SP/04

# Impact-based meteorological information to support ATM operation

Japan Civil Aviation Bureau
Japan Meteorological Agency

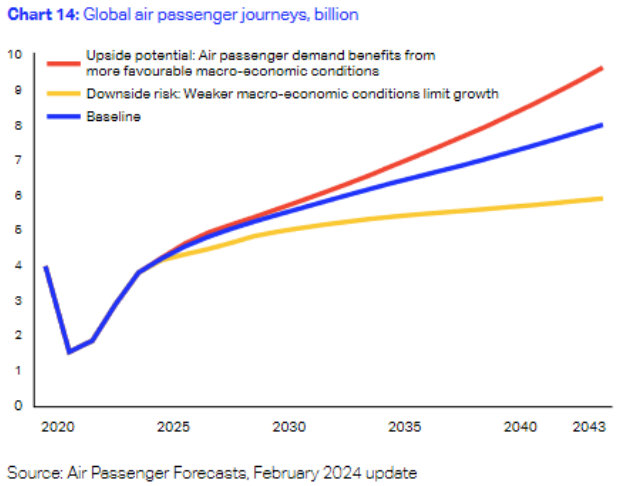
ICAO APAC MET/ATM Seminar

28 April 2025

# Contents

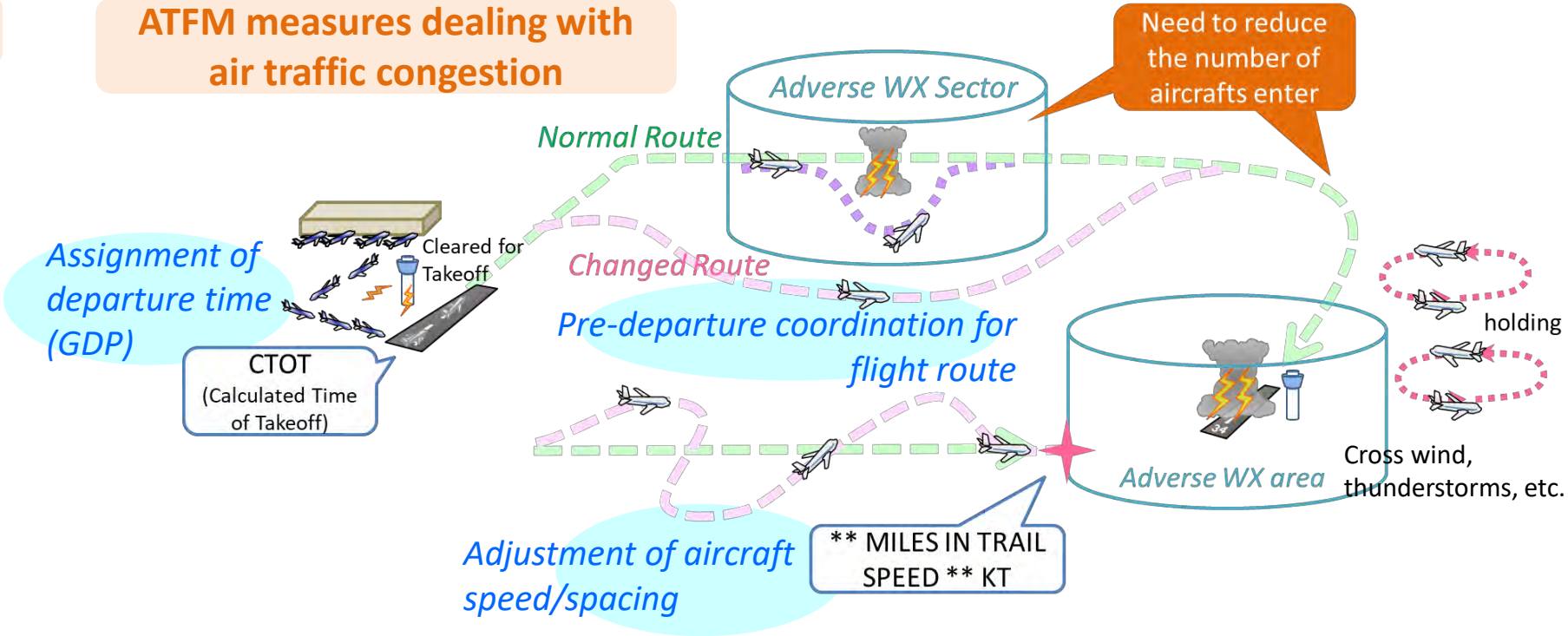
# Drivers of ATM-tailored MET services provision

## Growing demand on air traffic

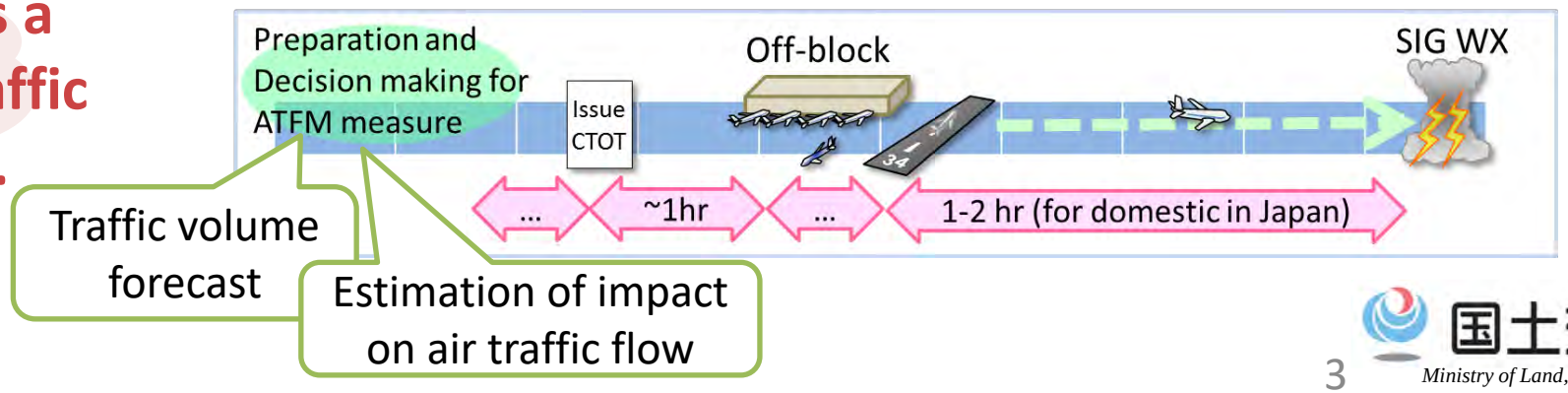



Global Outlook for Air Transport (IATA 2023)

## ATFM measures dealing with air traffic congestion

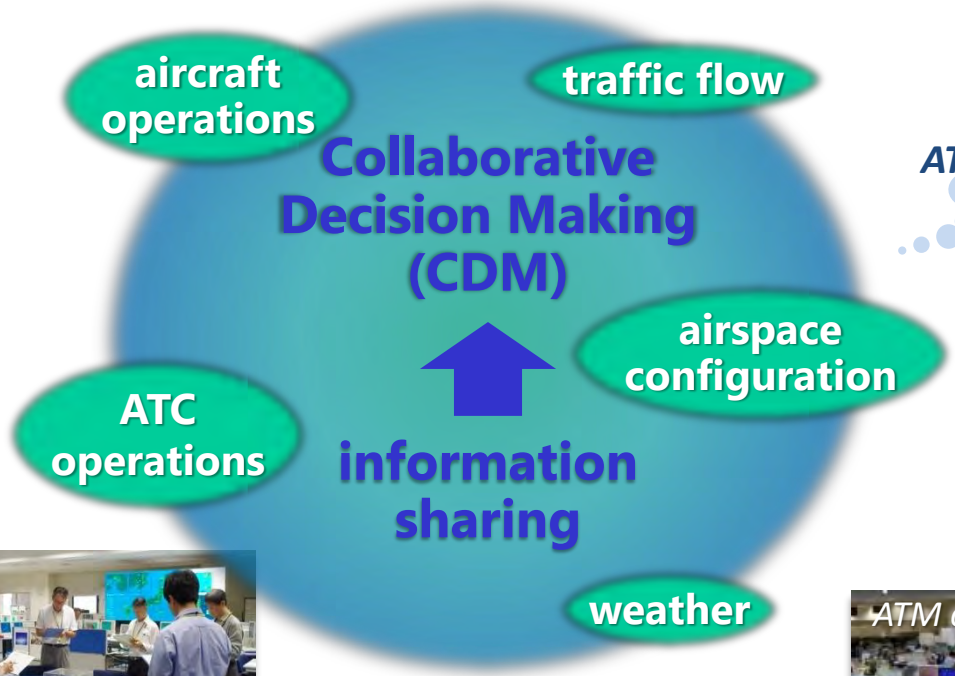



**Meteorological condition is a major factor which affect traffic flow forecast uncertainty.**



# MET services to support ATM in Japan

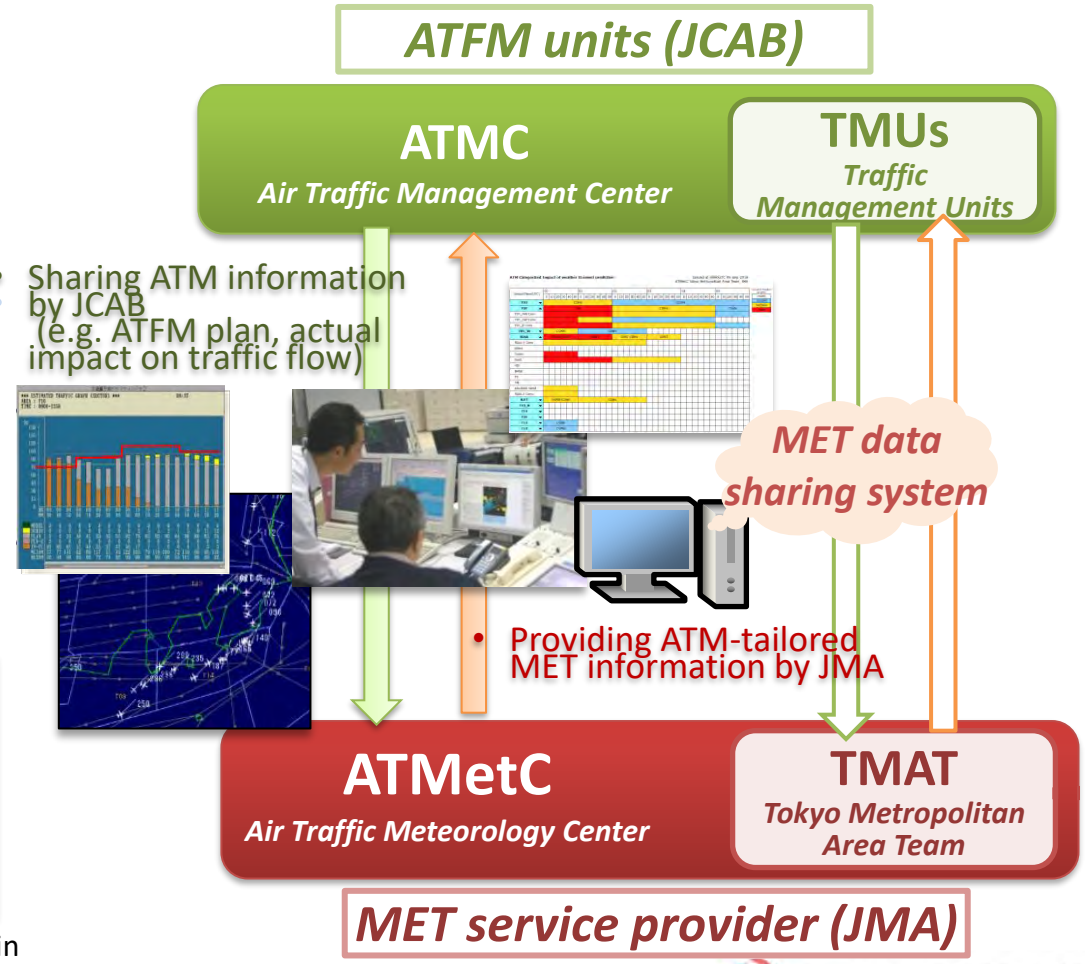
## Contribution to the CDM for ATM decision making




Regular CDM meeting


ATMetC forecasters are stationed in the ATMC operation room.

## Dedicated MET services for ATFM units

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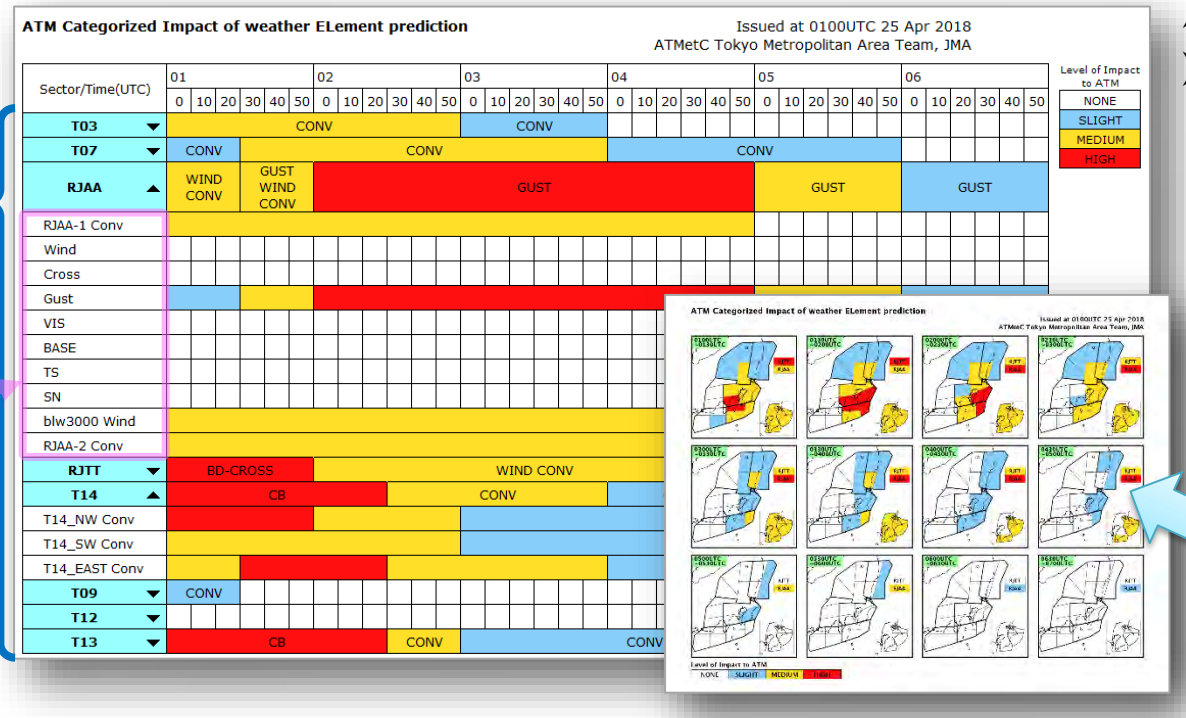
# Impact based MET information to support ATM decision making on capacity management

ATM CIEL (ATM Categorized Impact of weather Element prediction)




ATC sectors & airports

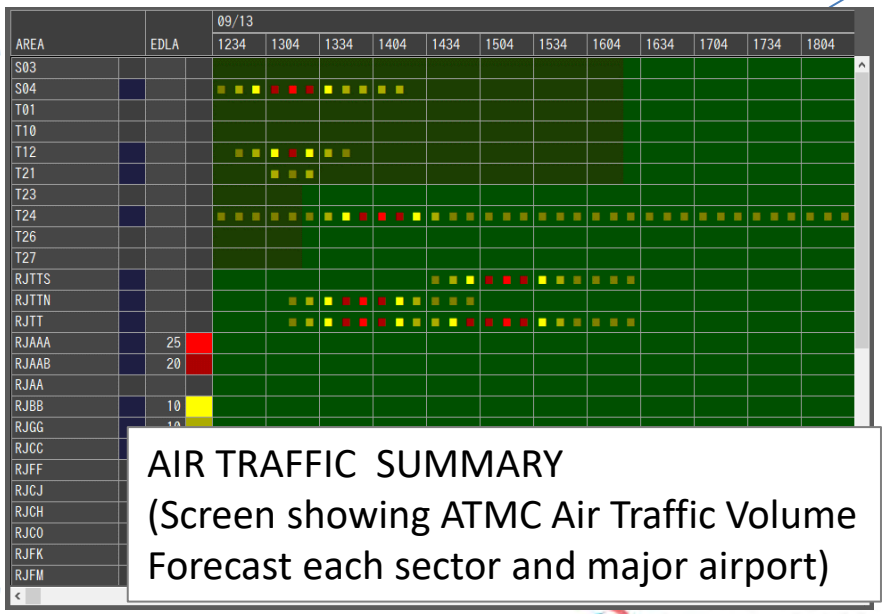
- Phenomena
- Sub-sectors of approach control area

**Level of expected impact on ATM (capacity reduction)**

| | |
|---|---|
| **High** | **Need to *reduce Capacity* significantly** |
| **Medium** | **Need to *reduce Capacity*** |
| **Slight** | **Need to *reduce Capacity* slightly** |
| **None** | **Not need to *reduce Capacity*** |

- Forecast for next 6 hours in 10-min resolution
- Target phenomena:
  - **ATC sectors:** Convective clouds including CBs, other types of clouds that affect air traffic flow
  - **Approach control areas:** CBs, Convective clouds and Wind
  - **Airports:** Thunderstorms, Visibility, Ceiling, Wind, etc.

Time




ATC sectors & airports

AIR TRAFFIC SUMMARY
(Screen showing ATMC Air Traffic Volume Forecast each sector and major airport)



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# 2. Translation from meteorological condition to impact on ATM

- Criteria for the Categories – ATM CIEL

Criteria are set for each airport and its Approach Control Area, as weather conditions that affect ATM depend on characteristics of local meteorological condition, airspace and runway configurations, etc.

Airports

Approach Control Area

ATC Sectors

**The criteria for ATM Categorized Impact of weather ELement prediction (ATM CIEL)**

As of 19th JUL 2025

| Target area | Elements | Abbreviations | Color code SLIGHT | MEDIUM | HIGH |
|---|---|---|---|---|---|
| RJTT<br>A RWY 34L-16R (3000m)<br>B RWY 04-22 (2500m)<br>C RWY 34R-16L (3360m)<br>D RWY 05-23 (2500m) | Change of wind direction | WIND-CHG | | Sudden changes in wind direction from south to north | |
| | Wind speed | WIND | | | ≧ 40kt |
| | Crosswind component of Wind speeds to runway | AC-CROSS or BD-CROSS | | ≧ 29kt | ≧ 33kt |
| | Crosswind component of Wind speeds to runway with moderate or heavy precipitation | | | | ≧ 25kt<br>for non-grooved runway ≧ 20kt |
| | Crosswind component of Wind speeds to runway | D-CROSS (for DEP only) | | ≧ 29kt | |
| | Crosswind component of Wind speeds to runway with moderate or heavy precipitation | | | ≧ 25kt<br>for non-grooved runway ≧ 20kt | |
| | Visibility | VIS | < 2000m with FG , DZ or BR without precipitation | | < 550m |
| | Cloud Base | BASE | SCT < 200ft | | BKN or OVC < 200ft |
| | Thunderstorm | TS | | TS | TS OHD |
| | Snow | SN | | wet snow (snow cover) | heavy wet snow fall |
| Tokyo Approach Control Area RJTT Sector | Wind speed below 5000ft | WIND | | ≧ 50kt | |
| | Convective clouds | CONV | out of STARs | on STARs | |
| RJAA<br>A RWY 34L-16R (4000m)<br>B RWY 34R-16L (2500m) | Wind speed | WIND | | | ≧ 40kt |
| | Crosswind component of Wind speeds to runway | CROSS | | ≧ 29kt | ≧ 33kt |
| | Crosswind component of Wind speeds to runway with moderate or heavy precipitation | | | | ≧ 25kt<br>for non-grooved runway ≧ 20kt |
| | Maximum wind gust speeds when wind direction 360 - 060° or 180 - 250° | GUST | ≧25kt | ≧31kt | ≧37kt |
| | Visibility | VIS | < 2000m with FG , DZ or BR without precipitation | | < 550m |
| | Cloud Base | BASE | SCT < 250ft | | BKN or OVC < 200ft |
| | Thunderstorm | TS | | TS | TS OHD |
| | Snow | SN | | wet snow (snow cover) | heavy wet snow fall |
| Tokyo Approach Control Area RJAA Sector | Wind speed below 3000ft | WIND | | ≧ 50kt | |
| | Convective clouds | CONV | out of STARs | on STARs | |
| ATC sectors: T34, T35, T36, T38, T39, T40, T41, T42 | Coverage of significant clouds in the detection area of each ATC sector | SIG-CLD | ≧ 1% | ≧ 10% | |
| | | CB | | | ≧ 30% including CB |

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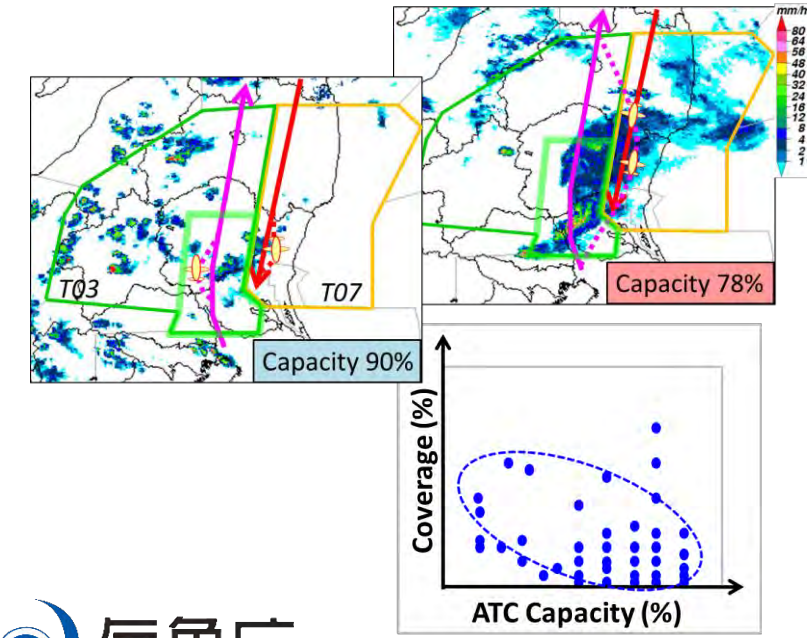
# How to translate?

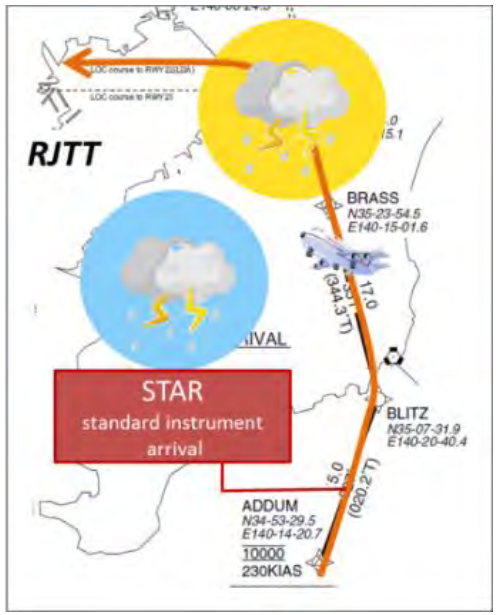
## Statistical assessment

e.g., correlation between convective clouds coverage rate in the specific airspace of ATC sector and impacts on ATC capacity



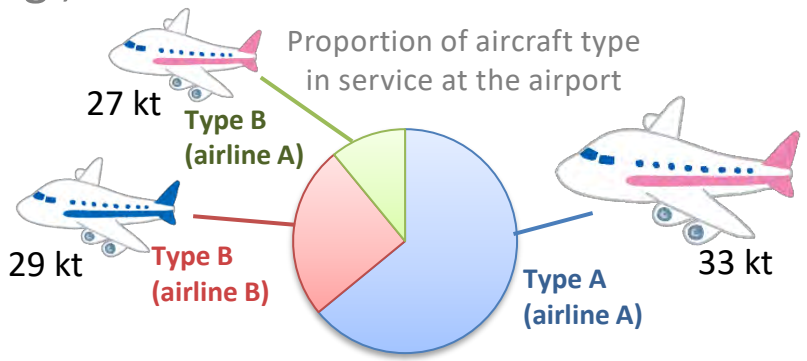

## Based on the situation that affect aircraft operations

e.g., whether convective clouds are on the arrival route or not




## Utilizing threshold of aircraft operations

e.g., cross wind limitations of aircrafts




| Level of impact | Cross wind component to the RWY (Tokyo Int'l) | |
|---|---|---|
| | Dry condition | Wet condition |
| High | 33 kt or above | 25 kt or above |
| Medium | 29 kt or above | - |
| Slight | - | - |
| None | Below 29 kt | Below 25 kt |



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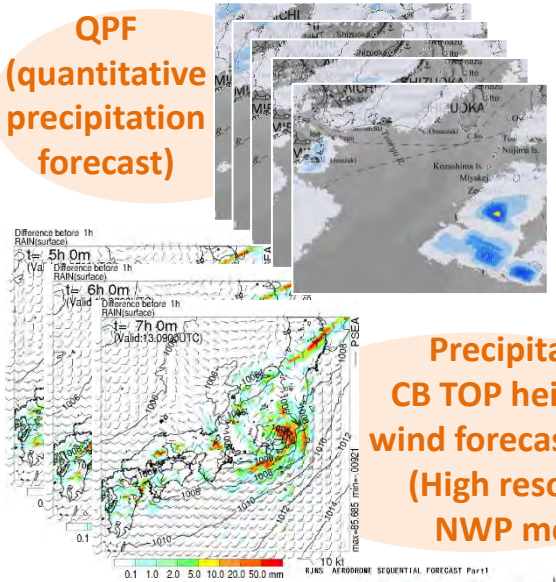
# 2. Translation from meteorological condition to impact on ATM

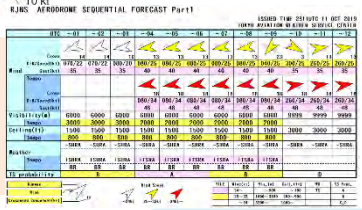
- Procedure of creating category forecast to show SIGWX impact to ATFM

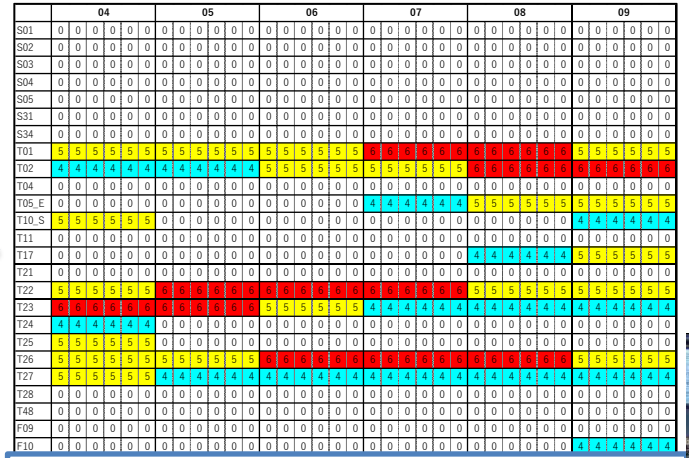
QPF (quantitative precipitation forecast)



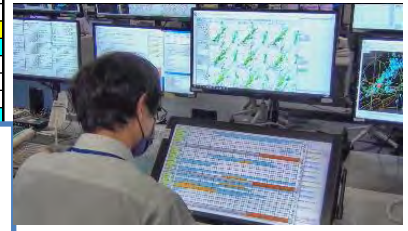
Precipitation, CB TOP height and wind forecast by LFM (High resolution NWP model)

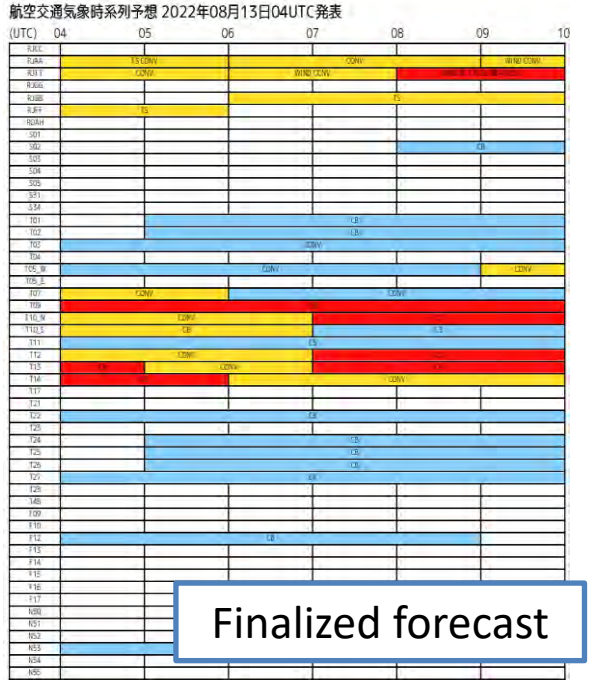
Aerodrome Sequential Forecast





Forecaster's input



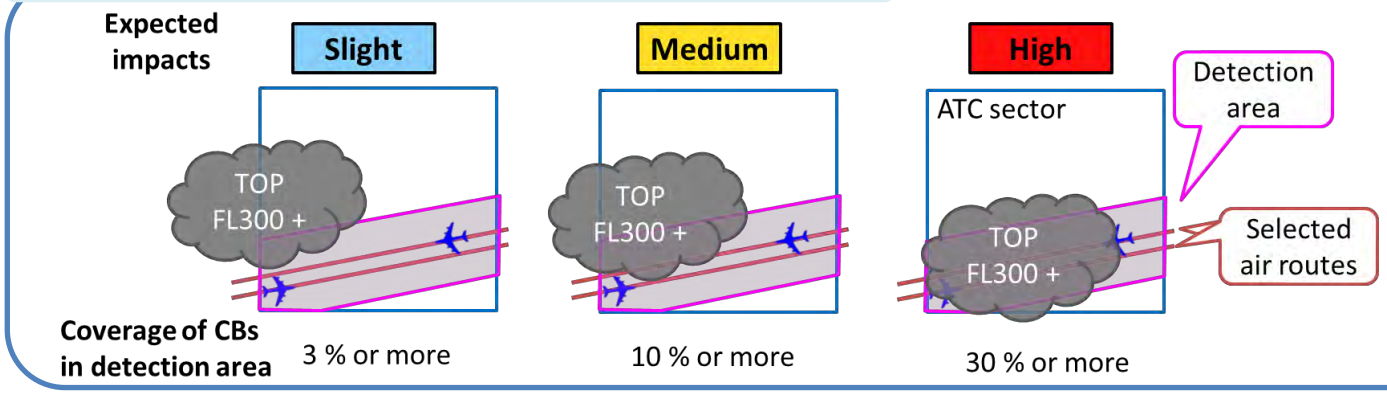



Finalized forecast

*ATMet Category Forecast*

ATM SIGWX index:
**first guess of the level of impact**
to ATC sectors, terminal areas, and airports

Criteria for categorization of estimated impact




Ref.
ICAO APAC MET/R WG/7 IP/05
ICAO APAC MET/R WG/12 IP/03, SP/12



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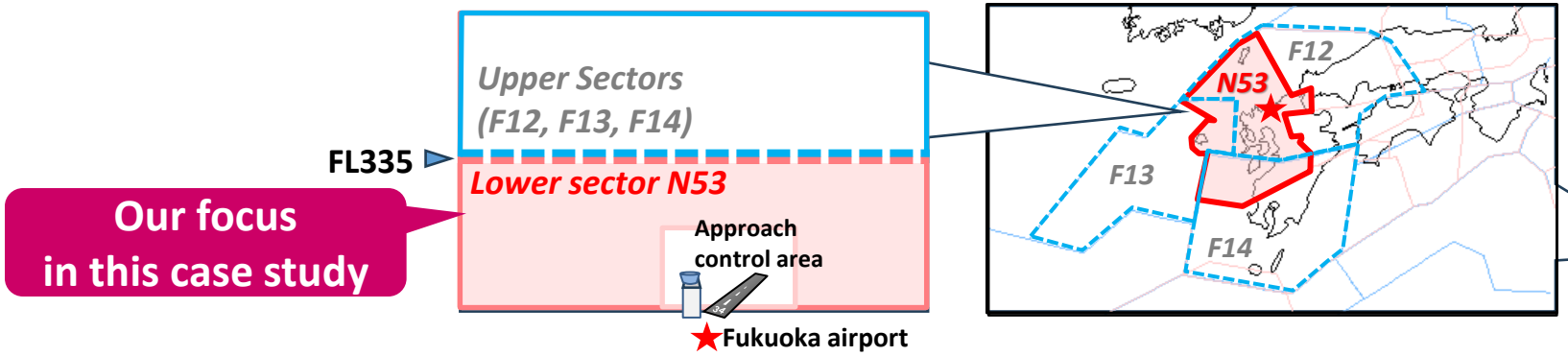
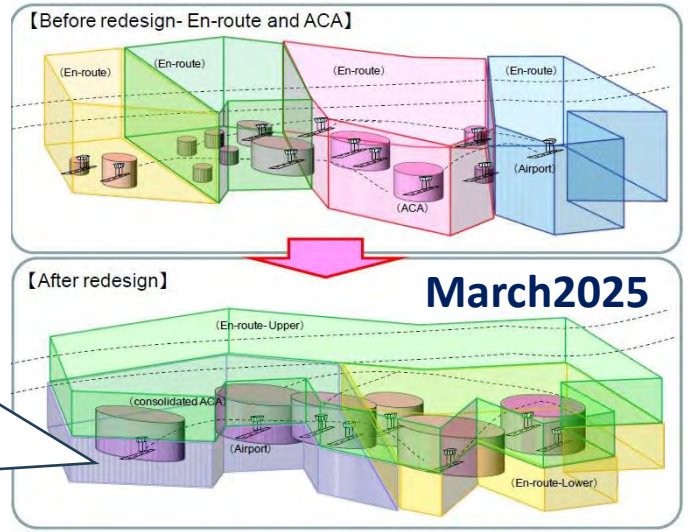
2. Translation from meteorological condition to impact on ATM
3. **Case Study: operational capacity management utilizing impact-based MET information**
   - **Stage 1. WX briefing before the ATMO on duty**
   - **Stage 2. Beginning of ATMO duty**
   - **Stage 3. Taking ATFM measures**




**Enroute airspace redesign has been completed March 2025.**

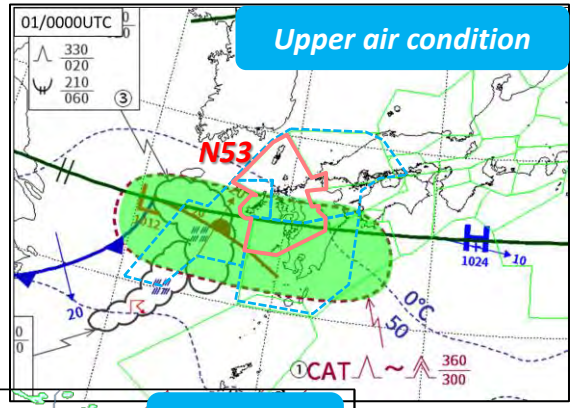


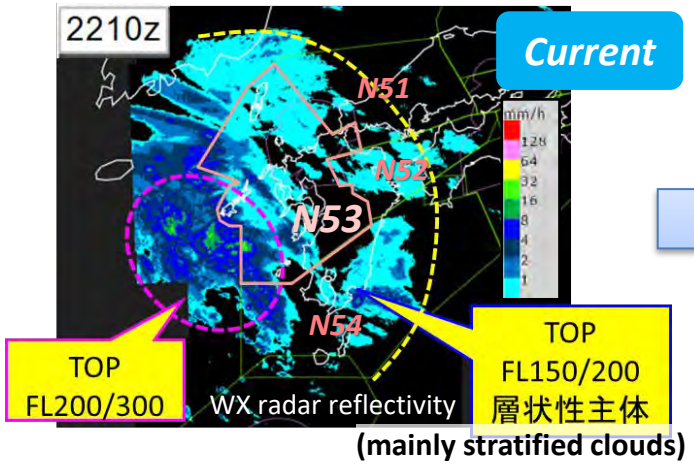
# 3. Case Study – *operational capacity management utilizing impact-based MET information*

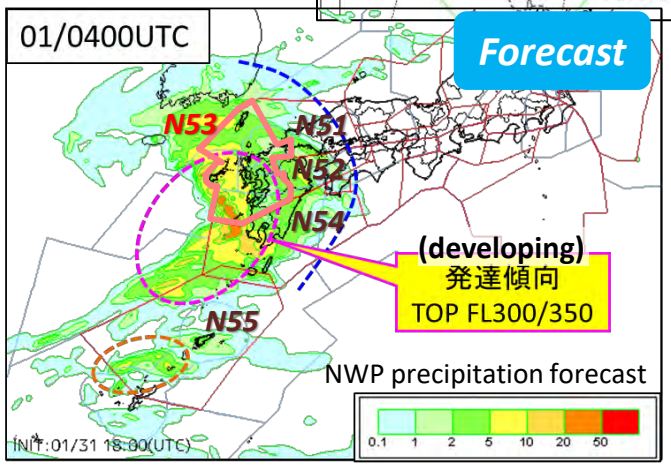
## Stage 1. WX briefing before the ATMO on duty

JMA forecasters input to ATMO about overview of current and forecast meteorological situation within their duty:

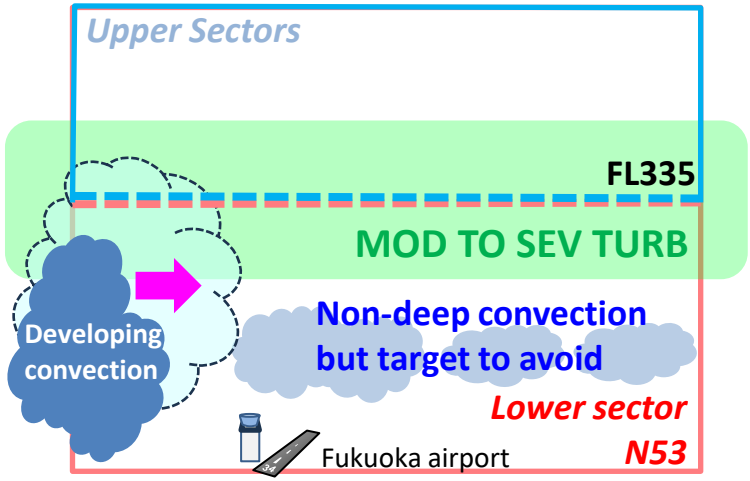
✓ SIG-CLOUDs and turbulence was estimated to impact on lower sectors' air traffic.



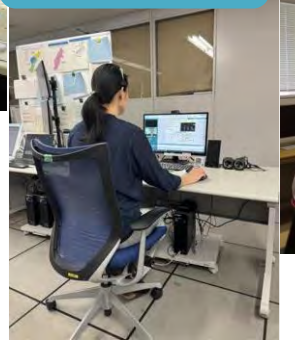

### Image of this case




✓ Developing convective clouds and non-deep convection at middle level of atmosphere was expected to be obstacles for the flights in lower altitude.

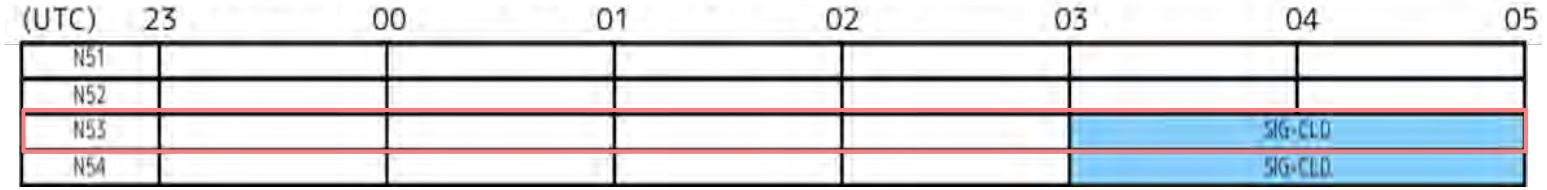
✓ Turbulence could affect aircrafts to select flight altitude.

TMAT to TMU @Tokyo



ATMetC to ATMC @Fukuoka

### ATMet Category forecast 23 UTC 31 Jan 2025 issue

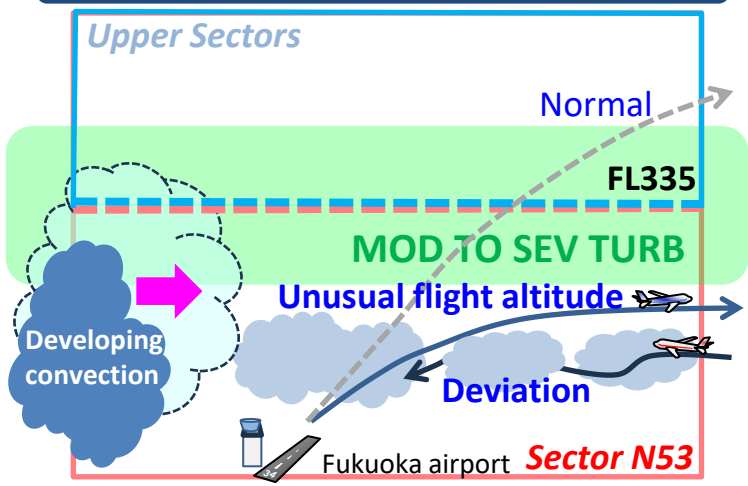



Level of impact to ATM: HIGH MEDIUM SLIGHT NONE

# 3. Case Study – *operational capacity management utilizing impact-based MET information*

## Stage 2. Beginning of ATMO duty


### Image of this case




Being aware of possible congestion and increase in ATCO workload within the lower sector N53, ATMO on duty:

- ✓ checked actual impact on ATCO operations
- ✓ adjusted the Airspace Capacity

### ATMet Category forecast 23 UTC 31 Jan 2025 issue

| (UTC) | 23 | 00 | 01 | 02 | 03 | 04 | 05 |
|---|---|---|---|---|---|---|---|
| N51 | | | | | | | |
| N52 | | | | | | | |
| N53 | | | | | SIG-CLD | | |
| N54 | | | | | SIG-CLD | | |

Level of impact to ATM: HIGH MEDIUM SLIGHT NONE

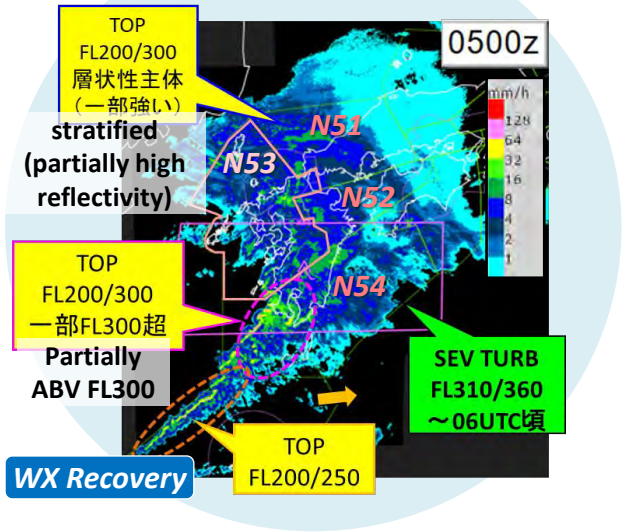
**Hourly refresh "at-a-glance information" to grasp overview of MET impact to multiple ATC sectors/airports within the target period.**

# 3. Case Study – *operational capacity management utilizing impact-based MET information*

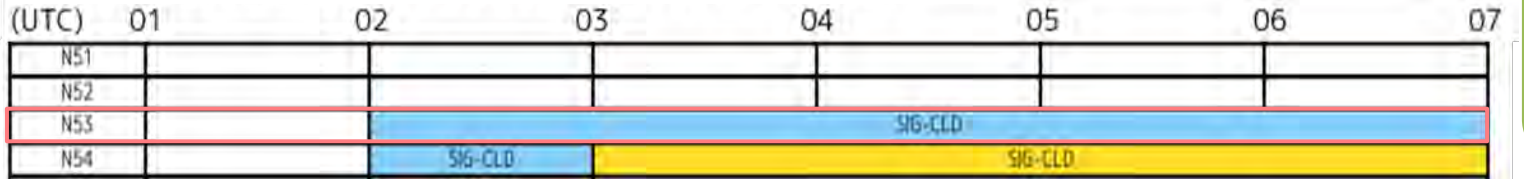
## Stage 3. Taking ATFM measures


An ATFM measure was implemented according to the adjusted airspace capacity.

### Updated MET info




### ATMet Category forecast 01 UTC 1 Feb 2025 issue



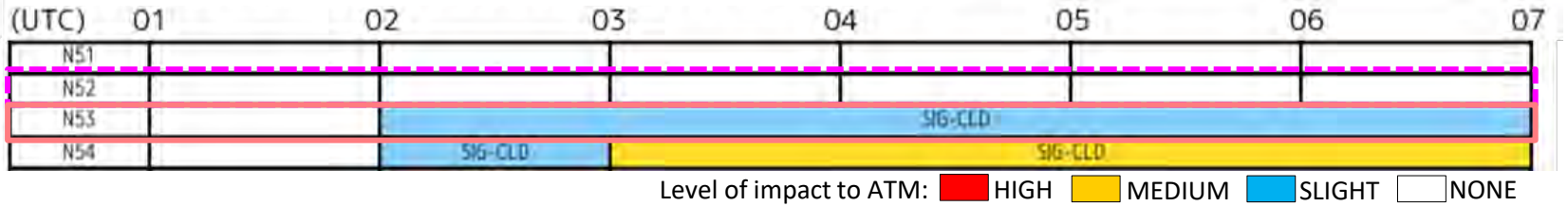

Level of impact to ATM: HIGH MEDIUM SLIGHT NONE

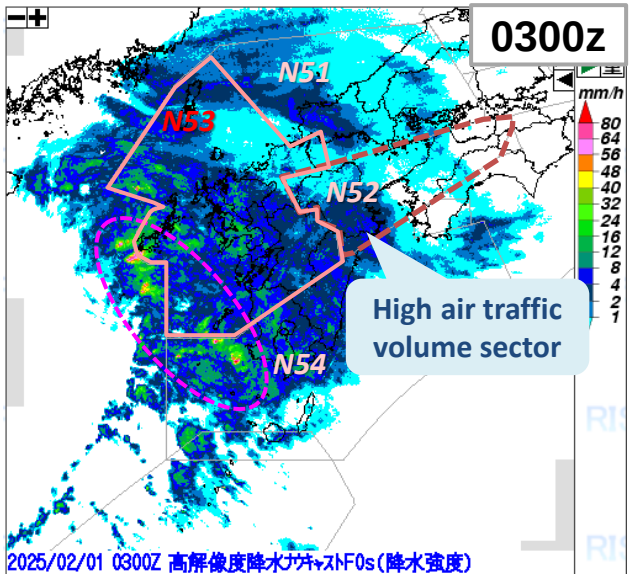
- ✓ ATMO consider severe weather forecasts and real-time information provided by MET, as well as aircraft flight status and plans, and determined airspace capacity in coordination with ATCO.
- ✓ After coordination with the ATCO, the ATMO will implement the ATFM measures for ACC sectors that are expected to exceed airspace capacity.
- ✓ ATMO consider restoring airspace capacity based on weather recovery forecasts and real-time information provided by MET, and restore airspace capacity while checking the actual operational status of ATCO.
- ✓ If the actual weather conditions differ from the forecast, MET will update the forecast. In addition to updating the forecast, ATMO also adjusts airspace capacity by taking into account the pre-forecast commentary, real-time weather information, and aircraft flight status.

# 3. Case Study – *operational capacity management utilizing impact-based MET information*

## Stage 3. Taking ATFM measures

### ATMet Category forecast 01 UTC 1 Feb 2025 issue




**MET/ATM joint review**

**N53: Forecast of meteorological impact was reasonable.**

**N52: There was a room for refinement; the forecast did not show possible meteorological impact, but ATFM measure was taken.**

# Conclusion

- JMA has developed impact-based MET information in coordination with JCAB and related stakeholders.
- Currently, the impact-based MET information (e.g. ATMET Category Forecast) support ATMO's overviewing the situation within the target period.
- Forecaster's verbal weather briefing provide necessary focus of adverse weather condition which affect to ATM. This essentially supports ATMO's decision making on adjustment of ATC capacity and taking effective ATFM measures.
- Based on the identified issue through the MET/ATM joint review, two parties are working together to refine the criteria for conversion of meteorological condition to the impact on ATM operation, aiming at more accurate MET/ATM translation.

Close coordination between MET/ATM is essential to deliver effective ATFM.

# Thank you!

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