Singapore

1. ATM-tailored MET information and services

Meteorological and Air Traffic Management (MET/ATM) Collaboration in Singapore

The provision of air navigation services in the Singapore Flight Information Region (FIR) is undertaken by the Civil Aviation Authority of Singapore (CAAS), and Meteorological Service Singapore (MSS) is the aeronautical meteorological service provider. CAAS and MSS collaborated to develop ATM-tailored MET information and services aimed at enhancing the safety, efficiency and orderly flow of air traffic. The following lists some examples of MET information and services implemented in Singapore.

1.1. Weather briefing for ATC

MSS provides daily MET weather briefings through teleconference to air traffic controllers at the start of the morning and afternoon shifts of ATC units. Aided by visuals from a dedicated weather information portal which provides an integrated view of meteorological information in graphical and tabular formats (Figures 1), operational meteorologists brief the air traffic controllers on the weather conditions that can be expected around Singapore and the surrounding region. Timely updates are also provided by operational meteorologists through a direct communication line (dedicated hotline) should there be any change in the weather conditions.

1.2. Weather Window Products

Given that thunderstorms are common weather hazards in the deep tropics, MSS has been delivering categorical forecast on the occurrence of thunderstorms over critical watch areas. The watch areas are determined in consultation with the CAAS ATS units to align with their operational requirements. The enhanced categorical forecast (called the 'Weather Window') augments the standard Annex 3 products and provides information on the forecast of not only the occurrence of thunderstorms, but also their areal extent. The forecast is valid for 24 hours and is updated every 3 hours or on an ad-hoc basis when changes to the weather situation warrants it. The temporal resolution is higher in the shorter forecast range to provide more detailed information of a possible rapid development of adverse weather (considering the dynamic nature of tropical weather systems). The temporal resolution becomes coarser at longer forecast range to reflect the lower predictability of tropical convective-scale weather. The weather window is presented in colour-coded, tabular format for easy interpretation and is used for air traffic flow management planning.

1.3. Improvements to SIGMET Information

Apart from the weather window products, MSS has been leading the coordination with MET Watch Offices (MWOs) of neighbouring States under the Operational SIGMET Coordination (OSC) for Southeast Asia initiative on the issuance of harmonised cross-FIR SIGMETs to airspace users, air traffic controllers and planners.

1.4. Nowcasting for convective weather

Tropical weather systems tend to be dominated by thunderstorms that are localized and short-lived and have significant impact on air traffic operations. Given the nature of our local weather systems, there is limited predictability, and forecasts tend to be short range. This poses difficulties for ATM. To address these challenges, MSS in collaboration with the UK Met Office has developed a convective-scale Numerical Weather Prediction (NWP) model – SINGV to better predict convective-scale weather in the tropics. In addition, Singapore is developing capabilities in nowcasting model, leveraging on techniques such as machine learning with radar and satellite data. This is a tropical convective-scale NWP/Nowcasting system that is continuously being fine-tuned to provide improved weather forecasts to support ATM decision making.

2. Means of Provision

2.1. Analysis by Operational Meteorologist

While outputs from numerical weather predictions are used to provide a first-cut forecast of the weather situation, these numerical predictions have limitations in predicting convective weather in the tropics. Local knowledge and expertise of operational meteorologists are essential and continue to be integrated in the provision of MET information and services to the users.

2.2. ATC Weather Information Portal

A dedicated web portal (ATC web portal) has been developed for the provision of more MET information in support of ATM decision-making. The web portal is an integrated platform that allow users to view the current observations and weather window forecast products to enhanced situational awareness for ATC, and to aid users in pre-tactical air traffic flow management planning. In addition, for ease of visualization that may not be best served by a tabular format of weather window, thunderstorm areas are also presented on geospatial maps. Weather briefings using this web portal allows the operational meteorologists and the users to establish a common understanding of the weather situation and to discuss on any possible adverse weather that may affect operations.

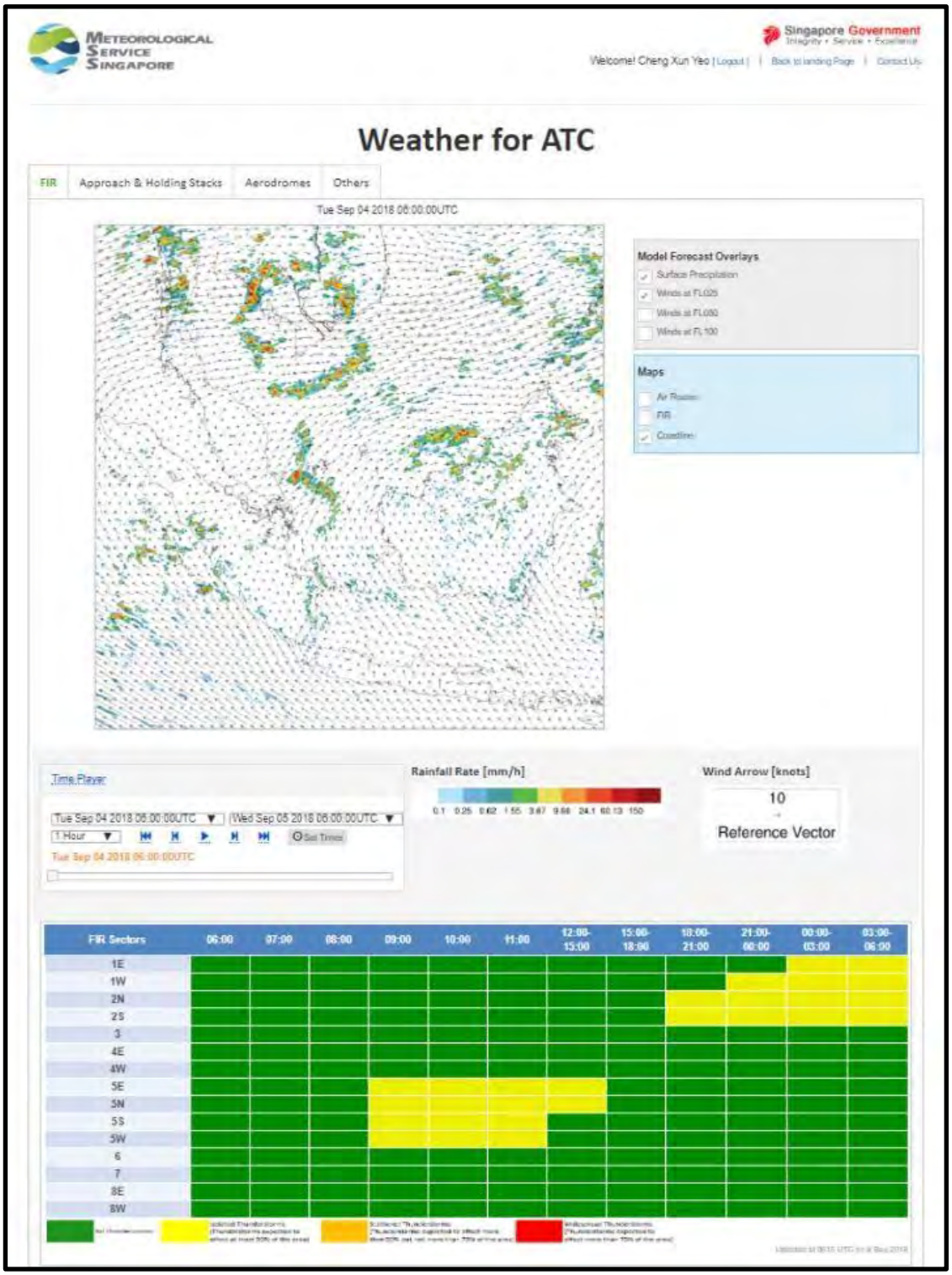

Figure 1a: Dedicated Web Portal for ATC showing Categorical Forecast of Thunderstorms.

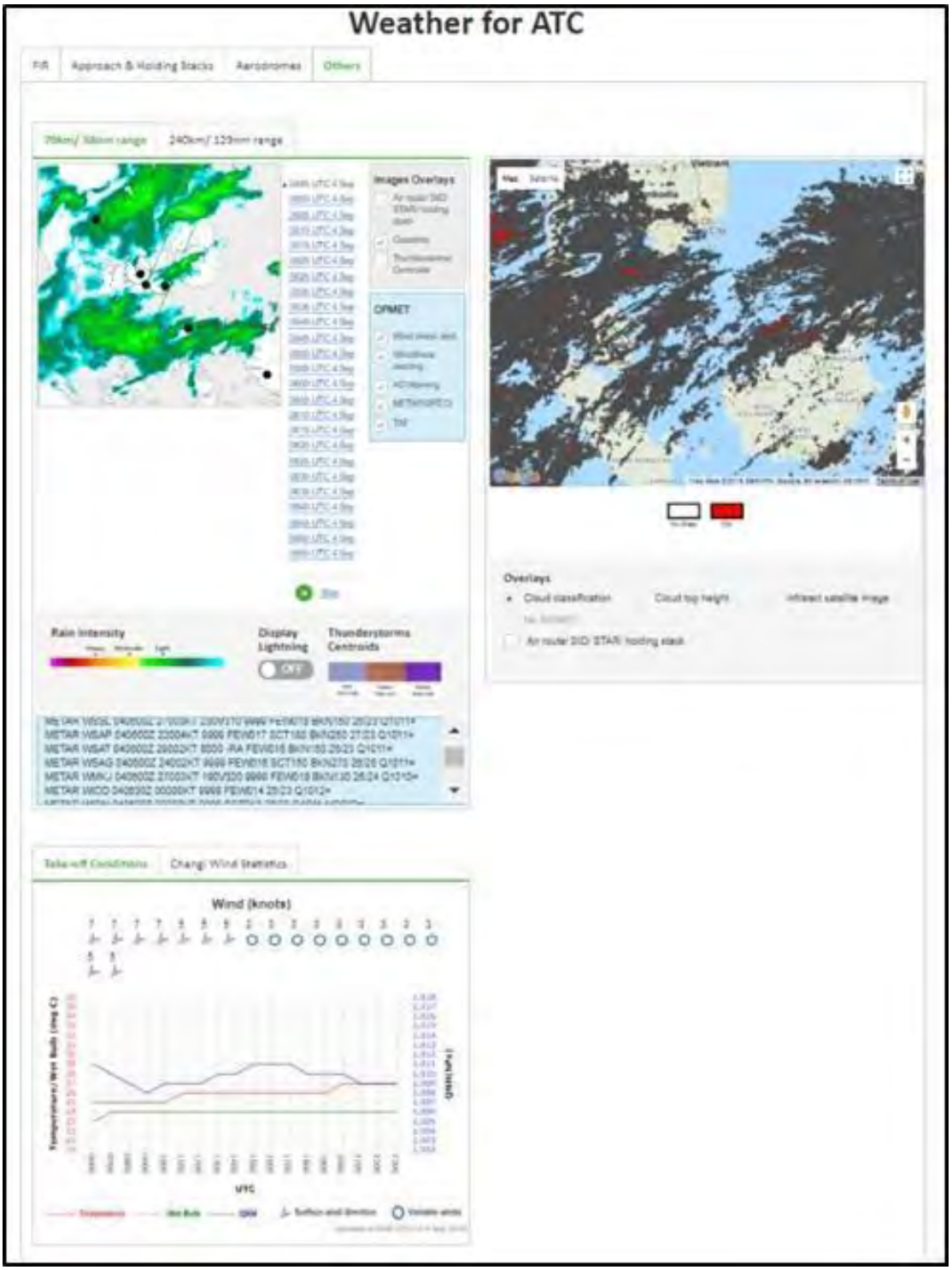

Figure 2b: Dedicated Web Portal for ATC showing observations including satellite and radar images, OPMET and AD warning information.

2.3. Direct Communication Line

A direct communication line has been established to facilitate exchange of information in a timely manner. This enables the operational meteorologists and ATC officers to readily react to changes in weather situation.