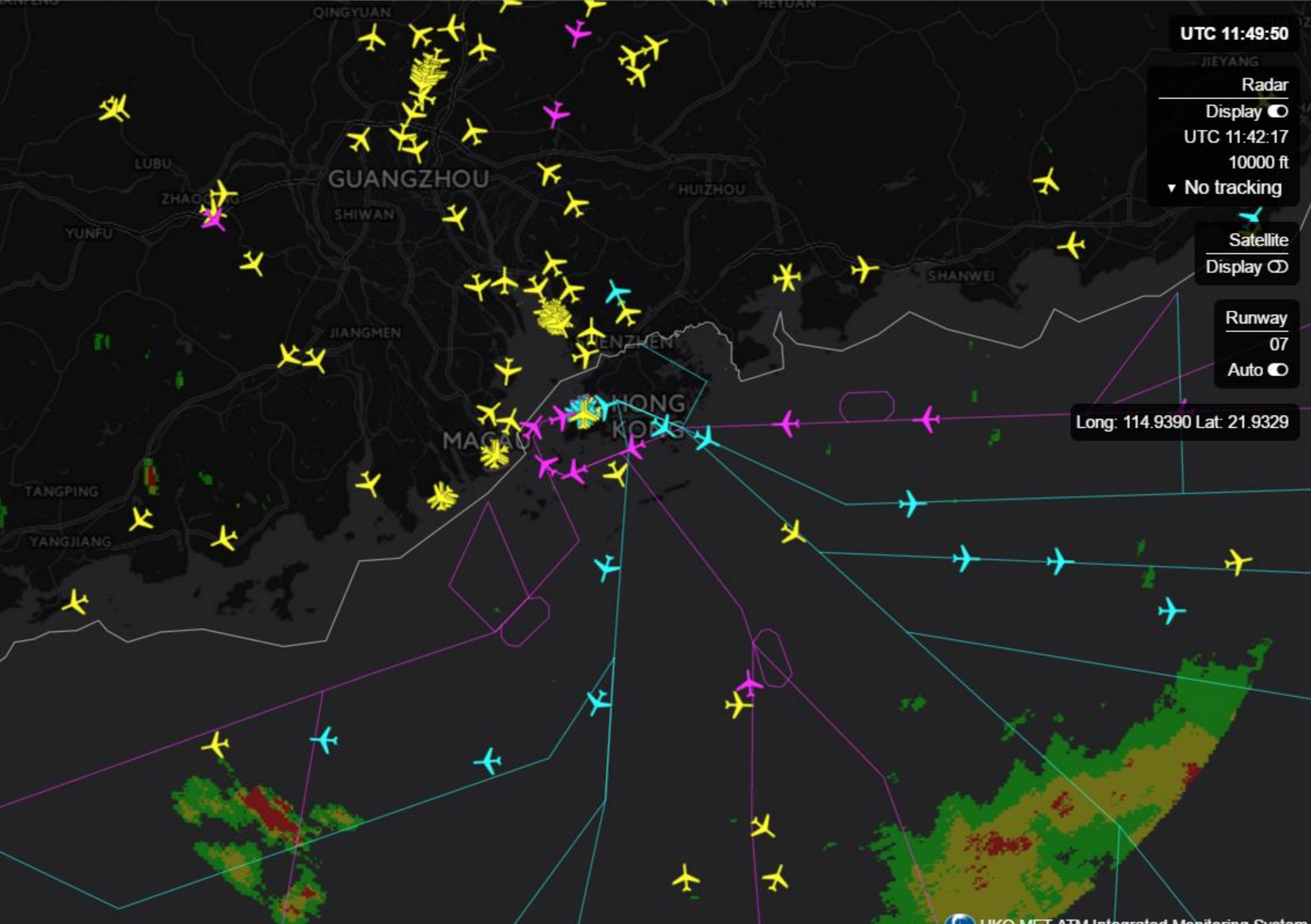




**PROVISION OF NEW MET INFORMATION  
FOR ATM VIA THE WMO AVIATION  
RESEARCH DEMONSTRATION PROJECT**

Presented by Hong Kong, China

ATFM/SG/6-IP/04  
6-9 June 2016



UTC 11:49:50

JIEYANG

Radar

Display

UTC 11:42:17

10000 ft

▼ No tracking

Satellite

Display

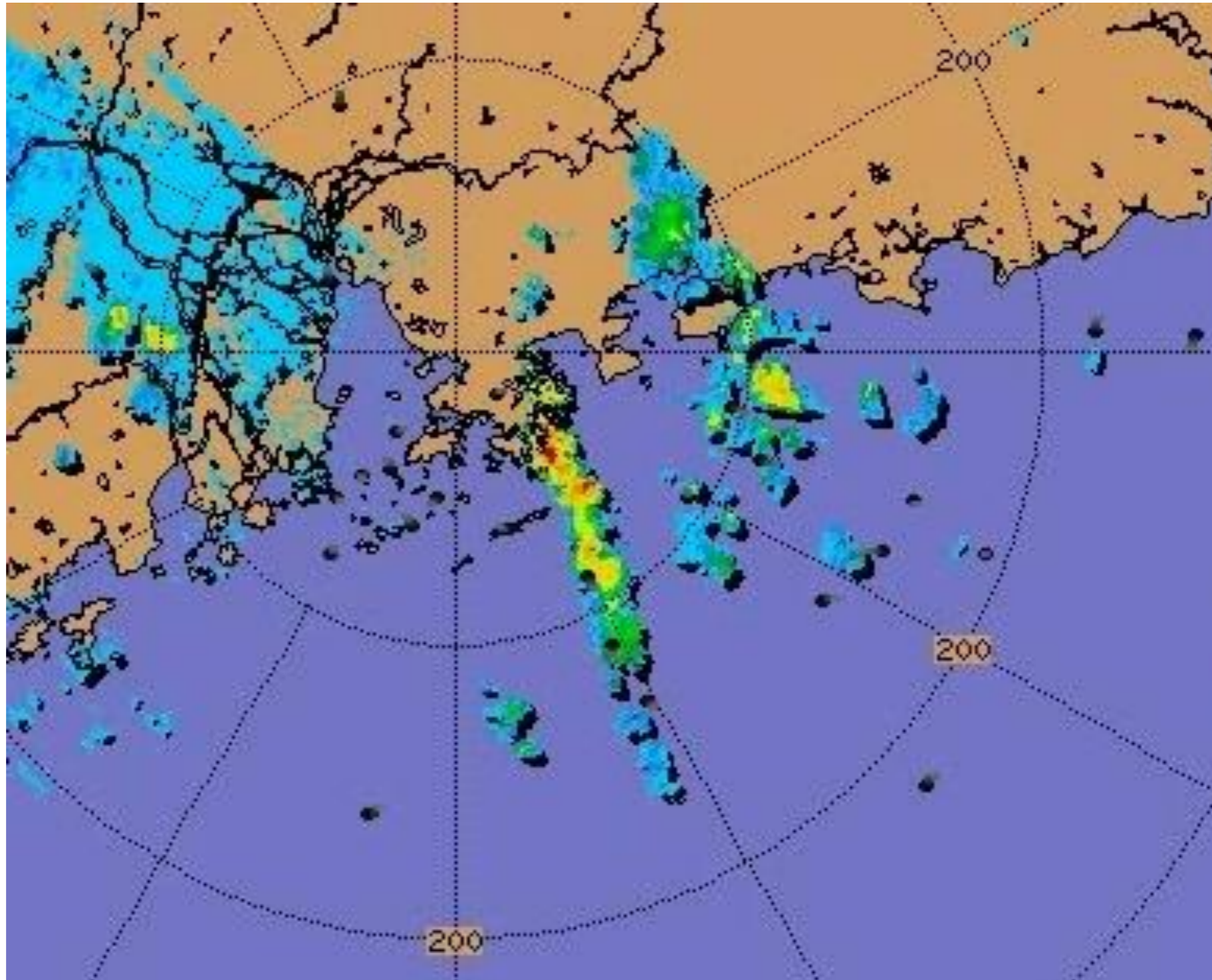
Runway

07

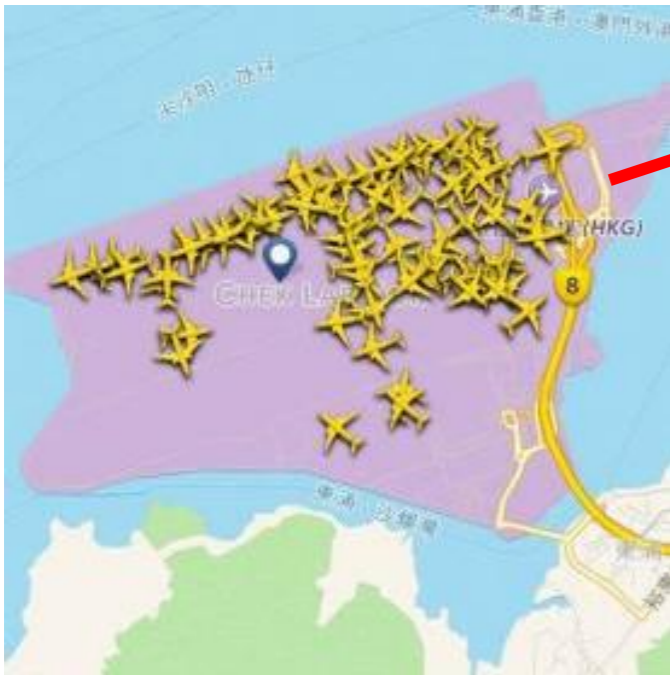
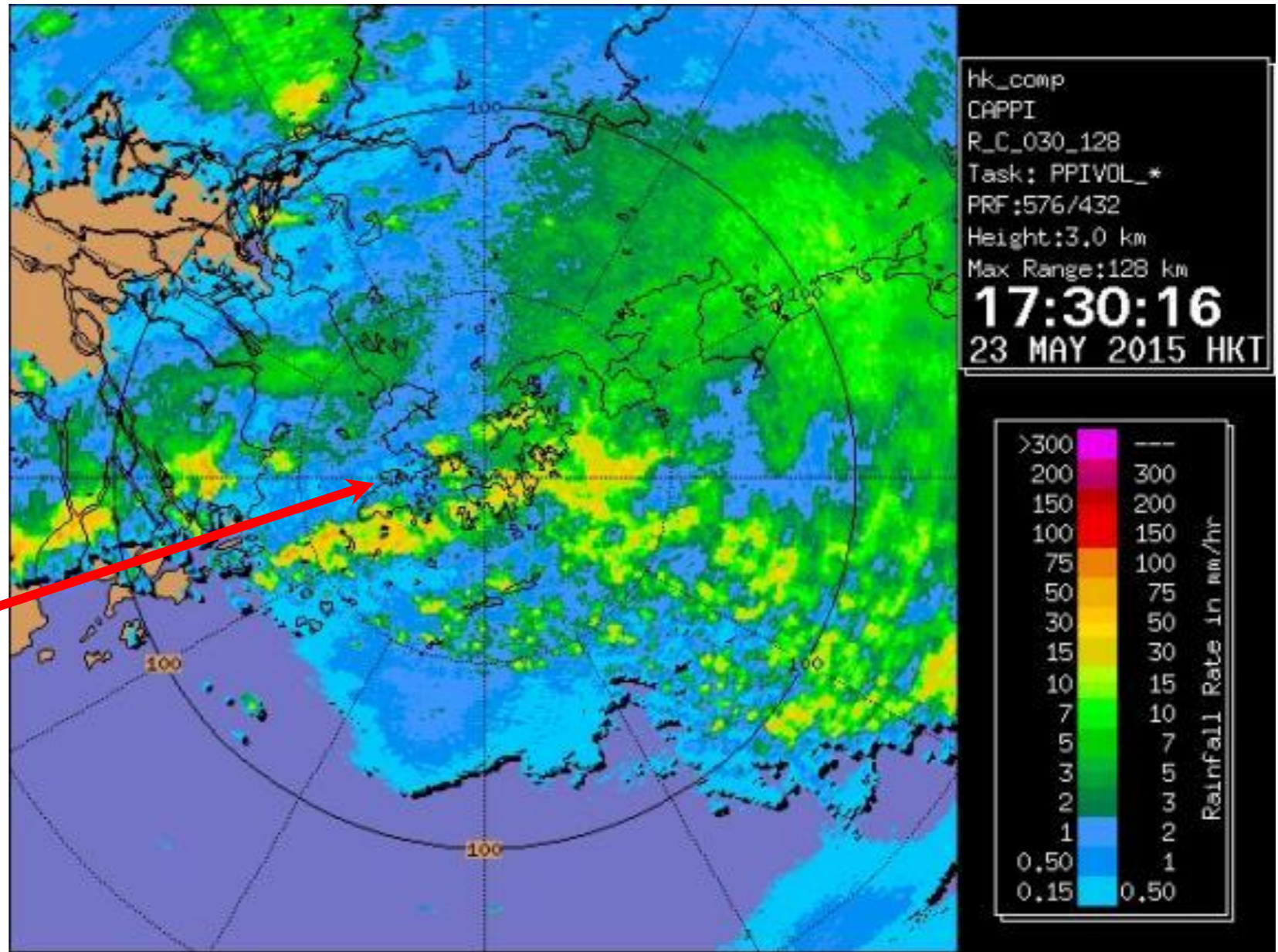
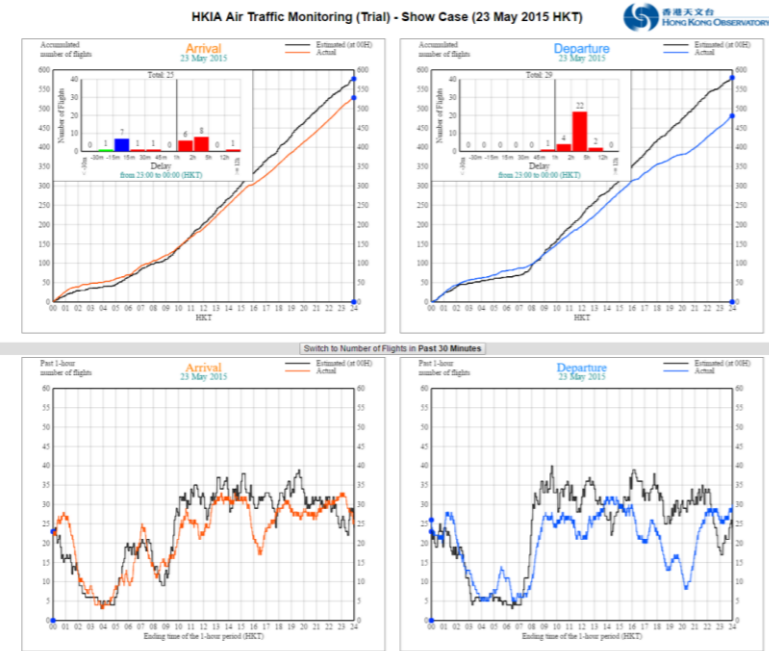
Auto

Long: 114.9390 Lat: 21.9329

# Weather Impact

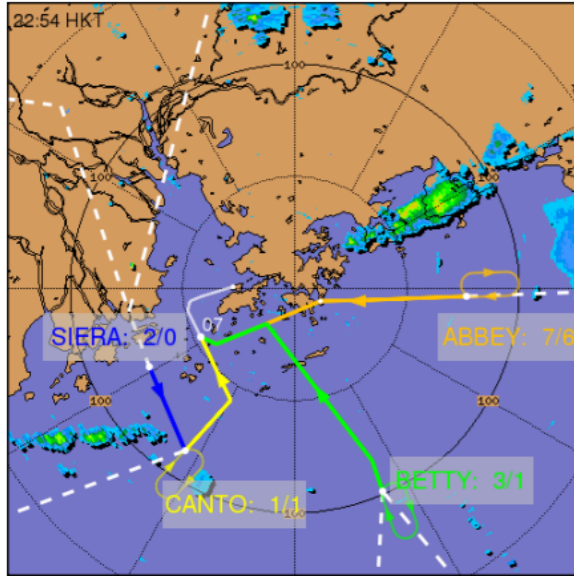


# Weather Impact - Full apron

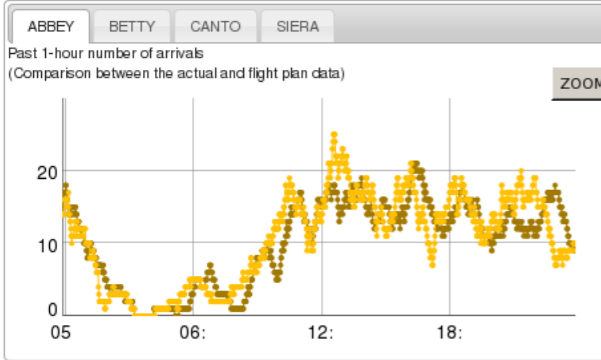


# Impact CAN extend for long time

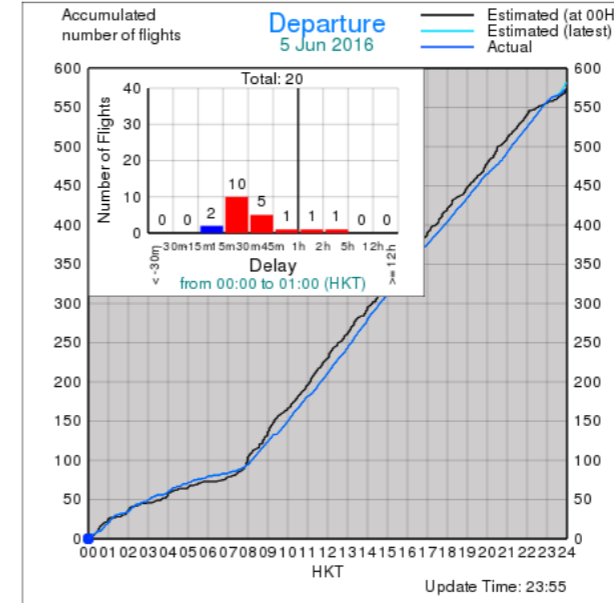
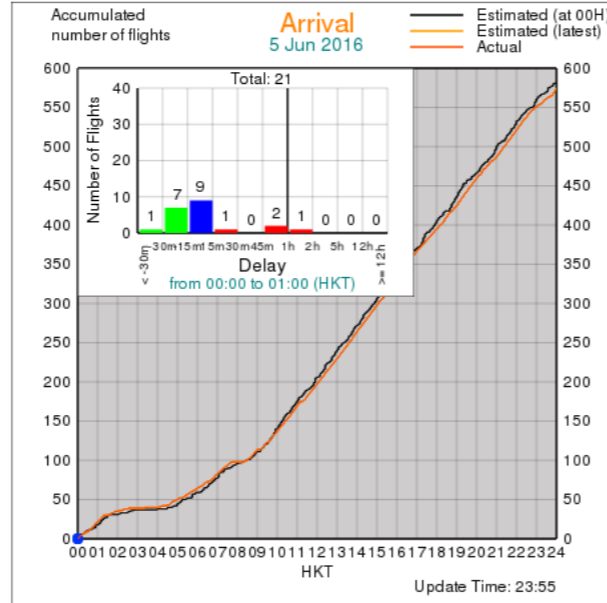
Distribution of flights arriving in the next hour (approx.)



NW Route (SIERA)			SW Route (CANTO)			S Route (BETTY)			E Route (ABBEY)		
ELDT	RWY	STAR	ELDT	RWY	STAR	ELDT	RWY	STAR	ELDT	RWY	STAR
1543	07	7A	1646		3A	1552	07	2A	1550	07	3A
1609	07	7A				1635		2A	1550	07	3A
						1649		2A	1602	07	3A
									1605	07	3A
									1610	07	3A
									1611	07	3A
									1614	07	3A



## MET-ATM Integrated Monitoring [Trial]



Capacity Forecast (for Arrivals)	
Last update:	2016-06-05 05:18
VALID:	050800 to 051600 UTC
CAPACITY LEVEL:	1
AIRPORT ACCEPTANCE RATE:	32 flights per hour
EXPECTED DELAY:	Up to 15 mins
REASON:	-
REMARK:	Convective activities to the west of HKIA moving east. AAR may reduce to 28 during the passage of TS between 0800 to 1200. Holding up to 30 minutes.

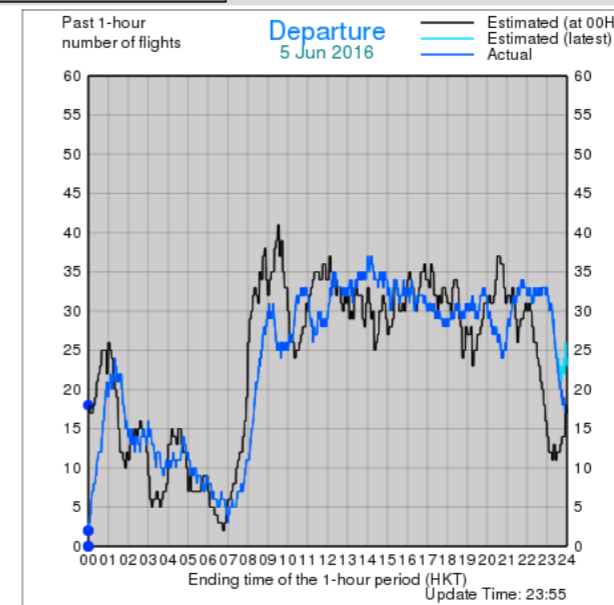
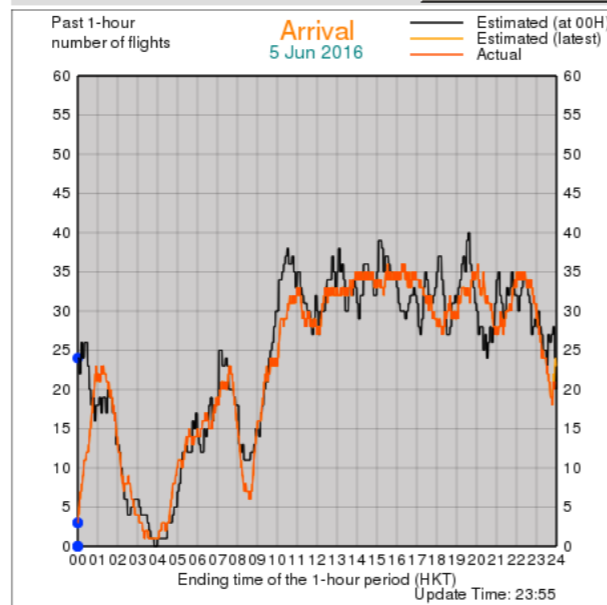
### Traffic Interruption Related Messages from ATIS

HONG KONG ARRIVAL INFORMATION	
A-TIME	1534
A-RUNWAY	07L
A-INFO-D2	RWY SFC WET
A-SUPPL1	WIND L&V
A-SUPPL2	
D-WXCHG	

HONG KONG DEPARTURE INFORMATION	
D-TIME	1534
D-RUNWAY	07R
D-SUPPL1	
D-SUPPL2	
D-WXCHG	

### Switch to Number of Flights in Past 30 Minutes



### Traffic Interruption Related Messages from NOTAM

VALID FROM:	2016-06-05 07:55 UTC
VALID TO:	2016-06-05 16:00 UTC
(ISSUED AT:	05 07:55 UTC)
A0766/16 NOTAMR A0765/16	
Q) VHHK/QXXXX/1V/NBO/A /000/999/2219N11355E005	
A) VHHH B) 1606050755 C) 1606051600	
<b>E) ALL ARRIVALS TO HONG KONG INTERNATIONAL AIRPORT CAN EXPECT HOLDING</b>	

### Flow Restriction (from ATC Watch Manager)

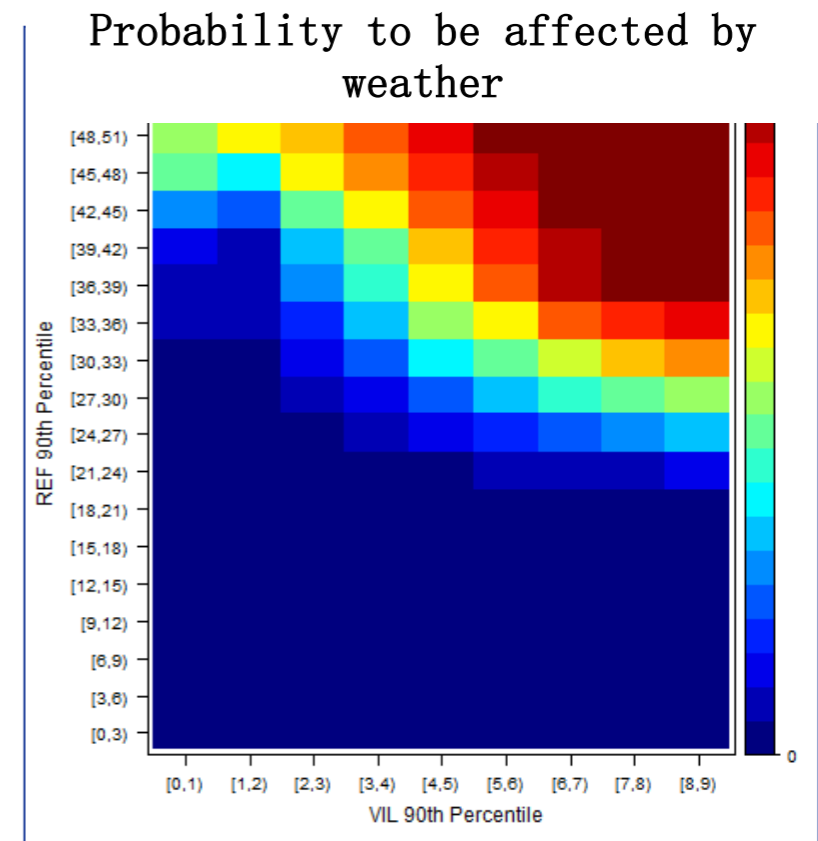
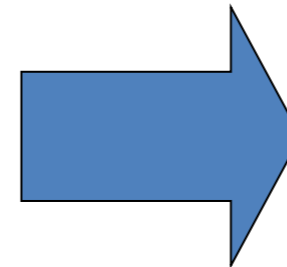
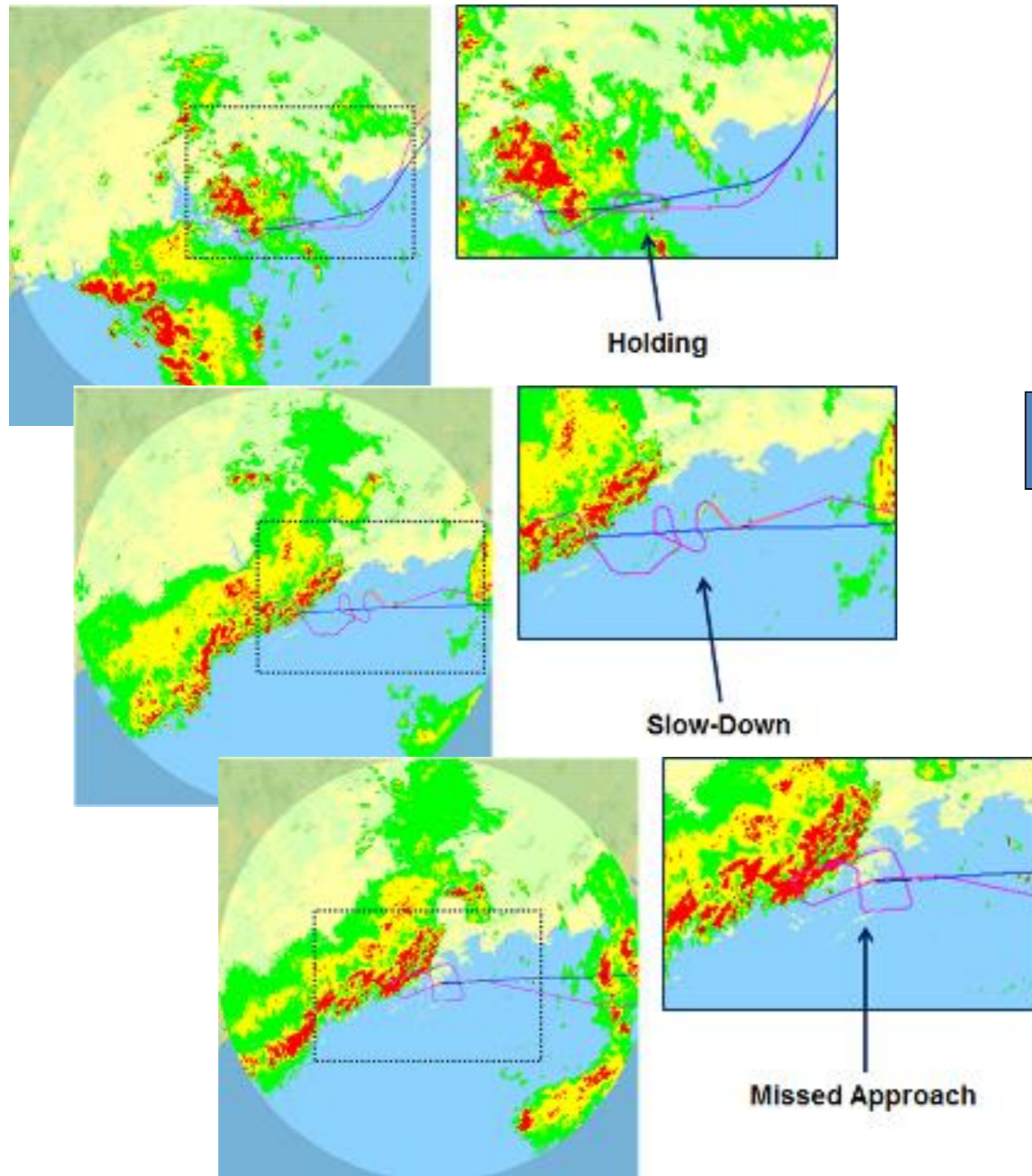
Last Update: 2016-06-03 17:37

[Re: Hong Kong departures via DOTMI destined for ZSPD expect delay]

To whom it may concern,

# Effect of Significant Convection to Capacity

Types of effect of significant convection



+ Trajectory Based SigConv F/C

+ ADS-B flight position

+ ...



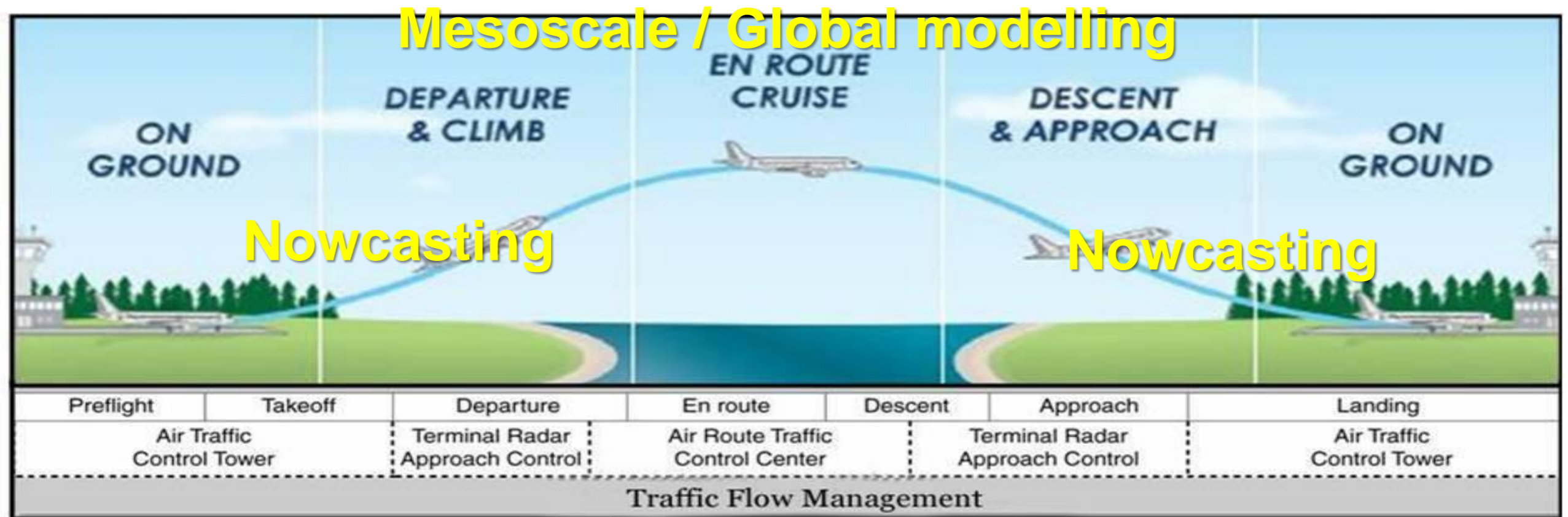
Capacity Forecast

Users said

**WE NEED BETTER MET  
SUPPORT!**

# Trajectory-Based Operation (TBO)

Transition from nowcasting scale -> mesoscale -> global scale -> mesoscale -> nowcasting scale



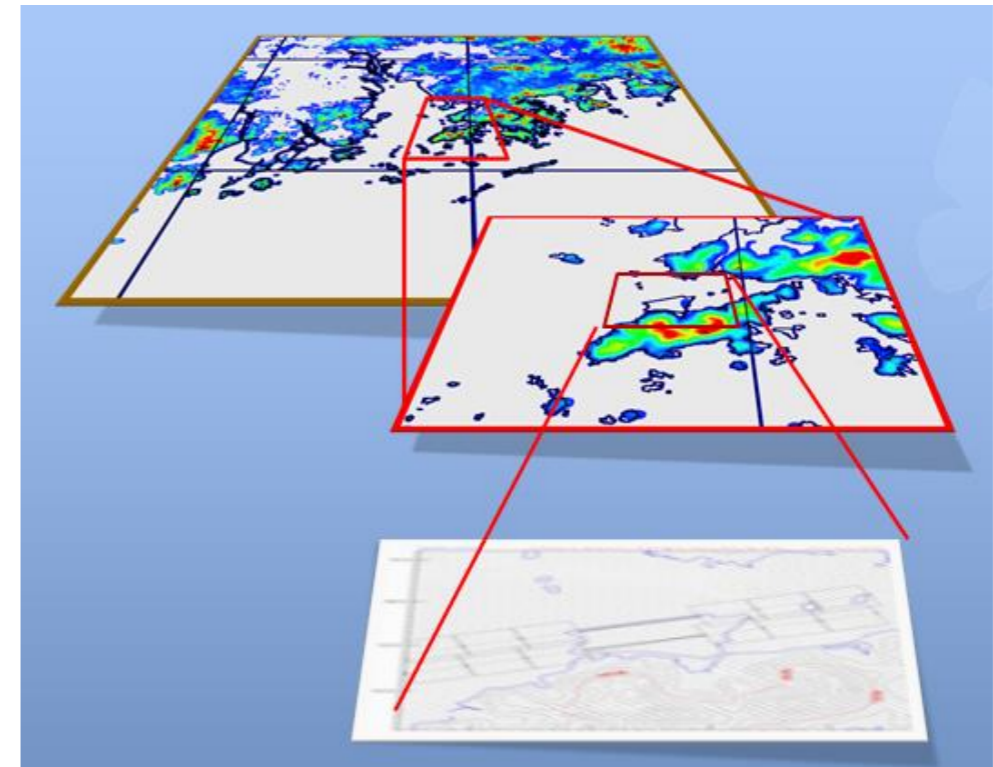
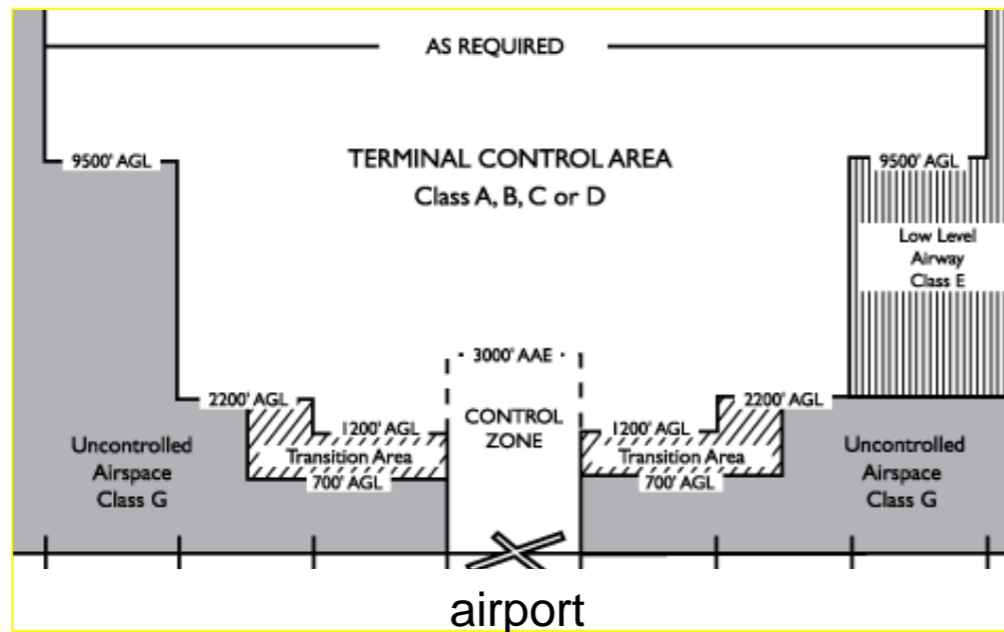
↑  
Terminal Control Area:  
Location specific

↑  
En Route Phase:  
Mainly supported by  
global/regional  
Multi-model Aviation  
Weather Forecast  
Centre (AWFC)

↑  
Terminal Control Area:  
Location specific



# Meteorological Service for the Terminal Area (MSTA)



This is the area needs 0-6 hr nowcast

- The closer to the airport, the high resolution meteorological information will be required.
- Different airports will have different requirements

\* Nowcast or nowcasting hereafter refers to all techniques/systems including observation-based, expert system-based, human-machine interfaced and meso/microscale NWP or any combination thereof which can generate high resolution, rapidly updated forecasts for the next 0-6hr ahead

# CAeM/ICAO Conjoint Meeting

## 7-18 July 2014, Montreal, CA

### Recommendation 2/10 — Development of meteorological service for the terminal area

That ICAO, in close coordination with WMO, be tasked to:

- a) include meteorological service for the terminal area and other relevant operational requirements in Block 1 and subsequent blocks of the aviation system block upgrade methodology to highlight potential related impacts on air traffic flow in consideration of air traffic control and air traffic management (ATM);
- b) develop ATM-tailored meteorological service for the terminal area to meet future ATM requirements identified by the *Global Air Navigation Plan* (Doc 9750) and reflect the appropriate functional and performance requirements in the relevant provisions, noting outcomes from ICAO expert groups on meteorology, ATM and flight operations.;
- c) develop guidance on verification methodology toward the continuous improvement of meteorological information to ATM; and
- d) integrate the information concerning meteorological service for the terminal area into the future system-wide information management environment underpinning the future globally interoperable ATM system.

#### Meteorology (MET) Divisional Meeting 2014

Agenda (all languages)

Daily Bulletin

Programme

Documentation

Working Papers

Information Papers

List of Documentation

Filmsies

List of WPs and IPs per Agenda Item

Order of Business

Draft Reports

Yellow Cover Reports

Reference Documents

Doc 9750

Doc 10004

Group Photo (1 of 2)

Group Photo (2 of 2)

Information for Delegates

Information Booklet

ICAO Meetings > Meteorology (MET) Divisional Meeting 2014



[French - Français](#)

[Spanish - Español](#)

[Russian - Русский](#)

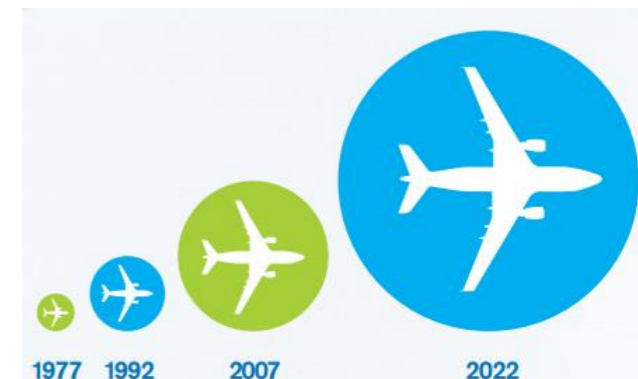
[Arabic](#)

ICAO Meteorology Divisional Meeting






(in part conjointly with the Fifteenth Session of the World Meteorological Organization (WMO)  
Commission for Aeronautical Meteorology (CAeM) including Technical Conference)

# WMO Congress XVII

- **Aviation meteorological services:** One of the 6 priorities in 2016-2019
- Improve the ability of national meteorological services to provide sustainable high quality services to support safety, efficiency and regularity of the air transport worldwide, with due account to environmental factors.
- Congress noted with interest the development of a joint CAeM/CAS/CBS Aviation Research Demonstration Project (AvRDP), with a view to demonstrate the capability of nowcasting and mesoscale modelling techniques in support of so-called “trajectory-based operations (TBO)”, with a planned ‘fast-track’ transfer of the research results into operational applications facilitated through a forecast demonstration phase



# AvRDP Airports (initial)

AvRDP Airport	Climatological regime	Weather elements to be studied in AvRDP
<p>Charles de Gaulle Airport (CDG)</p> 	<p>Mid-latitude in Northern Hemisphere</p> <p>Location: Inland</p>	<p>Winter weather - snowfall, icing, low temperature</p> <p>Fog</p>
<p>Hong Kong International Airport (HKG)</p> 	<p>Subtropical in Northern Hemisphere</p> <p>Location: Surrounded by water Next to high mountain</p>	<p>Convection and Thunderstorm</p> <p>Low visibility and ceiling</p>
<p>O.R. Tambo International Airport (Johannesburg Airport) (JNB)</p> 	<p>Subtropical in Southern Hemisphere</p> <p>Location: Inland</p>	<p>Convection</p> <p>Fog</p>
<p>Shanghai Hongqiao Airport (SHA)</p> 	<p>Subtropical/mid-latitude in Northern Hemisphere</p> <p>Location: Inland not far away from River Estuary and East China Sea</p>	<p>Convective weather</p>
<p>Toronto Pearson International Airport (YYZ) and Iqaluit Airport (YFB)</p> 	<p>Mid-latitude in Northern Hemisphere Location: Inland but not far away from Lake</p> <p>High-latitude in Northern Hemisphere Location: On Frobisher Bay</p>	<p>Winter weather – snowfall, icing, precipitation type and amount, visibility, wind speed, direction shear, and gust, turbulence, and low ceilings</p> <p>Convective Weather</p> <p>Arctic weather – Winds, blowing snow, fog, visibility, ceiling</p>

# Kickoff meeting cum CBS Nowcasting Workshop (24-26 June 2015, Shanghai, China)

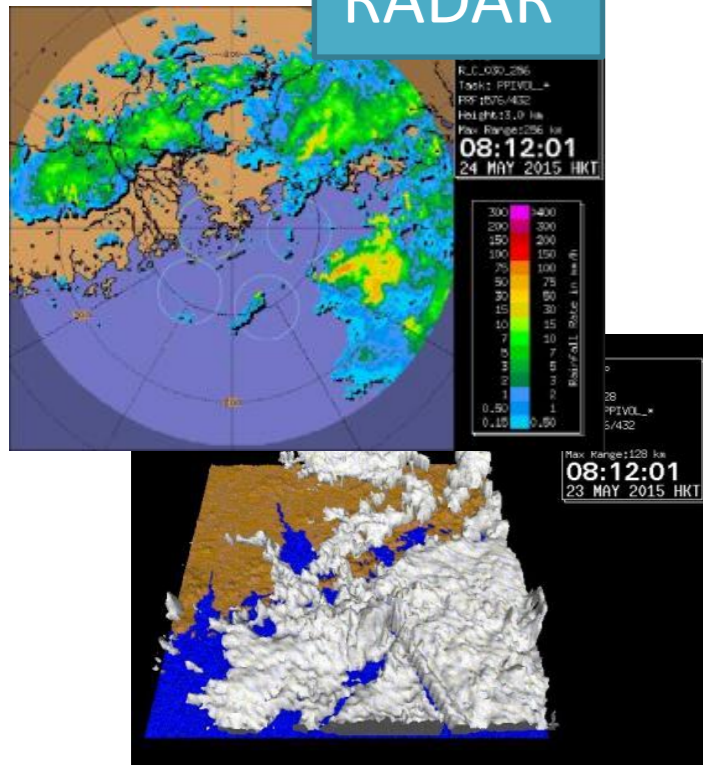


# HKG IOP Data summary

	Observations	Nowcasting, NWP Model and Forecast	ATM data
HKG	Doppler Weather Radar		
	Wind profiler		
	Anemometer		
	Automatic Weather Station		
	AMDAR data		
	METAR		
	SYNOP		
	SHIP		
	Sounding		
	Lightning		
	Aviation Thunderstorm Nowcasting System (ATNS)		
	Multi-Sensor Quantitative		
	Precipitation Forecast (MSQ)		
	RAPIDS - NHM		
	TAF		
	SIGMET		
	RAPIDS		
	Significant Convection Forecast		
	Hourly Airport Arrival Rate		
	Capacity forecast for AAR		
	ADS-B (since 2016)		

# Observational Data collected

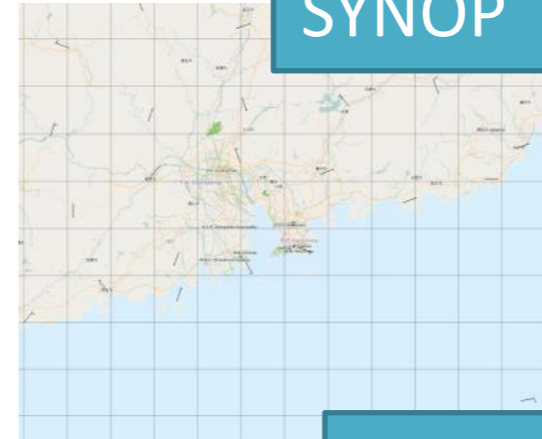
RADAR



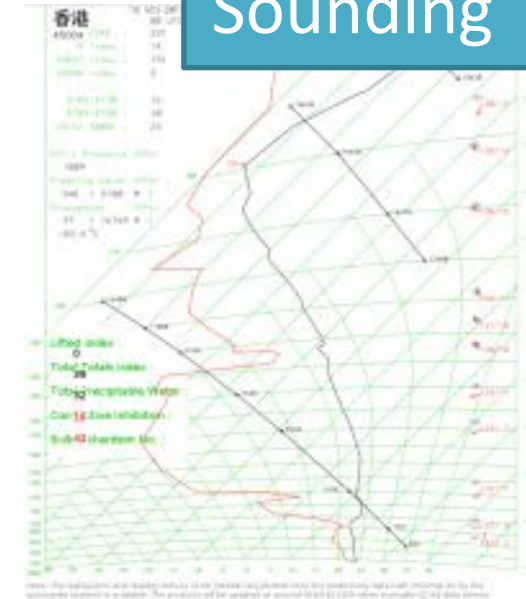
METAR



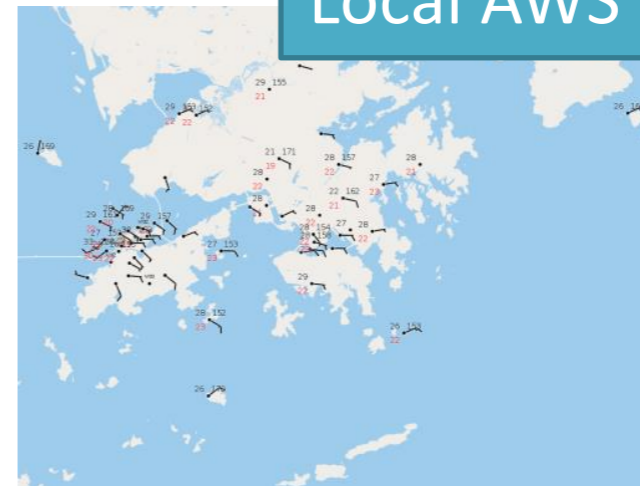
SYNOP



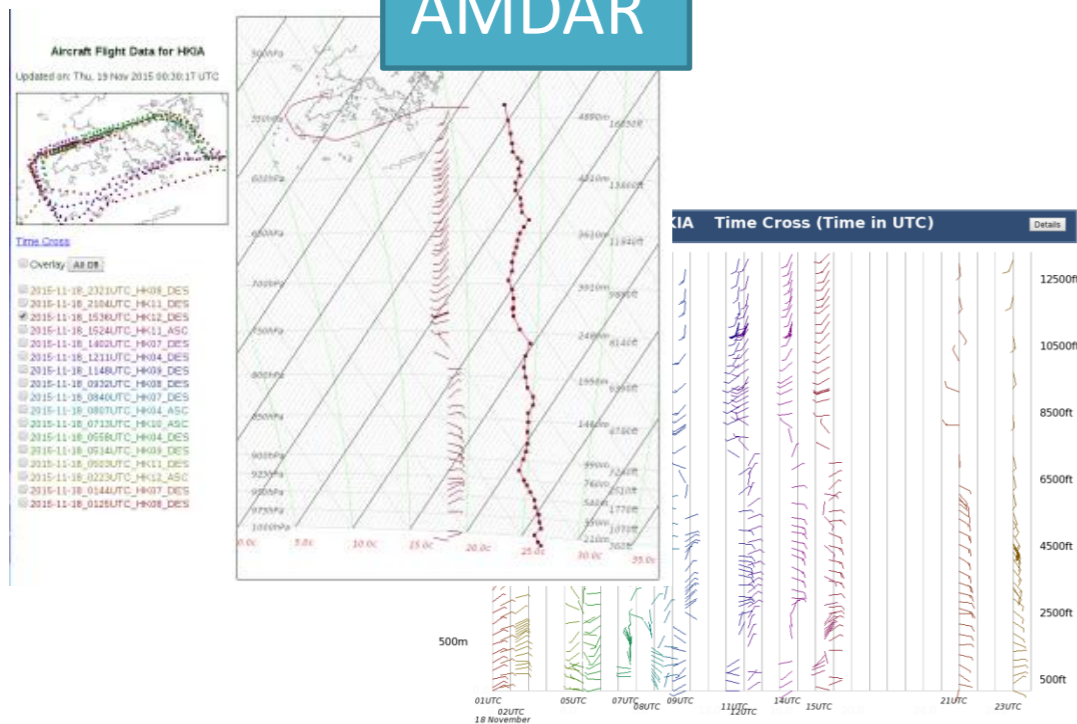
Sounding



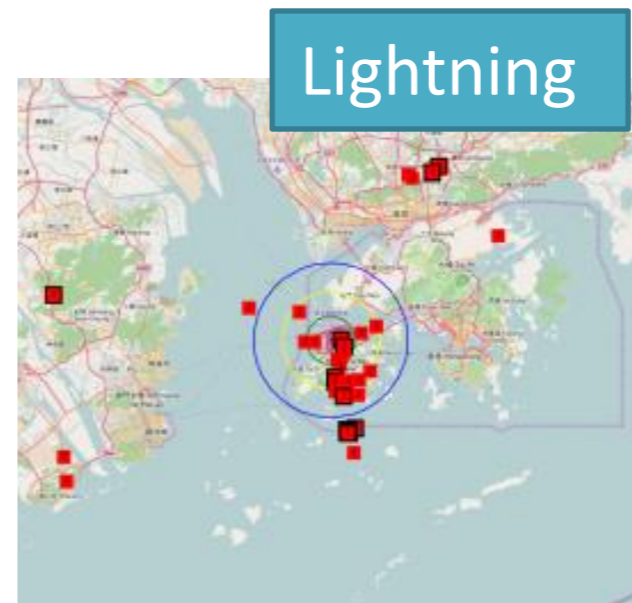
Local AWS



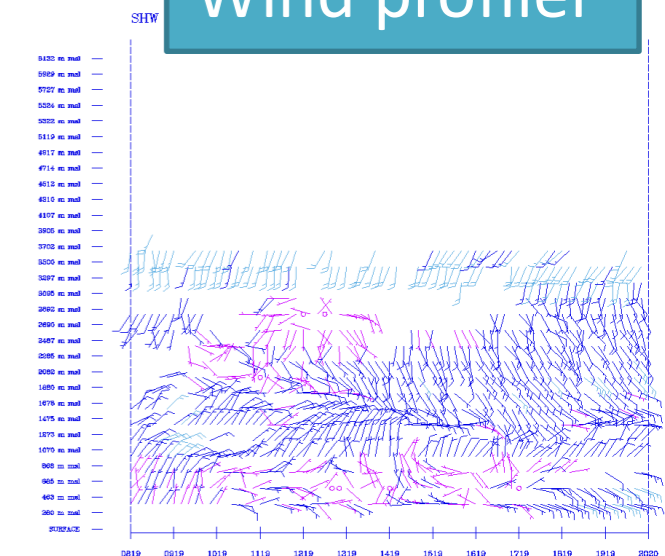
AMDAR



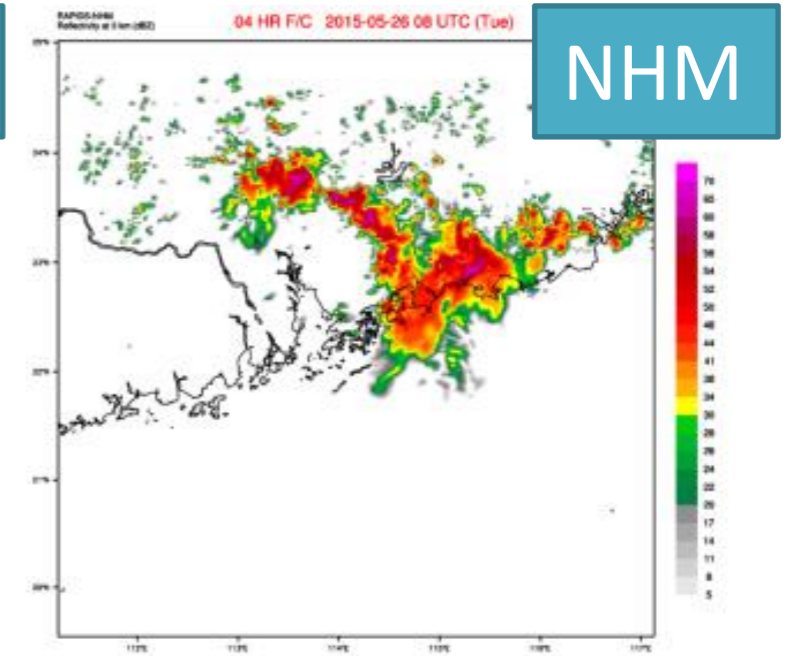
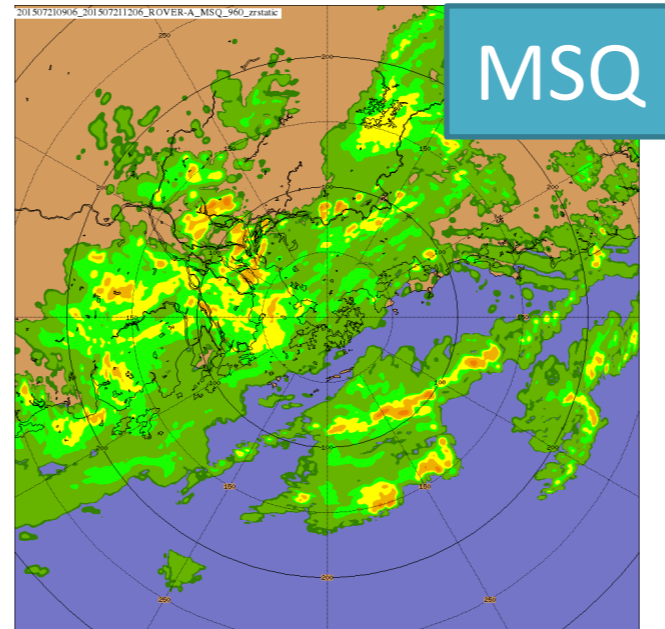
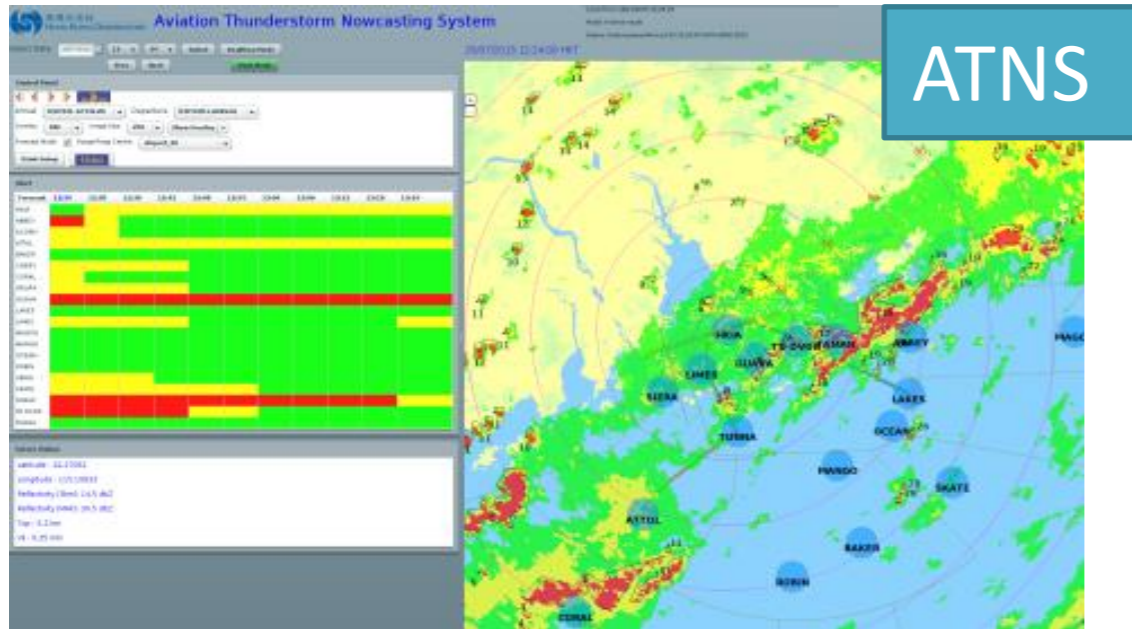
Lightning



Wind profiler



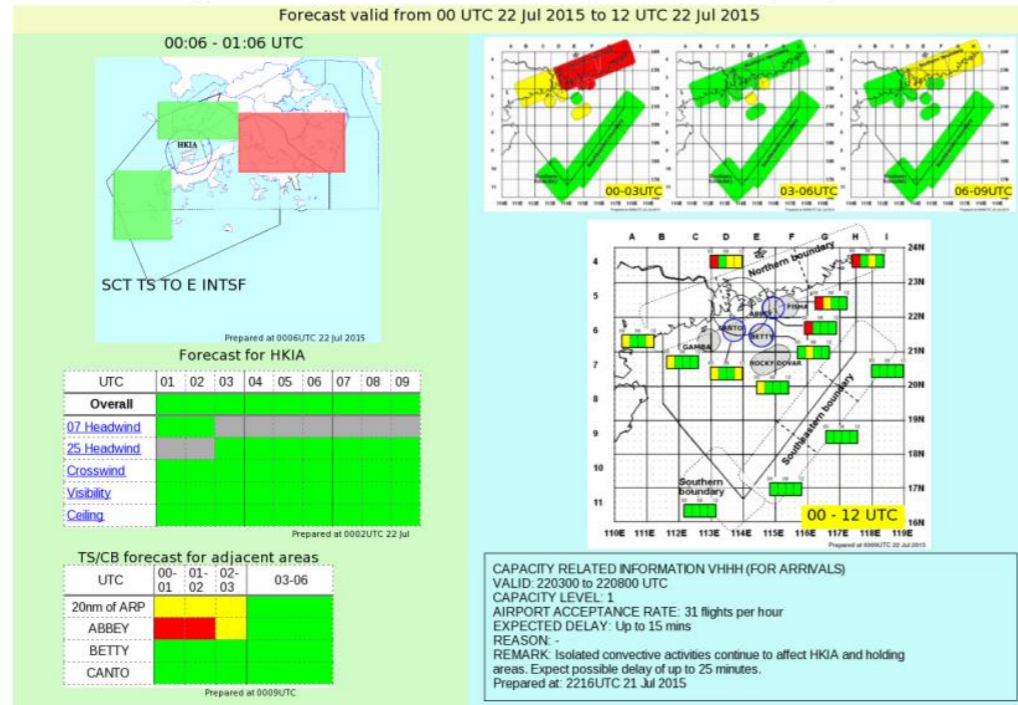
# Nowcasting / Model / ATM data collected



## SIGCONV and Capacity Notification

Significant Convection Monitoring and Forecast (trial)

Forecast valid from 00 UTC 22 Jul 2015 to 12 UTC 22 Jul 2015



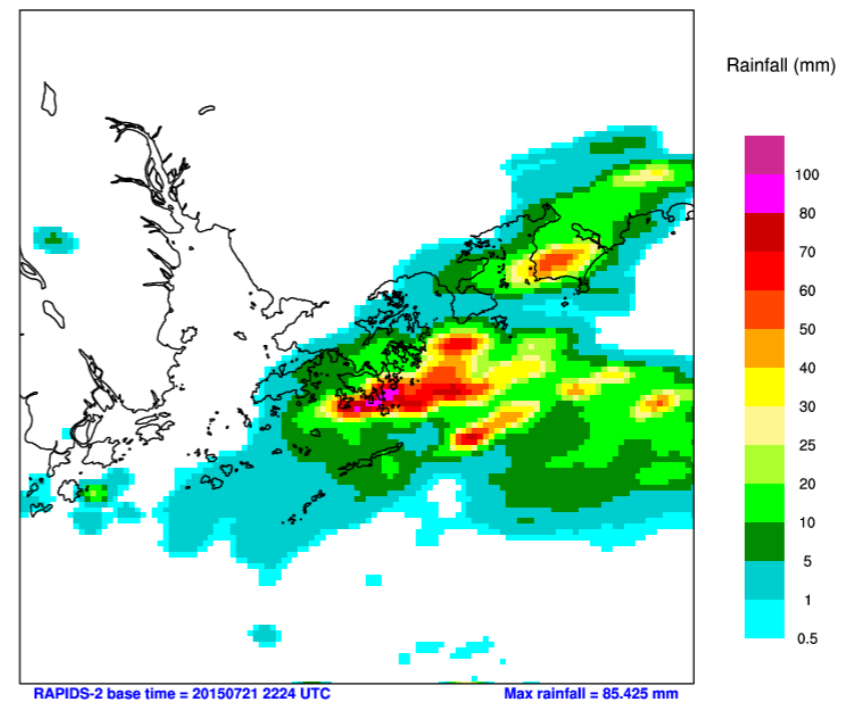
Notes

2015-07-22 0824 H

RAPIDS-2 T+2h 1-hour accumulated rainfall

## RAPIDS

香港天文台  
Hong Kong Observatory





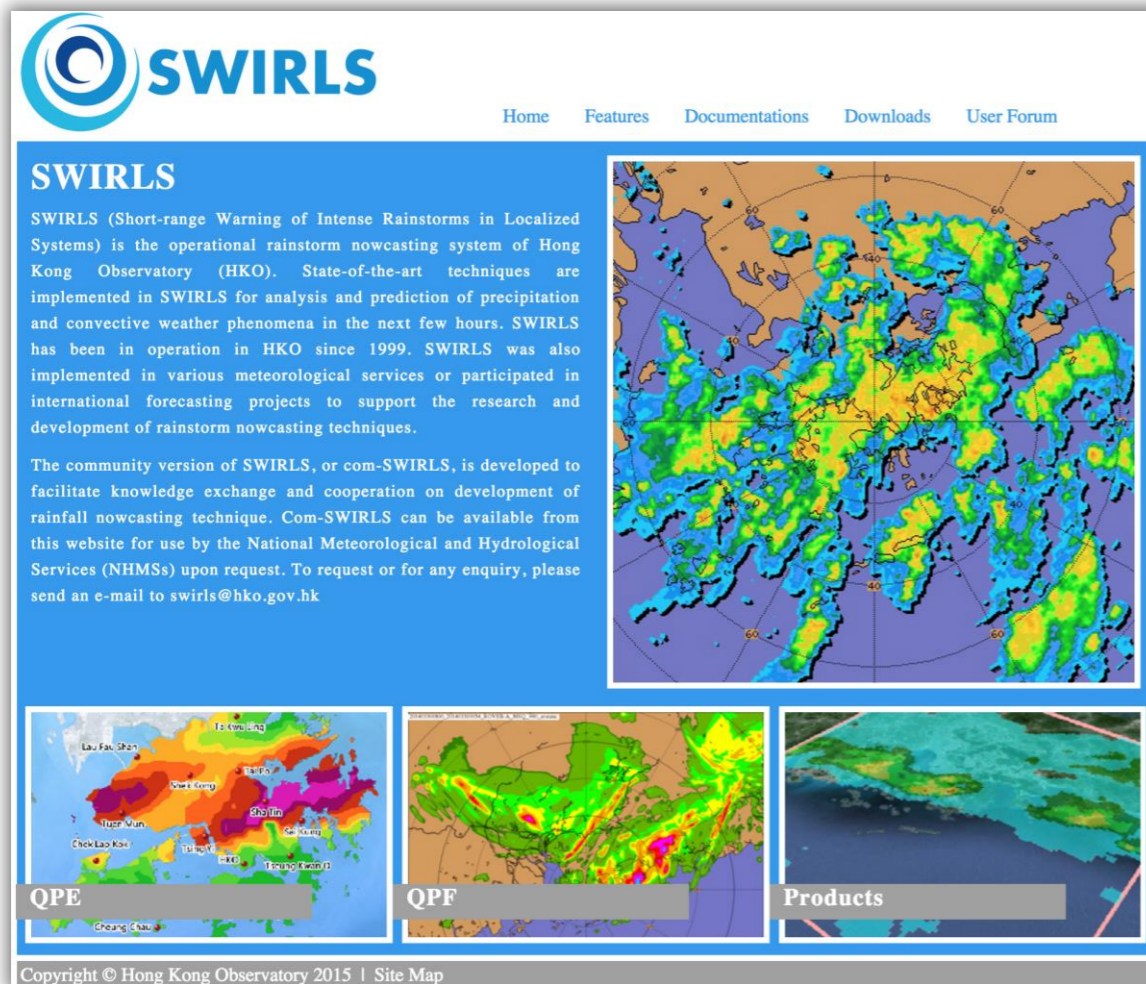
# Community SWIRLS (com-SWIRLS) - an radar-based nowcasting system

- WMO VCP Training Workshop on Rainfall Nowcasting in HKO (7-11 Dec 2015)
  - Including trainees from AvRDP players – Shanghai, South Africa (SAWS)

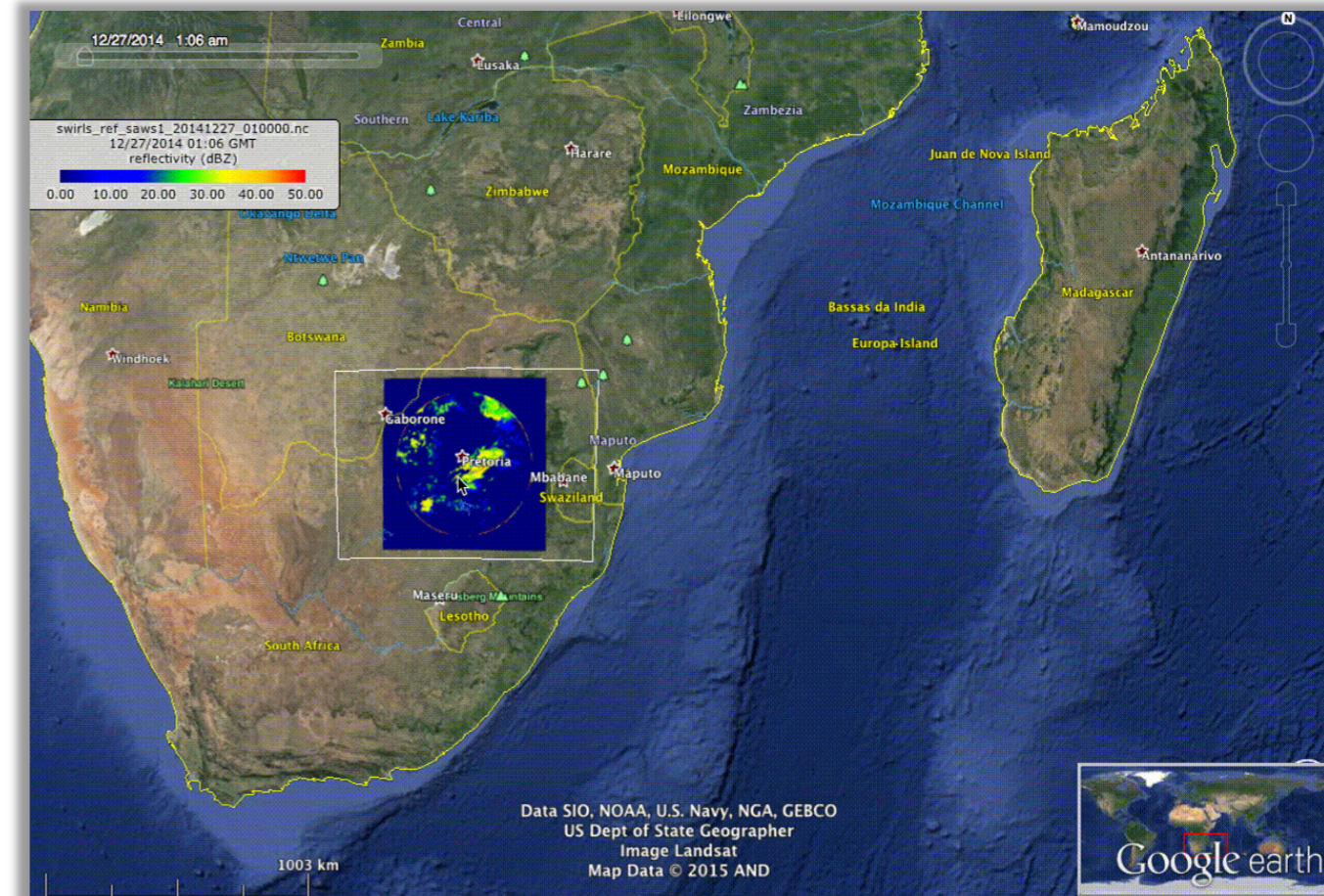


# Com-SWIRLS website online

- com-SWIRLS software and training materials available for registered users

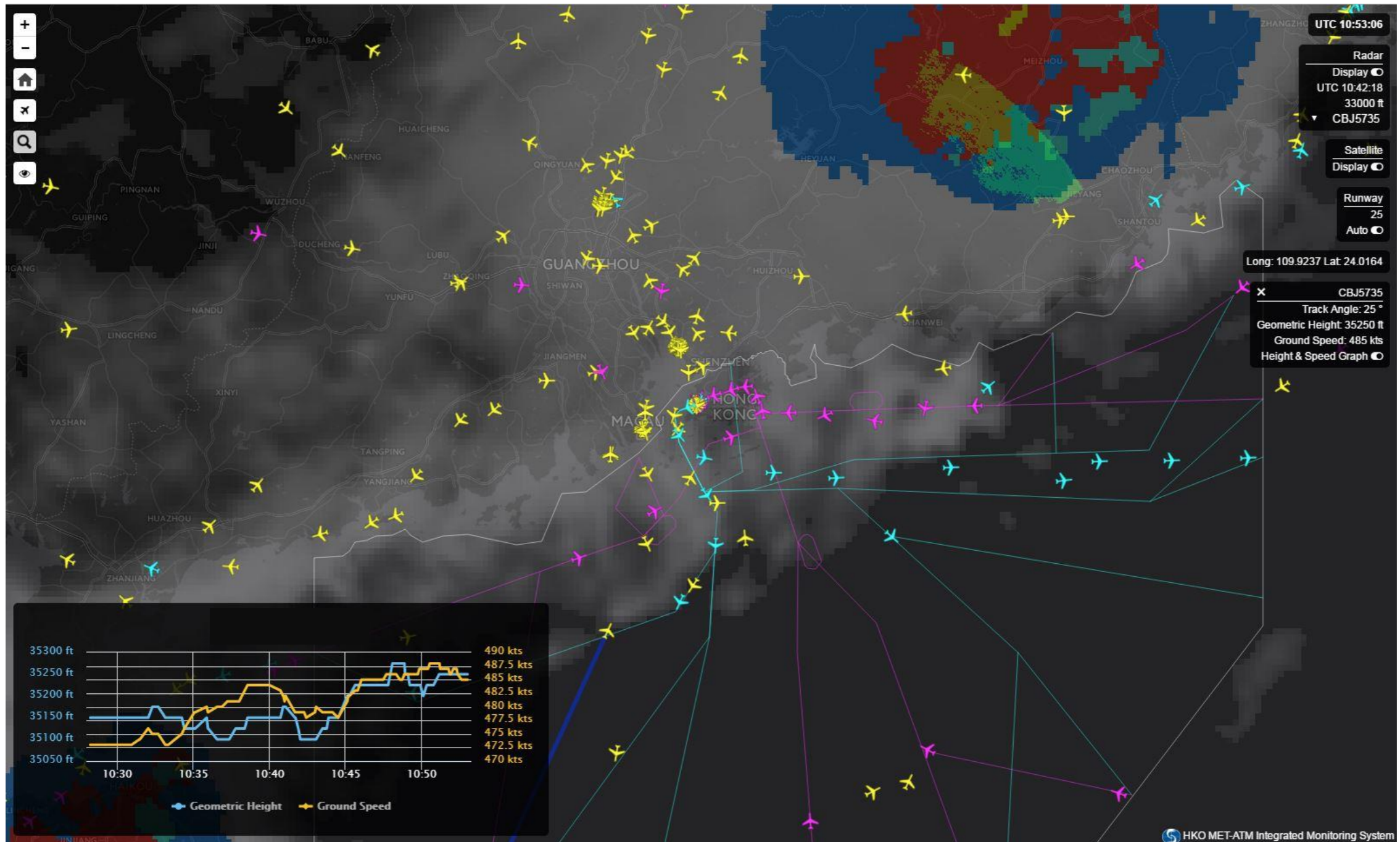


The screenshot shows the SWIRLS website homepage. At the top left is the SWIRLS logo, a stylized 'S' inside a circle. To the right of the logo are navigation links: Home, Features, Documentations, Downloads, and User Forum. Below the navigation is a large blue banner with the text 'SWIRLS' in white. Underneath the banner is a paragraph of text describing the system: 'SWIRLS (Short-range Warning of Intense Rainstorms in Localized Systems) is the operational rainstorm nowcasting system of Hong Kong Observatory (HKO). State-of-the-art techniques are implemented in SWIRLS for analysis and prediction of precipitation and convective weather phenomena in the next few hours. SWIRLS has been in operation in HKO since 1999. SWIRLS was also implemented in various meteorological services or participated in international forecasting projects to support the research and development of rainstorm nowcasting techniques. The community version of SWIRLS, or com-SWIRLS, is developed to facilitate knowledge exchange and cooperation on development of rainfall nowcasting technique. Com-SWIRLS can be available from this website for use by the National Meteorological and Hydrological Services (NHMS) upon request. To request or for any enquiry, please send an e-mail to swirls@hko.gov.hk'. To the right of the text is a large map showing a radar reflectivity image over a region, with colors ranging from blue (low) to red (high). Below the main text and map are three smaller thumbnail images labeled 'QPE', 'QPF', and 'Products'. At the bottom left of the page is the copyright notice: 'Copyright © Hong Kong Observatory 2015 | Site Map'.



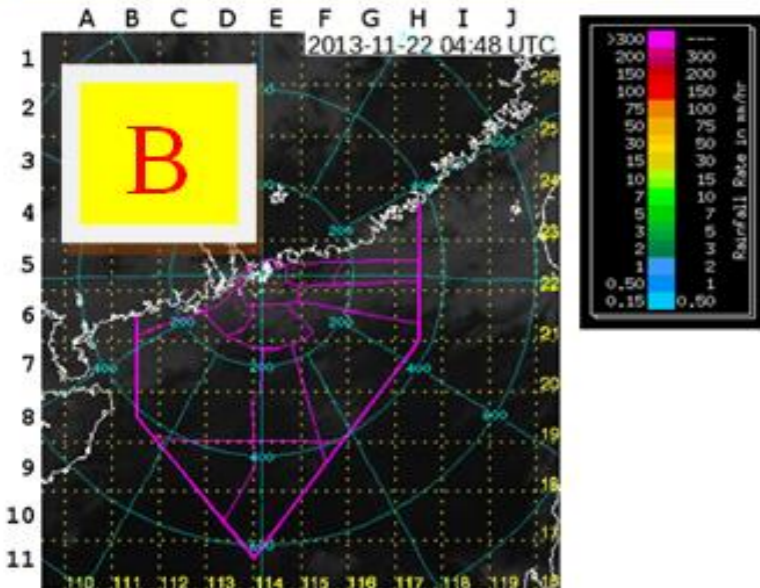
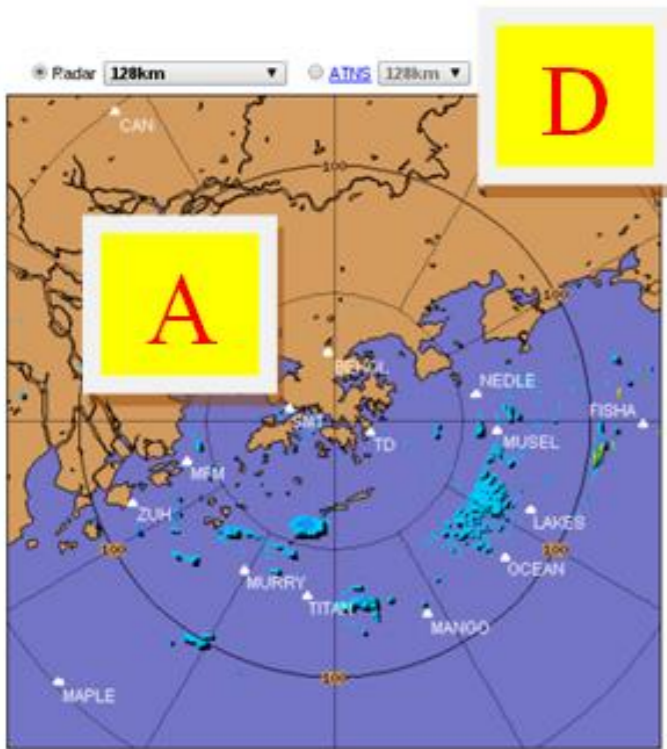
Com-SWIRLS in action (SAWS radar data)

# ADB-S collected



ABS-B overlaid with weather radar and satellite

# Significant Convection and Monitoring Forecast -> Capacity Notification (Airport Arrival Rate)



## Significant Convection Monitoring and Forecast (trial)

Forecast valid from 06 UTC 22 Nov 2013 to 18 UTC 22 Nov 2013

07:42 - 08:42 UTC



Prepared at 0742UTC 22 Nov 2013

Forecast for HKIA

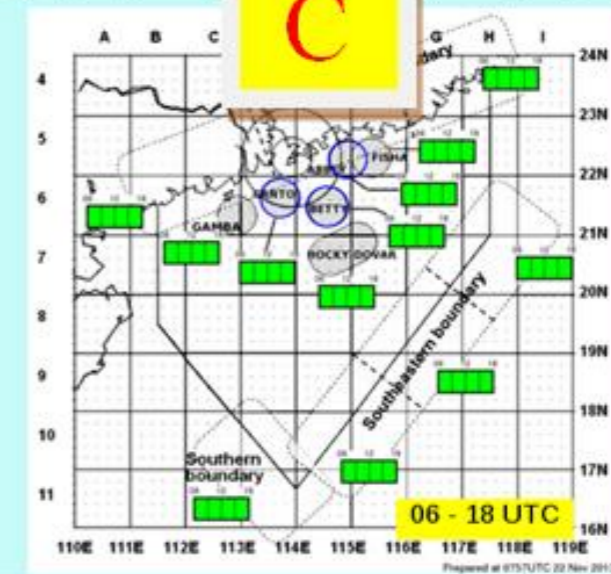
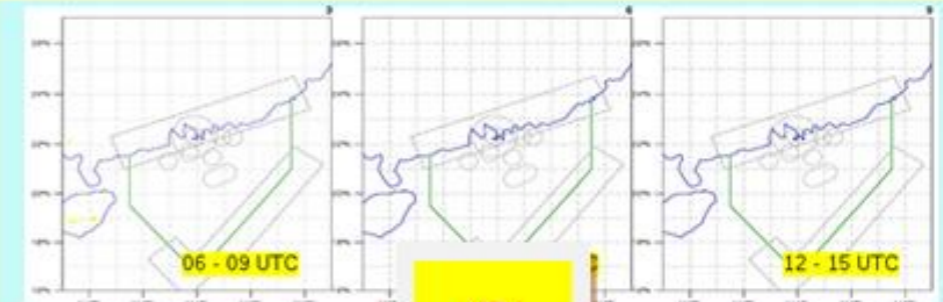
UTC	08	09	10	11	12	13	14	15	16
<b>Overall</b>	[Green]								
<b>07 Headwind</b>	[Green]								
<b>25 Headwind</b>	[Green]								
<b>Crosswind</b>	[Green]								
<b>Visibility</b>	[Green]								
<b>Ceiling</b>	[Green]								

Prepared at 0733UTC 22 Nov 2013

TS/CB forecast for adjacent areas

UTC	08-09	09-10	10-11	11-14
20nm of ARP	[Green]			
ABBEY	[Green]			
BETTY	[Green]			
CANTO	[Green]			

Prepared at 07



CAPACITY RELATED INFORMATION VHHH (FOR ARRIVALS)

VALID: 220800 to 221600 UTC

CAPACITY LEVEL: 1

AIRPORT ACCEPTANCE RATE: 32 flights per hour

EXPECTED DELAY: Up to 15 mins

REASON: -

REMARK:

H

# Collaboration between MET and ATM – Significant convection information for ATIS broadcast

## TERMINAL TS Activities for ATIS

OVERALL  << Guidelines Samples Tools

EAST (20NM TO E)  <<

WEST (10NM TO SW)  <<

NORTH (MISS APCH AREA)  <<

Submit Last update time: 201305160624

**Other useful tools**

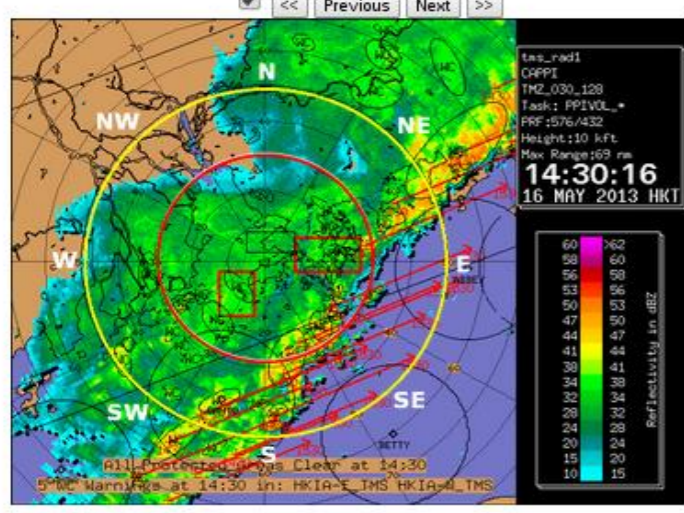
- Radar animations on Intranet, [HERE](#). Select Reflectivity 128KM, overlay with "Circles centered at CLK", and "CLK Corridors".
- [Nowcast viewer](#): 6-minutes forecasts from HKO nowcasting systems up to 1 hour ahead.
- [ROVER\[MuGOF\] track vectors](#)

LLIS/CLP Data @HKT 20130516 14:07:00 to 20130516 14:37:00

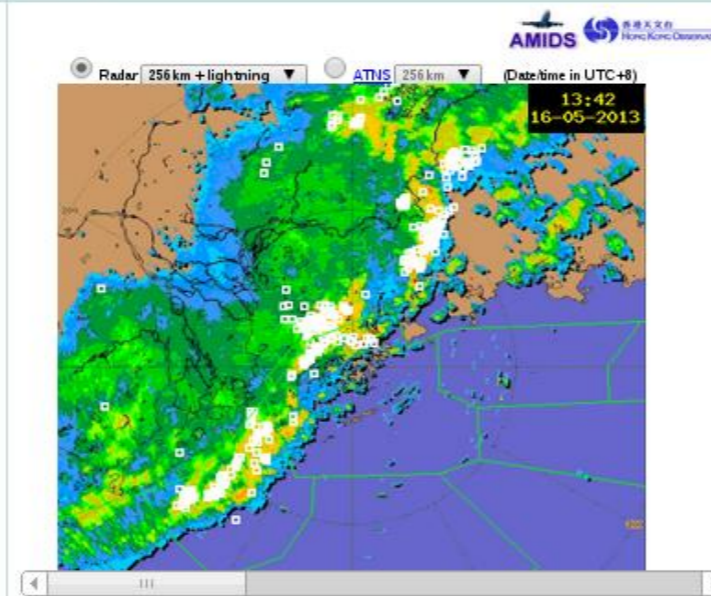
Number of stroke (in 50km): 481  
 Number of stroke (in 8km): 0  
 Number of stroke (in 5km): 0  
 Number of stroke (CLK 1km): 1

**INTRANET**

IRIS arrows of echo tracking for the next hour



**AMIDS**




## Hong Kong International Airport (HKIA) Automatic Terminal Information Service (ATIS)

ATIS 128

A-TITLE	HONG KONG ARRIVAL INFORMATION	D-TITLE	HONG KONG DEPARTURE INFORMATION
A-IDENT	J	D-IDENT	S
A-TIME	0335	D-TIME	0337
A-INFO-D1		D-INFO-D1	
A-RUNWAY	07L	D-RUNWAY	07R
A-INFO-D2		D-WS/TURB	
A-WS/TURB	WS AND TURB FCST	D-SUPPL1	RWY SFC WET
A-SUPPL1		D-WIND	130
A-WIND	120	D-SPEED	15
A-SPEED	15	D-VRB-BTN	
A-VRB-BTN		D-AND	
A-AND		D-MAX	
A-MAX		D-MNM	
A-MNM		D-VIS	5000M
A-VIS	10 KM	D-DIV	
A-RVR			
A-PRESENT-W			
A-CLOUD	FEW 1000FT SCT 3500FT	D-WXCHG	
A-WXCHG		D-TEMP	27
A-TEMP	27	D-DEWPOINT	25
A-DEWPOINT	25	D-QNH	1007
A-QNH	1007	D-METINFO	TS 15 NM SW MOV NE
A-METINFO	TS 15 NM SW MOV NE	D-TREND	
A-TREND		D-SUPPL2	
A-SUPPL2		D-ACK	ACK INFO S
A-ACK	ACK INFO J	D-CDCGMC	DELIVERY

Tool for Weather Observer

# AvRDP Website (<https://avrdp.hko.gov.hk>)



## Mission

The overall mission of the AvRDP is to, through international collaboration, develop, demonstrate and quantify the benefits of end-to-end nowcasting aviation weather services for the terminal area focused on high impact weather. The AvRDP will focus on nowcasting aviation weather, including the respective uncertainty/confidence estimation, over the Terminal Control Area for the next 0-6hr. For simplicity, nowcast or nowcasting hereafter refers to all techniques/systems including observation-based, expert system-based, human-machine interfaced and meso/microscale NWP or any combination thereof which can generate high resolution, rapidly updated forecasts for the next 0-6hr ahead. This definition of nowcast/nowcasting is in accordance with the definition/practice adopted in WWRP and the nowcasting community.

**Website and sftp Data server (for data exchange)**

# Meetings to come

- Preliminary research results to be presented in the 4th International Symposium on Nowcasting and Very-short-range Forecast in Jul 2016 (WSN16) <https://wsn16.hk>;
- Organize an AvRDP Training Workshop on aviation nowcasting and very-short-range forecasting techniques back-to-back with WSN16 for WMO Members' aviation meteorological personnel;
- Further discussion with ATM expertise on translation MET information into ATM impact products as well as methods of validation.

# Training Workshop/Symposium to come

Meeting	When & Where	Who
<b>WMO/WWRP &amp; CAeM AvRDP Training Workshop</b>	20-22 July 2016 Hong Kong, China	<ul style="list-style-type: none"><li>• Invited experts as trainers</li><li>• MWOs as participants</li></ul>
<b>WMO/WSN16 (with special session on AvRDP)</b>	25-29 July 2016 Hong Kong, China	<ul style="list-style-type: none"><li>• CAeM representative</li><li>• AvRDP Airports,</li><li>• Invited speakers on Aviation Meteorology, Verification and ATM experts</li></ul>

All are welcomed to the Training Workshop and Symposium : <https://wsn16.hk>

Contact person: [pwli@hko.gov.hk](mailto:pwli@hko.gov.hk) including AvRDP



# WMO Core Project

- WMO has plan to upgrade the AvRDP into a core project.
- Project scope to be extended
  - project period extended
  - Study MSTA to support multiple decision horizon including tactical, pre-tactical as well as strategic needs
  - allow for more airports to participate in the project
- To be discussed in the upcoming WMO Executive Committee – 68 (Jun 2016).

The Meeting is invited to:

- a) note the information contained in this paper
- b) lend its support to the AvRDP initiative
- c) participate in the upcoming training and symposium

# Questions?