Implementation of MET information exchange in IWXXM

INTERNATIONAL CIVIL AVIATION ORGANIZATION

Marco Kok

Senior Scientific Officer,
International Aviation Meteorological Collaboration Division,
Hong Kong Observatory

Vice Chair of ICAO APAC Meteorological Information Exchange Working Group

mhkok@hko.gov.hk

ICAO

Presentation Overview

01 IWXXM and its current status

02 Preparation of IWXXM reports

03 Quality control of IWXXM reports

04 Exchange of IWXXM messages

05 Communication infrastructure

06 Consuming IWXXM reports

IWXXM and its current status

- Became an ICAO Annex 3 Standard since Amendment 79 (Nov 2020)
- IWXXM messages are computer friendly. Tools are readily available to validate integrity of the messages against IWXXM schemas
- Updating of IWXXM schemas follows the amendment cycle of Annex 3 and PANS-MET
- With the publication of Amendment 82 of ICAO Annex 3 and the introduction of the new PANS-MET, a new version of IWXXM (Version 2025-2) was published in Nov 2025

IWXXM and its reports

- IWXXM reports are implemented as packages in the schema
- Starting from IWXXM 2021-2 individual product packages has its own version number, since only some of them will need to be changed in an amendment to Annex 3
- A compatibility table* is created to show the versions of IWXXM meeting requirements of an amendment to Annex 3

IWXXM Version	1.1	2.1	3.0	2021-2	2023-1	2025-2
METAR and SPECI	1.1.0	2.1.1	3.0.0	3.1.0	3.1.0	3.2.0
TAF	1.1.0	2.1.1	3.0.0	3.0.1	3.0.1	3.0.2
SIGMET	1.1.0	2.1.1	3.0.0	4.0.0	4.0.1	4.0.2
AIRMET		2.1.1	3.0.0	3.1.0	3.1.1	3.1.2
Tropical Cyclone Advisory		2.1.1	3.0.0	3.1.0	3.1.0	3.1.1
Volcanic Ash Advisory		2.1.1	3.0.0	3.1.0	3.1.0	3.2.0
Space Weather Advisory			3.0.0	3.0.1	3.0.1	3.1.0
WAFS SIGWX Forecast				1.0.0	1.1.0	1.2.0
Quantitative Volcanic Ash Concentration Information						1.0.0
Volcano Observatory Notice for Aviation						1.0.0
ICAO Annex 3 Amendment	76	77	78	79-80	79-81	82
PANS-MET Edition						first

* https://community.wmo.int/en/activity-areas/wis/iwxxm

Operational IWXXM versions for use after Nov 2025

- It was planned that only versions 2023-1 and later should be exchanged operationally

IWXXM Version	METAR/ SPECI	TAF	SIGMET	AIRMET	TCA	VAA	SWA	WAFS SIGWX F/C	VONA	QVACI	Requirements
~~1.1~~	~~1.1.0~~	~~1.1.0~~	~~1.1.0~~	~~N/A~~	~~N/A~~	~~N/A~~	~~N/A~~	~~N/A~~	~~N/A~~	~~N/A~~	~~Am76~~
~~2.1~~	~~2.1.1~~	~~2.1.1~~	~~2.1.1~~	~~2.1.1~~	~~2.1.1~~	~~2.1.1~~	~~N/A~~	~~N/A~~	~~N/A~~	~~N/A~~	~~Am77~~
~~3.0~~	~~3.0.0~~	~~3.0.0~~	~~3.0.0~~	~~3.0.0~~	~~3.0.0~~	~~3.0.0~~	~~3.0.0~~	~~N/A~~	~~N/A~~	~~N/A~~	~~Am78~~
~~2021-2~~	~~3.1.0~~	~~3.0.1~~	~~4.0.0~~	~~3.1.0~~	~~3.1.0~~	~~3.1.0~~	~~3.0.1~~	~~1.0.0~~	~~N/A~~	~~N/A~~	~~Am79 + Am80~~
2023-1	3.1.0	3.0.1	4.0.1	3.1.1	3.1.0	3.1.0	3.0.1	1.1.0	N/A	N/A	Am79 + Am80
2025-2	3.2.0	3.0.2	4.0.2	3.1.2	3.1.1	3.2.0	3.1.0	1.2.0	1.0.0	1.0.0	Am82 / PANS-MET

Preparation of IWXXM reports

By direct generation or by translation

- Producer are expected to generate OPMET data directly in both TAC and IWXXM format
- When direct generation is not feasible, it is possible for other States (e.g. a ROC) to help, through bilateral arrangement or otherwise, to translate TAC to IWXXM
- States who have their OPMET translated on their behalf are encouraged to engage with the translation centre for feedback on any translation failures
- While translation works for now, direct generation of IWXXM from source is preferred, because future IWXXM elements may not have a TAC equivalent

```
<iwxxm:METAR xsi:schemaLocation="http://icao.int/iwxxm/2025-2 http://schemas.wmo.int/iwxxm/2025-2RC2/iwxxm.xsd"
 gml:id="uuid.4324ada0-ddfc-4206-9689-3aa8b58649fd" reportStatus="NORMAL" permissibleUsage="OPERATIONAL"
 translatedBulletinID="TTAAiiCCCYYGGgg" translatedBulletinReceptionTime="2014-05-15T15:29:00Z" translationCentreDesignator="YUZZ"
 translationCentreName="Fictional translation centre" translationTime="2014-05-15T15:30:00Z" translationFailedTAC="METAR YUDO 221630Z
 INVALID">
  <iwxxm:issueTime>
    <gml:TimeInstant gml:id="uuid.e5460ae4-98a4-48fa-bbfc-21799896f1f2">
      <gml:timePosition>2012-08-22T16:30:00Z</gml:timePosition>
    </gml:TimeInstant>
  </iwxxm:issueTime>
  <iwxxm:aerodrome>
    <aixm:AirportHeliport gml:id="uuid.7a8db8f9-281a-40ca-a443-40253790bfff">
      <aixm:timeSlice>
        <aixm:AirportHeliportTimeSlice gml:id="uuid.6656af3d-e836-49d9-a7f1-f8c8b23790f9">
          <gml:validTime/>
          <aixm:interpretation>SNAPSHOT</aixm:interpretation>
          <aixm:designator>YUDO</aixm:designator>
          <aixm:name>DONLON/INTERNATIONAL</aixm:name>
          <aixm:locationIndicatorICAO>YUDO</aixm:locationIndicatorICAO>
        </aixm:AirportHeliportTimeSlice>
      </aixm:timeSlice>
    </aixm:AirportHeliport>
  </iwxxm:aerodrome>
  <iwxxm:observationTime>
    <gml:TimeInstant gml:id="uuid.064bf483-439b-4e40-91b8-8aadd0638d92">
      <gml:timePosition>2012-08-22T16:30:00Z</gml:timePosition>
    </gml:TimeInstant>
  </iwxxm:observationTime>
</iwxxm:METAR>
```

Ensuring quality OPMET data for TAC-to-IWXXM translation

- Generation of IWXXM messages through translation highly depends on the quality of the TAC messages
- Translation process often exposes issues in original TAC messages, such as missing fields or non-compliant coding
- Poor quality IWXXM data will not overcome IWXXM deficiencies

Conclusion MET SG/27-02: Provision of quality meteorological information	
What: That, States are reminded that the provision of specified meteorological information in IWXXM form has been an ICAO Annex 3 standard requirement since 2020. Where a State provides or arranges the provision of IWXXM information through translation services (from traditional alphanumeric code (TAC)-formatted information), the TAC-formatted information must be ICAO compliant; otherwise, translation errors occur, resulting in higher costs for users and preventing the benefits of IWXXM being obtained.	Expected impact: ☐ Political / Global ☐ Inter-regional ☒ Economic ☐ Environmental ☒ Ops/Technical
Why: Most States are now producing meteorological information in IWXXM. However, users will only consider transitioning from TAC to IWXXM forms when they can reliably access quality IWXXM information from all the required States.	Follow-up: ☒Required from States
When: 8-Sep-23	Status: Adopted by Subgroup
Who: ☐Sub groups ☒APAC States ☐ICAO APAC RO ☐ICAO HQ ☐Other:	

MET SG Conclusion in 2023

Quality control of IWXXM messages

- As per quality management processes, States shall arrange the validation of their IWXXM messages against the corresponding XML schema
    - make corrections to the process of generating their IWXXM messages as necessary
- IWXXM generator (State or Translation Centre) is responsible for validation
- The ROC/RODB should conduct validation of IWXXM messages within their Region/area of responsibility

(*Ref: Guidelines for the implementation of OPMET Data Exchange using IWXXM, Fifth Edition (October 2023), Session 6.1.5*)

Exchange of IWXXM messages

- IWXXM messages requires AMHS with FTBP feature to exchange
- They are compressed as *.gzip and sent as an attachment
- The name of the compressed file should follow the requirements in *Abbreviated Heading Lines (AHLs) for aviation data over ICAO Aeronautical Fixed Service (AFS)*[*]

[*] https://community.wmo.int/en/activity-areas/wis/iwxxm/ahl-icao-data

WMO Abbreviated Headings and Related Specifications Relevant for the Exchange of Aviation Data over ICAO AFS

- **Version:** 1.0.1
- **Date:** 11 August 2025
- **Location:** https://community.wmo.int/en/activity-areas/wis/iwxxm/ahl-icao-data

Abbreviated heading

(Original text from Section 2.3.2, Part II, WMO-No.386)

The abbreviated heading shall have the following format:

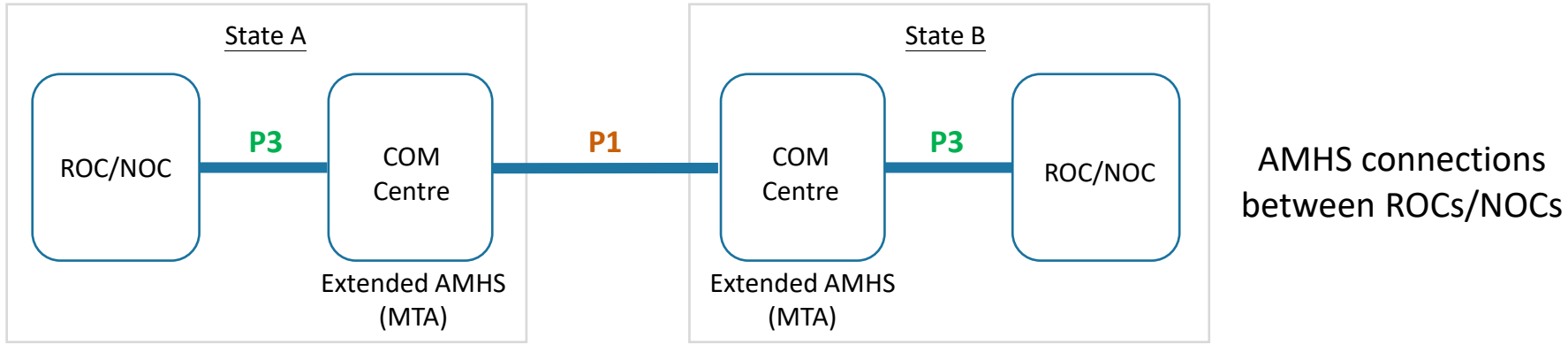
```
T1T2A1A2ii CCCC YYGGgg [BBB]
```

The symbols shall have the following meanings:

- **Data designators (T1T2A1A2ii)**
  - `T1T2` - Data type designators.
  - `A1A2` - Geographical designators.
  - `ii` - It shall be a number with two digits. When an originator or compiler of bulletins issues two or more bulletins with the same `T1T2A1A2` and `CCCC` the `ii` shall be used to differentiate the bulletins.
- **Location indicator (CCCC)**
  - `CCCC` - International four-letter location indicator of the station or centre originating or compiling the bulletin, as agreed internationally, and published in WMO-No.9, Volume C1, Catalogue of Meteorological Bulletins.

Requirements of communication infrastructure

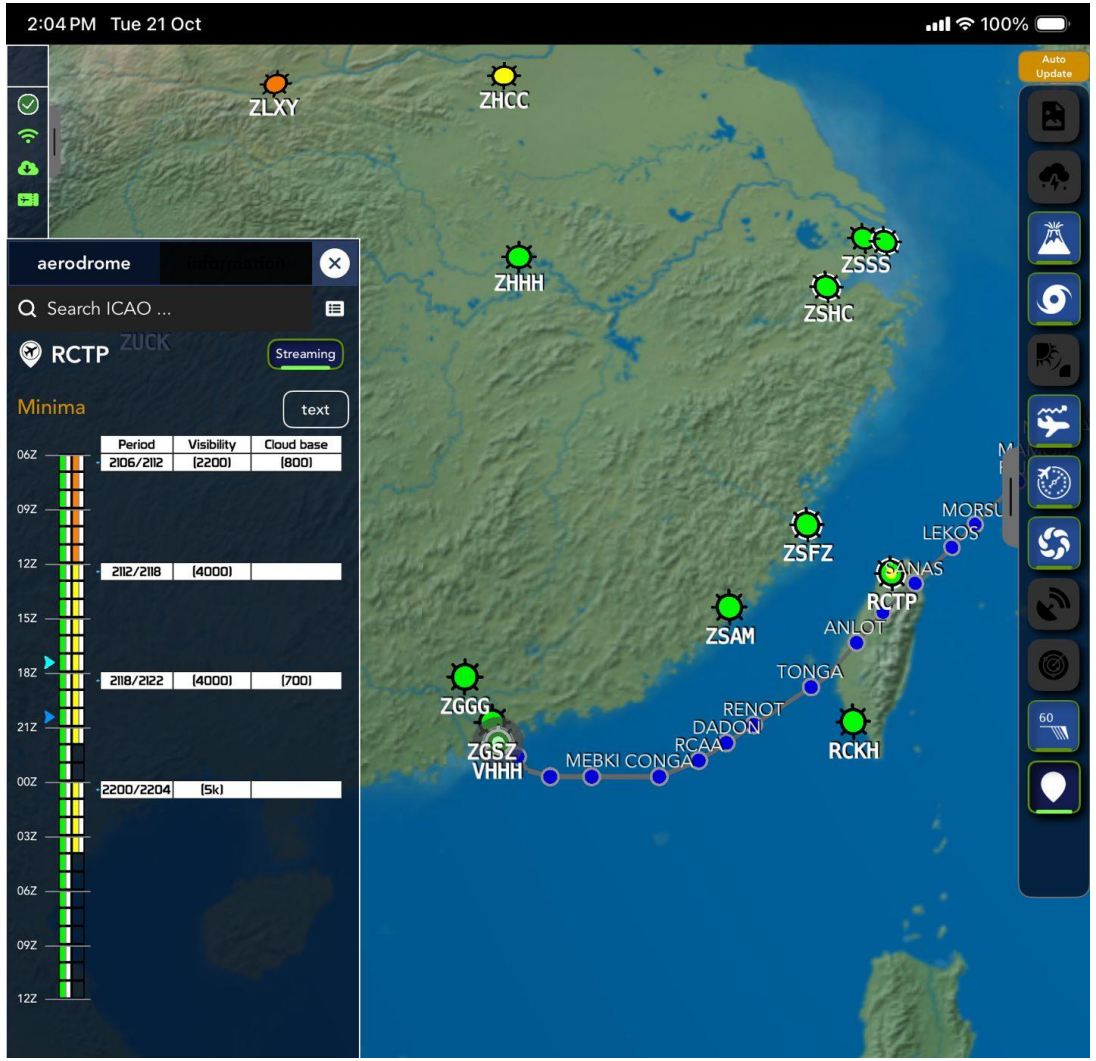
- IWXXM messages (which are larger XML files) cannot be sent over the older AFTN
- Requirement of AMHS (ATS Message Handling System) MTA (Message Transfer Agent) to support
  - File Transfer Body Part (FTBP) feature,
  - Interpersonal Messaging (IPM) Heading Extensions (IHE), and
  - IPM body containing exactly one body-part (specifically an FTBP)



AMHS connections between ROCs/NOCs

Consuming IWXXM reports

- IWXXM needs software to render the information it carries (c.f. TAC)
- It seems that TAC itself is welcomed for presentation
- There are also efforts trying to render the information in textual and graphical ways



The gap between IWXXM and TAC is widening

- Some IWXXM reports has more information than their TAC counterparts:
  - IWXXM METAR can report more than 4 RVRs if necessary
  - IWXXM METAR can report temperature in tenth of a degree
  - Polygons in IWXXM SIGMET can have more than 7 points
- New reports are having IWXXM versions only
  - WAFS Significant Weather Forecast
  - Quantitative Volcanic Ash Concentration Information (QVA)

Moving forward

- Migration to information services on SWIM sparks the development of new IWXXM-only representations:
  - supporting AMOIS, AMFIS, HWIS (to be introduced in the next presentation by Tim Hailes)
- There are ICAO METP WG-MIE activities to develop:
  - Informal guidance material on visualizing IWXXM data
  - A plan for communicating operational deprecation of IWXXM 2021-2 and earlier versions, and approaches to globally coordinating the implementation of new IWXXM schema versions

Operational and organisational requirements

- MET staff training
  - Understand IWXXM structure, error handling
  - If translation used, correct TAC formatting is critical
- IT staff training
  - IWXXM schema, validator, AMHS routing
- 24/7 system operation
  - Required for bulletins and alerts
- Change management
  - Procedures for version upgrades (e.g., IWXXM 2023-1 to IWXXM 2025-2)
- Contingency procedures
  - System failover, backup dissemination paths

Key messages

- IWXXM has become a standard since 2020
- Yet global exchange of IWXXM reports over AFS is less than expected
- Note that there are plans to introduce sunset clauses for TAC by 2030
- Furthermore, new information to be introduced in the coming years in Annex 3 and PANS-MET will only be available in IWXXM format
- Visualization could be an issue and this require discussions with your consumers
- It is of utmost importance to start implementing the preparation and exchange of IWXXM reports immediately, or otherwise not be able to catch up in several years' time

Thank You

ICAO

Location of IWXXM resources (WMO)

- **Manual on Codes (WMO-No. 306), Volume I.3*:** IWXXM standard definitions
- **http://schemas.wmo.int/iwxxm:** IWXXM artifacts, such as schema files, examples, UML model, and release notes
- **http://codes.wmo.int:** Code tables referenced in IWXXM
- **https://community.wmo.int/en/activity-areas/wis/iwxxm:** IWXXM landing page on the WMO Community Platform
- **https://groups.wmo.int/tt-avdata:** TT-AvData e-mail list for all stakeholders
- **https://github.com/wmo-im/iwxxm:** TT-AvData working space for development and recording meeting notes

* https://library.wmo.int/idurl/4/35769

Location of IWXXM resources (ICAO)

- **Guidelines for the implementation of OPMET Data Exchange using IWXXM :** Provides relevant information for preparation and exchanging IWXXM reports
- **Manual on the ICAO Meteorological Information Exchange Model (ICAO Doc 10003):** Gives an overall account of the structure of IWXXM ($)
- **IWXXM IMPLEMENTATION IN APAC REGION - Frequently Asked Questions (FAQs)**
- **Checklist of steps required to operational IWXXM exchange**
- **Educational material to manage the distribution of IWXXM information for COMM experts in the event of primary link failure**