APPENDIX 1 - Hong Kong, China

1. ATM-tailored MET information and services

Under the agreement between the Hong Kong Observatory (HKO) and Civil Aviation Department (CAD), HKO provides a suite of ATM-tailored MET information and services in support of international air navigation.

1.1 Tactical Decision Products

1.1.1 Taking the opportunity of the replacement of CAD's Air Traffic Management System (ATMS), closer integration of tailored MET information with ATMS was realized to support ATC in tactical decision making. These include a) 10 layers of Constant Altitude Plan Position Indicator (CAPPI) imageries from 1 km to 10 km with range 256 km of the two Doppler weather radars in Hong Kong; and b) 1 layer of the HKO Aviation Thunderstorm Nowcasting System (ATNS) 1hr forecast for the assessment of the significant convection over HKFIR at 3 km height.

Figure 1 ATC console display showing aircraft positions overlaid on a CAPPI imagery

1.1.2 On the ATC console of the new ATMS, either weather radar imagery of a specific height or an ATNS forecast can be chosen to be overlaid with the aircraft indicators (Figure 1). Further details can be found in the presentation included in Joint Session ATFM/SG/7 and MET/R WG/6.

1.2 Meteorological Services for Terminal Area (MSTA) Products

1.2.1 The Hong Kong Air Traffic Flow Management Unit (ATFMU) of CAD regularly assesses the capacity of the Hong Kong International Airport (HKIA), which depends on both the runway and airspace capacity, in the next few hours. In collaboration with CAD, HKO has been providing tailored MSTA, grouped under the product named Significant Convection Monitoring and Forecast (Figure 2), to support ATFM operation since 2010. These are briefly summarized in the following paragraphs. Further details can be found in MET/R TF/3 WP07.

1.2.2 The suite of MSTA products to support runway capacity estimation includes amongst others, ATNS to automatically forecast the future location of weather cells that may block the intended flight path or significant points in the airspace. While forecasts of products D, E, and G in Figure 2 are generated automatically, they could be adjusted manually by Aviation Forecasters.

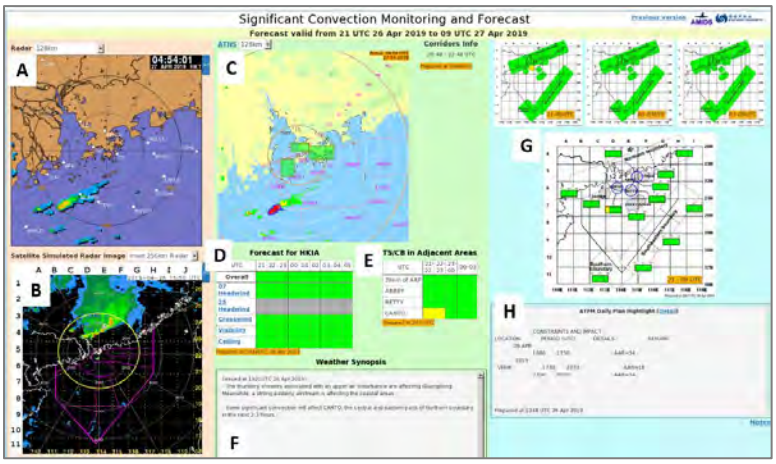

Figure 2. Integrated display of the MSTA: A) Choice of actual radar at different ranges and lightning overlays; B) Radar blended with satellite simulated radar image developed using Artificial Neural Network technology; C) 2hr convection nowcast for arrival/departure corridors by ATNS; D) 9hr performance-based weather forecast for the aerodrome; E) 6hr convection forecast around HKIA and major waypoints; F) weather synopsis around HKIA and the major waypoints; G) 12hr significant convection forecast time series for key ATC areas based on blended NWP and nowcasting outputs; and H) ATFM Daily Plan.

1.2.3 All the above products/systems use three levels of colour code to indicate the impact to air traffic, viz GREEN for mild or no impact, AMBER for medium impact and RED for significant impact. Though the actual criteria for defining the colour codes vary across different forecast products, the simple three levels of colour code are adopted uniformly in all the products described above. The Significant Convection Monitoring and Forecast also includes the latest ATFM Daily Plan issued by ATFMU after taking into account the above significant convection nowcast and forecast information as well as consultation by Aviation Forecaster via regular and ad hoc weather briefings (para.1.5 below).

1.3 Arrival Management and other Miscellaneous tailored Products

1.3.1 25 layers of gridded upper wind and temperature forecasts over HKFIR at a resolution of 0.2 degrees at hourly interval for up to 24 hours are provided to ATMS for trajectory prediction of individual aircraft and a system for aircraft arrival sequencing.

1.3.2 Apart from the above products, other major tailored products include a) Weather Summary for HKIA which includes, inter alia, local winds, radar, satellite, lightning information and lightning alert for the airport, weather synopsis, aerodrome forecast with possible alternative scenario, TAFs of nearby airports, SIGMET for the HKFIR, TC track, weather analysis and forecast charts (Figure 3); b) HKIA Local Routine/Special Report and c) MET page showing the latest observation, data from the Automatic Meteorological Observing System, windshear alerts, forecast of HKIA and neighbouring aerodrome.

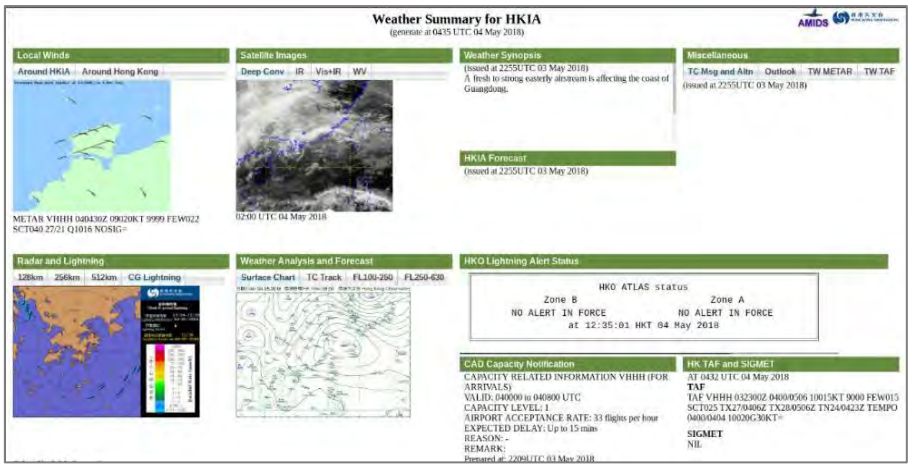

Figure 3. HKO Weather Summary for HKIA

1.4 Lightning Nowcast Products

1.4.1 For the protection of ground personnel from being injured by lightning strikes, HKO has developed the Airport Thunderstorm and Lightning Alerting System (ATLAS), a nowcasting system for detecting and nowcasting lightning activities over HKIA. The system generates RED or AMBER alerts based on either detection or forecast of cloud-to-ground lightning activities (CG). When CG is detected within 10 km or forecast to be within 5 km from the ARP, AMBER alert will be issued. When CG is detected or forecast to be within 1 km boundary of the alert zones (respectively encompass the Chek Lap Kok Island, and the majority of passenger and cargo apron), RED alert will be issued for the corresponding zone.

1.5 Integrated monitoring system for MET-ATM

1.5.1 HKO has developed two integrated monitoring pages for aviation forecasters to appreciate the weather impact on air traffic. One displays the real time aircraft positions together with weather radar (Figure 5, Left). Another one displays arrival and departure rates and any traffic interruption messages from ATIS and NOTAM (Figure 5, Right). These two pages heighten common situation awareness and enhance the communications between MET and ATM office particularly during weather briefings (para. 1.6 below).

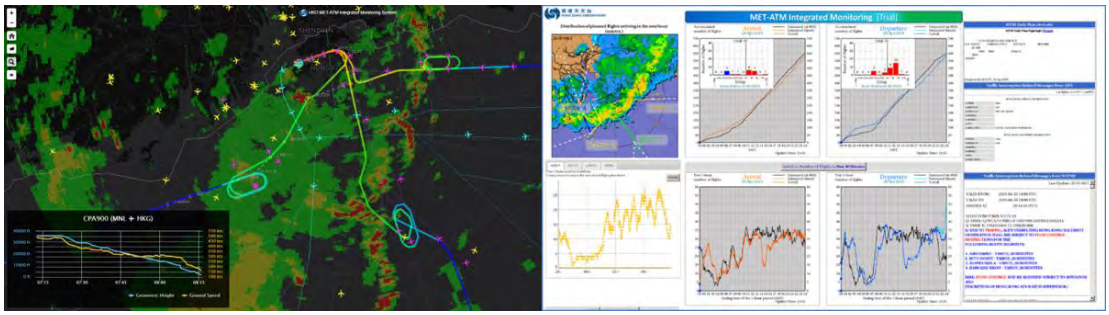

Figure 5. MET-ATM Integrated Displays showing arrival flights forced into holding patterns due to convective activities (Left) and the arrival/departure rates (Right).

1.6 Regional SIGMET monitoring

1.6.1 To support Hong Kong ATFMU's participation in Distributed Multi-Nodal ATFM Network trial operation, HKO has developed an Integrated Monitoring webpage to show real-time en-route hazardous weather within the APAC region. Information provided includes SIGMET and advisory information, as well as VONA, METAR, TAF, PIREP, global satellite imageries, radar reflectivity, lightning, numerical weather prediction data, significant convection and turbulence forecast, etc., for ATFMU's reference (Figure 6).

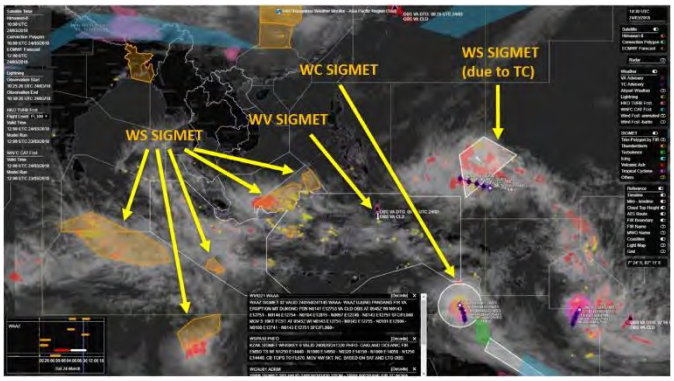

Figure 6. HKO Regional SIGMET Monitoring Page.

1.7 Weather briefing

1.7.1 HKO provides MET weather briefings to ATFMU/ATC three times a day, once in the early morning, once at noon and once in the early evening, through teleconference. The briefing mainly makes use of the MSTA products and the Weather Summary for HKIA discussed under 1.2 and 1.3.2 above. Timely updates are also provided through a hotline should there be any change in the weather conditions.

1.7.2 In preparation for adverse weather such as the approach of tropical cyclone (TC), additional weather briefings are conducted for the whole aviation community at HKIA to heighten common situation awareness and to support Collaborative Decision Making.

2. Means of Provision

2.1 The tactical decision products and the arrival management products discussed under para. 1.2 and 1.3.1 respectively are ingested directly into CAD's ATMS. Products under para. 1.3.2 b) are sent to CAD's ATS Data Management System (ATSDMS).

2.2 The rest of the products, including MSTA and miscellaneous tailored products are provided via the web-based Aviation Meteorological Information Dissemination System.

3. Other useful information

3.1 Regular high level meetings with CAD and the Airport Authority Hong Kong are held on an annual basis. Regular working level meetings with ATC are held generally a few times every year.

3.2 A Verification System has been set up for verification of both the ICAO Annex 3 and MSTA products.