



METEOROLOGY PANEL



ICAO ESAF 2026 Virtual Regional Workshop on Aeronautical Meteorology
(14 July 2026, Virtual)

Updates on the work of ICAO METP

- Modernization of MET information to support ICAO GANP

Jun Ryuzaki

Technical Officer Meteorology (METP Secretary)
Air Navigation Bureau, ICAO





Intro – the “3 fundamentals” of MET service in aviation

- ☑ “Meteorology” is one of the very first key factors for aviation safety.
- ☑ No flight may be commenced without obtaining appropriate meteorological information.
- ☑ In every phase, single authoritative meteorological information is shared among aviation users.





Intro – ICAO SARPs for Aeronautical Meteorological Service

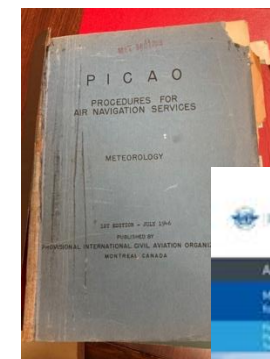
The Beginning of aeronautical meteorological service

- 1944 – Exchange of the Chicago Convention
- 1947 – Establishment of ICAO Council, Special Session for Meteorology
- 1948 – Council adopted the first Annex 3 to the Convention
- Title of the Annex 3 was “*Standards and Recommended Practices — Meteorological Codes*”

Annex 3 - “Meteorological Service for International Air Navigation”

- Defines ICAO SARPs (Standards and Recommended Practices) for meteorological services to support international air navigation
- Contracting States are encouraged to use the same provisions in domestic regulations

2.1.1 The objective of meteorological service for international air navigation shall be to contribute towards the safety, regularity and efficiency of international air navigation.





Intro – ICAO SARPs for Aeronautical Meteorological Service

Every service are designed to support specific phases of aircraft operations

Information provided by designated Centres

- WAFS SIGWX forecast, upper temp/wind data
- Volcanic Ash Advisory (VAA)
- Tropical Cyclone Advisory (TCA)
- Space Weather Advisory (SWXA)

Information for air space

- Low-level Area Forecast
- SIGMET, AIRMET
- Special Air Reports

Information at aerodrome

- METAR/SPECI, Local reports
- TAF, TREND
- Aerodrome warnings
- Windshear warnings/alert



Intro – ICAO SARPs for Aeronautical Meteorological Service

Overview of Annex/PANS amendment process

Proposed amendment is subject to the official reviewing process

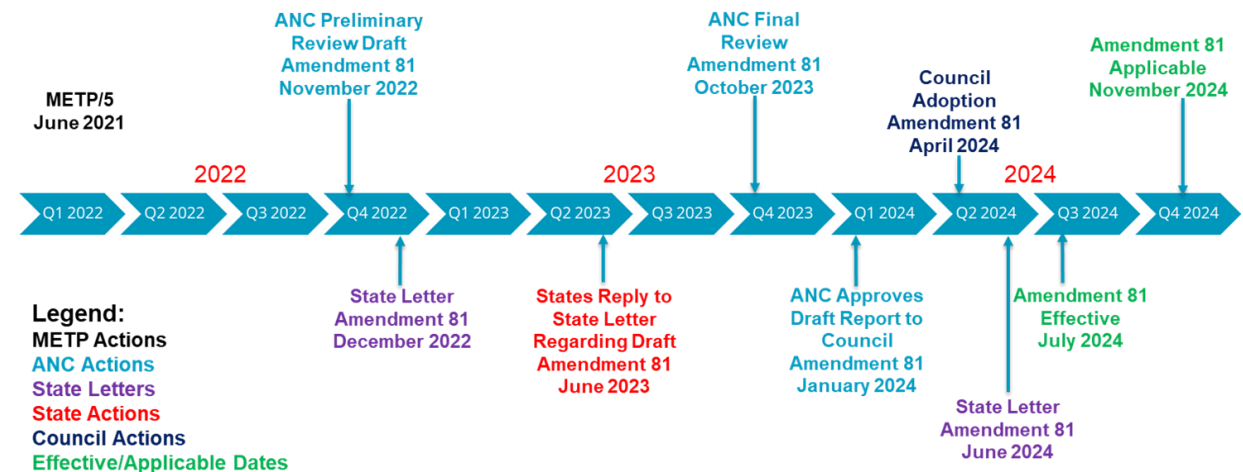
- Preliminary review (PR) by the Air Navigation Commission (ANC)
- Consultation with Contracting States and International Organizations
- Final review (FR) by the Air Navigation Commission (ANC)
- Approval by Council

After Council's approval

- Publication
- Effective
- Applicable (November AIRAC)

Amendment 81 (November 2024 Applicability Date)

Updated: 6 October 2022

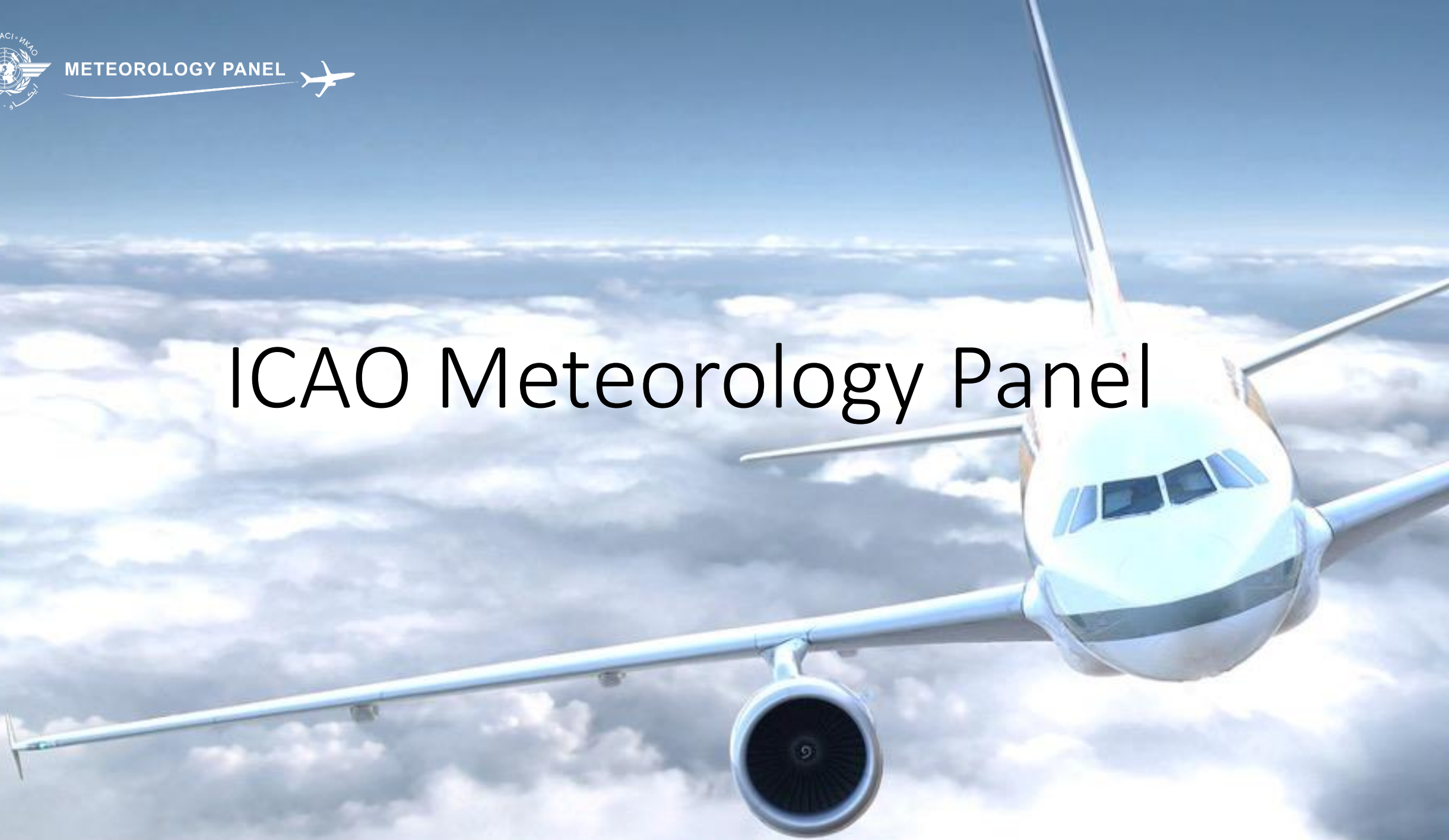




METEOROLOGY PANEL



ICAO Meteorology Panel





Meteorology Panel (METP)

- **Established in 2014 (ANC 197th)** – One of 19 Air Navigation Commission Panels, the METP is tasked to further the development of aeronautical meteorological services, address specific global issues, and enhance global standards for aeronautical meteorological information
- **Non-governmental technical expert group**, consisting of 33 Member experts and 4 Observers nominated by 29 States and 8 International Organizations
- **Key Areas of work (assigned by the ANC)**
 - Extended use of IWXXM and MET-SWIM information service (JC METP.004)
 - Further developments of:
 - International Airways Volcano Watch (IAVW) (JC METP.003)
 - Provision of SO₂ information (JC METP.012) *paused*
 - World Area Forecast system (WAFS) (JC METP.010)
 - SADIS and WIFS (JC METP.008)
 - Space weather information service (SWIS) (JC METP.014)
 - Development of future aeronautical meteorological information services:
 - New Requirements to support GANP (JC METP.013)
 - Hazardous Weather Information Service (HWIS) (JC METP.007)
 - Guidance on cost recovery framework and governance (JC METP.011) *closed at METP/6*

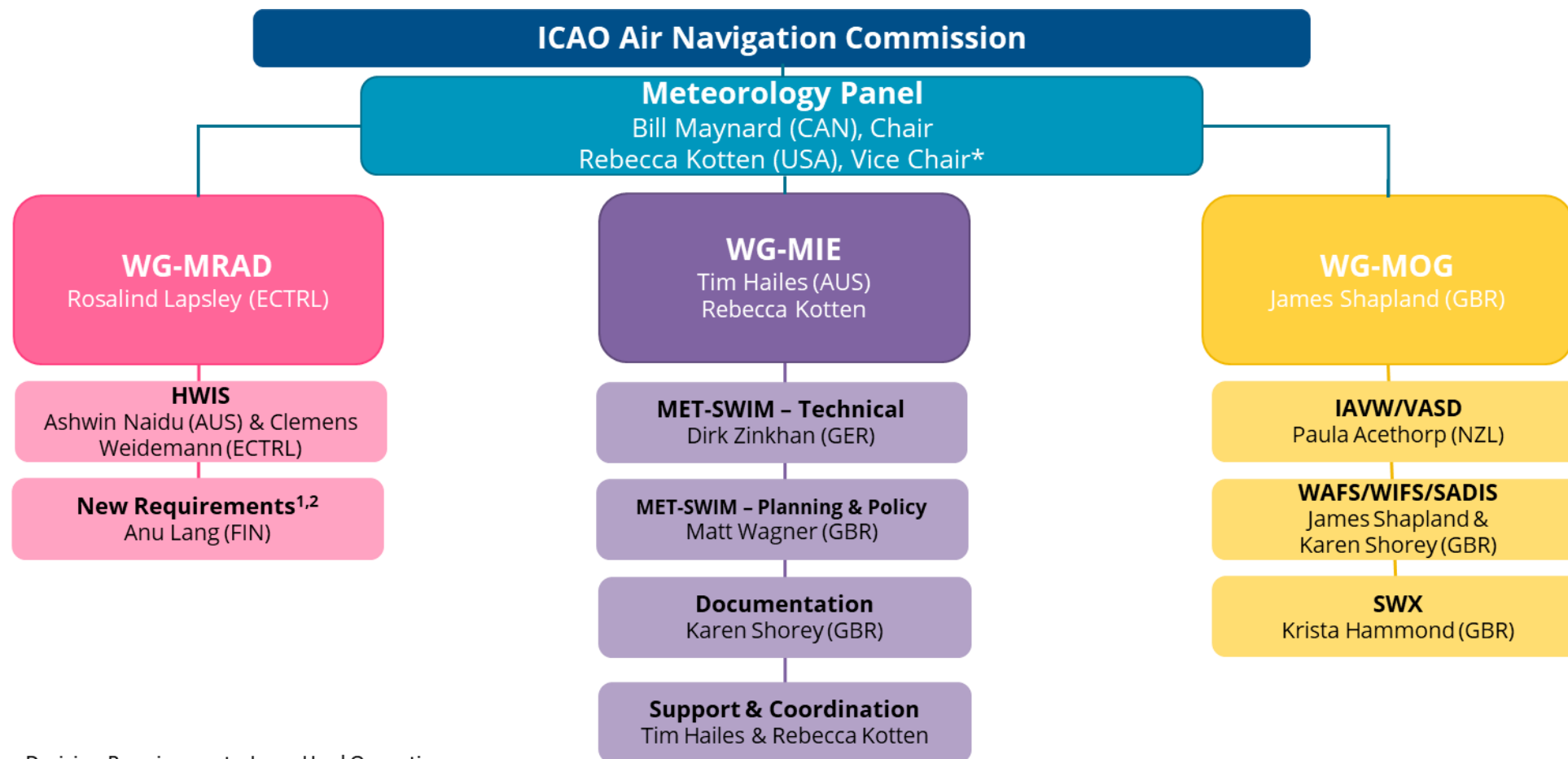


MET Panel Members (as of 19 May 2026)

Name	States/IO	Name	States/IO	Name	States/IO
Ribero, Claudia	Argentina	Romito, Angelo	Italy	Lootah, Sultan	United Arab Emirates
Hailes, Tim	Australia	Ikeda, Michiko	Japan	Shapland, James	United Kingdom
Ali Al-Alawi, Dheya	Bahrain	Gicheru, Winstone	Kenya	Kotten, Rebecca	United States
Rangel, Vicente Batista	Brazil	Rodriguez Hernandez, Joaquin	Mexico	Asumu Mbeze Esono, Nuria Mikue	ASECNA
Maynard, Bill	Canada	Acethorp, Paula	New Zealand	Jericevic, Amela	EASA (Obs.)
Fajardo, Rodrigo	Chile	Chibuzo Egere, Douglas	Nigeria (Obs.)	Lapsley, Rosalind	EUROCONTROL
Zhang, Zhongfeng	China	Lee, Seung-Ju	Republic of Korea	Manicus, Jiska	IATA
Sy Diop, Babakar	Cote d'Ivoire	Gogu, Silviu	Romania (Obs.)	Rahmes, Timothy	ICCAIA
Gonzalez Valdes, Ivan	Cuba	Kriukov, Dmitrii	Russian Federation	Wille, Hendrik	IFALPA
Nuottokari, Jaakko	Finland	Alsulaim, Waleed	Saudi Arabia	Avila, Eric	IFATCA
Tabary, Pierre	France	Cheong, Wee Kiong	Singapore	Wigniolle, Stéphanie	WMO
Sturm, Klaus	Germany	Moloto, Albert	South Africa	33 Members / 4 Observers from 29 States / 8 Intl. Organizations	
Kumar, Gajendra	India	Haeffliger, Marcel	Switzerland (Obs.)		



Current MET Panel Structure



¹Includes: De-icing Requirements, Long-Haul Operations Requirements, Terminal Requirements

²Includes: Ice Crystal Observations, Evaluation of IWXXM Extensions, High Altitude Ice Crystals

*Rosalind Lapsley, second vice chair, and Jaakko Nuottokari, third vice chair



METP/6 (3-7 March 2025, ICAO HQ Montreal)

- METP/6 meeting was held in Montréal, ICAO Headquarters
- 60 Attendees from 19 States and 6 International Organizations
- 40 Working Papers, 19 Information Papers, and 9 Flimsies reviewed and discussed
- 22 Recommendations and 21 Decisions formulated

(Ref) Previous meetings of METP

- METP/1: 20 - 24, April 2015, Montreal
- METP/2: 17-21, October 2016, Montreal
- METP/3: 26-27, April 2018, Montreal
- METP/4: 10-14, September 2018, Montreal
- METP/5: 7-9, 11, 14 and 16 June 2021 (virtual)





(Ref) summary of draft AMD83 proposals arising from METP/6

Annex 3 & PANS-MET

- **IAVW & QVA information service:** Addition of SVO & VAAC as recipients of volcanic activity information from AMO / Introduction of QVA “information service” via SWIM
- **Extended use of IWXXM:** To retain IWXXM as a single standard exchange format in Nov 2030 / Retirement of TAC and plain language products to facilitate IWXXM transition **MET-SWIM transition roadmap attached to SL*
- **Guidelines on access to aeronautical meteorological information:** Clarify States responsibility for arranging access by non-aeronautical users
- **Further development of WAFS:** new probability forecast and turbulence type forecast in Nov 2028
- **Further development of space weather information service:** Finer time-resolution (+3, +9 hours to be added) for up to +12 hours / Longer forecast elements (beyond +18 hours) to be once removed
- **Transposal of former WMO No.49 Vol II, Part III and IV to PANS-MET:** aeronautical climatological information (Part III) and flight documentation (Part IV)

PANS-ABC

- **IAVW & QVA information service:** New abbreviation for QVA – “quantitative volcanic ash concentration information”



METEOROLOGY PANEL



Modernization of aeronautical MET service



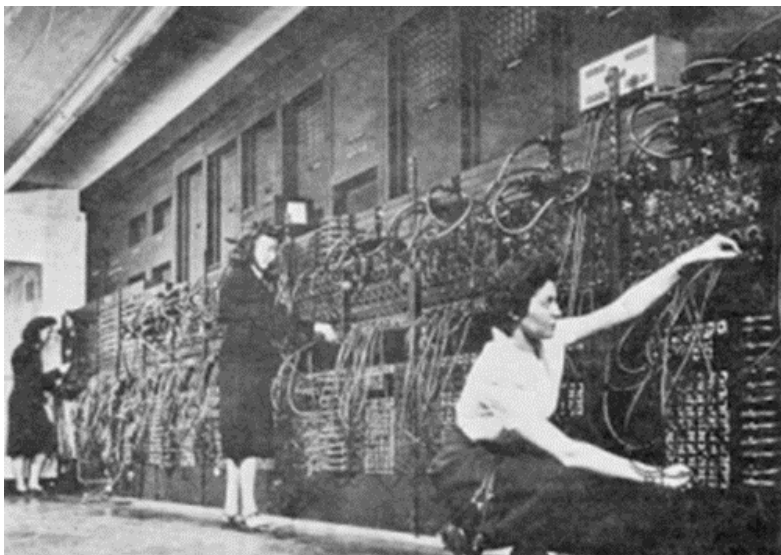
Where did we come from?

- Hand drawn analysis (isobars, nephanalysis, stability etc.)
- Teletype distribution of coded weather reports and forecasts
 - SA code (hourly code) in some places
- Use of dedicated “fixed” lines for aeronautical information
 - Transmission windows, intermediate data aggregators in some cases
- Graphical products sent by fax
- Observations almost all done by humans
- Counter briefings were commonly available
- Information included in State AIP

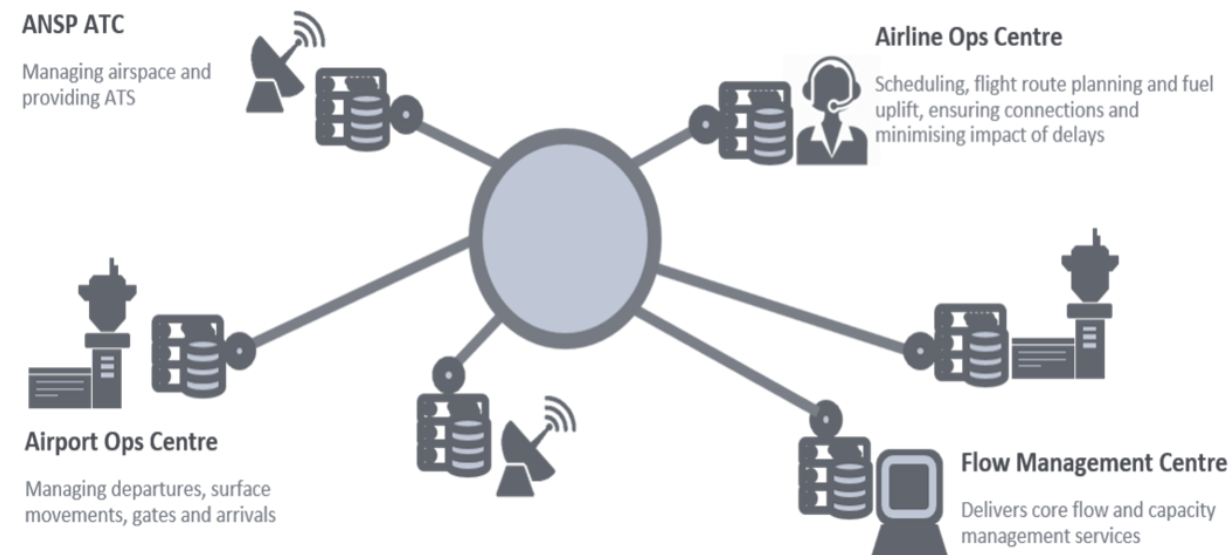


Then and Now – Aeronautical MET Information Transmission

Fixed Lines



System Wide Information Management



Cirium Sky for SWIM

Source: www.cirium.com/solutions/swim (16 January 2025)



Then and Now – Aeronautical MET Information Dissemination

Teletype Machines



Aviation Weather Display



Display at 2019 Air Traffic Controller Association Conference (Photo by Raytheon)

Source: www.faa.gov/nextgen/programs/weather (16 January 2025)



Where are we now?

- Increased automation (observations and data analysis and assimilation)
- Significant increase in computing ability and remote observational capabilities
- Internet distribution (e-mail, x400 with attachment). Increasing web distribution
- The core content of weather information remains code based
 - **Advantage** – it is understood, essentially globally used, and a useful abbreviated method to distribution information that is integrated into decision making criteria (often linked to regulations)
 - **Disadvantages** – requires code training, can be cumbersome (especially by voice) and is limited in its ability to provide additional useful information.



However, we are still using codes

METAR

CYOW 170100Z 17004KT 15SM -SN FEW040 BKN065 OVC120 M06/M09 A2974 RMK SC2SC4AC2 SLP081

TAF

TAF CYOW 162340Z 1700/1806 18010KT P6SM OVC030
TEMPO 1700/1703 4SM -SN OVC020
FM170300 19008KT 1 1/2SM -SN SCT008 OVC012
TEMPO 1703/1705 4SM -SN OVC025
FM170500 18006KT P6SM -SN SCT012 BKN030
TEMPO 1705/1709 5SM -SN OVC020
BECMG 1705/1707 24005KT
FM170900 24005KT P6SM FEW003 BKN025
FM171200 24005KT P6SM SCT003 BKN020
FM171800 19007KT P6SM BKN025
FM172300 18008KT P6SM BKN015 OVC100 RMK NXT FCST BY 170300Z

SIGMET

WSCN02 CWA0 162246
CZEG SIGMET E2 VALID 162245/170245 CWEG-
CZEG EDMONTON FIR SEV TURB OBS WI 60NM WID LINE BTN N5036 W11837 - N5053
W11455
- N5128 W11123 FL160/250 MOV SE 25KT NC=



Current coded products are still constrained

METAR/SPECI

- 4 RVR values
- 3 phenomena in present weather element
- 3 phenomena in recent weather element
- 3 phenomena in trend forecast

TAF

- 4 cloud layers
- 3 phenomena in present weather element
- 2 temperature groups

SIGMET

- 7 points in a polygon

VA SIGMET

- 2 volcanic ash clouds (affecting the FIR concerned)

TC SIGMET

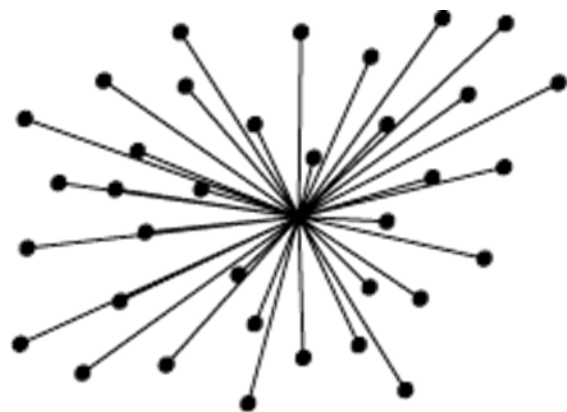
- 2 centres (eyes) of tropical cyclones (affecting the FIR concerned)

AIRMET

- 1 hazardous weather phenomenon



Evolution of Dissemination Models



centralised



decentralised



distributed

Past

Present

Future



AMET Modules

AMET	/1	/2	/3	/4
B0	Meteorological observations products	Meteorological forecast and warning products	Climatological and historical meteorological products	Dissemination of meteorological products
B1	Meteorological observations information	Meteorological forecast and warning information	Climatological and historical meteorological information	Dissemination of meteorological information
B2	Meteorological observations information	Meteorological forecast and warning information	Climatological and historical meteorological information	Meteorological information service in SWIM
B3	Meteorological observations information	Meteorological forecast and warning information	Climatological and historical meteorological information	Meteorological information service in SWIM
B4	Meteorological observations information	Meteorological forecast and warning information	Climatological and historical meteorological information	Meteorological information service in SWIM



AMET Module

AMET BBB: Meteorological information provided to support operational efficiency and safety.

AMET Block 0: Global, regional and local meteorological information to support flexible airspace management, improved situational awareness, collaborative decision-making and dynamically optimized flight trajectory planning.

AMET Block 1: Meteorological information supporting automated decision process or aids, involving meteorological information, meteorological information translation, ATM impact conversion and ATM decision support.

AMET Block 2: Integrated meteorological information in support of enhanced operational ground and air decision-making processes, particularly in the planning phase and near-term.

AMET Block 3: Integrated meteorological information in support of enhanced operational ground and air decision-making processes, for all flight phases and corresponding air traffic management operations.

AMET Block 4: Integrated meteorological information supporting both air and ground decision making for all phases of flight and ATM operations, especially for implementing immediate weather mitigation strategies.



AMET Module - AMET Bx/4 - Dissemination

AMET B0/4: Dissemination of Meteorological Products

Commencement of IWXXM, being the conversion of TAC using an IWXXM schema into XML/GML.

AMET B1/4: Dissemination of Meteorological Information

IWXXM form starts to replace TAC products. Human-readable products start to be derived from the IWXXM information (rather than the other way around). The introduction of web services allows for progressive replacement of fixed line dissemination systems.

AMET B2/4: Dissemination of Information Services in SWIM

Implementation of a data-centric MET information into a SWIM environment. User-defined products derived from meteorological information in IWXXM. Wider use of secure web services and decommissioning of fixed line and satellite dissemination systems. Commencement of the use of business-to-business services, allowing integration of MET information into ATM systems. Increased use of air-to-air datalink for transmission of upper air meteorological observation in near real-time.

AMET B3/4: Dissemination of Information Services in SWIM

Continued implementation of a data-centric meteorological information service into SWIM. Enhancement of IWXXM with further schemas and formats for meteorological information exchange. User-defined products automatically derived from meteorological information IWXXM form. Extensive use of secure web services, in particular business-to-business services that allows full integration of meteorological information.



The Evolution of Aeronautical Meteorological Information

- From teletype, through e-mail, through dial up to WiFi, to the web, to EFBs
- Dramatic increases in computing and communications technology
- From limited coded messages to high fidelity information
- From fully manual processes to increased use of automation
- New means of observation (both airborne and remote)
- From set products to flexible information
- New types of information: Space Weather, Quantitative Volcanic Ash, probabilistic information, ultra long haul and both higher and lower altitude requirements etc.
- From past limits to future possibilities.



METEOROLOGY PANEL



Transition to MET-SWIM



METP Plans for MET-SWIM

- Per the ICAO GANP, information service provision and consumption should commence within Aviation System Block Upgrade (ASBU) 2 (2025-2030)
- Roadmap for Meteorology in System Wide Information Management (MET-SWIM Roadmap) describes the transition plan and associated timelines for implementing MET-SWIM
- MET-SWIM Roadmap includes graphics for overarching information exchange across ASBUs 1-4, as well as transition plan for specific components of MET-SWIM (ex: communication protocols, information exchange services, data types, data addressing, etc.)

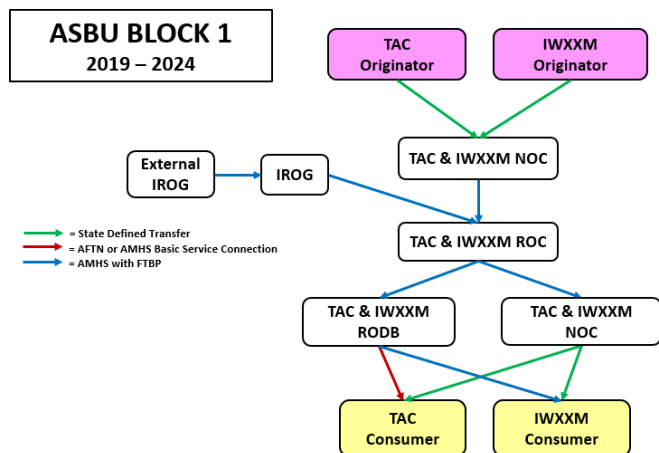
ASBU Element	ASBU Element Description	ASBU	Timeline
AMET-B1/4	Dissemination of MET Information	1	2019 – 2024
AMET-B2/4	MET Information Service in SWIM	2	2025 – 2030
AMET-B3/4	MET Information Service in SWIM	3	2031 – 2036
AMET-B4/4	MET Information Service in SWIM	4	2037 – 2042

Source: MET-SWIM Roadmap, Table 1

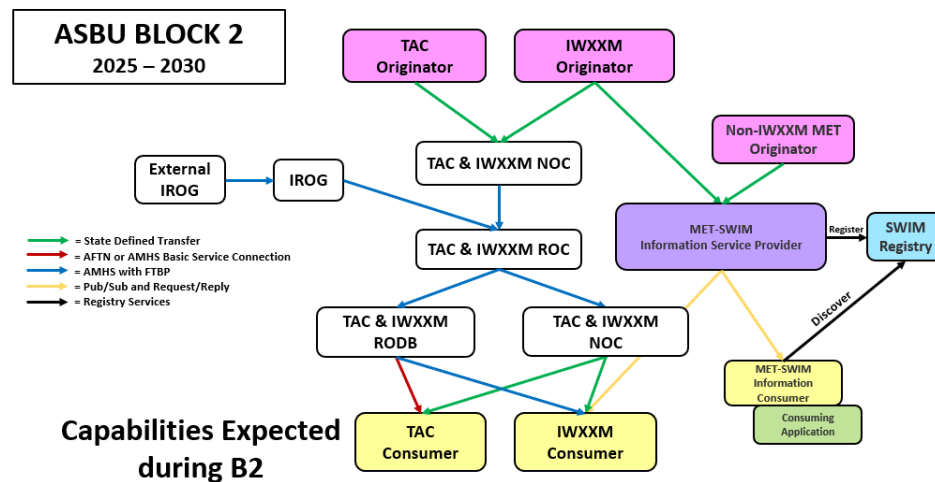


MET-SWIM Roadmap

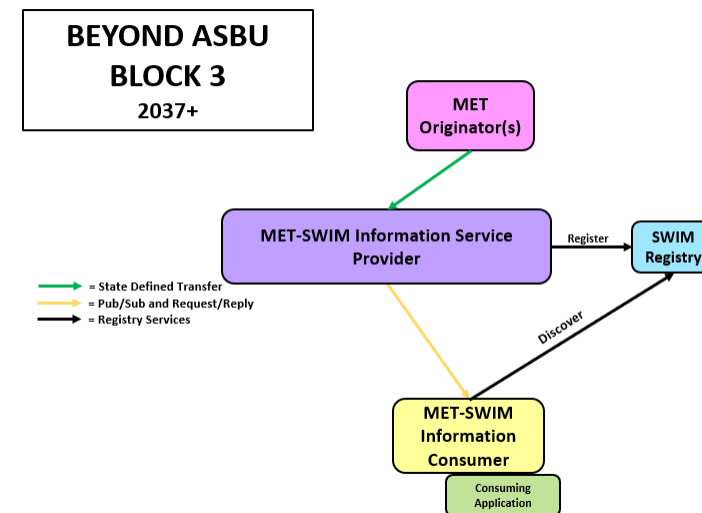
The Past



The Present



The Future



The provision of aeronautical meteorological information via SWIM-enabled information services will be one of the most significant developments in aviation in the last 30 years.



Added value of MET information services – advantages over current “products”

- **Increased temporal resolution**
 - Weather observation information updated at shorter cycle (e.g., 5-minutes intervals)
 - Weather prediction model with finer temporal resolution and shorter update cycle
 - Future possibilities for “streaming” information services with very low latency
- **Increased spatial resolution**
 - High-resolution weather model data can be extracted in fit-for-purpose elements/areas/altitude levels
 - Severe weather phenomena captured more precisely than polygons or geographical reference points
- **Fit-for-purpose information services**
 - Tailored information services (e.g., regional information services developed in EUR) can be developed
 - More flexibility to respond to various local user needs
- **Free from legacy technical constraints**
 - No constraints on data volume — only minimum mandated information required for airspace users



Added value of MET information services – challenges for implementation

- **Much larger data volume**
 - Systems need adaptation to manage data influx
 - Users should select only necessary data (e.g., avoid downloading the whole global model data set)
- **“No State left behind”**
 - Balancing innovation with realistic global standardization
 - Varied capabilities and progress across States and ICAO regions
- **Data Visualization**
 - Standardization of MET data visualization once data moves beyond TAC format



Expected Initial MET-SWIM Services

SADIS & WIFS API: Enhancing Aviation Data Services

- **Operational since 2024:**
 - **SADIS** (WAFC London) & **WIFS API** (WAFC Washington) provide access to key aviation data
 - Both are SWIM-compliant, based on the OGC Environmental Data Retrieval (EDR) API framework
- **Key Data Provided:**
 - Upgraded WAFS gridded data, METARs, TAFs, SIGMETs, WAFS SIGWX forecasts
 - Serves National Met Services, ANSPs, flight planning companies, airlines, and aviation software providers

Quantitative Volcanic Ash Concentration Information (QVA)

- **Introduced in Amendment 82** to Annex 3 (effective 27 November 2025)
- **QVA information service (Amendment 83 to Annex 3, expected applicability in Nov 2027)**
 - All nine ICAO-designated VAACs to commence QVA data provision via SWIM-compliant information service



Expected Initial MET-SWIM Services (Cont.)

AMOIS (Aerodrome Meteorological Observational Information Service)

- Provides aerodrome observations with higher fidelity than METAR, SPECI, etc., in terms of representation, spatial/temporal accuracy, and coverage

AMFIS (Aerodrome Meteorological Forecast Information Service)

- Delivers aerodrome forecasts beyond the specifications of TAF, TREND, and other current aerodrome forecasts

Implementation

- Expected introduction as Recommended Practices in **Amendment 84** to Annex 3 and **Amendment 2** to PANS-MET, with applicability in **November 2030**
- Service providers must register and publish their services in a standardized format



Further beyond...

HWIS (Hazardous Weather Information Service)

- Provides regionally/globally harmonized data for en-route hazardous weather phenomena (Turbulence, Icing, CBs) with high spatial precision
- HWIS consist of multiple layer of service contribution: HWIS integrator/sub-regional contributor/single contributor.

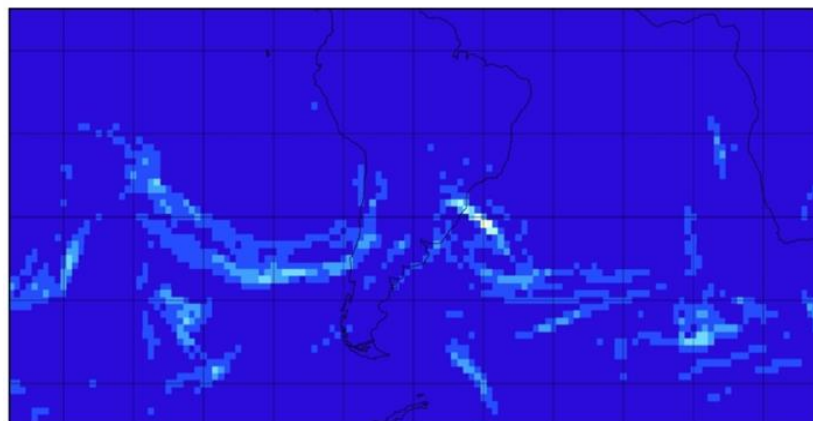
Towards future implementation

- Development of service architecture is still on-going, aiming at expected introduction as Recommended Practices in **Amendment 85** to Annex 3 and **Amendment 3** to PANS-MET, with applicability in **November 2033**
- Service will be provided via SWIM Information Service

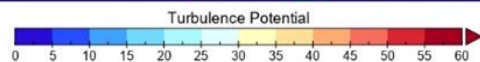
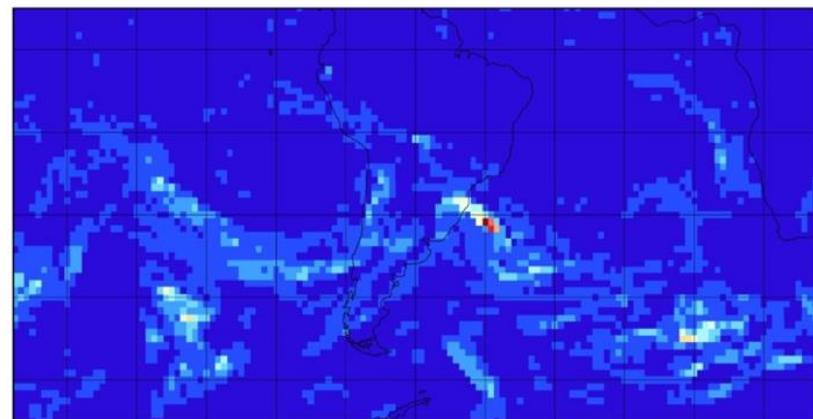


Higher Resolution Information

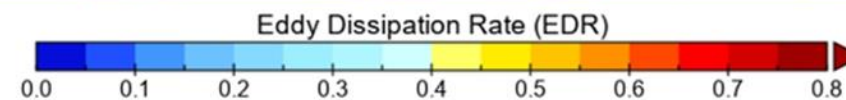
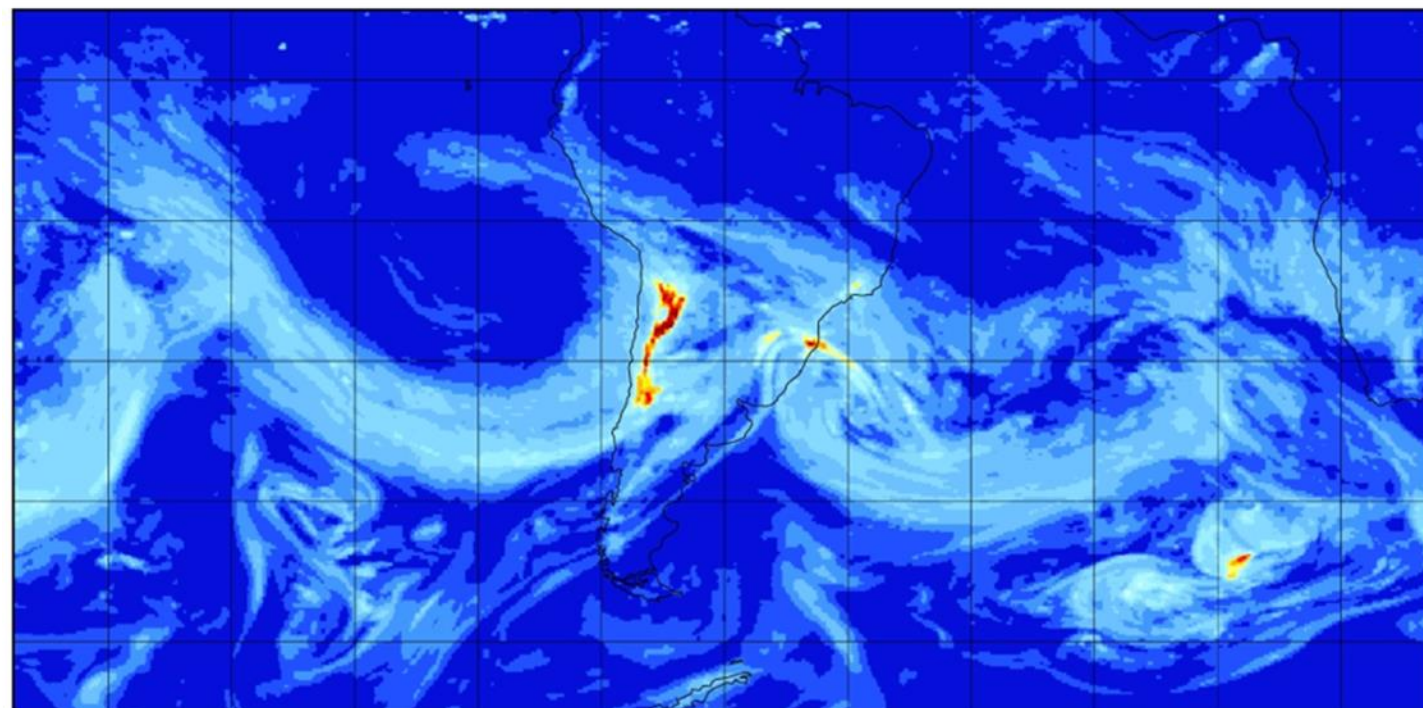
1.25 degree Clear air turbulence (CAT) Potential Average at 400hPa (FL240)



1.25 degree Clear air turbulence (CAT) Potential (Max) at 400hPa (FL240)



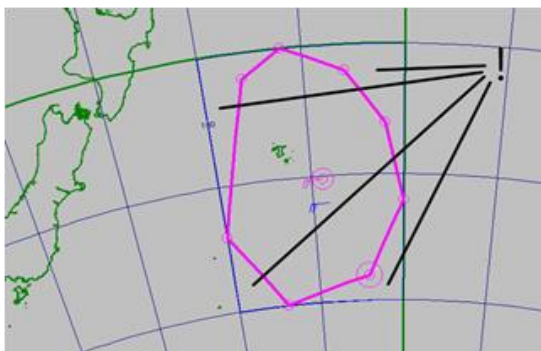
0.25 degree Turbulence Severity (GTG) at FL240 (392.7hPa)



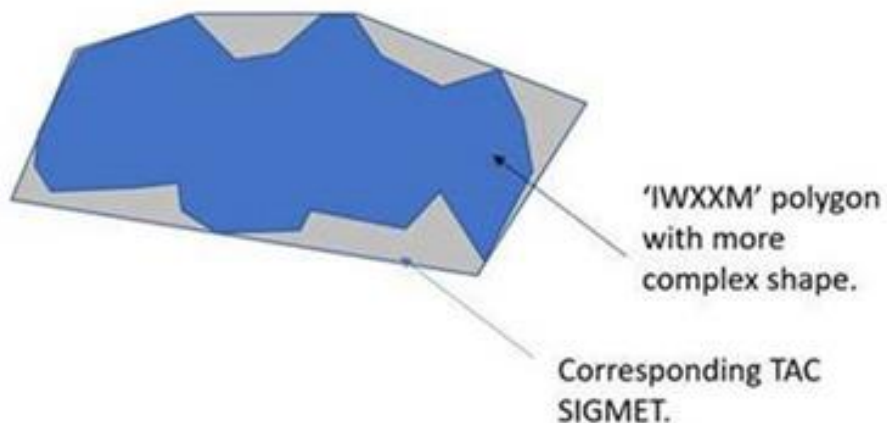


Improving Hazardous Weather Information

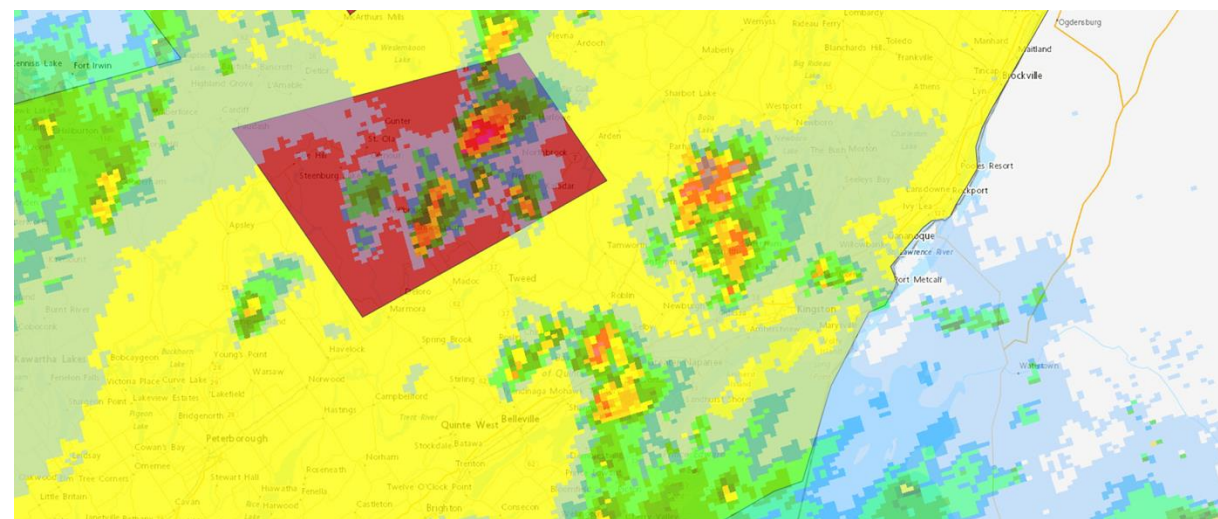
Current constraints - SIGMET limited to 7 points



SIGMET in IWXXM – no constraints for the number of points



The future – Hazardous Weather Information Service





Summary



Summary – METP's background and structure

- **ICAO Meteorology Panel (METP) was established by the Air Navigation Commission** to further develop enhanced global standards for aeronautical meteorological services.
- **METP has been addressing several key identified areas to address global requirements** as identified in ANC Job Cards.
 - Extended use of IWXXM and MET-SWIM information service (JC METP.004)
 - Further developments of International Airways Volcano Watch (IAVW) (JC METP.003)
 - Further developments of World Area Forecast system (WAFS) (JC METP.010)
 - Further developments of SADIS and WIFS (JC METP.008)
 - Further developments of Space weather information service (SWIS) (JC METP.014)
 - New Requirements to support GANP (JC METP.013)
 - Hazardous Weather Information Service (HWIS) (JC METP.007)



Summary – Modernization of Aeronautical Meteorological Service

- **Modernization of meteorological information services** – enhanced meteorological service is an essential enabler for the operational advancements required to achieve the future air traffic management (ATM), as outlined in the ICAO Global Air Navigation Plan (GANP).
- **Successful implementation of MET-SWIM information services** – clear and coordinated timelines must be communicated across all ICAO Regions and States to ensure harmonized implementation and consistency in the global framework.
- **Engagement with aviation stakeholders** – In addition to the technical and regulatory alignment, effective stakeholder outreach is crucial. Engaging with relevant stakeholders—ranging from air navigation service providers (ANSPs) to operators, air crews, and aviation system/software developers—will be essential to facilitate a smoother and seamless transition and integration of enhanced MET information services.



Summary – Forthcoming changes and further beyond

- **Amendment 83 (Applicable November 2027)**
 - **Amendment proposals have been consulted with States/International Organizations**
 - ANC final review is scheduled on 29 Sept 2026
 - **QVA** is to be provided via SWIM information service
 - **WAFS** probability forecast and turbulence-type forecast will be introduced in Nov 2028
 - **SWXA** will contain finer time resolution (3hr steps until +12hrs)
 - **IWXXM** is to become a single standard exchange format in Nov 2030
 - TAC/plain language “products” are to be retired
- **Amendment 84 (Applicable November 2030)**
 - **AMOIS/AMFIS** are to be introduced as Recommended Practices
 - **Space Weather Information Service (SWIS)** is to be provided via SWIM information service
- **Further beyond... (TBD)**
 - **Hazardous Weather Information Service (HWIS)** is to be introduced as a Recommended Practice



Useful links

- ICAO METP Public Website:
<https://www.icao.int/airnavigation/aeronautical-meteorological-service>
- ICAO GANP Portal: <https://www4.icao.int/ganpportal/>
- ICAO e-library: <https://elibrary.icao.int/home;seoMode=true>
- World Civil Aviation Report Vol.6 – 2023 Edition: <https://elibrary.icao.int/product/443879>
- ICAO TV: <https://www.icao.tv/>
 - Air Navigation World 2023 – Shaping Skies of Tomorrow
 - Harmonized & quantitative meteorological information services
<https://www.icao.tv/air-navigation-world/season:1/videos/anw2023-harmonized-quantitative-meteorological-information-services>
 - Delivery, use and integration of future meteorological information
<https://www.icao.tv/air-navigation-world/season:1/videos/anw2023-delivery-use-and-integration-of-future-meteorological-information>



METEOROLOGY PANEL



Thank you
Any questions?

