for meteorological information from ATM officers, and spent more than a year planning and developing content in association with ATM officers. TMAT plans ongoing product improvement based on changes in ATC operations and feedback from ATM officers who operationally use the information provided.

3. SUMMARY

3.1 TMAT launched new products to support ATM in line with the new ATC procedures.

3.2 TMAT provides detailed information indicating the impacts of weather on individual approach/departure routes via ECLAIR. This is an NWP-based automated product adjusted by other manually processed products that compensates for weaknesses in NWP forecasting.

3.3 As ATC procedures become more complex and air traffic volumes grow, information on weather phenomena that could not be presented in deterministic forecasting but may greatly impact air traffic is required.

Agenda Item 4

11-14/05/20

3.4 ATC operation will continue to be advanced, as air traffic volume increases. This TMAT's development of new products indicates that it is important for MET officers to identify requirements of ATM officers and strive to improve meteorological service methods and information to support ATM operation.

4. ACTION BY THE MEETING

4.1 Note the information contained in this paper.

Appendix 1. New ATC procedures

- Point Merge System (PMS)
 Fan-shaped routes toward a merge point are set for individual arrival routes (Figure 1).
 PMS facilitates ATC operations, such as aircraft separation.

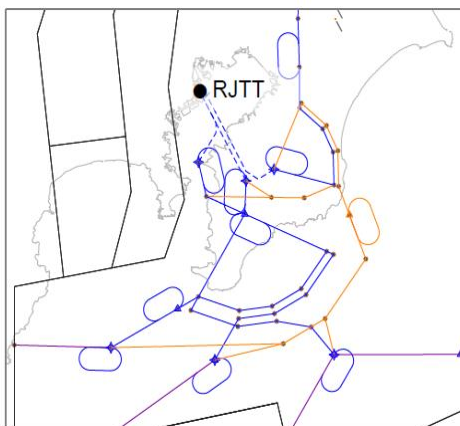


Figure 1. RJTT Point Merge System

- New RJTT approach/departure courses
 A JCAB review of runway/air route usage and setting of special approach/departure courses for periods when airspace around RJTT is congested (Figure 2) improved the flexibility/efficiency of runway operations and optimized ATC capacity.

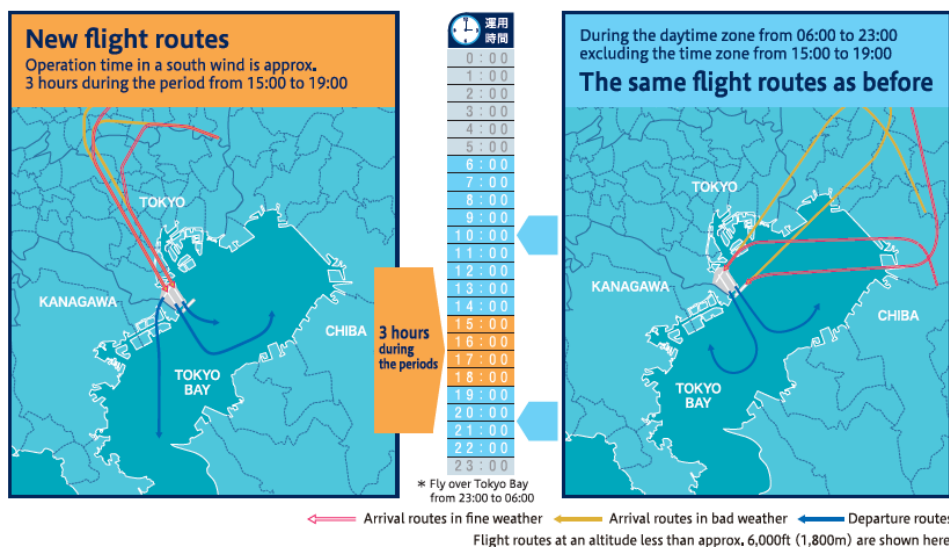


Figure 2. Example of new approach/departure courses (south wind operation)

Appendix 2. TMAAT product specifications

1. Tokyo Approach Control Area Weather Bulletin for ATM

Target areas: Tokyo approach control area, Tokyo/Narita International Airport (RJTT/RJAA)
 Content: Brief keyword comments on weather phenomena expected to affect air traffic flow, imagery highlighting weather conditions and forecasts
 Convective clouds around the merge point on approach routes for RJTT/RJAA, speed/direction of winds affecting runway operation
 Issuance: 21, 03 and 06 UTC; amended as necessary
 Validity: 6 hours

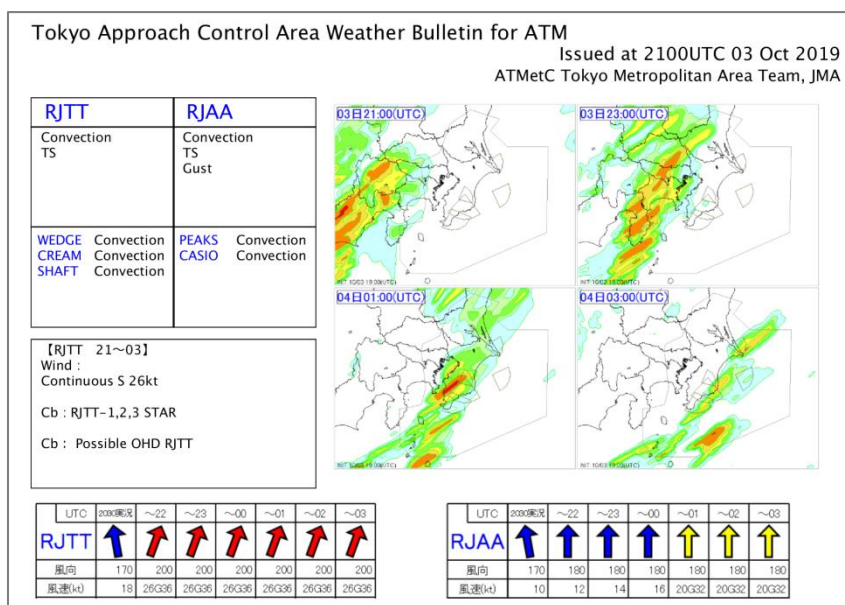


Figure. Tokyo Approach Control Area Weather Bulletin for ATM

2. Adverse Weather Forecast for Tokyo Metropolitan Area

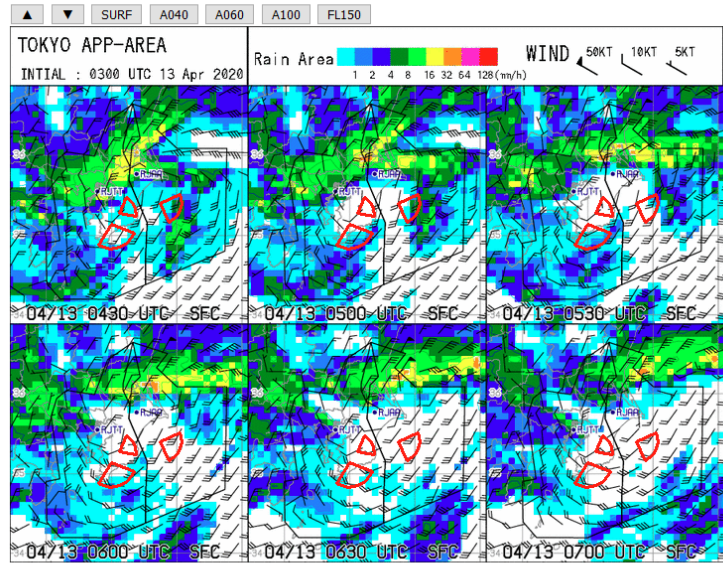
Target areas: Tokyo approach control area, RJTT, RJAA
 Content: precipitation and surface/upper wind in the Tokyo approach control area, wind in vertical sections along arrival routes, airport surface wind with 10-minute resolution
 Issuance: hourly
 Forecast period: up to 3 hours

Adverse Weather Forecast for Tokyo Metropolitan Area (首都圏悪天予想)

- Horizontal Distribution
- Vertical Cross Section
- Time Sequence

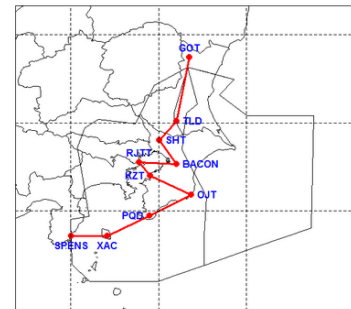
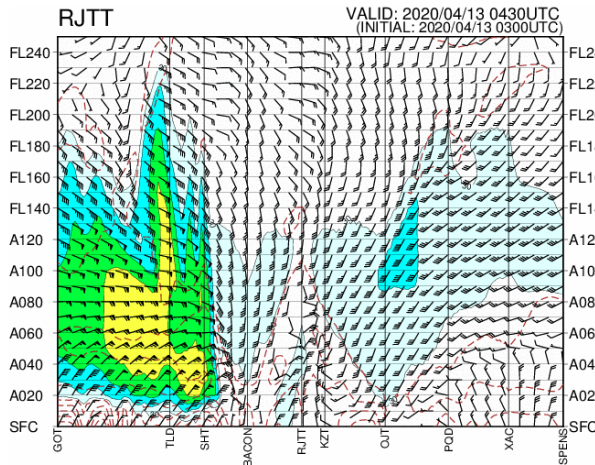
Horizontal Distribution (平面図) [Top \(トップ\)](#)

Altitude (高度)



Vertical Cross Section (鉛直断面図) [Top \(トップ\)](#)

Route (経路): Forecast Time (予想時間:分):



Aerodrome Time Sequence (時系列図) [Top \(トップ\)](#)

RJTT VALID (UTC)	0300	0310	0320	0330	0340	0350	0400	0410	0420	0430	0440	0450	0500	0510	0520	0530	0540	0550	0600
WIND DIRECTION	360	6	8	0	349	350	351	352	350	347	344	342	341	339	337	337	339	338	336
WIND SPEED (KT)	19.3	19.2	20.1	20.4	20.1	18.1	14.9	11.9	11.2	12.9	14.2	15.0	15.5	15.1	13.9	13.2	13.0	12.7	13.1
CRGS / PARALLEL RunwayA,C	9.6 / 16.8	11.3 / 15.5	12.5 / 15.7	10.2 / 17.6	6.5 / 19.1	6.1 / 17.1	5.5 / 13.8	4.4 / 11.0	3.8 / 10.6	3.8 / 12.3	3.4 / 13.8	3.2 / 14.6	3.1 / 15.2	2.3 / 14.9	1.6 / 13.8	1.7 / 13.1	2.1 / 12.8	1.8 / 12.6	1.3 / 13.0
CRGS / PARALLEL RunwayD	13.2 / 14.1	11.4 / 15.4	11.3 / 16.6	13.8 / 15.0	16.3 / 11.8	14.5 / 10.9	11.6 / 9.3	9.2 / 7.5	9.0 / 6.8	10.6 / 7.3	12.2 / 7.4	13.0 / 7.4	13.6 / 7.5	13.5 / 6.6	12.7 / 5.7	11.9 / 5.5	11.6 / 5.9	11.5 / 5.4	12.0 / 5.1
RJAA VALID (UTC)	0300	0310	0320	0330	0340	0350	0400	0410	0420	0430	0440	0450	0500	0510	0520	0530	0540	0550	0600
WIND DIRECTION	47	51	53	58	79	95	89	103	108	112	114	115	114	148	202	230	241	257	284
WIND SPEED (KT)	13.9	12.9	13.7	12.9	12.8	18.2	17.1	14.4	10.4	6.6	4.3	2.8	1.9	1.5	2.4	4.1	4.7	4.8	5.8
CRGS / PARALLEL RunwayA,B	13.5 / 2.9	12.8 / 2.0	13.6 / 1.5	12.9 / 0.3	12.1 / 4.3	14.7 / 10.6	14.9 / 8.5	10.4 / 9.9	6.9 / 7.8	4.0 / 5.2	2.5 / 3.5	1.5 / 2.3	1.1 / 1.6	0.0 / 1.5	1.9 / 1.5	4.0 / 0.7	4.7 / 0.2	4.6 / 1.5	4.1 / 4.0

INITIAL : 0300 UTC 13 Apr 2020 WIND <-5KT- <-10KT- <-20KT- <-25KT- <

Figure. Adverse Weather Forecasts for the Tokyo Metropolitan Area

Agenda Item 4

11-14/05/20

3. Estimated convective CLOUD impact on AIR-routes (ECLAIR)

Target air routes: main RJTT/RJAA arrival/departure routes

Content: levels of expected impact from convective clouds on individual air routes with 10-minute resolution

Issuance: hourly (except 14 - 16 UTC)

Forecast period: up to 6 hours

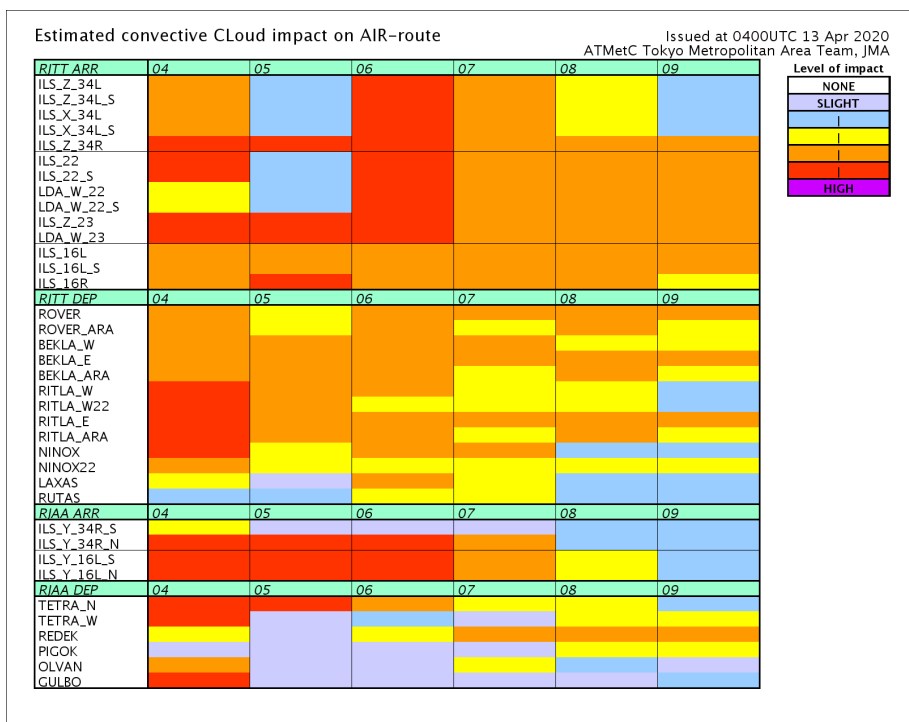
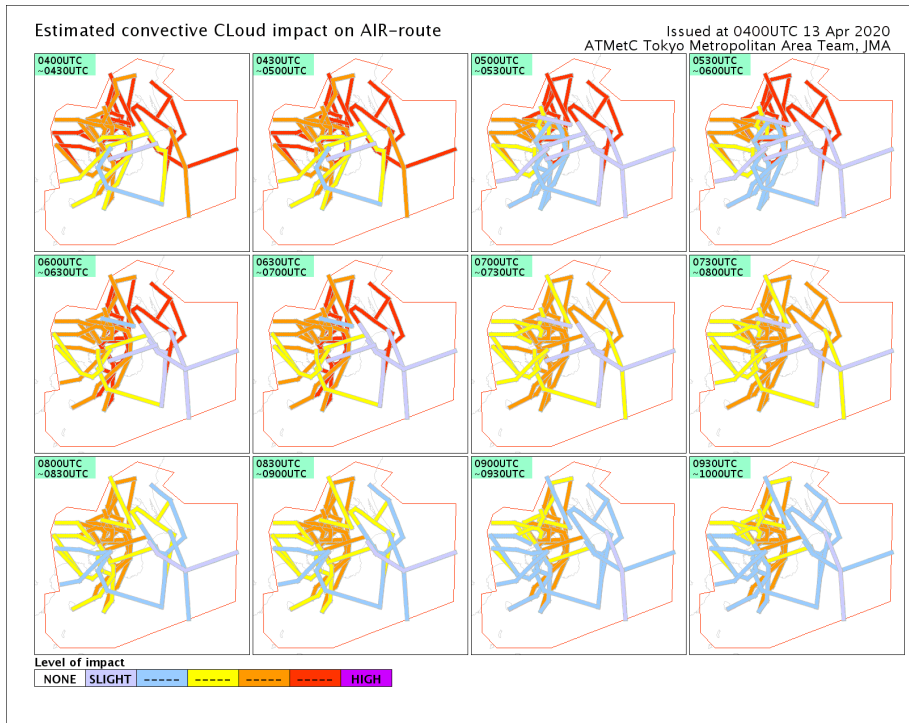


Figure. ECLAIR (top: map format; bottom: tabular format)