International Civil Aviation Organization

INFORMATION PAPER (IP/05)

ICAO ASIA AND PACIFIC (APAC)
THIRTIETH MEETING OF THE METEOROLOGY SUB-GROUP (MET SG/30)

Bangkok, Thailand, 20 - 24 July 2026

Agenda Item 6: Turbulence Information

HONG KONG OBSERVATORY'S EXPERIENCES ON COLLECTION, DISSEMINATION AND UTILISATION OF AIRCRAFT OBSERVATIONS ON TURBULENCE

(Presented by Hong Kong, China)

SUMMARY

This paper summarises the experiences of the Hong Kong Observatory of Hong Kong, China in collecting and disseminating aircraft observations on turbulence, and the research and development activities in relation to these observations for continuous improvement of turbulence-related service.

1. INTRODUCTION

1.1 According to Chapter 5 of ICAO Annex 3 (Meteorological Services for International Air Navigation), aircraft are required to make special observations when they encounter or observe certain hazardous weather condition. These conditions include moderate or severe turbulence; moderate or severe icing; severe mountain wave; thunderstorms with or without hail; heavy duststorm or sandstorm; and volcanic ash cloud or related activity. The role of air traffic services (ATS) unit and meteorological watch office (MWOs) are also clearly defined in ICAO Annex 3 on the relay of these special air-reports (ARS) to related centres.

1.2 According to Chapter 3 of Procedures for Air Navigation Services --- Meteorology (PANS-MET), if air-ground data link is established, aircraft may report turbulence in terms of eddy dissipation rate (EDR). EDR is the ICAO-standard, aircraft-independent metric for turbulence intensity.

1.3 Other non-routine aircraft observations and reports are also mentioned in Section 3.2 of PANS-MET about the reporting of aircraft observations of wind shear encountered during the climb-out and approach phases of flight.

1.4 These turbulence and wind shear observations from aircraft are vital, real-time observations for other flights operating along the same flight paths, and also serve as valuable information for MWOs or Aerodrome Meteorological Offices (AMOs) to issue accurate warnings and forecasts.

1.5 This paper discusses the collection, dissemination and utilisation of the above-mentioned aircraft observations on turbulence in Hong Kong Observatory (HKO).

2. DISCUSSION

Special Air-Reports (ARS)

2.1 The dissemination of pilot-reported turbulence observations relies on seamless coordination among pilots, ATS unit, and MWOs:

- When a pilot encounters a hazardous phenomenon (such as severe turbulence), they report it in real time or as soon as practicable via voice communication to the ATS unit (the Hong Kong Civil Aviation Department (HKCAD) in Hong Kong).
- Upon receipt, the ATS unit (HKCAD) will relay the special air-report (ARS) without delay to its associated MWO (in Hong Kong, this is AMO of HKO).
- The MWO (HKO AMO) will then encode the ARS into the standard ICAO specified format.
- The encoded ARS is disseminated globally via the Air Traffic Services Message Handling System (AMHS) to relevant parties around the globe including ATS units, World Area Forecast Centres (WAFCs), MWOs, airlines, etc. The encoded information will also be distributed via VOLMET broadcast/D-VOLMET, which are periodic broadcasts of meteorological information.

The detailed workflow of reception and dissemination process of ARS is illustrated in Figure 1.

2.2 In accordance with the Conclusion APANPIRG/36/17, which urged States to provide information on the number of special air-reports received by meteorological service providers each calendar year, HKO received a total of 112 ARS concerning turbulence within the Hong Kong Flight Information Region during the calendar year 2025.

2.3 The ARS received are displayed in real-time on HKO's Electronic Flight Bag application "MyFlightWx", collaborative decision-making platform, and HKO Regional SIGMET Coordination platform (Figure 2). The aviation forecaster of AMO will assess the intensity and duration of the phenomenon, and issue SIGMET if deemed necessary.

2.4 The collected ARS will be stored in a database for the compilation of the climatology of hazardous weather over the flight information region. They can also be served as ground truths for validating turbulence detection algorithms (e.g. ADS-B Turbulence detection for cruising flights) and forecast algorithms (e.g. Numerical Weather Prediction models), and for post-event analysis.

Aircraft in-situ turbulence information

2.5 While manual pilot reports are valuable, they are inherently subjective and dependent on the characteristics of the aircraft. To improve the objectivity of the observations, HKO has partnered with local airlines directly to collect

(i) Real-time automatic downlink of turbulence information
These are automatic reports from aircraft fleet equipped with the necessary hardware and software to calculate EDR reports directly onboard.

(ii) High resolution Quick Access Recorder (QAR) flight data
Upon special request, HKO can obtain the raw QAR flight data of selected flights from local collaborating airlines. These data are of very high temporal resolution and include multiple parameters (e.g. vertical rate, speed, etc.) that can be utilised to calculate the EDR. However, as it takes time to collect and process the data, these data would not be available in real-time and can only be used for post-event analysis.

2.6 The real-time EDR data are displayed on HKO's Electronic Flight Bag "MyFlightWx" (Figure 3) and collaborative decision-making platform. The data policy of each airline is respected via

tailored configurations. As for the high-resolution QAR flight data, it has been widely used in research and development efforts to enhance turbulence and wind shear forecasting through comprehensive validation.

Low-level wind shear reports

2.7 Upon receiving low-level wind shear reports from the pilots, the ATS unit (HKCAD) would fax a reporting form to HKO containing the report observation details, including the time of event occurrence, callsign, arrival/departure corridor, runway, altitude, reported intensity and sign of wind shear (headwind change/loss), or turbulence intensity.

2.8 As the Hong Kong International Airport (HKIA) is susceptible to low-level wind shear due to its unique location, low-level wind shear alerting service is essential to the aviation community for safeguarding aviation safety. These wind shear pilot reports are stored in an online database, which is used to compare the performance of various detection algorithms in HKO's Windshear and Turbulence Warning System (WTWS), the operational low-level wind shear alerting system for HKIA. The evaluation is performed regularly, and the performance of WTWS is continuously monitored. These wind shear reports can also improve understanding of the wind shear conditions at HKIA across different seasons and environmental factors through the research and analysis. A related publication can be assessed here.

3. ACTION BY THE MEETING

3.1 The meeting is invited to note the information contained in this paper.

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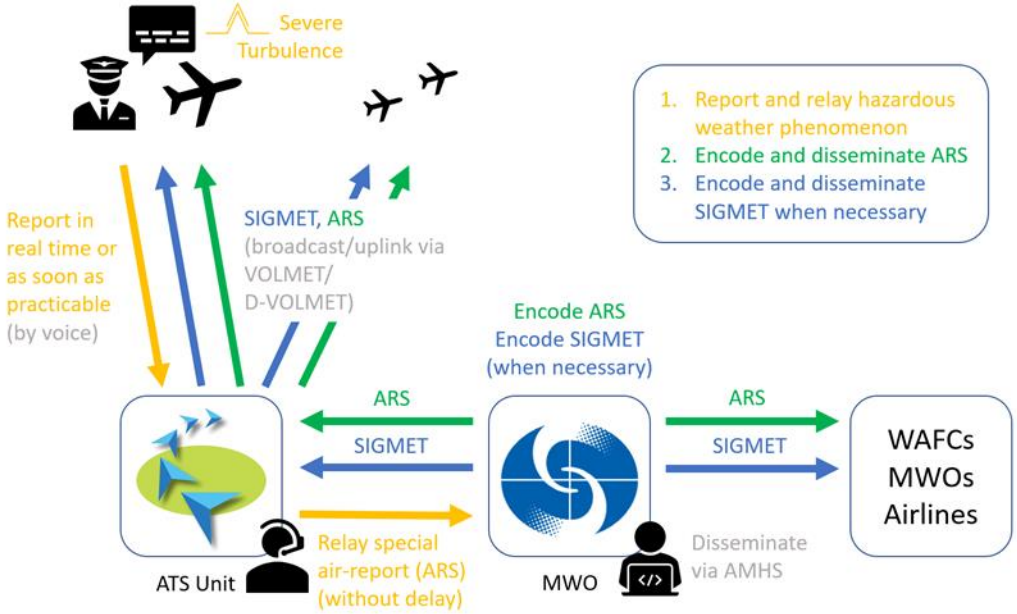

Figure 1 The reception and dissemination process of special air-reports in Hong Kong

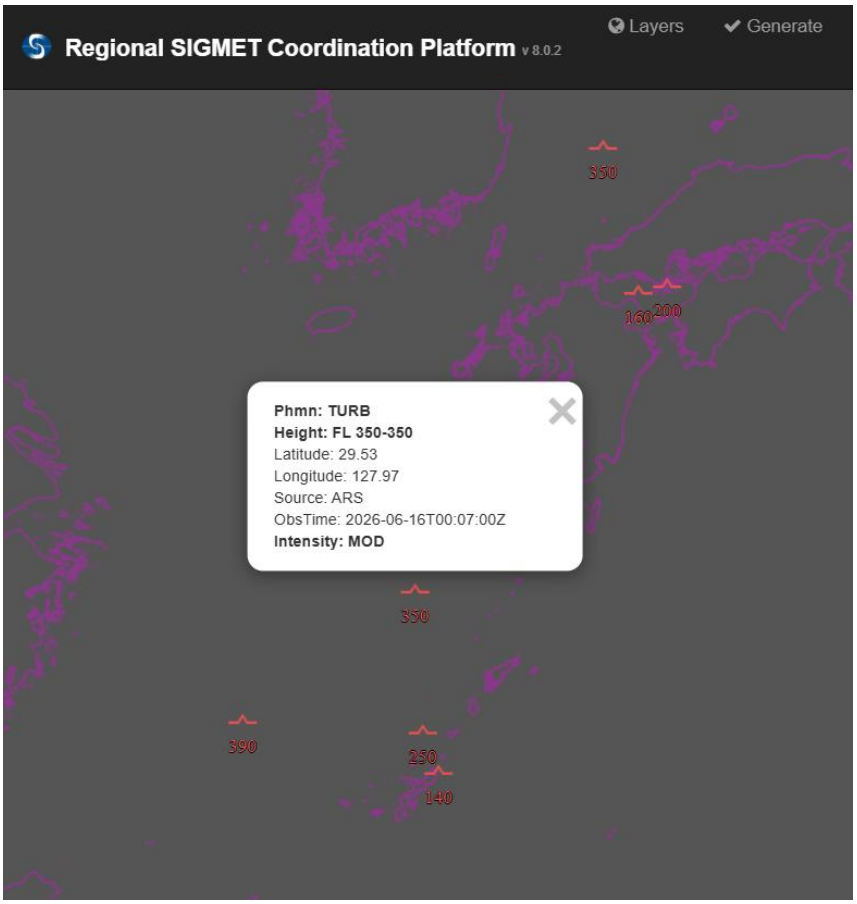

Figure 2 Real-time special air-reports displayed on HKO Regional SIGMET Coordination platform

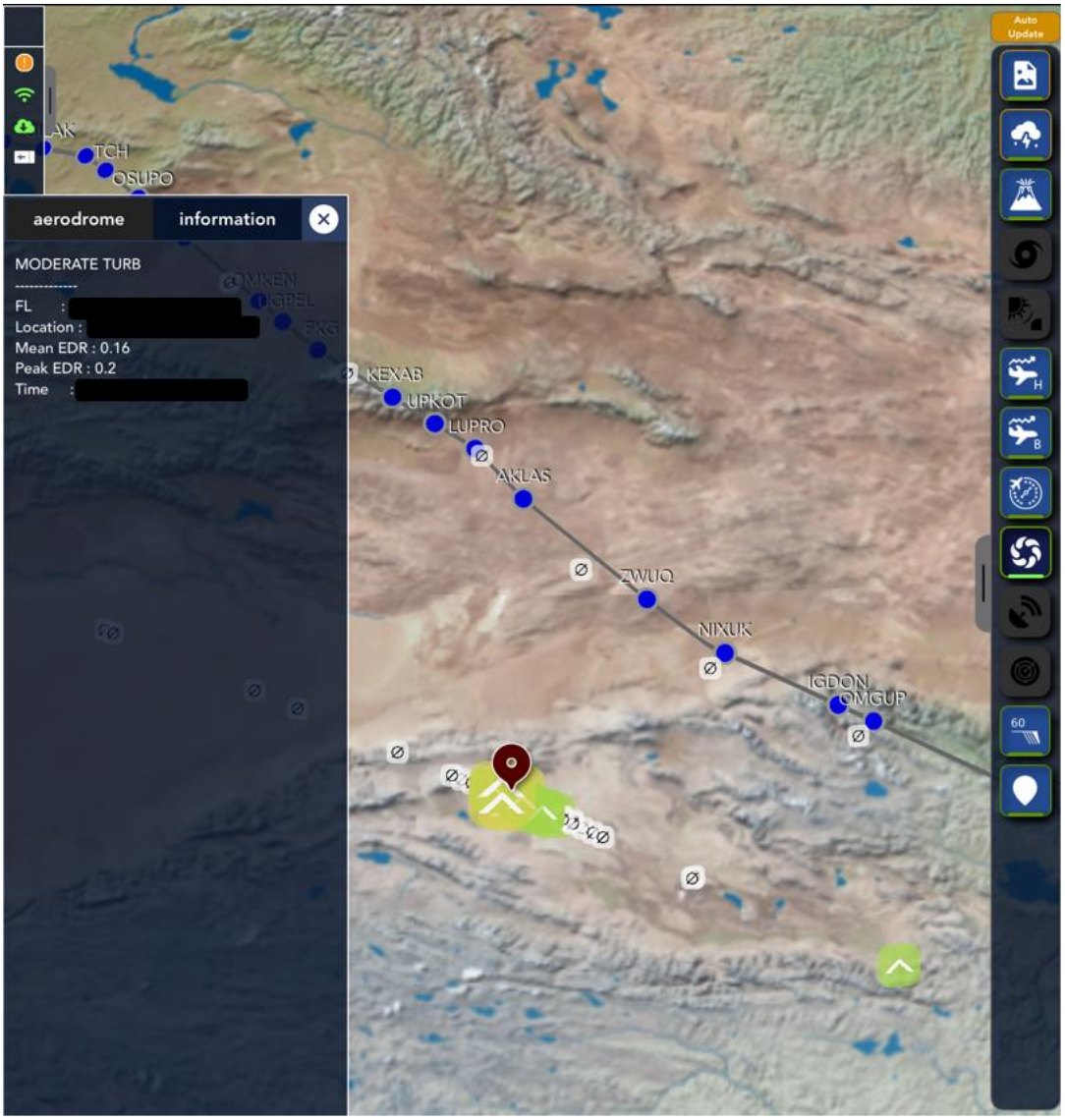

Figure 3 Real-time EDR reports displayed on “MyFlightWx”. The current flight route is displayed in blue dots connected with a grey line, while the EDR reports in the vicinity are extracted from past flights and displayed for common situational awareness.