International Civil Aviation Organization

INFORMATION PAPER (IP/13)

ICAO Asia and Pacific (APAC)
Twenty-Eighth Meeting of the Meteorology Sub-Group
(MET SG/28)

Bangkok, Thailand, 8 to 12 July 2024

Agenda Item 6: **Research, development, and other initiatives**

USE CASE OF MET INFORMATION SERVICES FOR ATFM IN SWIM DEMONSTRATION

(Presented by Hong Kong, China)

SUMMARY

This paper presents the potential operational benefits for ATFM that could be brought by sharing of MET information and surveillance data through a SWIM demonstration conducted in May 2024.

1. INTRODUCTION

1.1 Surveillance data and MET information sharing via System Wide Information Management (SWIM) would lead to significant advancement in air traffic management (ATM). With the increasing aviation traffic demands and environmental awareness, there is a need for accurate and timely information exchange. SWIM addresses these challenges by standardising the communication protocols and information exchange models, thereby facilitating seamless information exchange among diverse systems and operational parties for enhancing operational efficiency while ensuring safety.

1.2 The following paragraphs highlight the use case and the potential operational benefits of MET information sharing through SWIM for enhancing air traffic flow management (ATFM) in one of the demonstration scenarios jointly conducted by the Hong Kong Civil Aviation Department (HKCAD), the Hong Kong Observatory (HKO), the Civil Aviation Authority of Singapore (CAAS) and the Aeronautical Radio of Thailand (AEROTHAI) in the "Joint event of SWIM over CRV Demonstration and Surveillance data over SWIM Trial" held on 29 May 2024.

2. DISCUSSION

2.1 In the demonstration scenario, based on the latest assessment of aeronautical meteorological forecaster on the deteriorating weather at the Hong Kong International Airport (VHHH), a timely update of the Aerodrome Forecast (TAF) is issued by HKO to HKCAD in IWXXM format through SWIM. With the digital TAF in IWXXM format, the impact of the anticipated weather on VHHH Airport Acceptance Rate (AAR) could be calculated automatically via the Surveillance Data

Processor (SDP) and Flight Data Processor (FDP) trajectory capability in future advanced ATFM systems.

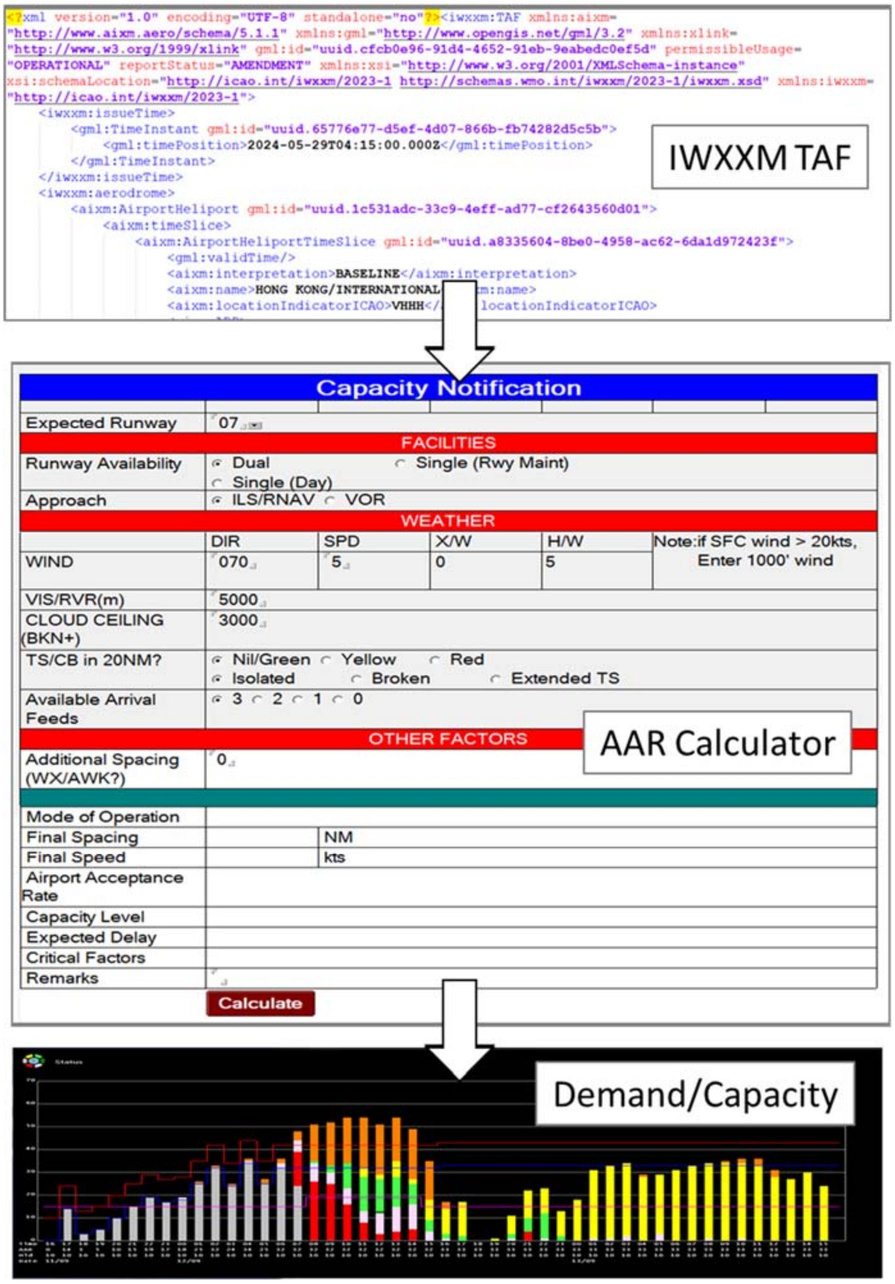

Figure 1: Illustration of IWXXM TAF feeding directly to AAR Calculator in advanced ATFM system for estimating the reduction in capacity

2.2 In addition to TAF, HKO also provides the gridded information of hourly significant convection forecast over the South China Sea with forecast lead time up to 8 hours in this SWIM demonstration and the associated visualisation on HKO's SWIM-enabled MET application. HKO's SWIM-enabled MET application would provide the Hong Kong ATFM Unit (ATFMU) with the forecast distribution of significant convection covering the Hong Kong Flight Information Region (FIR) and its surrounding areas (Figure 2). With this MET information visualisation supplementing the TAF, Hong Kong ATFMU would notice that due to a trough of low pressure, severe convective activities would be expected over the northern part of the South China Sea including the Terminal Area in Hong Kong FIR. Based on the calculation using IWXXM TAF and the forecast spatial distribution of severe convective weather, Hong Kong ATFMU determines a reduction in AAR by 33% from 0900-1200 UTC and publishes the ATFM Daily Plan.

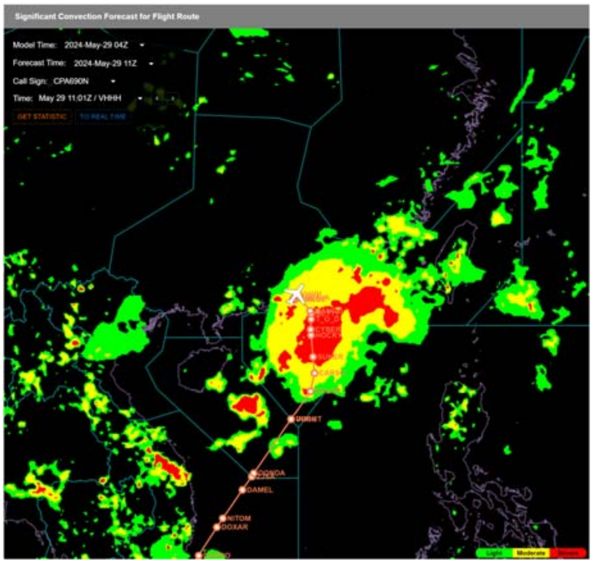

Figure 2: HKO's SWIM-enabled MET application showing forecast distribution of significant convection over Hong Kong FIR

2.3 The SWIM-enabled MET application has the capability to ingest and process the flight plan information published in FIXM format. The application could provide a rough estimate on cross-route deviation, as well as its uncertainty range, by integrating FIXM-formatted flight plan information and forecast MET information. Through the SWIM-enabled application, pilots of a flight from Singapore to Hong Kong (CPA690) in this demonstration would also be aware of possible isolated convections along the flight path before reaching Hong Kong FIR during the flight planning stage (Figure 3). The pilots decide to load an extra fuel of 15 minutes. Hong Kong ATFMU would also note the potential convective activities along the CPA690 flight plan via the same application.

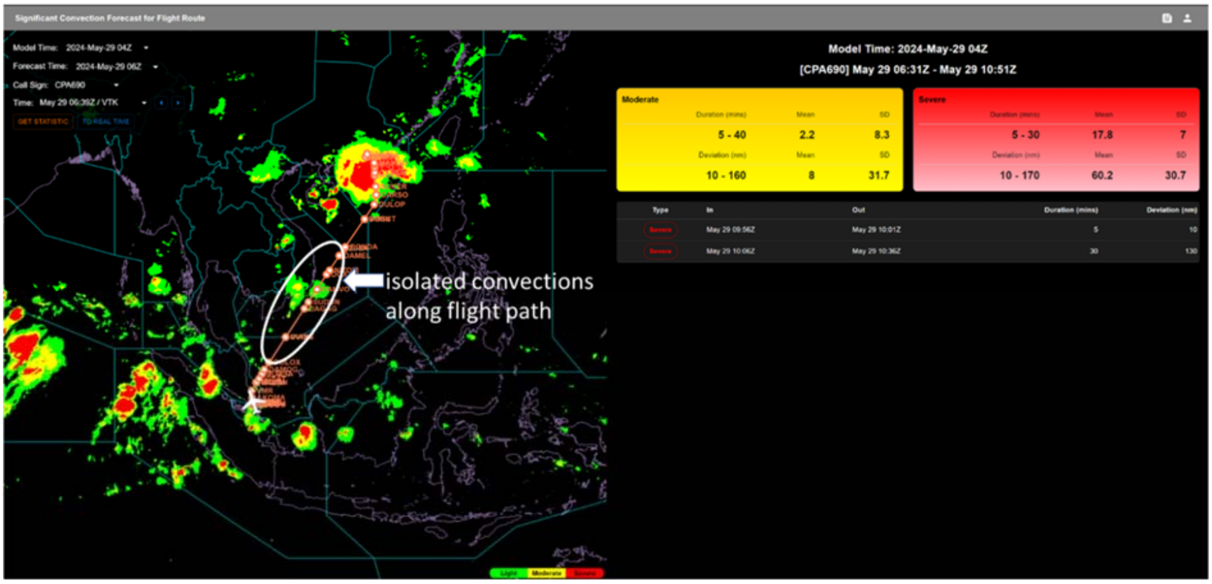

Figure 3: HKO SWIM-enabled MET application showing possible isolated convections along CPA690 flight path and rough estimated statistics of cross-route deviation (tables on the right)

2.4 Meanwhile, the flight plans published by the airline in FIXM format through SWIM are being fed into the Hong Kong ATFM systems, Calculated Take-Off Time (CTOT) and Calculated

Landing Time (CLDT) for two flights from Singapore and Bangkok could be calculated automatically with reference to the latest VHHH ATFM Daily plan with reduced AAR.

2.5 When CPA690 is approaching waypoint DOLOX on airway M771, the pilots obtain updated MET information via uplink and note isolated convections have been forecast to occur earlier along their flight path. They indeed observe active convection ahead on the weather radar also and request a large deviation off course to avoid the weather with a safe margin. Singapore ATC approves the deviation and their surveillance data shared over SWIM indicate CPA690 has deviated almost 50NM east of M771. After the weather avoidance, ATC clears CPA690 to rejoin M771 at waypoint DUDIS, on the Singapore/Ho Chi Minh FIR boundary (Figure 4).

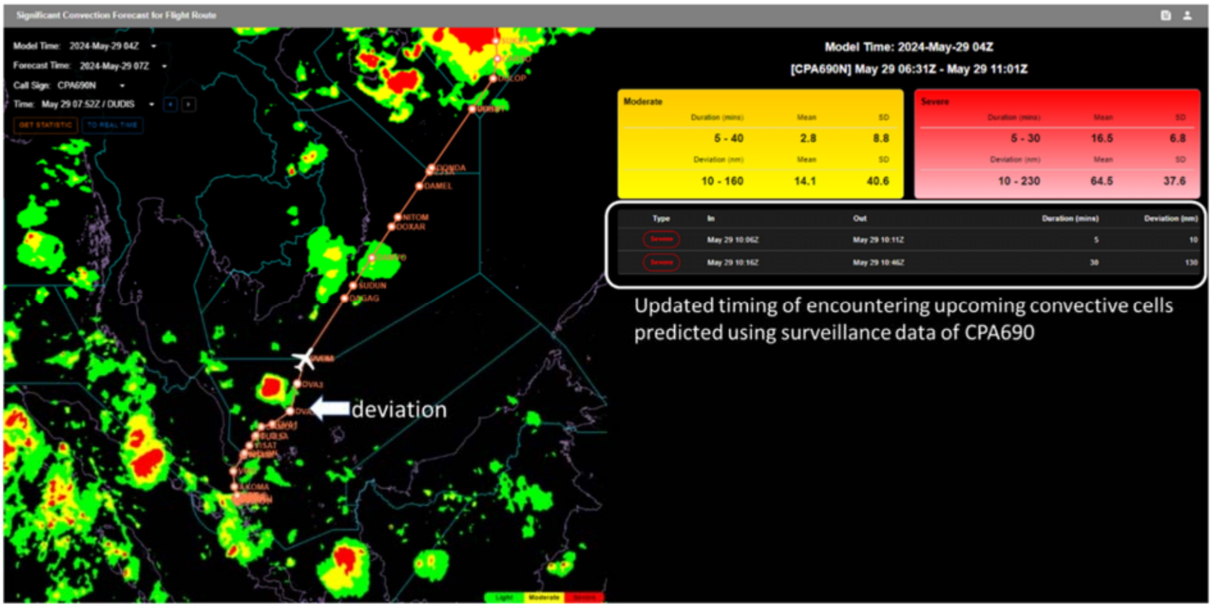

Figure 4: Deviation due to convective weather and updated timing of encountering upcoming convective cells predicted based on the surveillance data of CPA690

2.6 The surveillance data of CPA690 shared over SWIM could be fed to HKO's SWIM-enabled MET application, so that the predicted timing of encountering upcoming convective cells (on the right of Figure 4) could be reassessed and updated for pilots' situational awareness via uplink.

2.7 During the flight deviation, the FDP in the Hong Kong ATFM System has calculated a trajectory update based on the aircraft CPA690's surveillance data shared by Singapore ANSP over SWIM and the flight plan held in the system. The updated landing time for CPA690 is 8 minutes later than previously calculated. At the same time, a flight from Bangkok to Hong Kong (CPA770) is boarding and getting ready for pushing back then taking off. The Hong Kong ATFM System indicates that a CTOT improvement for CPA770 could be offered as CPA690 will land later than previously expected. Based on the availability of earlier CLDT, a Slot Revision Message is published for CPA770 and accepted by airline ground staff and Bangkok ATFMU/ATC, as the scenario is still consistent with CPA770's original Target Off-Block Time (TOBT). Finally, CPA770 arrive at VHHH earlier than CPA690.

2.8 The above demonstration scenario outlines the operational benefits of efficient MET information exchange and surveillance data sharing for improving the traffic demand and capacity forecasting in ATFM. Machine-readable MET and surveillance information in SWIM could potentially be used directly in future ATFM Systems for automatic calculations and updates of landing slot allocations. Real-time updates enabled by SWIM could also facilitate more efficient re-sequencing of traffic demand. The MET information and surveillance data shared in SWIM environment would also increase situational awareness of airlines and their pilots.

3. ACTION BY THE MEETING

3.1 Note the information contained in this paper.

– – – – – – – – – – – – – –