FINAL DRAFT REPORT
2021 ICAO APAC REGIONAL SURVEY

On the Provision of Meteorological Services to Support Air Traffic Management (ATM) and Air Traffic Flow Management (ATFM)

Adapted from WP/26 of the Twenty-ninth Meeting of the ICAO APAC Meteorology Sub-Group (MET SG/29), Bangkok, Thailand, 18 – 22 August 2025

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Final Draft Report on 2021 ICAO APAC Regional Survey on the provision of Meteorological services to support Air Traffic Management and Air Traffic Flow Management

(MET/R WG Ad-hoc Group)

1. Executive Summary

1.1 Introduction

In Oct 2021, a State Letter (Ref.: T 4/3.2.7 – AP170/21 (MET)) was issued by the Asia/Pacific (APAC) Regional Office requesting APAC States to complete and submit an online survey questionnaire. The purpose was to inform ICAO (and States) of the provision of current and future meteorological (MET) information services by States specifically to support Air Traffic Management (ATM), in particular Air Traffic Flow Management (ATFM).

This report outlines the process and presents the results of the survey on the provision of current and future MET information services by States to support ATM, in particular ATFM conducted between Oct and Dec 2021.

1.2 Survey Questionnaire

1.2.1 Purpose

The objective of the survey was to solicit input from the MET and ATM communities and Airspace Users in the APAC Region with the following terms of reference regarding the initiative and objective of the survey:

i. To identify current and future meteorological requirements, in terms of the provision of MET information and communication methods, to support ATM;
ii. To identify the types and importance of MET information for ATM;
iii. To identify the gaps between the existing MET information services and the requirements of ATM community and Airspace Users;
iv. To identify challenges faced by States/Administrations regarding the provision of MET information to support ATM, in particular ATFM;
v. To identify other guidance and education material required to support States/Administrations in implementing MET information to support ATFM; and
vi. To remind States/Administrations of the existence of *Asia Pacific Regional Guidance for Tailored Meteorological Information and Services to Support ATM Operations* document.

1.2.2 Components of the survey questionnaire

The survey was divided into five parts, with some questions targeted at respondents within specific community.

i. Part A: Governance and Legislation (Questions for MET and ATM)
ii. Part B: Implementation of ATFM (Questions for ATM only)
iii. Part C: Provision of MET Information
    a. Current provision of MET Information (Questions for MET and ATM)
    b. Future provision of MET Information (Questions for MET, ATM and Airspace Users)
iv. Part D: Communication Methods (Questions for MET, ATM and Airspace Users)
v. Part E: Education (Questions for MET, ATM and Airspace Users)

A copy of the survey questionnaire is provided in **Appendix 1** of this report.

1.2.3 Distribution and communication

APAC States via State Letter (Ref.: T 4/3.2.7 – AP170/21 (MET)), were requested to complete and submit the online survey questionnaire at:
https://www.surveymonkey.com/r/5XLX97H.

For ease of reference, a copy of the survey questionnaire was attached to the State Letter.

To collect input from both the MET and ATM communities in the APAC Region, each State/Administration was requested to provide at least 2 separate survey returns, one from each of the MET and ATM communities. State/Administrations were also encouraged to invite additional responses from their State-based Airspace Users, such as airlines, for some of the specific questions in the questionnaire.

1.2.4 Benefits and expectation

The survey results were expected to assist the MET/R WG with the following tasks:

i. Understand States/Administration current status and requirements of MET information to support ATM, particularly ATFM;
ii. Explore opportunities and enhance MET-ATM integration in APAC States/Administrations;
iii. Facilitate a coordinated approach for the further improvement of MET services in support of ATM, especially ATFM in the APAC Region; and
iv. Seek further input from States/Administrations on other guidance or educational material required to assist the implementation of MET information service to support ATFM.

1.3 Key findings

i. A few States/Administrations do not have any primary legislation and supporting regulations to implement MET services in accordance with ICAO Annex 3.
ii. Most States/Administration identified wind (including cross wind, windshear, strong wind/ strong tail wind leading to runway changes), aerodrome visibility/runway visibility (RVR), QNH and significant phenomena such as thunderstorm, tropical cyclones or heavy precipitation as the key aerodrome meteorological factors impacting ATM/ATFM operations.
iii. For en-route flight operations, significant factors affecting aircraft include thunderstorms (including convective clouds), tropical cyclones and wind-related factors, such as turbulence.
iv. Key Operational Meteorological (OPMET) data, such as Aerodrome Weather Reports, Aerodrome Forecasts, remains as the most useful and impactful MET information to support ATFM. However, many States/Administrations are now providing additional tailored MET information in support of ATFM.
v. Gridded MET information (e.g. WAFS forecasts) is identified as very useful and impactful for generating air-routes or supporting flight planning.
vi. Timeliness (e.g..forecast lead time and update frequency) and forecast quality (e.g. accuracy and reliability) are identified as extremely important factors for effective and efficient ATM/ATFM decision making processes.
vii. Most States/Administrations face challenges such as technical challenges (systems and scientific capabilities), and lack of resources for developing, implementing and/or utilising enhanced MET services to better support ATFM operations.
viii. Some States still do not use global standards for meteorological information exchange.

2 Overview of results

This section provides an overview of selected results, with raw data provided in **Appendix 2**.

2.1 Respondents

A total of 50 responses to the survey were received from Twenty-Three (23) States/Administrations, namely: Australia, Bangladesh, Bhutan, Brunei, India, Indonesia, Japan, Hong Kong China, LAO PDR, Macao, Malaysia, Maldives, Myanmar, New Zealand, Pakistan, Papua New Guinea, Philippines, Republic of Korea, Singapore, Sri Lanka, Thailand, USA and Vietnam. Number of responses and participating organizations are available in Table 1. Work nature of the respondents is provided in ***Figure 1.***

States/Administration	**Number of responses**	**Stakeholder Community**	**Organisations**
Australia	2	ATM and MET	• Airservices Australia (ATM); • Australian Bureau of Meteorology (MET)
Bangladesh	1	MET	• Bangladesh Civil Aviation Authority
Bhutan	2	ATM and MET	• Bhutan Civil Aviation Authority
Brunei	1	MET	• Brunei Darussalam Meteorological Department
India	1	ATM	• Airports Authority of India
Indonesia	2	ATM and MET	• BMKG (Badan Meteorologi, Klimatologi, dan Geofisika) • DGCA (Directorate General of Civil Aviation (Indonesia)
Japan	4	Airline, ATM and MET	• Japan Airline (*note, no data provided*) • Fuji Dream Airline • Japan Civil Aviation Bureau • Japan Meteorological Agency
Hong Kong China	2	ATM and MET	• Hong Kong Civil Aviation Department • Hong Kong Observatory
LAO PDR	2	ATM and MET	• Lao Air Navigation Service • Lao Department of Meteorology and Hydrology
Macao	2	ATM and MET	• Macao Civil Aviation Authority • Macao Meteorological and Geographical Bureau
Malaysia	1	MET	• Malaysian Meteorological Department
Maldives	2	ATM and MET	• Maldives Civil Aviation Authority
Myanmar	1	Met	• Myanmar Department of Meteorology
New Zealand	1	ATM	• Airways Corporation of New Zealand
Pakistan	2	ATM and MET	• Pakistan Civil Aviation Authority • Pakistan Meteorological Department
Papua New Guinea	2	ATM and MET	• Civil Aviation Safety Authority of Papua New Guinea • PNG National Weather Service
Philippines	3	Airline, ATM and MET	• AirAsia Philippines • Civil Aviation Authority of the

			Philippines • PAGASA (Philippine Atmospheric, Geophysical and Astronomical Services Administration)
Republic of Korea	2	ATM and MET	• Korea Air Traffic Control Centre • Korea Meteorological Administration/ Aviation Meteorological Office
Singapore	2	ATM and MET	• Civil Aviation Authority of Singapore • Meteorological Service Singapore
Sri Lanka	1	ATM	• AASL (Airport & Aviation Services (Sri Lanka) Limited)
Thailand	8	Airline, ATM and MET	• THAIPA Airline • AEROTHAI • Civil Aviation Authority of Thailand (4 surveys, including ATM and MET) • Thailand Airport Operations (AOC/JAL) • Thai Meteorological Department
USA	3	ATM and MET	• Federal Aviation Administration (2 surveys, one each for ATM and MET) • National Weather Service
Vietnam	1	ATM	• Northern Region Air Traffic Service Company

Table 1: Survey responses provided by States/Administrations

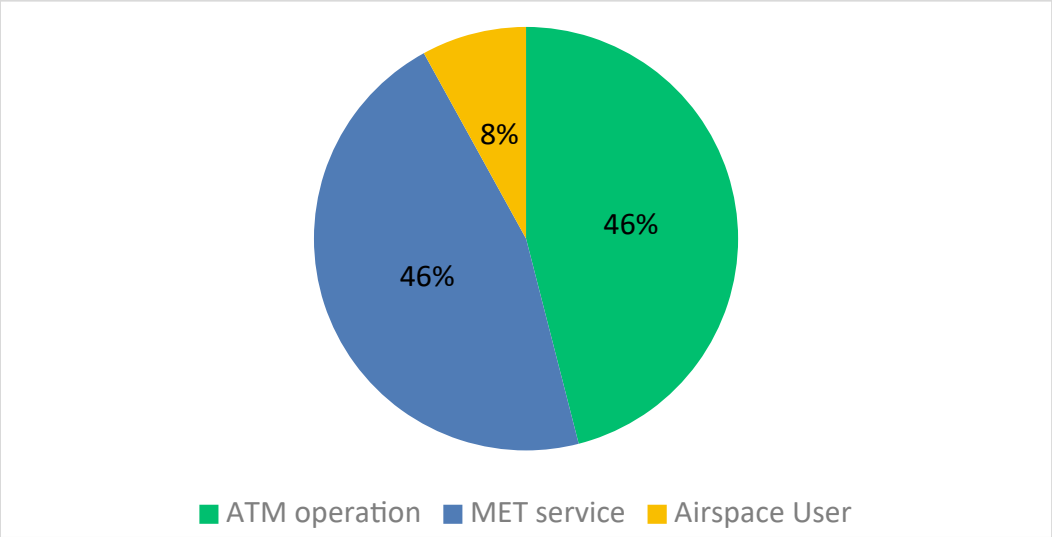

Figure 1: Work nature of survey respondents

2.2 Part A: Governance and Legislation

- 13% of the respondents indicated that their State/Administration does not have any primary legislation and/or supporting regulations, such as any regional air navigation agreements, to implement MET service in accordance with ICAO Annex 3 - Meteorological Service for International Air Navigation.

- Approximately 96% of the respondents indicated that their State/Administration has a written agreement in place between the air traffic authority/service and the meteorological authority/service defining roles and responsibilities, and the MET information to be provided in

accordance with ICAO Annex 3 and ICAO Doc.9377 – *Manual on Coordination between Air Traffic Services, Aeronautical information Services and Aeronautical Meteorological Services*.

2.3 Part B: Implementation of Air Traffic Flow Management (ATFM)

- 80% (of the 25 respondents) indicated that their State/Administrations have implemented ATFM, while the other 20% indicated their State/Administration intends to implement ATFM in the near future.

2.3 Part C – Provision of MET Information

2.3.1 Part C1 - Current provision of MET Information

- Respondents indicated the following meteorological information/services (top 5) are required to support ATFM. ***Figure 2*** provides full assessment of specific MET information/services required to support ATFM.
    1. Aerodrome meteorological report, routine/special (METAR/SPECI) (95.45%)
    2. Aerodrome forecast (TAF) (93.18%)
    3. SIGMET information (86.36%)
    4. Trend forecast (TREND) (84.09%)
    5. Local Report, routine/special (79.55%)

    (percentages are out of 44 respondents)

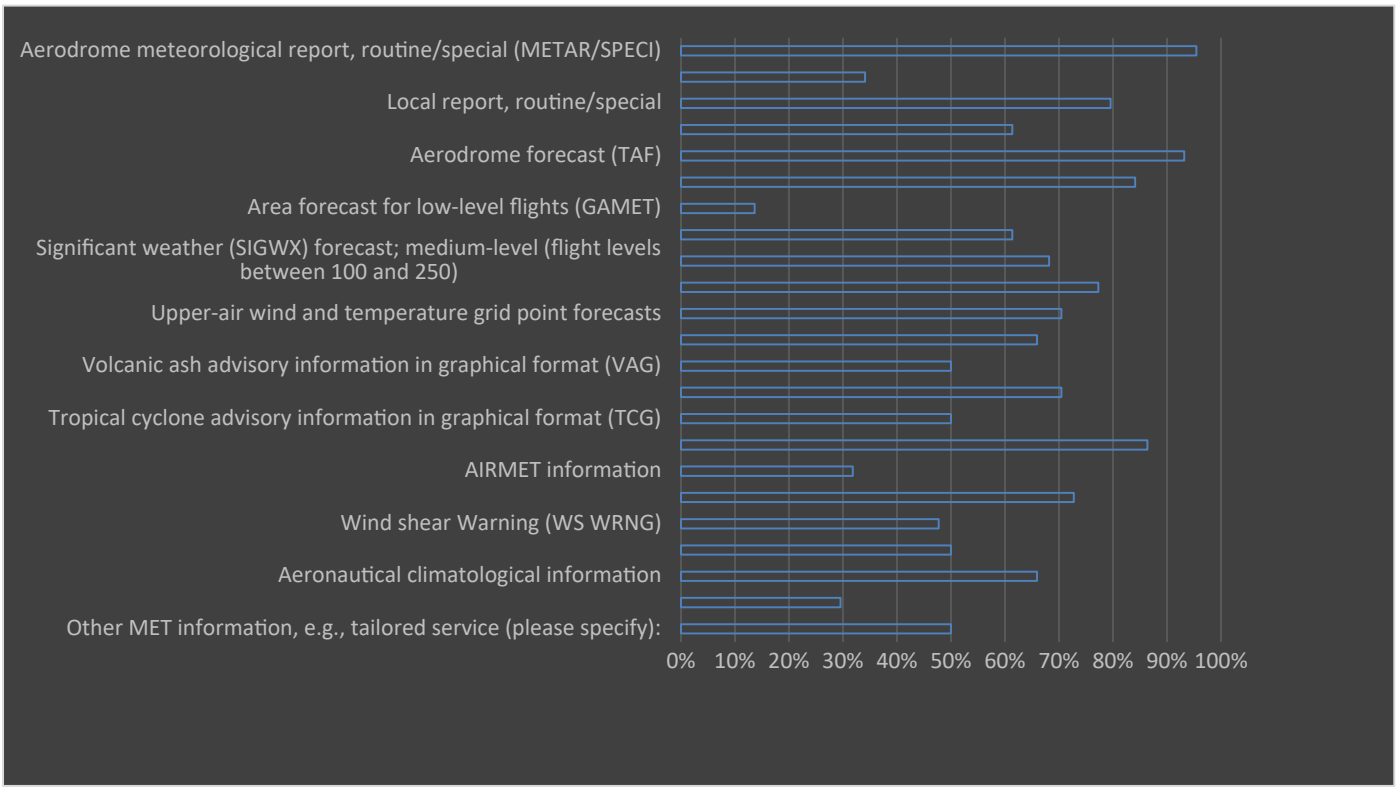

Figure 2: Availability of specific MET information/services to support ATFM

- Other tailored meteorological information services currently provided by some States/Administrations to support ATFM includes:
    - Lightning Advisories

- Weather Radar and Satellite Images
- Significant convection monitoring and forecast
- Categorical forecasts of TS over critical watch area
- Windshear prediction information
- ATM-tailored information and services based on State requirements.

- Only 48% (of 21 ATM respondents) indicated that their States'/Administrations' ATM/ATFM system(s) utilise automated processing of gridded MET information (e.g. World Area Forecast System (WAFS) information) to support flight planning.

- Only 16 States/Administrations MET Agencies indicated that they provide gridded MET information (e.g. WAFS information) to ATM for supporting flight planning. Some of these States/Administrations also provide MET data from their local Numerical Weather Predication Models. ***Figure 3*** shows the gridded MET information provided (or not) by these States to support flight planning.

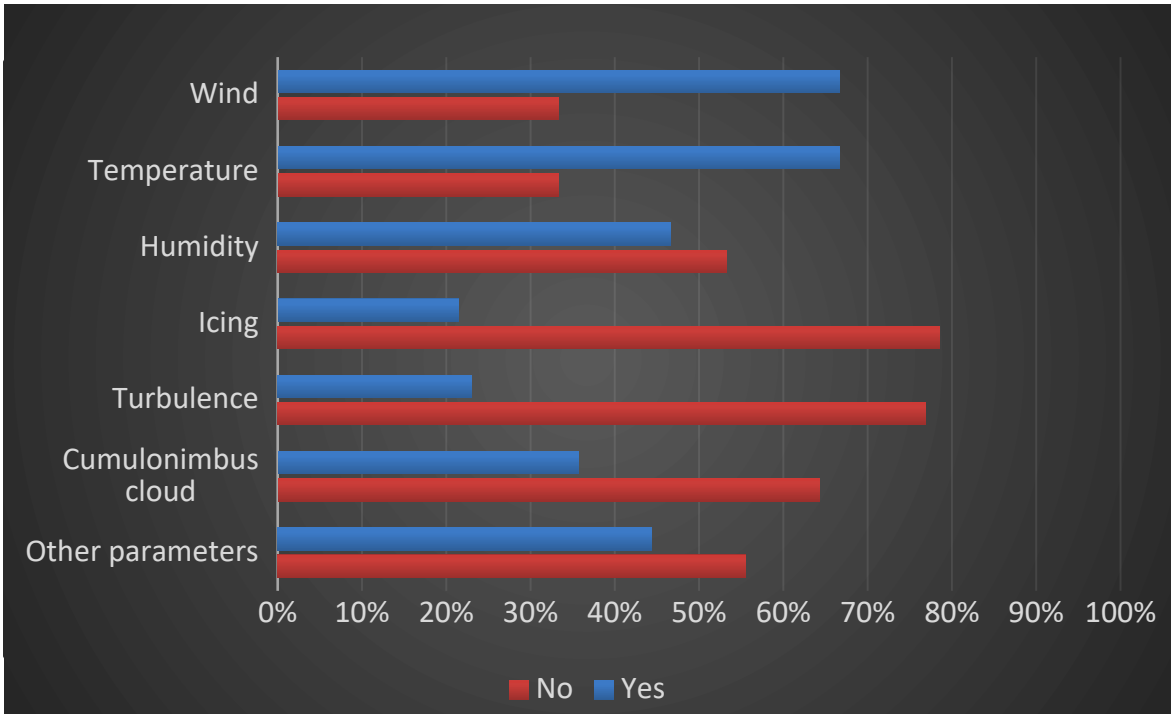

Figure 3: Gridded MET INFO provided to the States/Administration to ATM to support flight planning

2.3.2 Part C2 – Future provision of MET information

- The aerodrome meteorological information are considered most useful for ATM and ATFM decision making process includes wind (including cross wind, windshear, strong wind/ strong tail wind leading to runway changes), aerodrome visibility/runway visibility (RVR), QNH and significant phenomena such as tropical cyclones, thunderstorms or heavy precipitation (e.g. heavy showers, rain, snow, etc). Similarly, these MET factors were considered the most impactful for ATM/ATFM operations. See ***Figures 4 and 5*** for ratings provided by the States/Administrations ATM and Airspace users.

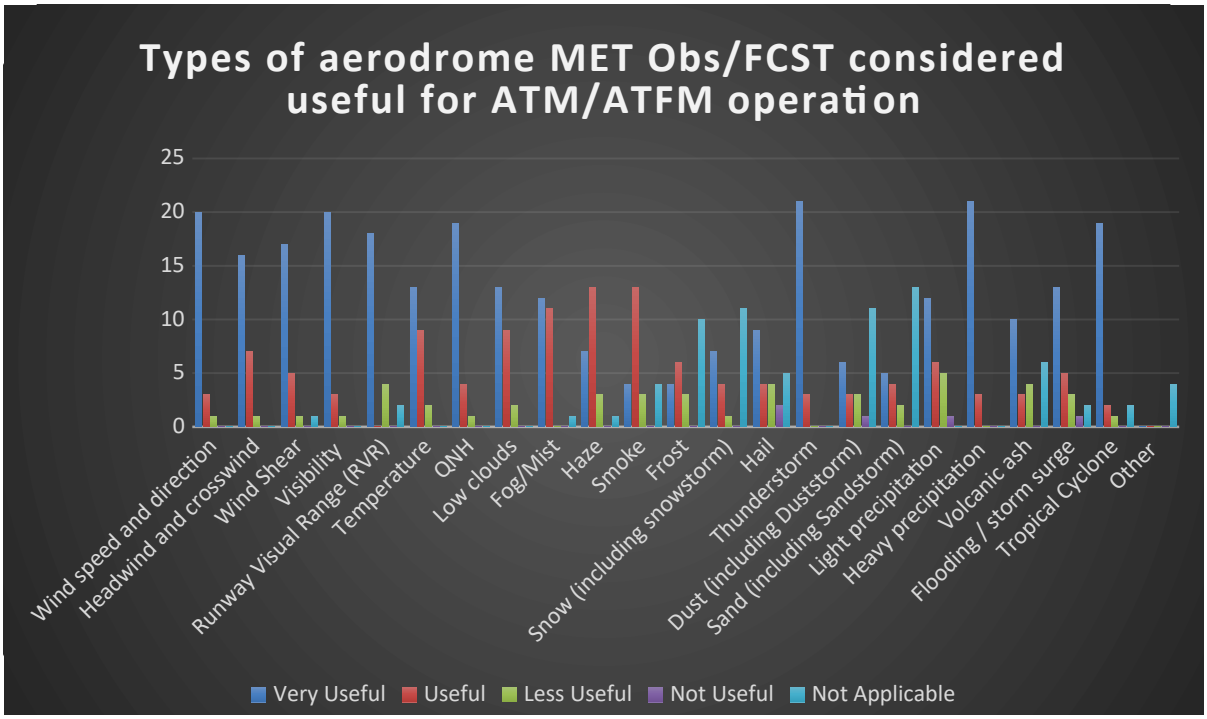

Figure 4: Aerodrome MET information considered to be most useful for ATM/ATFM operations

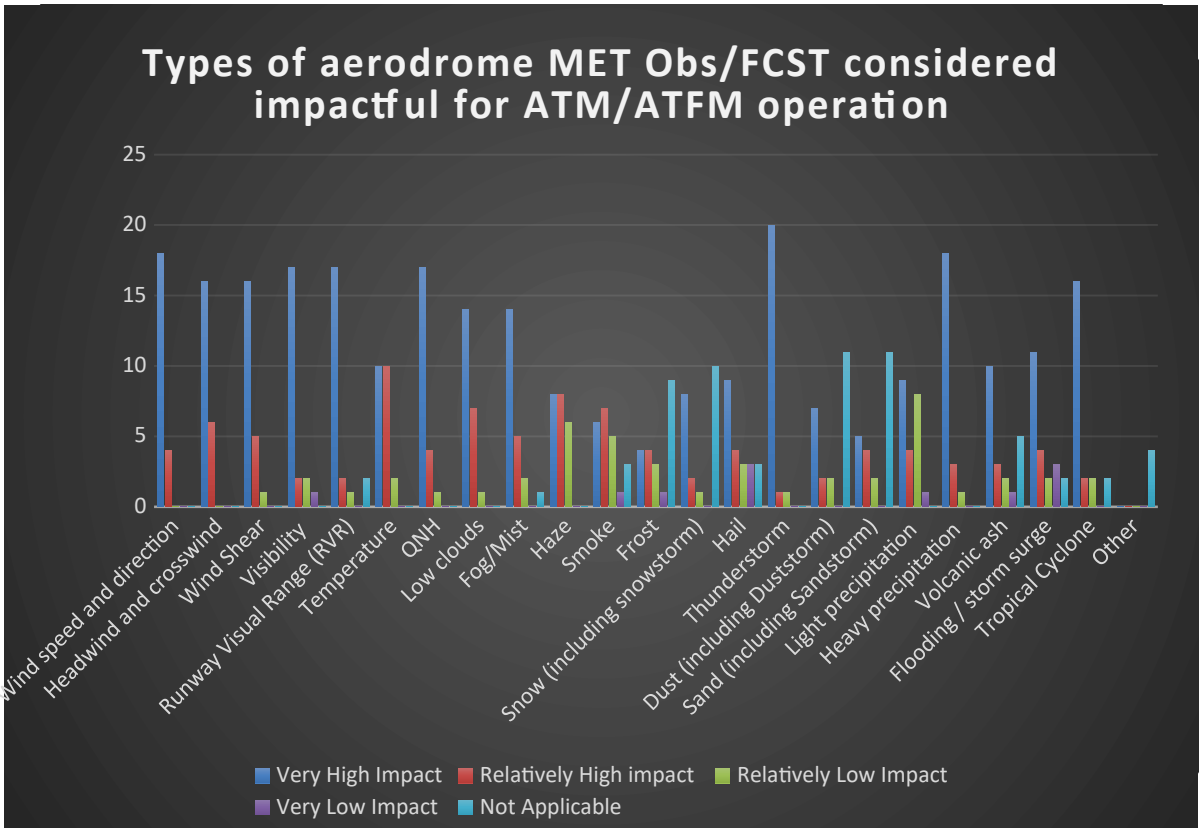

Figure 5: Aerodrome MET information considered to be most impactful for ATM/ATFM operations

- For en-route flight operations, significant factors affecting aircraft include thunderstorms, (including convective clouds), tropical cyclones and wind-related factors, including turbulence. See ***Figures 6 and 7*** for ratings provided by the States/Administrations ATM and Airspace Users.

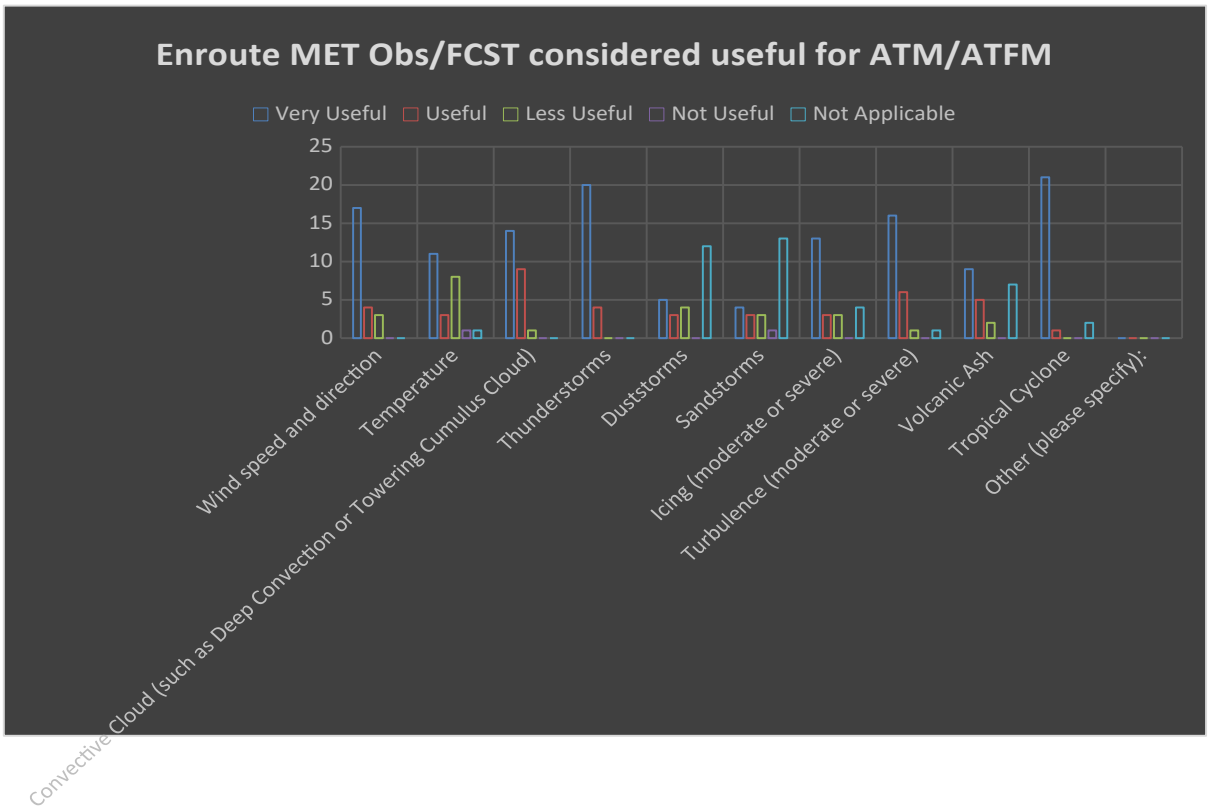

Figure 6: Enroute MET Observations and forecasts considered useful for ATM/ATFM

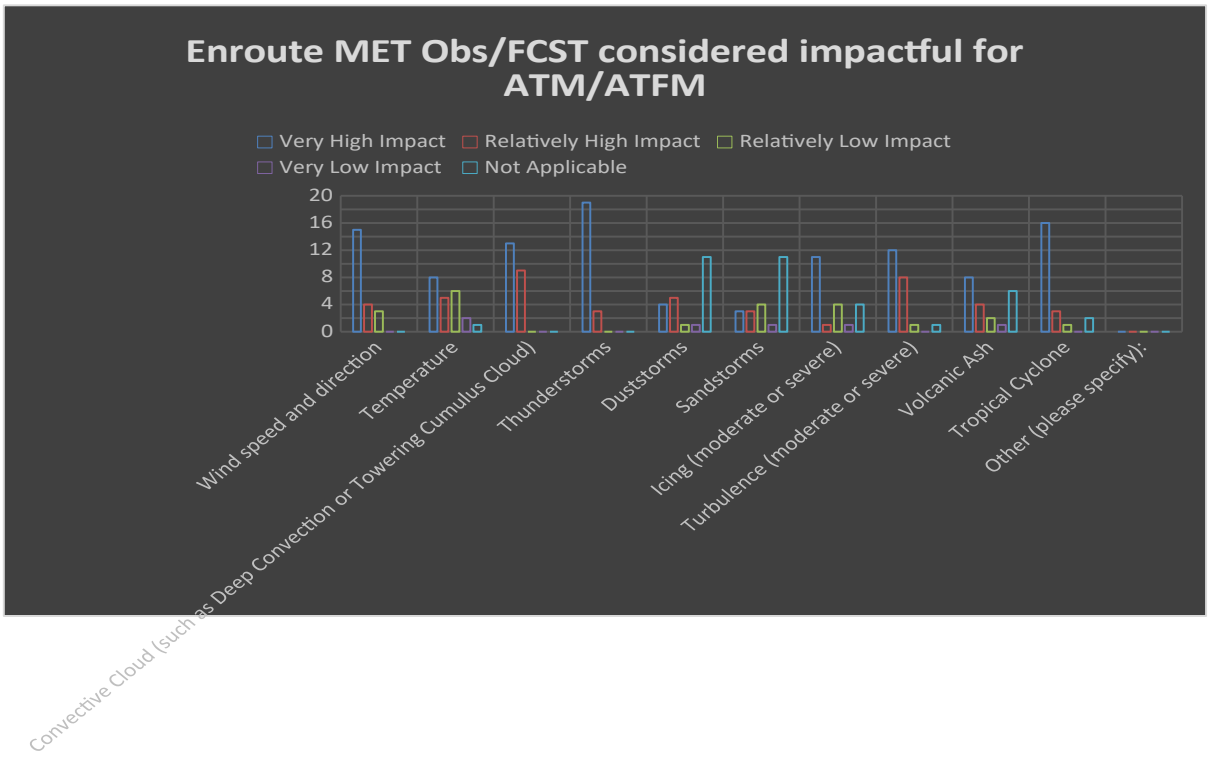

Figure 7: Enroute MET Observations and forecasts considered impactful for ATM/ATFM operations

- The ATM and Airspace Users rated the time of issuance and validity, observed and forecast movements, forecast position, and horizontal and vertical extent of phenomena as very important descriptive characteristic for effective and efficient ATFM. See ***Figure 8*** for more details.

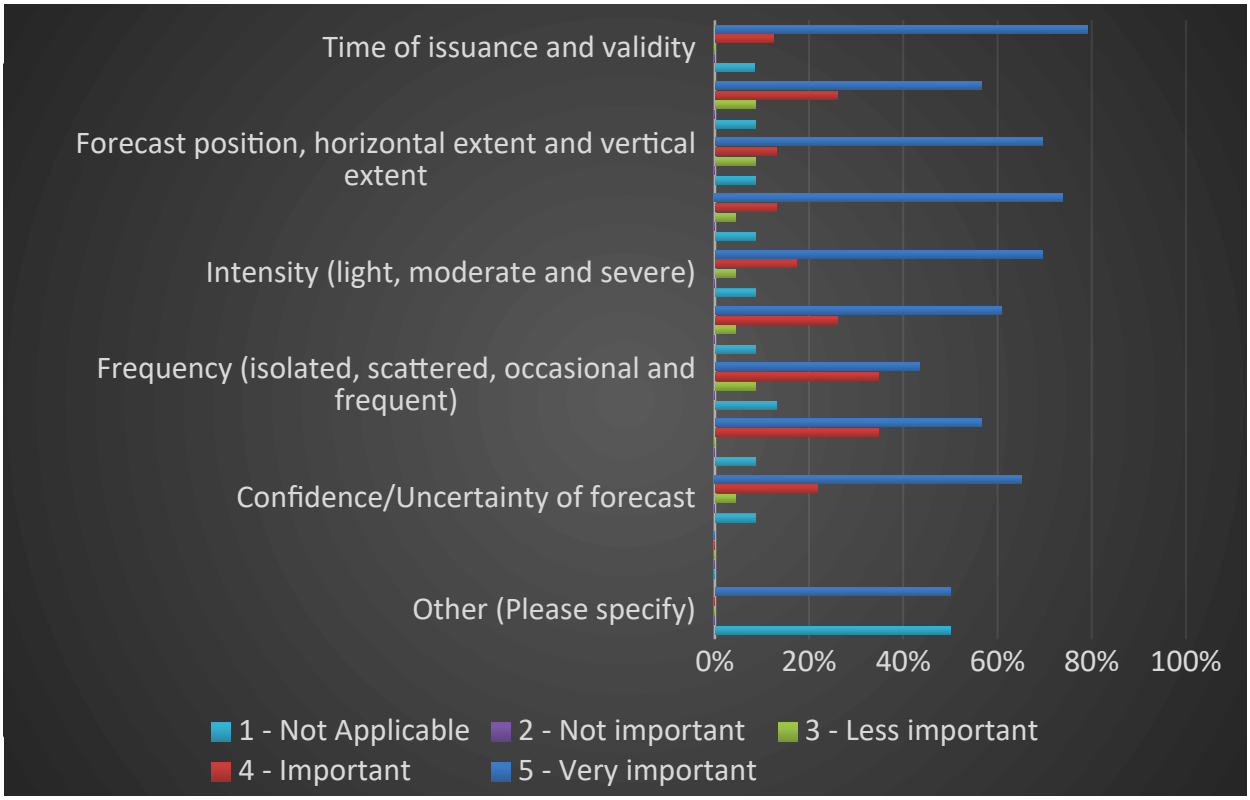

Figure 8: Importance of descriptive characteristics of MET phenomena for effective and efficient ATFM

Some key reasons identified:

- "Timely and detailed description of the weather cells lead to the success of ATFM operation (in terms of planning and selection of the appropriate measures) to manage demand and capacity situations caused by weather phenomenon."
- "Affects the Airport Arrival Rate, Airport Departure Rate, Sector capacity, etc."
- "Trusting the forecast and issuing flow management in the area."
- "Flight planning and Flight safety"
- "It is important to have high confidence in forecasting, as this leads to fewer last-minute changes to planned operations and fewer unnecessary delays (e.g. cancelling a planned ATFM measure halfway when airlines already incurred delay on ground)"
- "If the forecast is not reliable then it is useless"
- "Consistency of information for forecast/observed phenomena across different jurisdictions"

- Regarding the quality of MET service and information in ensuring the effectiveness and efficiency of ATFM operations, ATM and Airspace Users put the highest importance on timeliness (e.g. forecast lead time and update frequency) and quality of forecast (e.g.accuracy and reliability). These factors are extremely important for ATM/ATFM decision-making and flight planning. Another common request among MET users is the ability to translate MET constraints into ATFM impact (decision support tools). See ***Figure 9***.

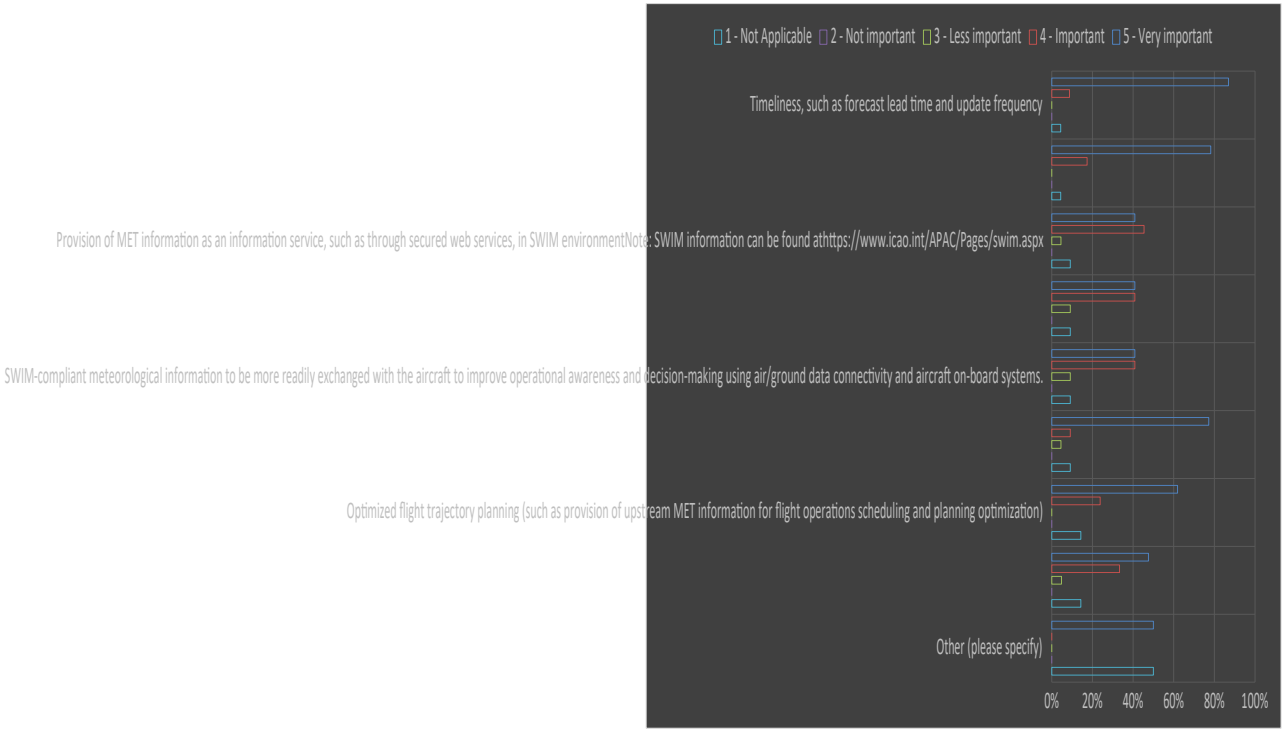

Figure 9: Important MET information for an effective and efficient ATFM

Additional details for each key aspect:

- Timeliness:
  - "More timely information leads to better advanced planning, improved reliability and accuracy, and enables planning and activate of appropriate ATFM measures.";
  - "Earlier lead time with greater resolution."
  - "Aids in timely runway selection – *Note: reactive updating of forecasts, when actual reported conditions vary from forecast (due to poor quality forecasting,) can result in adverse outcomes e.g. excessive numbers of amended MET products being issued within extremely short time periods."*
- Quality:
  - "Updates are needed to improve reliability and accuracy."
  - "High quality and accurate forecasts are critical for decision making regarding ATFM initiatives."
  - "Important to have accurate and reliable weather forecasting as basis for activation of ATFM measures, resulting from inclement weather forecasts, especially for weather in the vicinity of the aerodrome (TAF). Good forecasts also allow airlines to use the information effectively for flight planning."
  - "Unreliable and inaccurate forecast is useless for airspace users."
- Provision of MET info:
  - "Aviation Met products should be in IWXXM format."
  - "It is good to exchange information based on a common info exchange model so that all consumers are connected through the same platform with expectations of a common data set."
  - "Easily accessible MET information is vital for airspace users."
- Capability to translate MET constraints into ATFM:
  - "Met service Provider should be aware of how to translate MET constraints."
  - "Weather is essential for those in charge of operations and control, so it is necessary."

- "It is important and useful if a system can translate the MET constraints into ATFM impact, allowing FMPs to act appropriately, especially if the mpact can be quantified."
- "Understanding the impact on ATFM is important for airspace users as it leads to well- thought-out decisions."

- Regarding challenges encountered in development, implementation and/or utilisation of enhanced MET services to better support ATFM operation, ATM and Airspace Users rated systems integration and lack of resources as major issues. Similar views were shared by the MET community when developing and implementing enhance MET services. See ***Figures 10 and 11*** for details.

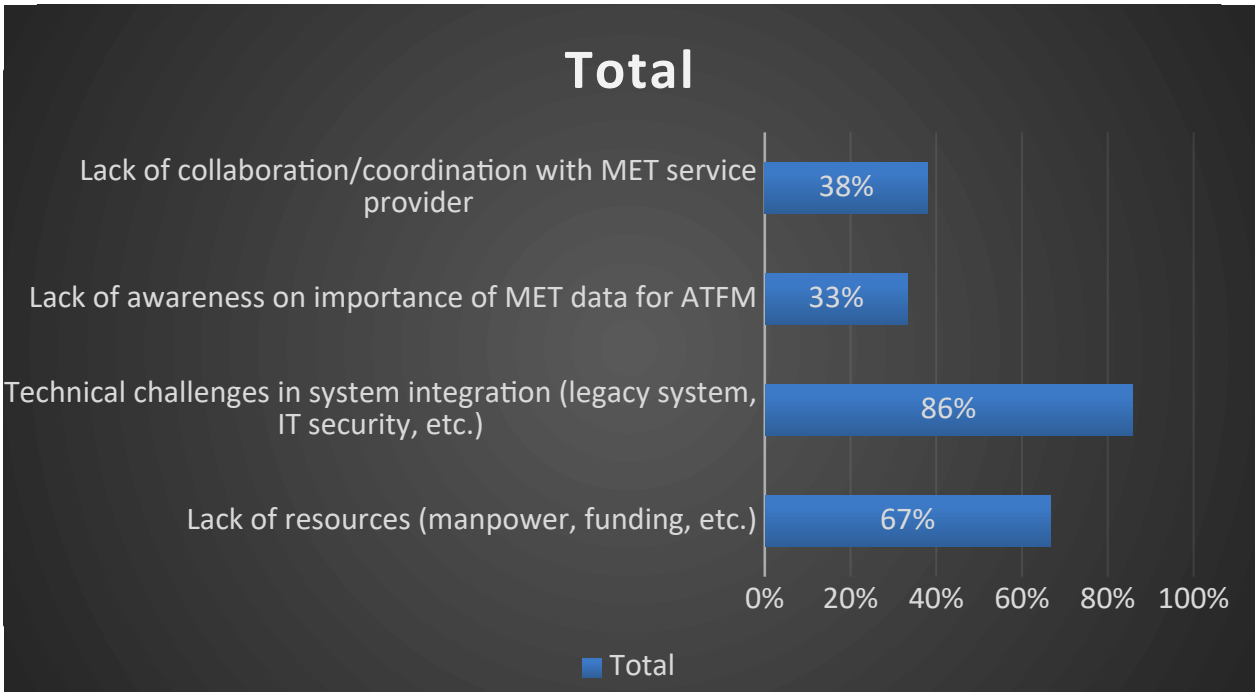

Figure 10: Challenges ATM and Airspace Users face when developing, implementing and/or utilising enhanced MET services to better support ATFM operation

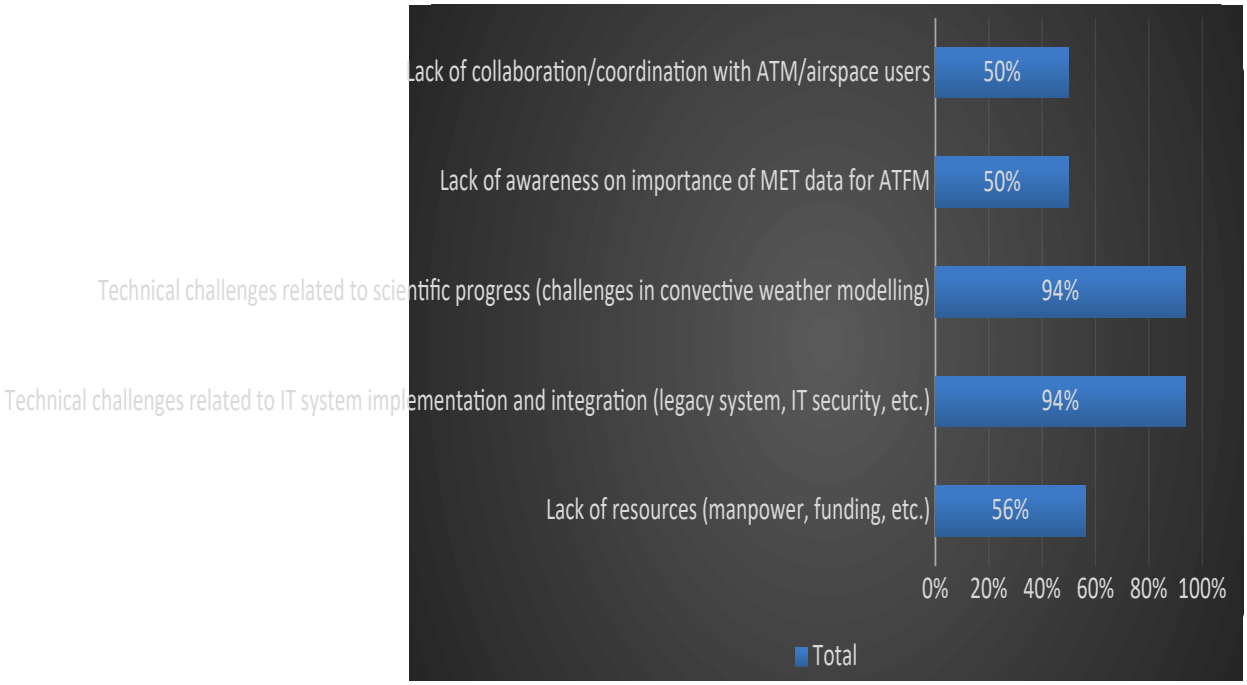

Figure 11: Challenges MET organisation encounter when developing and implementing enhanced MET services to better support ATFM operation

Some comments:

- "Lack of established formal and concrete communication channels between MET and ATM service providers."
- "Professional exchanges between MET and ATM experts are necessary for a better understanding of the requirements."
- "Budgetary constraints, lack of technical capability for equipment maintenance."
- "From the ATM perspective, ATFM project was implemented many years ago, and challenges were resolved at the time. Due to this, we are unable to provide details of past challenges. Future systems will be upgraded as needed to support new capabilities and services."
- "Managing the gap between ATM requirements and current MET capabilities, and data sharing."
- And many more…

- ***Figure 12*** presents the current and planned initiatives and timelines by States/Administrations to enhance MET service provision specifically in support of ATFM operations.

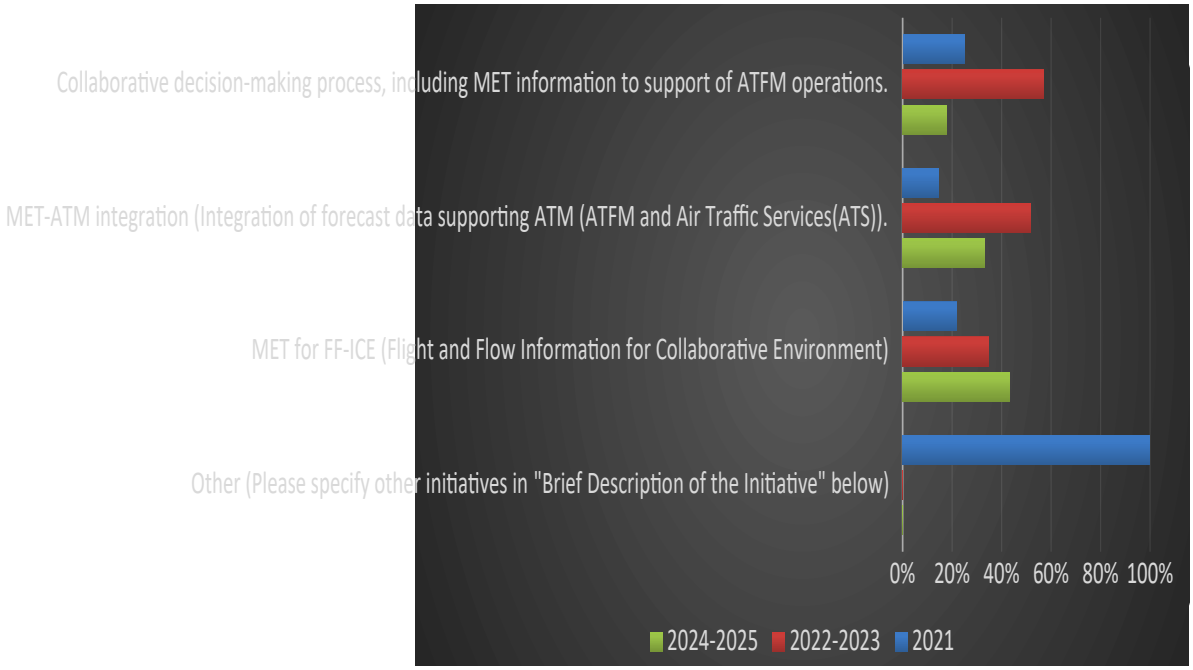

Figure 12: Initiatives State/Administrative undertake (or will undertake) to enhance MET service provision to support ATFM operations

2.4 Part D – Communication methods

- Most of the States disseminates aeronautical MET information to ATS units, Airspace Users and other stakeholders via the internet, aeronautical fixed telecommunication network (ATFN), and use telephone services to provide additional information. However, 15% of the respondents indicated that their States/Administrations still do not use AFTN to exchange information.

2.5 Part E - Education

- 23% of the respondents are still unaware of the APAC Regional Guidance for Tailored Met Services to support ATM Operations.

- Some comments on how States/Administrations can benefit from the guidance in the implementation or enhancement of MET information and services for ATM and/or what other guidance or education material is needed:
  - "Webinars or presentations detailing development, implementation, benefits achieved and lessons learned of any new idea/technology that has been implemented by States/Administrations"
  - "Courses/ Training/ Seminars on implementing or improving provisions of MET information and services to support effective ATFM"
  - "Guidance to develop a MET data catalogue to better support ATFM, including guidance and sample scenarios on how MET data would be used and which MET data should be considered during the Demand/Capacity Balancing (DCB) process. In addition, any case study of successful ATFM implementation based on MET information would be useful"
  - "Sharing more examples of MET-ATM integrated system / More guidance about information sharing systems / Best practices or education material on using MET information for ATFM in a future SWIM environment / Lists of suppliers/developers of systems related to the integration of MET information into ATM"
  - "Sharing more effective examples on the ICAO e-document page. Furthermore, the ICAO Regional Office should promote these documents from time to time via State Letters"

- "Webinar sessions or even creating videos to ensure it is easy for developing States to understand the process. Any additional guidance from Global MET Panel group would be beneficial"
- "Provide more guidance, effective examples, best practices or education material on MET-ATM integrated systems, information sharing systems and/or usage of MET information for ATFM in the future SWIM environment; a catalogue of suppliers/developers of system related to the integration of MET information into ATM"
- "Guidance material on the translation of MET constraints into objective, quantifiable impact on ATM operations, e.g. reduction in air traffic capacity. Any other supporting documents from WMO/ICAO would be beneficial , along with in-depth guidance from subject matter experts."

3 Conclusion and recommendations

3.1 Key findings and Conclusion

- A few States/Administrations still do not have any primary legislation and supporting regulations to implement MET service in accordance with ICAO Annex 3. However, it is encouraging to see many States are considering MET information as an essential component for ATM. In addition, most States have now implemented ATFM and include MET as an essential component of the process by having written agreements in place between the air traffic authority/service and the meteorological authority/service defining roles and responsibilities and the MET information to be provided in accordance with ICAO Annex 3 and ICAO Doc.9377.
- Most States/Administration identified wind (including cross wind, windshear, strong wind/ strong tail wind leading to runway changes), aerodrome visibility/runway visibility (RVR), QNH and significant phenomena such as thunderstorms, tropical cyclones or heavy precipitation as the key aerodrome meteorological factors impacting ATM/ATFM operations. For en-route flight operations, significant factors affecting aircraft include thunderstorms (including convective clouds), tropical cyclones and wind-related factors, including turbulence.
- The key Operational Meteorological (OPMET) data, such as Aerodrome Weather Reports and Aerodrome Forecasts, remains the most useful and impactful MET information to support ATFM. However, many States/Administrations are now providing additional tailored MET information in support of ATFM.
- Most responding States informed that the gridded MET information, such as WAFS forecasts, is very useful and impactful in generating air routes or supporting flight planning. However, more precise data are obtained from States'/Administrations' NWP systems to provide additional support and/or improve the quality of WAFS forecasts.
- Timeliness (such as forecast lead time and update frequency) and quality of forecast (such as accuracy and reliability) are identified as extremely important factors for effective and efficient ATM/ATFM decision-making processes. Another common factor identified is the capability to translate MET constraints into ATFM impacts (decision support tools).
- While it is encouraging to see most States have mutual understanding and close coordination among stakeholder (ATM, MET, and airline users), States/Administrations face challenges such as technical limitations (systems and scientific progress), and a lack of resources in developing, implementing and/or utilising enhanced MET services to better support ATFM operations.
- There are still some States that are not using global standards for meteorological information exchange. It is encouraged to become aware of these global standards for meteorological information exchange and consider establishing agreements and procedures to increase safety and airspace capacity and to improve the efficiency and flexibility of aircraft operations. This

will become increasingly important when ICAO adopts SWIM as a standard information exchange mechanism.

3.2 Recommendations

The following recommendations are presented to ensure the survey results can be used to facilitate a coordinated approach to the further development of MET services specifically in support of ATM and ATFM operations.

i. To consider the results of this survey when:
   - Developing future MET requirements to support ATM/ATFM
   - Developing and/or updating future guidance material for tailored MET information services to support ATM operations
   - Developing the document titled 'APAC User Requirements for SWIM-based MET Information Services Supporting ATFM'.

ii. Socialise the survey results with the ATM community, via ATFM SG and ATM SG

iii. Promote the document titled *Asia Pacific Regional Guidance for Tailored Meteorological Information and Services to Support Air Traffic Management Operations*.

Appendix 1 – Survey Questionnaire

INTRODUCTION

Purpose: This survey is intended to inform ICAO (and States) of the provision of current and future meteorological (MET) information services by States specifically to support Air Traffic Management (ATM), in particular Air Traffic Flow Management (ATFM).

The survey solicits input from the MET and ATM communities and Airspace Users in the Asia/Pacific Region (APAC) Region with the following terms of reference regarding the initiative and objective of the survey.

- To identify current and future meteorological requirements, in terms of the provision of MET information and communication methods, to support ATFM;
- To identify the types and importance of MET information for ATFM;
- To identify the gaps between the existing MET information services and the requirements of ATM community and Airspace Users;
- To identify challenges faced by States/Administrations regarding the provision of MET information to support ATFM;
- To identify other guidance and education material required to support States/Administrations in implementing MET information to support ATFM.
- To remind States/Administrations of the existence of Asia Pacific Regional Guidance for Tailored Meteorological Information and Services to Support ATM Operations document.

Benefits: The survey results will assist ICAO APAC Regional Office to:

- Understand States/Administration current status and requirements of MET information to support ATFM;
- Explore opportunities and enhance MET-ATM integration in APAC States/Administrations;
- Facilitate a coordinated approach for further improvement of MET services in support of ATM, especially ATFM in the APAC Region.
- Seek further input from States/Administrations on other guidance or education material required to assist the implementation of MET information service to support ATFM.

To collect input from BOTH the MET and ATM communities in the APAC Region, each State/Administration would be requested to provide at least **2 separate survey returns,** one from each of the MET and ATM communities.

State/Administrations are also encouraged to invite additional survey returns from their State-based Airspace Users such as airlines, for some of the specific questions indicated in the Questionnaire.

Please select all relevant responses (there may be more than one per question)

PART A – GOVERNANCE AND LEGISLATION (Questions for MET and ATM)

(1) Has your State/Administration enacted primary legislation and supporting regulations to ensure that the implementation of MET service is in accordance with ICAO Annex 3 - *Meteorological Service for International Air Navigation* and any applicable regional air navigation agreements?

a) No

b) Yes (please specify):

_____

_____

_____

(2) Does your State/Administration have a written agreement in place between the air traffic authority/service and the meteorological authority/service defining roles and responsibilities and the MET information to be provided in accordance with ICAO Annex 3 and ICAO Doc. 9377 – *Manual on Coordination between Air Traffic Services, Aeronautical information Services and Aeronautical Meteorological Services*?

a) No

b) Yes (please specify):

_____

_____

_____

PART B – IMPLEMENTATION OF AIR TRAFFIC FLOW MANAGEMENT (ATFM) – Questions for ATM only

(3) Has your State/Administration implemented ATFM?
a) Yes
b) No

(4) If Yes to Q3, please specify your State's level of implementation of ATFM and provide further details.
Note: Level of implementation defines the phase at which the States are in implementing their ATFM procedures and processes. For example, Level 1, 2 or 3 of Distributed Multi-Nodal ATFM Project or implementation phases of any other ATFM projects the States are involved in.

(5) If No to Q3, is your State/Administrative intending to implement ATFM?
a) Yes
b) No

If yes, please specify the expected timeline and provide further details:

PART C- PROVISION OF MET INFORMATION

PART C1 - CURRENT PROVISION OF METEOLOGICAL INFORMATION (Questions for MET and ATM)

(6) **For ATM and MET:** Indicate below the specific MET information/services available in your State/Administration to support ATFM (select more than one options as necessary):

a) Local report, routine/special
b) Aerodrome meteorological report, routine/special (METAR/SPECI)
c) Volcanic activity report
d) Volcano Observatory Notice to Aviation (VONA)
e) Air-report, routine/special (ARP/ARS)
f) Aerodrome forecast (TAF)
g) Trend forecast (TREND)
h) Area forecast for low-level flights (GAMET)
i) Significant weather (SIGWX) forecast; low-level (flight levels below 100)
j) Significant weather (SIGWX) forecast; medium-level (flight levels between 100 and 250)
k) Significant weather (SIGWX) forecast; high-level (flight levels between 250 and 630)
l) Upper-air wind and temperature grid point forecasts
m) Volcanic ash advisory information (VAA)
n) Volcanic ash advisory information in graphical format (VAG)
o) Tropical cyclone advisory information (TCA)
p) Tropical cyclone advisory information in graphical format (TCG)
q) SIGMET information
r) AIRMET information
s) Aerodrome warning (AD WRNG)
t) Wind shear Warning (WS WRNG)
u) Wind shear alert
v) Aeronautical climatological information
w) Other MET information, e.g., tailored service (please specify):

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(7) **For ATM only:** Does your State/Administration's ATM/ATFM system(s) utilize automated processing of gridded MET information (e.g. World Area Forecast System (WAFS) information) to support flight planning?

For MET only: What gridded MET information (e.g. World Area Forecast System (WAFS) information) is provided to your State's ATM to support flight planning.?

Parameter	WAFS as the information	Other sources (Yes / No)

	source (Yes / No)	**(If yes, please specify the source(s))**
Wind		
Temperature		
Humidity		
Icing		
Turbulence		
Cumulonimbus cloud		
Other (please specify):		

PART C2 - FUTURE PROVISION OF METEOLOGICAL INFORMATION (Questions for MET, ATM and Airspace Users)

(8) **For ATM and Airspace Users:** Rate the types of aerodrome MET observation and forecast parameters considered useful to support ATM/ATFM operation and rate the impact of these parameters to ATM/ATFM operations. Please use the ratings as follows

- Ratings on usefulness: 5-Very useful / 4-Useful / 3-Less useful / 2-Not useful / 1-Not Applicable
- Ratings on impact: 5-Very high impact / 4- Relatively high impact / 3 – Relatively low impact / 2 – Very low impact / 1-Not Applicable

Aerodrome MET information	**Ratings on usefulness**	**Ratings on impact**
Wind speed and direction		
Headwind and crosswind		
Wind Shear		
Visibility		
Runway Visual Range (RVR)		
Temperature		
QNH		
Low clouds		
Fog/Mist		

Haze		
Smoke		
Frost		
Snow (including snowstorm)		
Hail		
Thunderstorm		
Dust (including Duststorm)		
Sand (including Sandstorm)		
Light precipitation (e.g. drizzle, light rain)		
Heavy precipitation (e.g. Heavy showers, rain, snow, etc)		
Volcanic ash		
Flooding / storm surge		
Tropical Cyclone		
Other (please specify):		

(9) **For ATM and Airspace User:** Rate the types of MET observation and forecast phenomena within your Flight Information Region (FIR) considered useful to support ATFM operation and rate the impact of these phenomena to ATM/ATFM operations.
Please use the ratings as follows

- Ratings on usefulness: 5-Very useful / 4-Useful / 3-Less useful / 2-Not useful / 1-Not Applicable
- Ratings on impact: 5-Very high impact / 4- Relatively high impact / 3 – Relatively low impact / 2 – Very low impact / 1-Not Applicable

Airspace (Enroute) MET information	**Ratings on usefulness**	**Ratings on impact**
Wind speed and direction		
Temperature		
Convective Cloud (such as Deep Convection or Towering Cumulus Cloud)		

Thunderstorms		
Duststorms		
Sandstorms		
Icing (moderate or severe)		
Turbulence (moderate or severe)		
Volcanic Ash		
Tropical Cyclone		
Other (please specify):		

(10) **For ATM and Airspace User:** Rate the importance of characteristic descriptions of MET phenomenon for an effective and efficient ATFM in your State/Administration. Please use the ratings as follows and provide further details.
(Ratings of importance: 5-Very important / 4-Important / 3-Less important / 2-Not important / 1-Not Applicable)

Characteristic descriptions of MET Information	**Ratings of importance**	**Please provide further details**
Time of issuance and validity		
Observed position, horizontal extent and vertical extent		
Forecast position, horizontal extent and vertical extent		
Observed movement / forecast movement		
Intensity (light, moderate and severe)		
Expected change in intensity (weakening, intensifying or no change)		
Frequency (isolated, scattered, occasional and frequent)		
Probability of occurrence		
Confidence/Uncertainty of forecast		
Other (Please specify):		

(11) **For ATM and MET:** Are there any established objective rules for automatic quantitative translation from MET constraints to ATFM impact (e.g. change in Airport Arrival Rate, Airport Departure Rate, Miles-in-Trail (MIT)/Minutes-in-Trail (MINIT), other flow control measures) developed or planned to be developed in your State/Administration? If yes, please provide the implementation details.

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(12) **For ATM and Airspace Users:** In relation to MET information, rate the importance of the following components for an effective and efficient ATFM in your State/Administration. Please provide your expectations from MET service providers for each component. Please use the ratings as follows and provide further details.
(Ratings of importance: 5-Very important / 4-Important / 3-Less important / 2-Not important / 1–Not Applicable)

Needs of ATFM operation	Ratings of importance	Please provide further details
Timeliness, such as forecast lead time and update frequency		
Quality of forecast, such as accuracy and reliability		
Provision of MET information as an information service, such as through secured web services, in SWIM environment ***Note:*** *SWIM information can be found at* *https://www.icao.int/APAC/Pages/swim.aspx*		
Integration of MET information, provided through information service in SWIM, with other information domain, such aeronautical information and flight information to enable a data-centric operational environment.		
SWIM-compliant meteorological information to be more readily exchanged with the aircraft to improve operational awareness and decision-making using air/ground data connectivity and aircraft on-board systems.		
Capability to translate MET constraint into ATFM impact is required for decision support		

tool.		
Optimized flight trajectory planning		
Information on the state of the runway as provided by the appropriate airport authority, such as runway deposits, the extent of runway contamination, the depth of deposit and the estimated surface friction.		
Other (please specify):		

(13) **For ATM and Airspace User:** Based on the response from Q8 to Q12, what the challenges that your organization may have encountered, if any, regarding the development and implementation of enhanced MET services to better support ATFM operation?

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(14) **For MET only:** In reference to Q8 to Q12, what are the challenges your organization may have encountered (or may encounter), if any, regarding the development and implementation of enhanced MET services to better support ATFM operation?

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(15) **For ATM and MET:** What initiatives does your State/Administration currently undertake, or will undertake in future, to enhance MET service provision specifically in support of ATFM operations? Indicate the expected implementation timeline for these initiatives.

Future Initiatives	**Expected Timeline** **(2020-2021) / (2022-2023) / (2024-2025)**	**Brief Description of the Initiative**
Meteorological collaborative decision-making process		
MET–ATM integration (Integration of forecast data supporting ATM (ATFM and Air Traffic Services (ATS)).		
MET for FF-ICE (Flight and Flow Information for Collaborative Environment –		

Reference ICAO Doc 9965) (link the brochure)		
Other (Please Specify):		

PART D – COMMUNICATION METHODS (Questions for MET, ATM and Airspace Users)

(16) **For ATM and MET:** By which mode does your State/Administration disseminate aeronautical MET information to ATS units, Airspace Users and other stakeholders (select more than one option as necessary)?

a. Aeronautical Fixed Telecommunications Network (AFTN)
b. ATS Message Handling System (AMHS)
c. Telephone
d. Facsimile
e. Internet
f. Web/video conferencing
g. System to system Interface, e.g. web-based technology.
h. Other (please specify):
_____

(17) **For ATM and MET:** What is the most effective means of representing MET information in support of AFTM in your State/Administration? Please use the ratings below for your preference. (Preference: 5-Most preferred / 4-Preferred / 3-Less preferred / 2-least preferred / 1-Not Applicable)

Form of MET information presentation	Preference
Text	
Chart / Graphical	
Animation / Video	
Briefing	
Other (please specify):	

(18) **For ATM, MET and Airspace Users:** What are the challenges that your State/Administration may have encountered, if any, for an effective collaboration and communication between ATM and MET while developing and implementing ATFM?

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PART E – EDUCATION (Questions for MET, ATM and Airspace Users)

A document titled *Asia Pacific Regional Guidance for Tailored Meteorological Information and Services to Support Air Traffic Management Operations* is now available on the ICAO APAC Electronic Documents web-page (https://www.icao.int/APAC/apac-electronic-documents). The aim

of the document is to foster States' implementation and enhancement of MET information and services for ATM within APAC region.
The guidance captures most of the necessary processes from preparatory to operational phases. A stepwise (process-wise) structure of the guidance is expected to allow each State to refer to chapters, sections or subsections useful for the commencement, implementation or improvement of its MET information and services to support effective ATM. This guidance is expected to support State implementation of the Regional Framework for Collaborative ATFM.

(19) Was your State/Administration aware of this document?
a) No

b) Yes

(20) How do you think your State/Administration can benefit from the guidance in implementation or enhancement of MET information and services for ATM?

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(21) What other guidance or education material required to support State/Administration in implementing or improving provisions of MET information and services to support effective ATFM?

Thank you for your time to complete this survey

Respondent Information

State/Administration: _____

Organization: _____

Name: _____

Post title: _____

Email: _____

Work nature: (ATM operation / MET service / Airspace User)

Appendix 2 – Full Results

To ensure the ICAO (and States) gets the full results, excluding the personal data (i.e., name, post of title and email), the raw data from the survey results will be made available on the ICAO APAC eDocuments webpage.