



METEOROLOGY PANEL



Meteorology in SWIM

ICAO Meteorology Panel (METP)

Presented by Karen Shorey





- ✈ Introduction
- ✈ Transition from Products to Information Services
- ✈ Requirements for MET-SWIM
 - ✈ GANP ASBUs
 - ✈ Annex 3 and PANS-MET
- ✈ Current and Future MET-SWIM Services
- ✈ Stakeholder Impacts
 - ✈ Benefits
 - ✈ Challenges
- ✈ Key Takeaways



- SWIM enables interoperability across the entire global air traffic management (ATM) system
- Meteorology in SWIM (MET-SWIM) applies the global SWIM framework to the aeronautical meteorological (MET) domain
- MET-SWIM is intended to replace the Aeronautical Fixed System (AFS), the legacy point-to-point message exchange system at some point

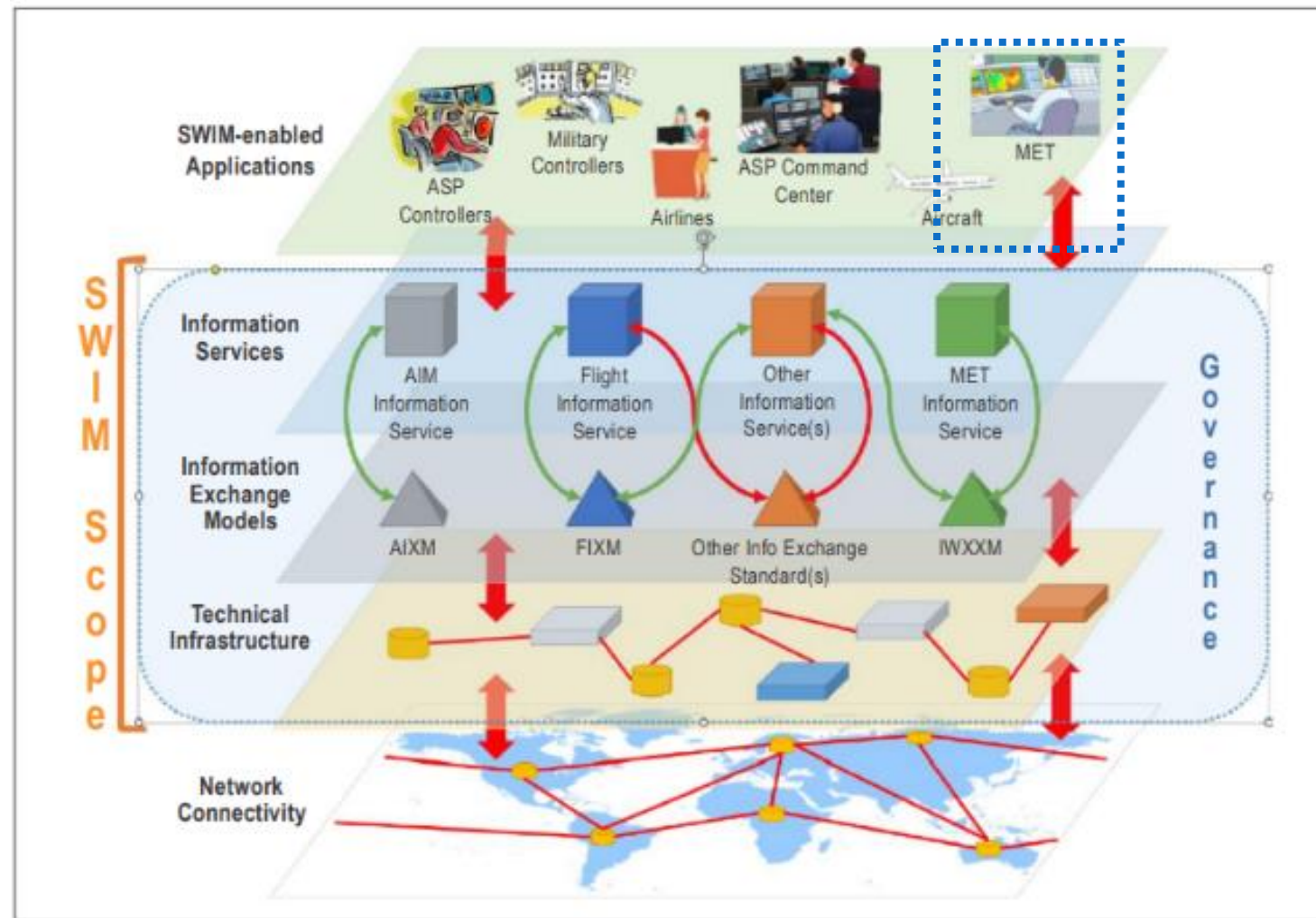


Figure 1-1 from ICAO Doc 10203, *Manual on SWIM Implementation*



Transition from products to information services



- Traditional MET products in teletype, traditional alphanumeric code (TAC) format no longer suffice for international air navigation
- MET information is now required to be provided and exchanged in ICAO Meteorological Information Exchange Model (IWXXM) format (aligned with flight and aeronautical information domains)

Traditional approach	Future approach
Static, text-based products (e.g., METAR and TAF)	Dynamic, machine-readable data (e.g., IWXXM format)
Limited integration with automated systems	Seamless integration with ATM and airline systems, decision-aids

- Information services are automated, tailored to user needs and decision-making timeframes



Requirements for MET-SWIM



- ➔ The Global Air Navigation Plan (GANP) Aviation System Block Upgrades (ASBUs) sets the following modules for Meteorology:

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 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.



- ➔ Amendment 81 to ICAO Annex 3, *Meteorological Service for International Air Navigation*, included the following provision (ref. para. 2.2.10):

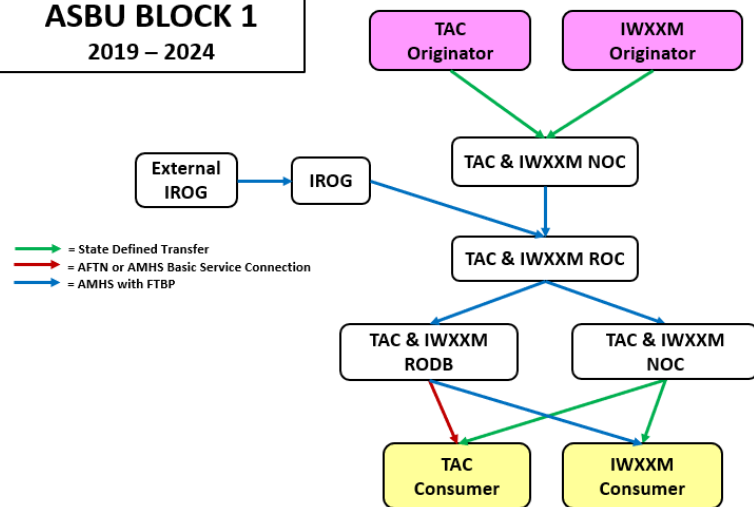
2.2.10 Recommendation.— *Contracting States should ensure that the meteorological information supplied to the users listed in 2.1.2 is provided through information services.*

Note 1.— In the context of system-wide information management (SWIM), the notion of information service addresses machine-to-machine interaction in a service-oriented architecture.

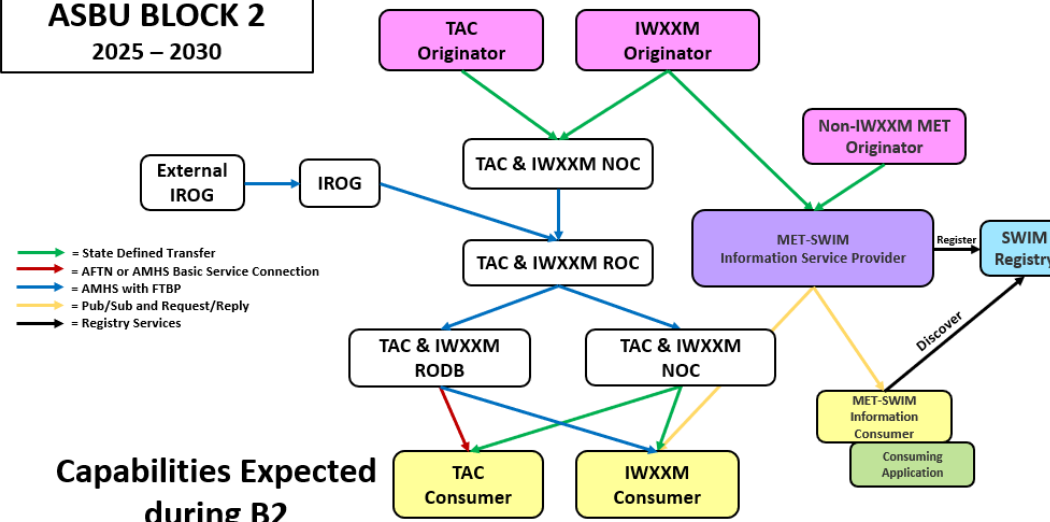
Note 2.— Procedures on information services are contained in the Procedures for Air Navigation Services – Information Management (PANS-IM, Doc 10199).

Note 3.— Guidance material on information services can be found in the Manual on System-wide Information Management Implementation (Doc 10203).

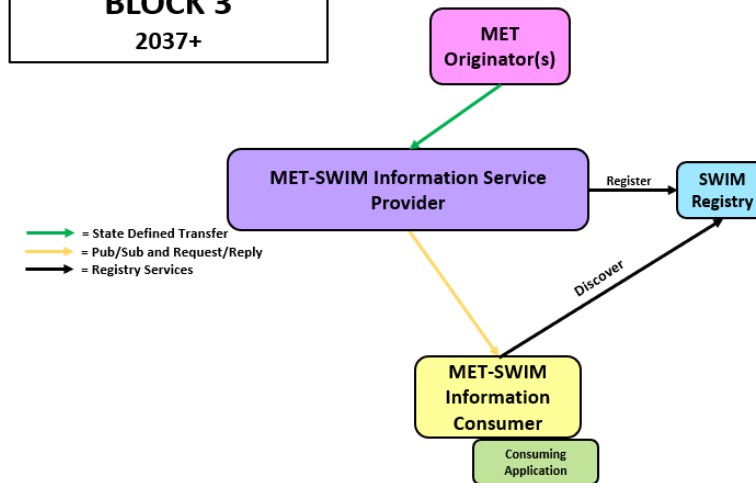
- ➔ As a result, the ICAO METP is developing subsequent Standards and Recommended Practices (SARPs) to enable information services for the provision of MET information

**ASBU BLOCK 1**
2019 – 2024**The Past**

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

The Present**ASBU BLOCK 2**
2025 – 2030

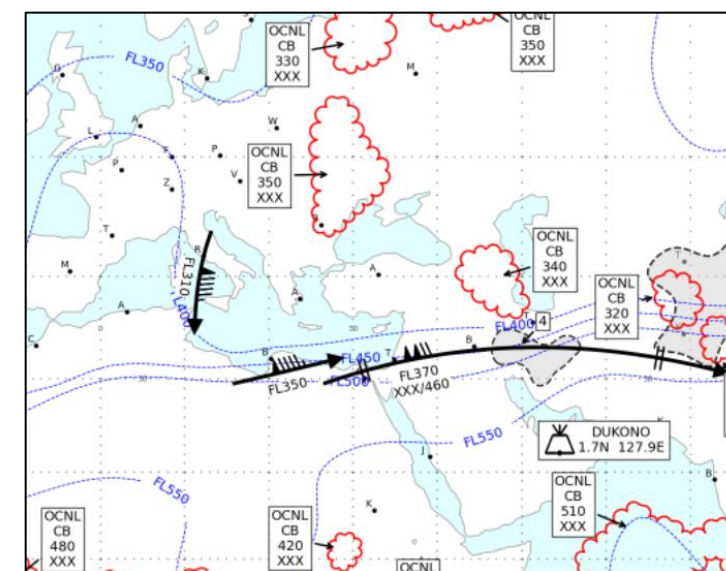
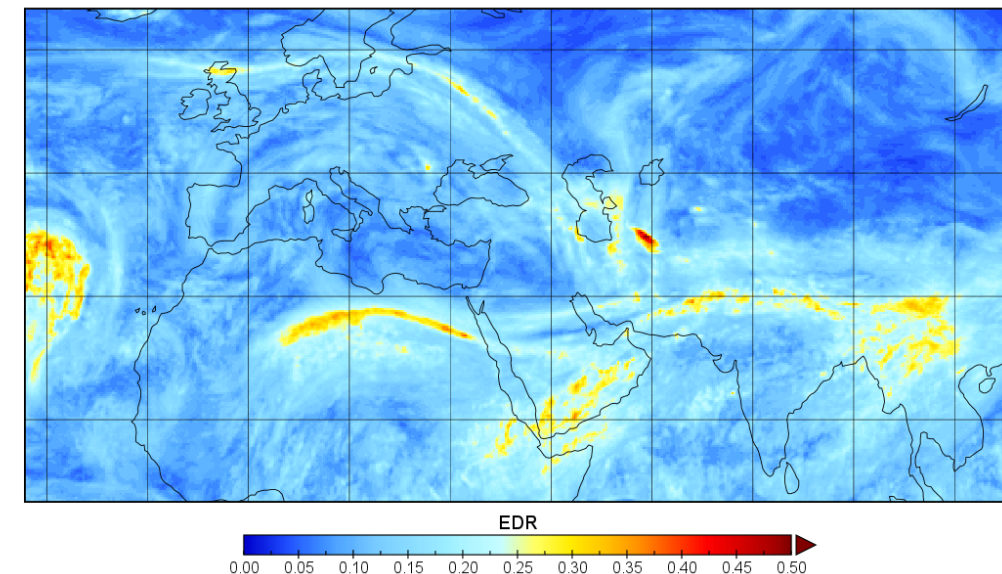
Capabilities Expected during B2

BEYOND ASBU BLOCK 3
2037+**The Future**



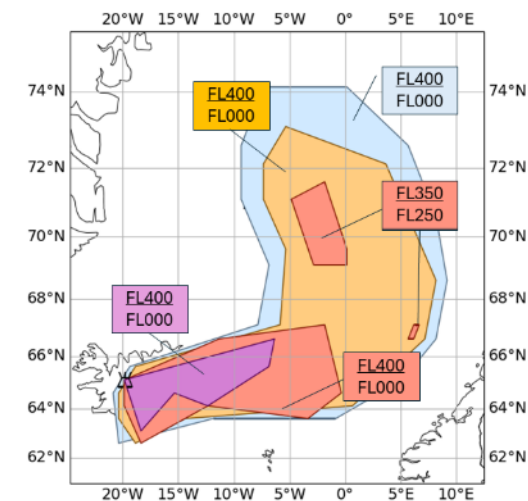
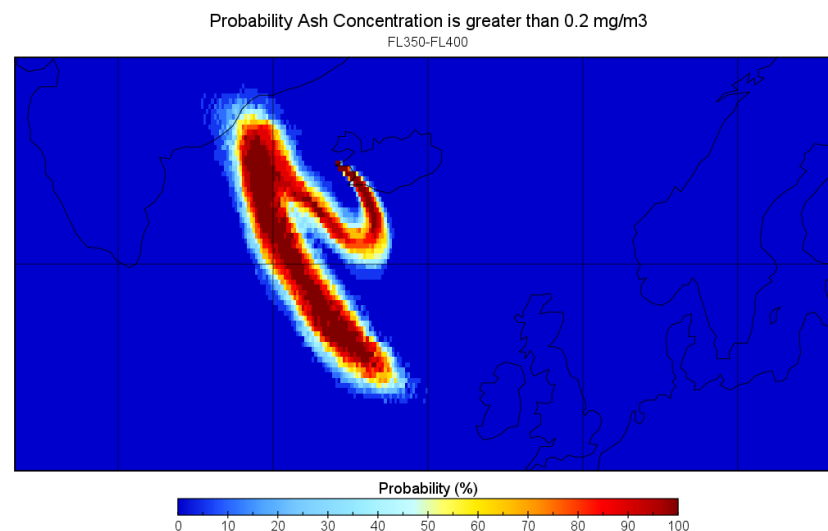
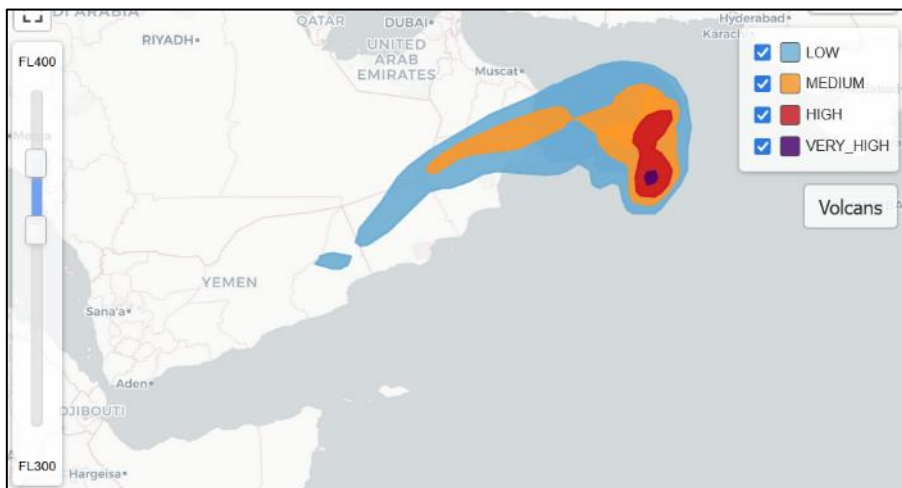
- ➔ WAFS
- ➔ Secure Aviation Data Information Service (SADIS) and WAFS Internet File Service (WIFS) Application Program Interfaces (APIs)
 - ➔ SADIS API, provided by World Area Forecast Centre (WAFC) London, and WIFS API, provided by WAFC Washington, became operational in 2025
 - ➔ Both systems are SWIM compliant and based on the Open Geospatial Consortium (OGC) Environmental Data Retrieval (EDR) API framework
 - ➔ SADIS API and WIFS API provide access to upgraded WAFS gridded data sets, global METARs, TAFs, SIGMETs and other advisories, and multi-timestep WAFS SIGWX forecasts
 - ➔ These systems supply data to National Met Services, ANSP's, Flight planning companies, Airlines, and other aviation specific software suppliers across the globe

WAFC Turbulence
FL340





- ➔ Quantitative Volcanic Ash (QVA)
- ➔ Introduced to ICAO Annex 3 with Amendment 82
 - ➔ VAAC London and VAAC Toulouse QVA API's became operational on 27 November 2025. The other 7 VAACs will follow in late 2026.
 - ➔ Provides deterministic and probabilistic gridded ash concentration forecasts as well as QVA ash polygons
 - ➔ All VAACs agreed to use the OGC-EDR API framework
 - ➔ These systems are starting to supply data to National Met Services, ANSP's, Flight planning companies, Airlines, and other aviation specific software suppliers across the globe





- ➔ **AMOIS** (Aerodrome Meteorological Observation Information Service) is the future aerodrome observation, which will eventually replace METAR, SPECI and local routine/special report
 - ➔ Significantly increased temporal resolution, possibility to provide data on e.g. 1-minute intervals
 - ➔ Increased optional parameters, and multiple sensor data can be included alongside more traditional aerodrome met data
 - ➔ Possibility to include both automated and manual observation data
 - ➔ New IWXXM schema to be developed
 - ➔ Initial base requirements can still be met based on METAR/SPECI.
 - ➔ Distribution only via SWIM information services, not planned to distribute via AFS/AMHS



- **AMFIS** (Aerodrome Meteorological Forecast Information Service) is the future aerodrome forecast, which will eventually replace TAF and TREND
 - Increased temporal resolution: base forecast interval 1 hour, put optionally up to 15 minutes
 - Increased optional parameters, e.g. lightning risk, runway temperatures
 - Extended use of probabilities for certain parameters and thresholds
 - New IWXXM schema to be developed
 - Initial base requirements can be met based on TAF
 - Distribution only via SWIM information services, not planned to distribute via AFS/AMHS



- ➔ **HWIS** (Hazardous Weather Information Service) is the future en-route warning information service, which will compliment and eventually replace SIGMETs
 - ➔ HWIS parameters to be provided: CB clouds, turbulence and icing
 - ➔ Analysis and forecast: T+0 to T+6 hrs
 - ➔ Consolidation of state-level hazardous weather information into regional datasets by data aggregators
 - ➔ Regional HWIS datasets to become initial operational services
 - ➔ Eventually aggregation of regional datasets into global operational HWIS service
 - ➔ Distribution only via SWIM information services



- ➔ Standardisation of MET-SWIM services
 - ➔ Better experience for the end users if everyone uses the same standards for their Information Systems:
 - ➔ Service Definitions
 - ➔ Use of AMQP and OGC EDR API frameworks
 - ➔ Technical implementation guidance



- ➔ Benefits of MET-SWIM across the entire aviation system:
 - ➔ ATC → Real-time updates and better rerouting
 - ➔ Pilots → Real-time hazard awareness in cockpit systems
 - ➔ Dispatchers → More accurate flight planning
 - ➔ Airlines → Proactive operations management
 - ➔ ANSPs → Automated data for ATM systems
 - ➔ Aerodrome ops → Better planning for aerodrome conditions



- ✈ Challenges of implementing MET-SWIM services:
 - ✈ Much larger data volumes for users to manage
 - ✈ Systems must be adapted to handle influx of data
 - ✈ Users should only select data they need (ex: not download global data)
 - ✈ “No country left behind”
 - ✈ Difficult to strike a balance between innovation and realistic expectations for global standardization
 - ✈ Not every State has the same capabilities
 - ✈ ICAO Regions move at different paces
 - ✈ Visualization of MET data
 - ✈ Should visualization of MET data be standardized in the future, when data is no longer in TAC format?
 - ✈ Investment requirements
 - ✈ Sustainability of legacy systems (end of lifecycle) and persistent use of legacy products
 - ✈ Costs associated with implementing new systems



Key takeaways



- ICAO has endorsed the transition to data-centric MET services
- Transition from legacy METAR, TAF, SIGMETs, etc. to digital, automated information services
- WAFS, QVA, AMOIS, AMFIS, and HWIS define the next generation of aviation weather data
- Final requirements and timelines being actively developed by the ICAO METP
- Stakeholders should:
 - Stay informed of progress on implementation plans
 - Participate in national, regional, and global planning efforts
 - Collaborate with system developers to ensure SWIM and IWXXM readiness
 - Educate and prepare to understand and adopt future MET information services



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Thank you!