

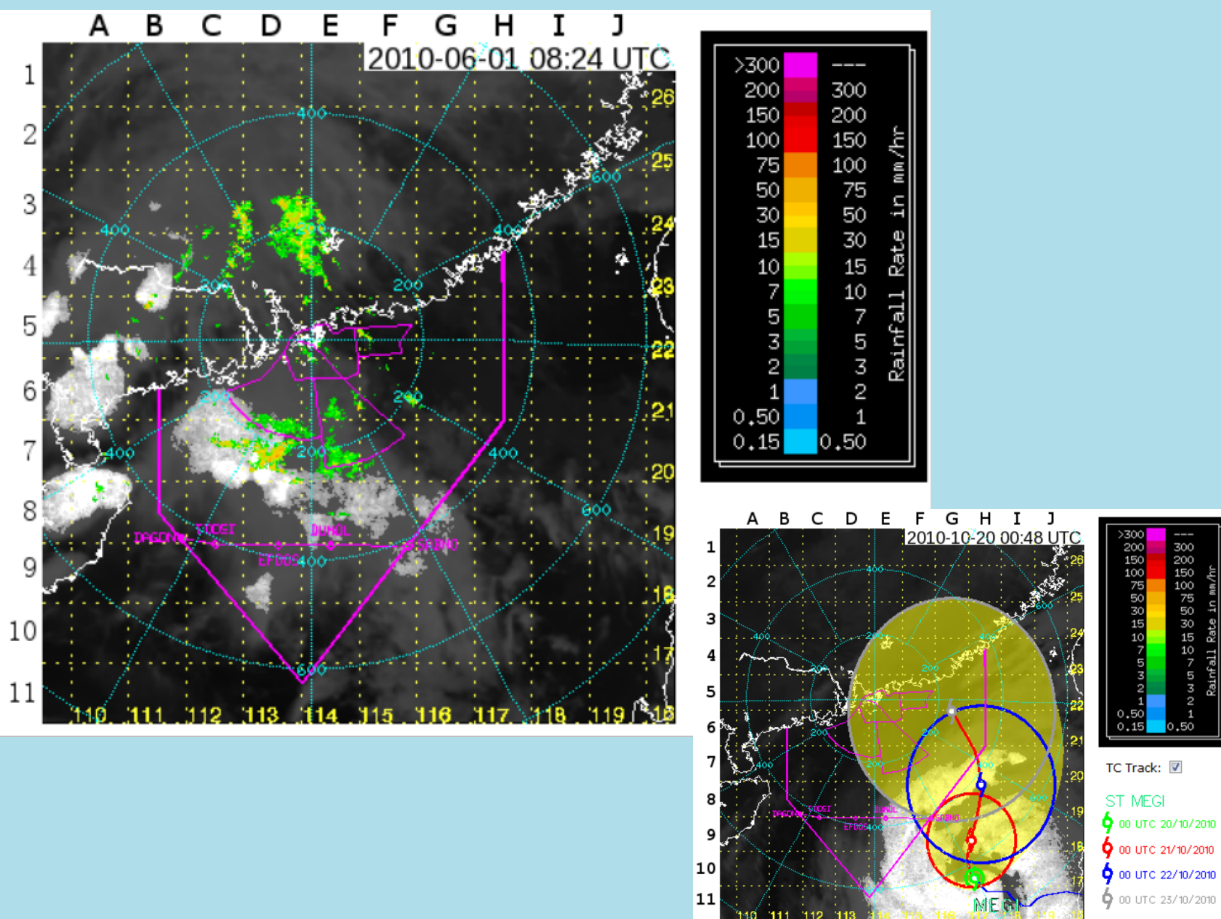
# Development of significant convection forecast product and service for air traffic flow management in Hong Kong

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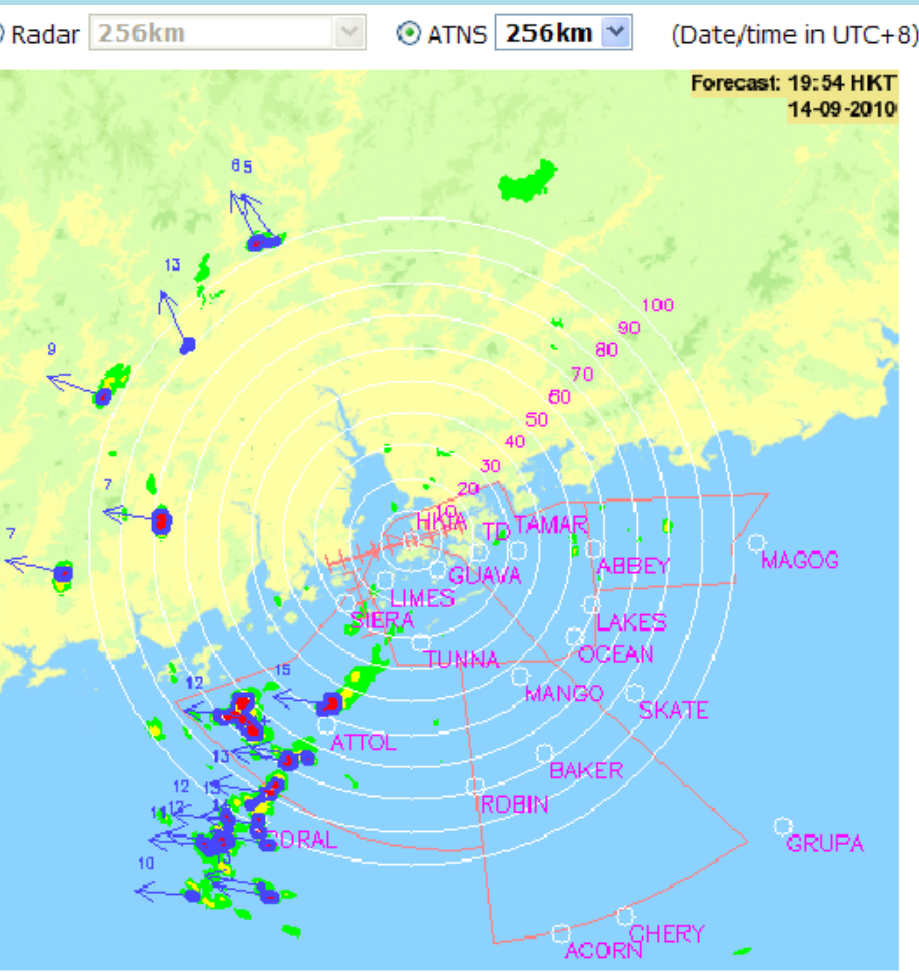
## Significant Convection Monitoring Tools

Radar images showing the estimated rainfall rate of rain areas at 3 km above mean sea level for the past hour at 6-minute intervals are displayed in an animation sequence. Users can select a radar range of 64-km, 128-km or 256-km with or without overlay of lightning location data. The Air Traffic Control (ATC) sector boundaries are overlaid on the base map of the 256-km radar image while checkpoints are overlaid on the 128-km and 64-km radar images.

Composite of 512-km and 256-km radar images overlaid on the satellite image highlighting deep convection areas in bright white color are displayed in an animation loop for the past 3 hours at half-hourly intervals. The ATC sector boundaries and the boundary of the Hong Kong Flight Information Region (HKFIR) are overlaid on the base map. Coordinate grid labels are marked on the horizontal and vertical axes to aid specifying areas of concern during communication between aviation forecaster and ATC personnel. The same coordinate grid system is also applied to the significant convection forecast product.



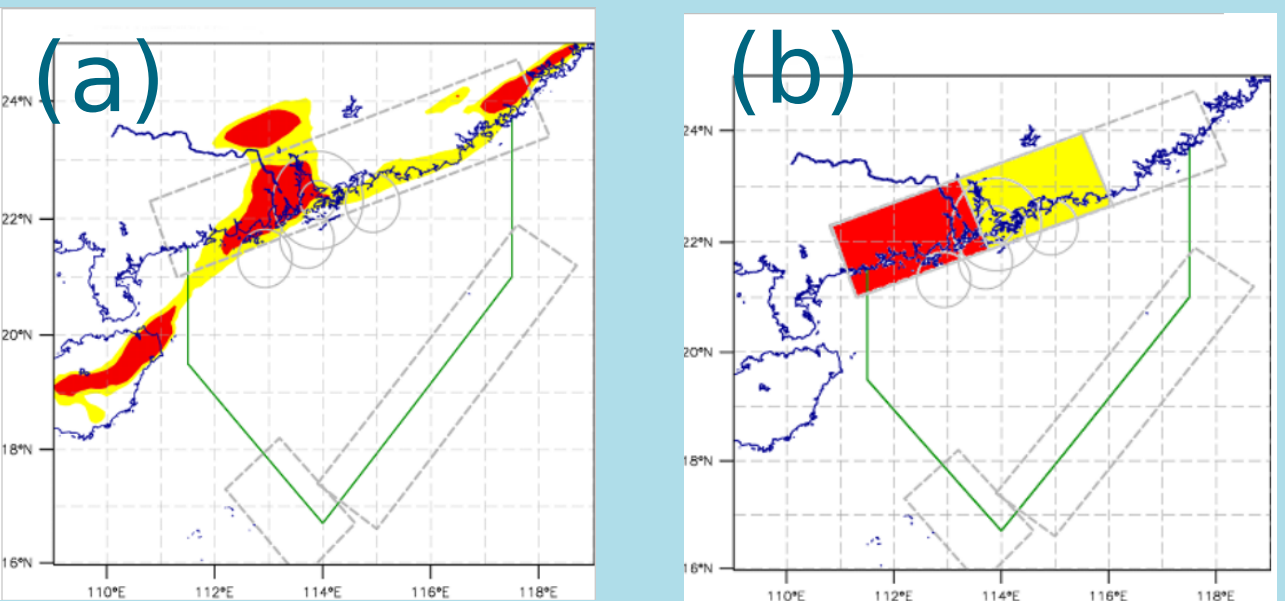
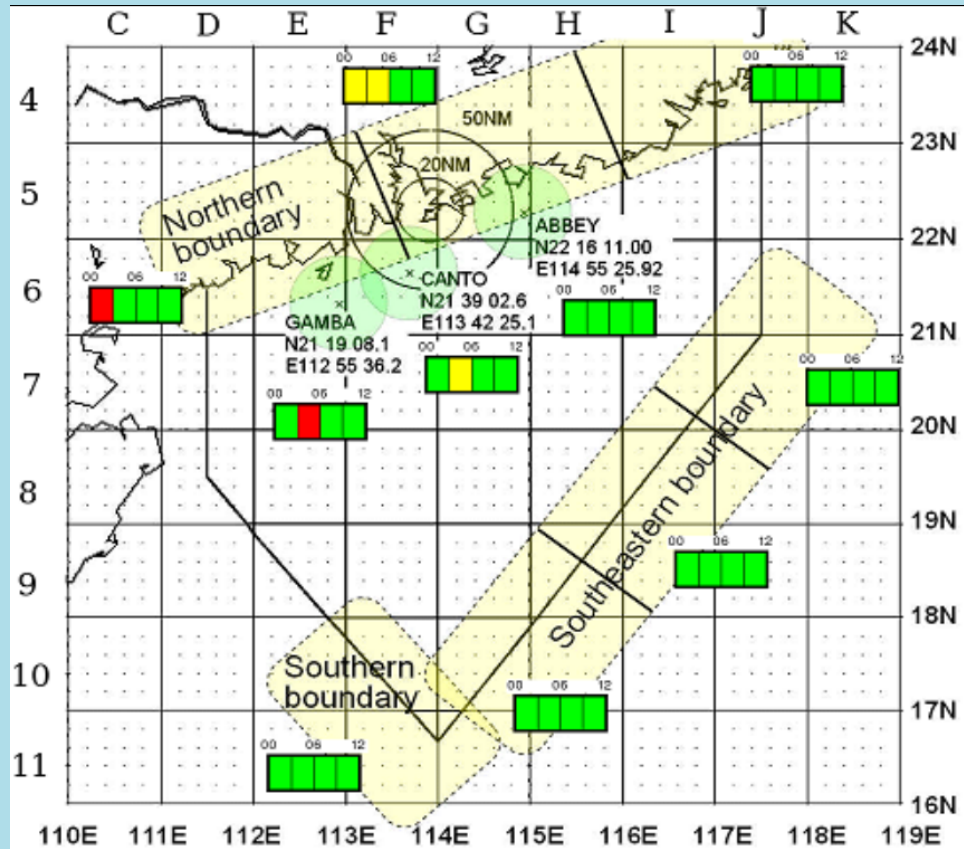
When a tropical cyclone is observed or forecast within the area of the image, its position and the latest tropical cyclone forecast track of the Hong Kong Observatory (HKO) will be shown on the composite image.



Short-term forecast of thunderstorms for the next hour is generated by the Aviation Thunderstorm Nowcasting System (ATNS) developed by HKO. It automatically determines the movement of thunderstorms from the radar image sequence every 6 minutes and forecasts the location of thunderstorms in the next 60 minutes by extrapolation based on artificial intelligence technique.

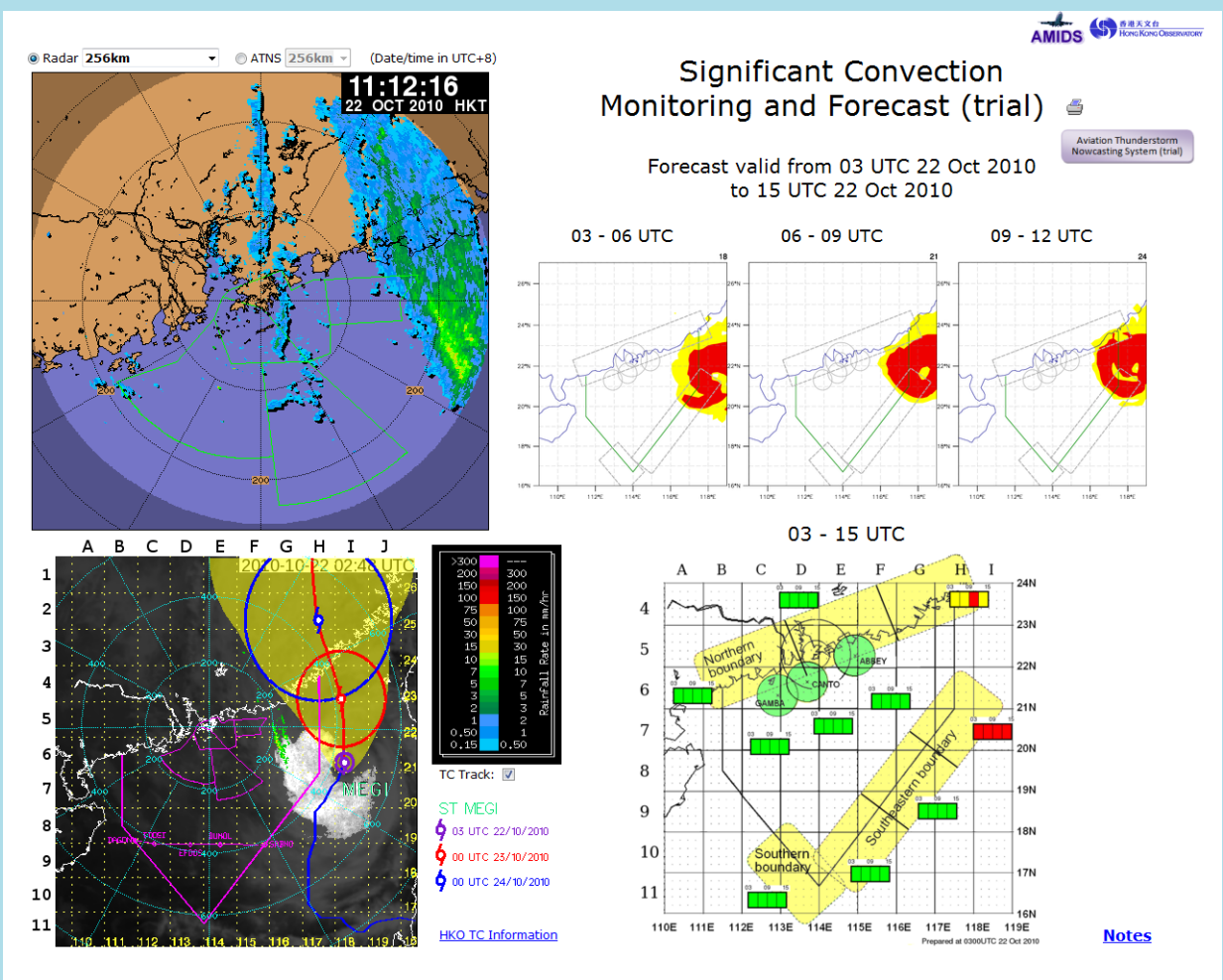
## Significant Convection Forecast Product

Green/Yellow/Red markings indicate a low/medium/high chance of significant convection over the specified area within a 3-hour time frame up to 12 hours ahead. The forecast areas are key holding areas for arrival flights and the boundary regions of HKFIR. The forecast is based on objective guidance including model outputs from ECMWF and is updated every 3 hours. Manual adjustment by aviation forecasters may be applied to the automatically generated forecast for the first few hours based on latest weather observations.



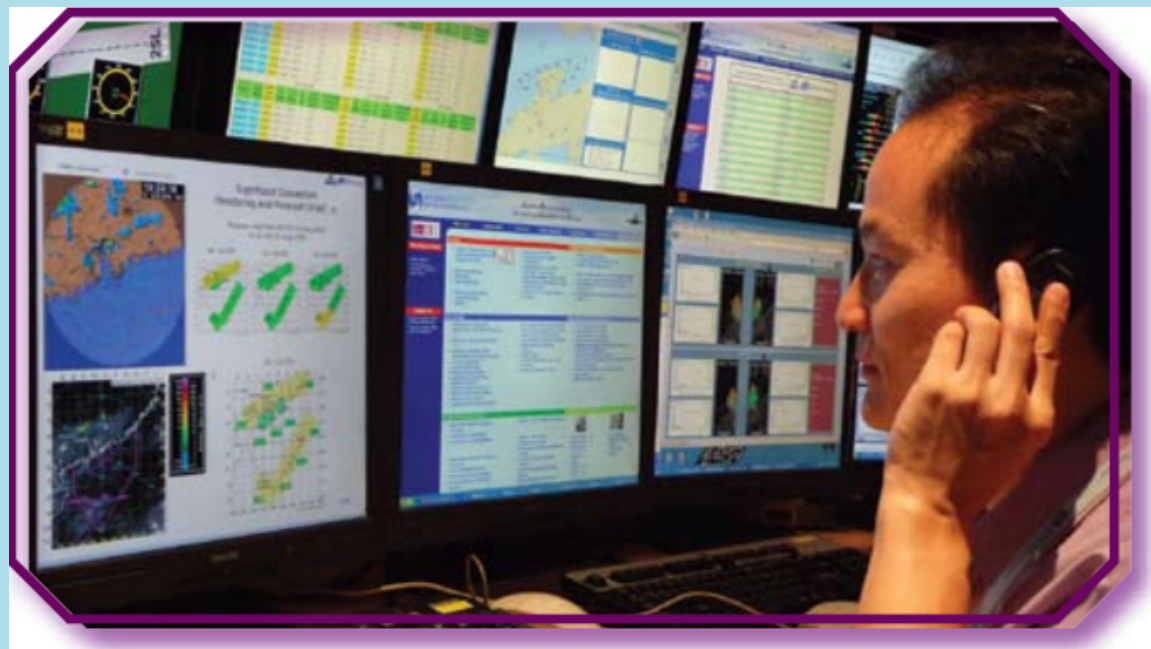
Significant convection forecast in pictorial form:  
(a) "weather map" without forecaster's adjustment;  
(b) "areal map" with forecaster's adjustment.

## Significant Convection Monitoring and Forecast Webpage



The "Significant Convection Monitoring and Forecast" webpage is an integrated webpage showing the significant convection monitoring tools, significant convection forecast product and the ATNS product. Outreach visits were made to the Air Traffic Control Centre (ATCC) to engage users in the design phase of this integrated webpage.

## Weather Briefing Service

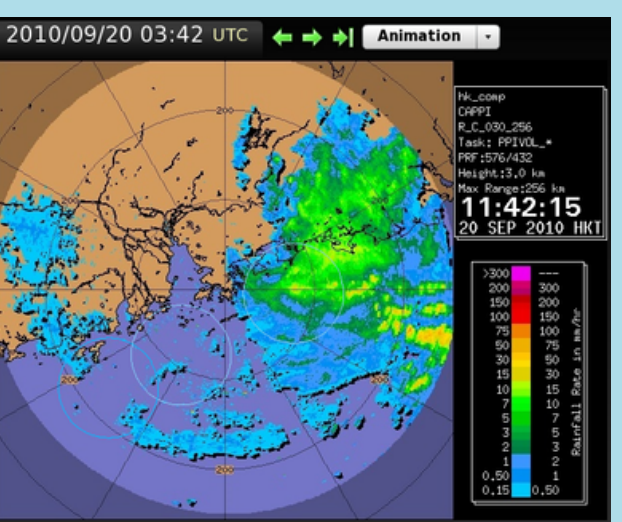


Commencing June 2010, the Observatory's Aviation Forecaster provides trial daily weather briefings to ATC Watch Manager on significant convection forecast in support of their planning of air traffic

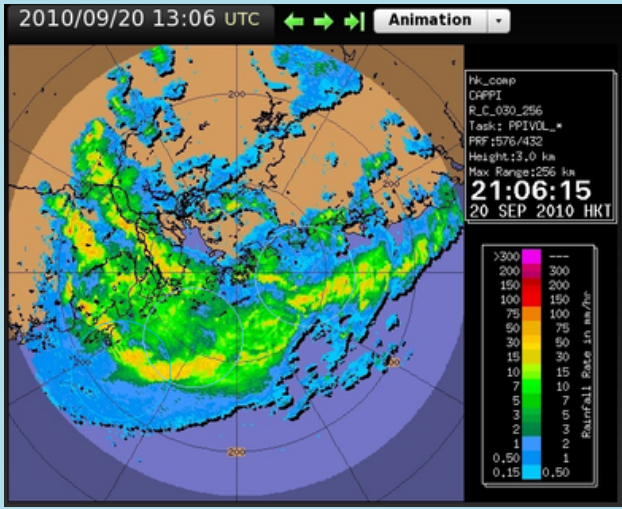
flow management. Aviation forecaster makes use of the tailor-made webpage for significant convection monitoring and forecast during the weather briefing.

## Performance

Objective verification of significant convection forecast for three key holding areas for arrival flights (circular regions on the forecast product) based on pre-defined thresholds of radar reflectivity and area of coverage over the verification area was performed.



A case of "Yellow" alert for the right-most holding area "ABBEY".



A case of "Red" alert for all three key holding areas.

Verification results for the period of July - November 2010 showed that the Threat Score (TS) or Critical Success Index (CSI) for the Red alert was around 0.25 and that for the Amber alert ranged between 0.29-0.39 for the first 6 hours forecast.

Verification of ATNS was also performed using 12 cases of intense convection in 2010 within about 130 km from Hong Kong. The CSI for the first 30 minutes forecast was about 0.6.