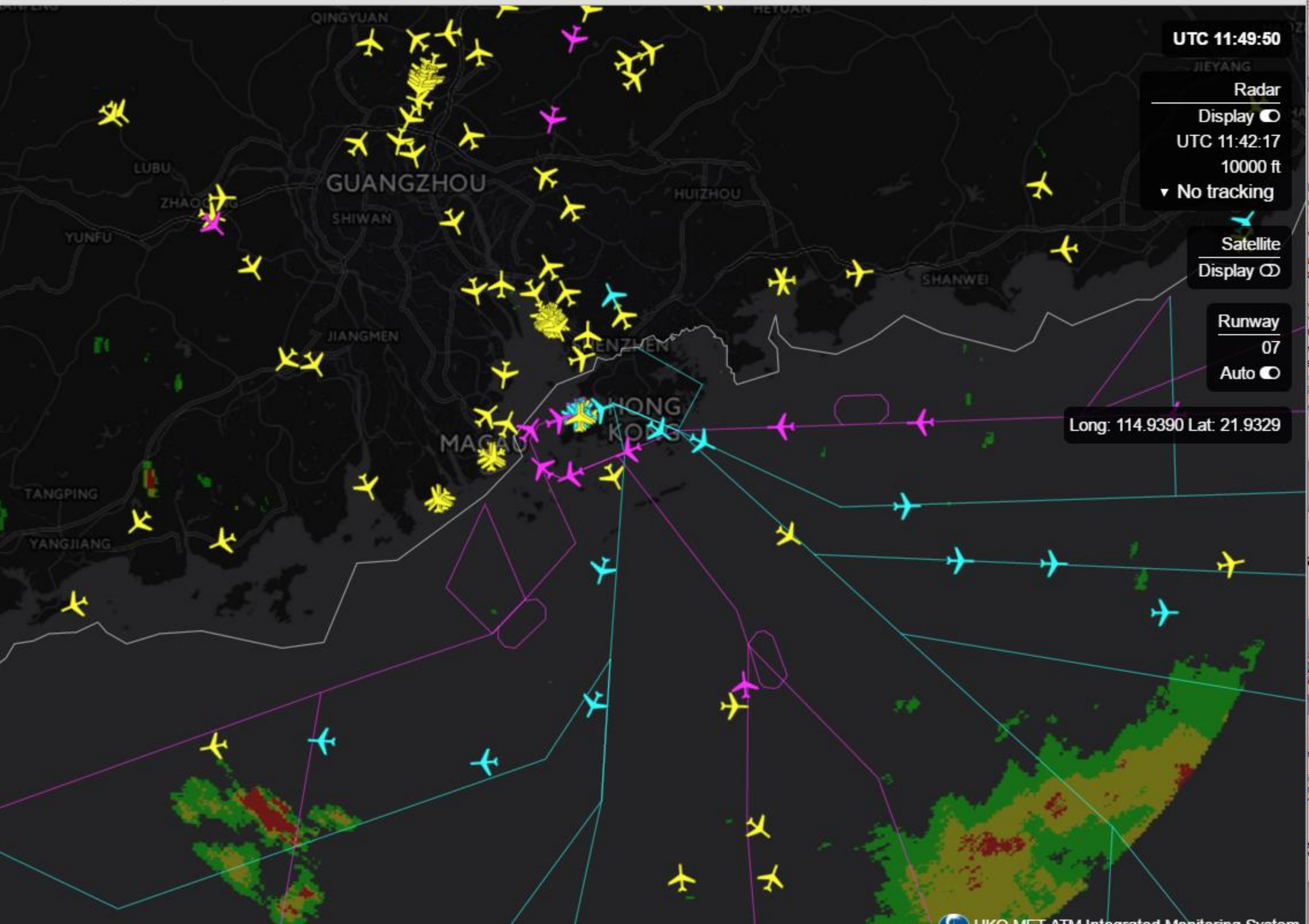
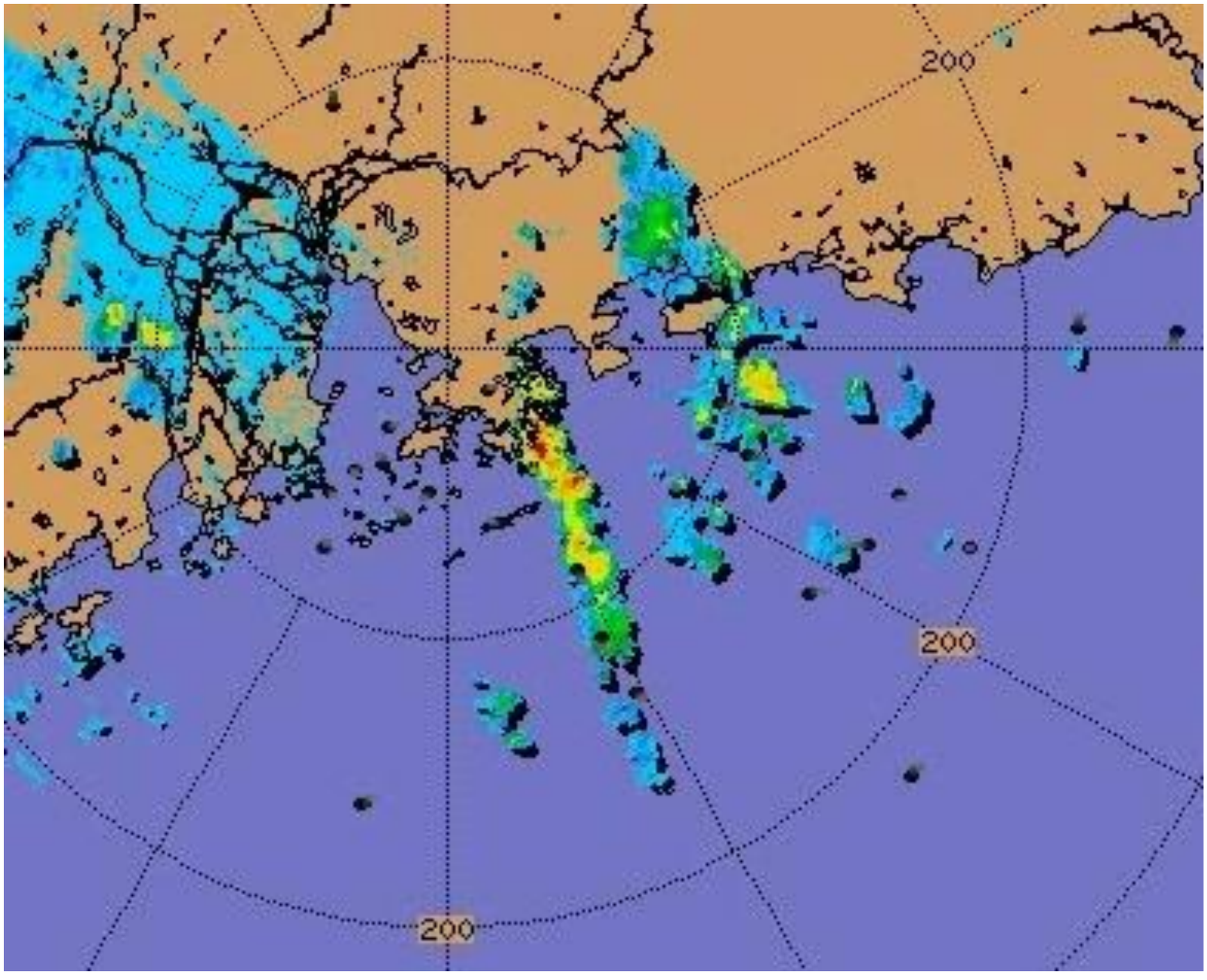
PROVISION OF NEW MET INFORMATION FOR ATM VIA THE WMO AVIATION RESEARCH DEMONSTRATION PROJECT

Presented by Hong Kong, China

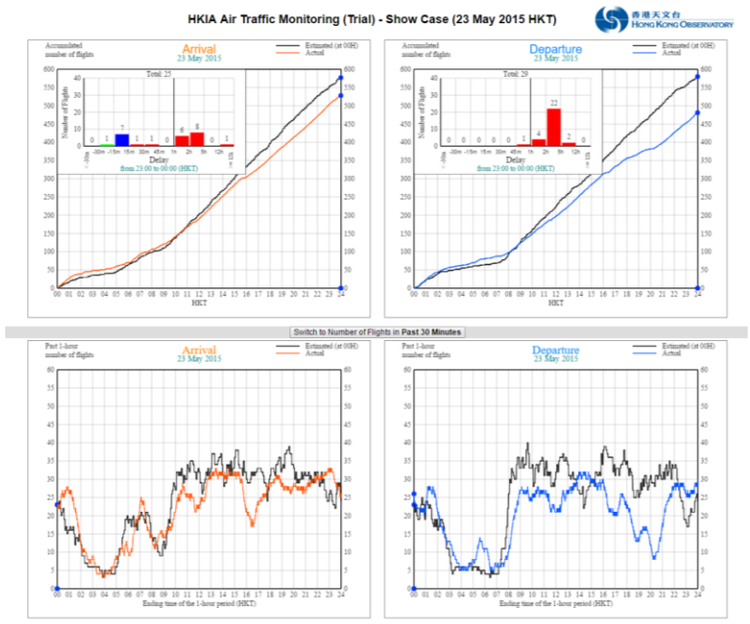
ATFM/SG/6-IP/04
6-9 June 2016

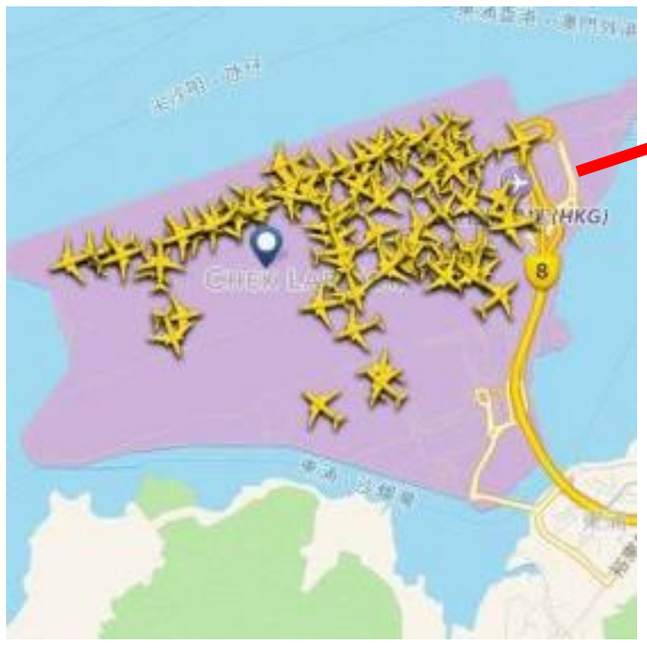


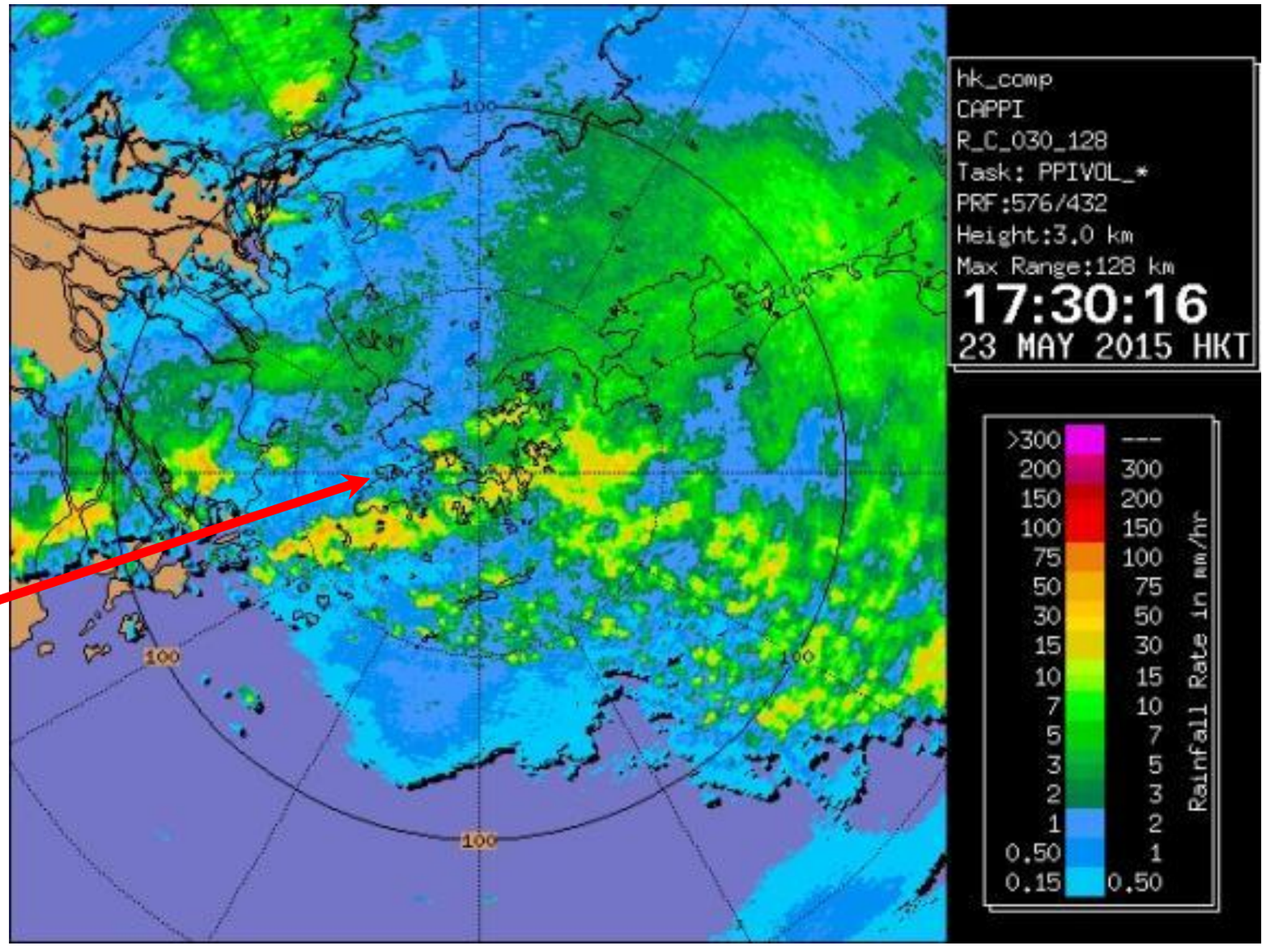
Weather Impact



Weather Impact - Full apron



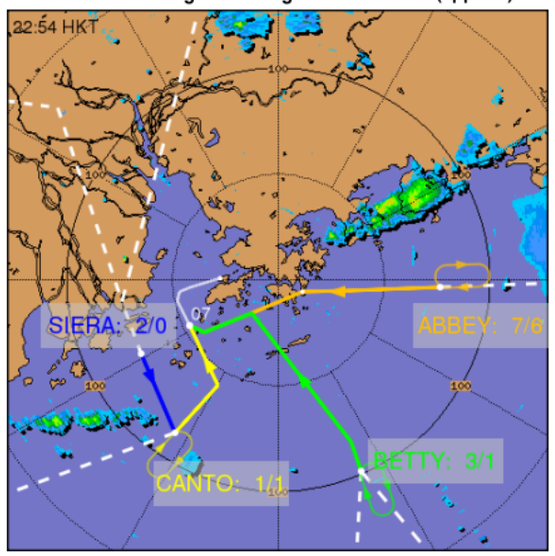




Impact CAN extend for long time

香港天文台 HONG KONG OBSERVATORY

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

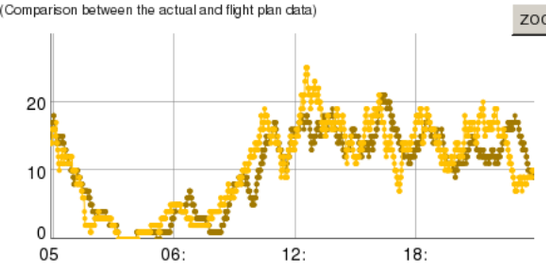


NW Route (SIERA)			SW Route (CANTO)			S Route (BETTY)			E Route (ABBEY)		
ELDT	RWY	STAR	ELDT	RWY	STAR	ELDT	RWY	STAR	ELDT	RWY	STAR
1543	07	7A	1646		3A	1552	07	2A	1550	07	3A
1609	07	7A				1635		2A	1550	07	3A
						1649		2A	1602	07	3A
									1605	07	3A
									1610	07	3A
									1611	07	3A
								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

ABBEY | BETTY | CANTO | SIERA

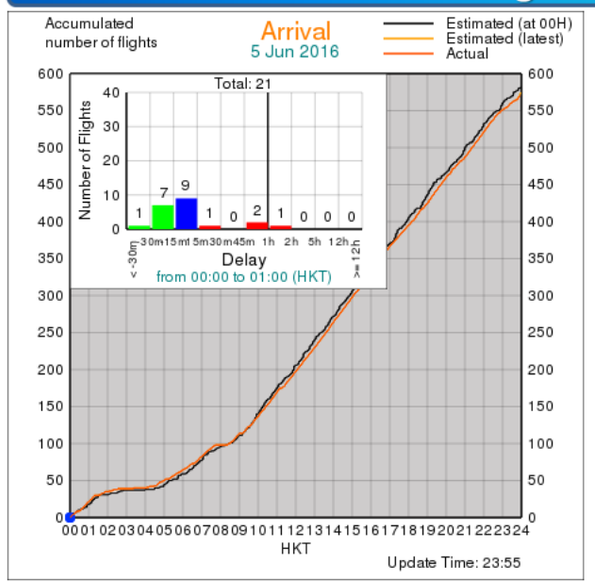
Past 1-hour number of arrivals
(Comparison between the actual and flight plan data)

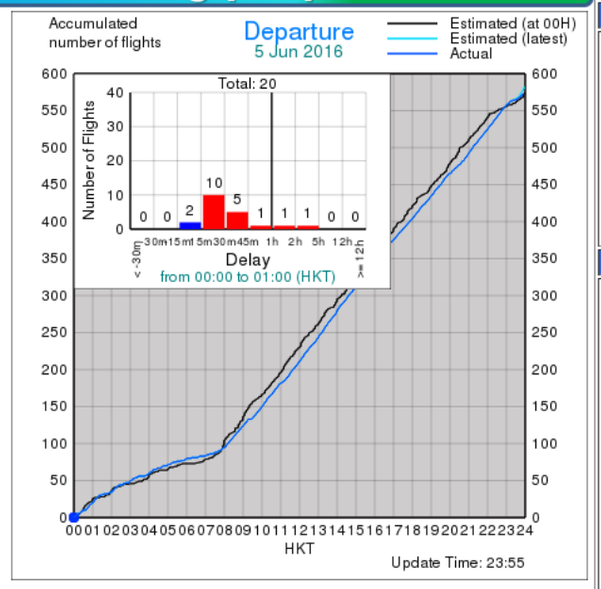
ZOOM



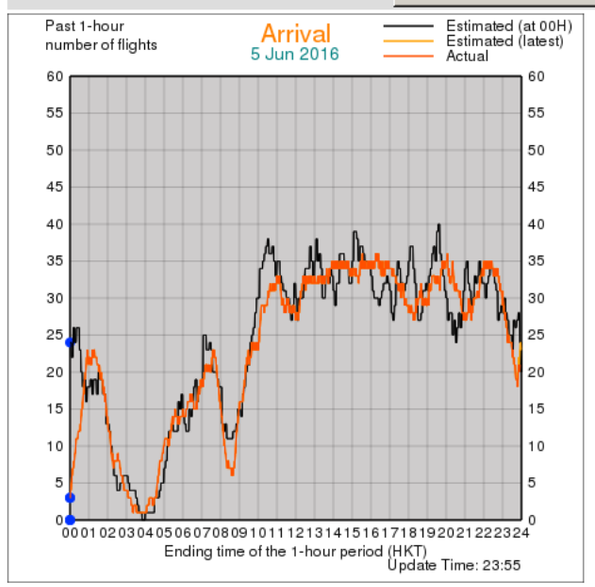
4-in-1 | One-year Statistics

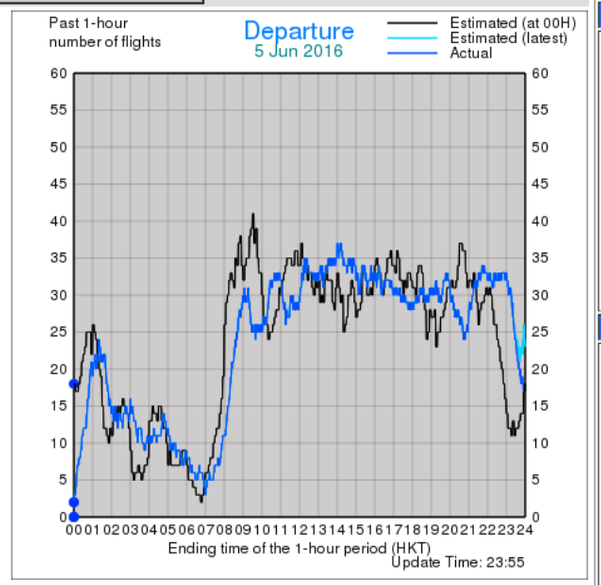
MET-ATM Integrated Monitoring [Trial]





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





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

Last Update: 15:38 UTC

HONG KONG ARRIVAL INFORMATION

A-TIME	1534
A-RUNWAY	07L
A-INFO-D2	RWY SFC WET
A-SUPPL1	WIND LaV
A-SUPPL2	
D-WXCHG	

HONG KONG DEPARTURE INFORMATION

D-TIME	1534
D-RUNWAY	07R
D-SUPPL1	
D-SUPPL2	
D-WXCHG	

Traffic Interruption Related Messages from NOTAM

Last Update: 23:56 HKT

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/IV/NBO/A /000/999/2219N11355E005
A) VHHH B) 1606050755 C) 1606051600
E) ALL ARRIVALS TO HONG KONG INTERNATIONAL AIRPORT CAN EXPECT
HOLDING

Flow Restriction (from ATC Watch Manager)

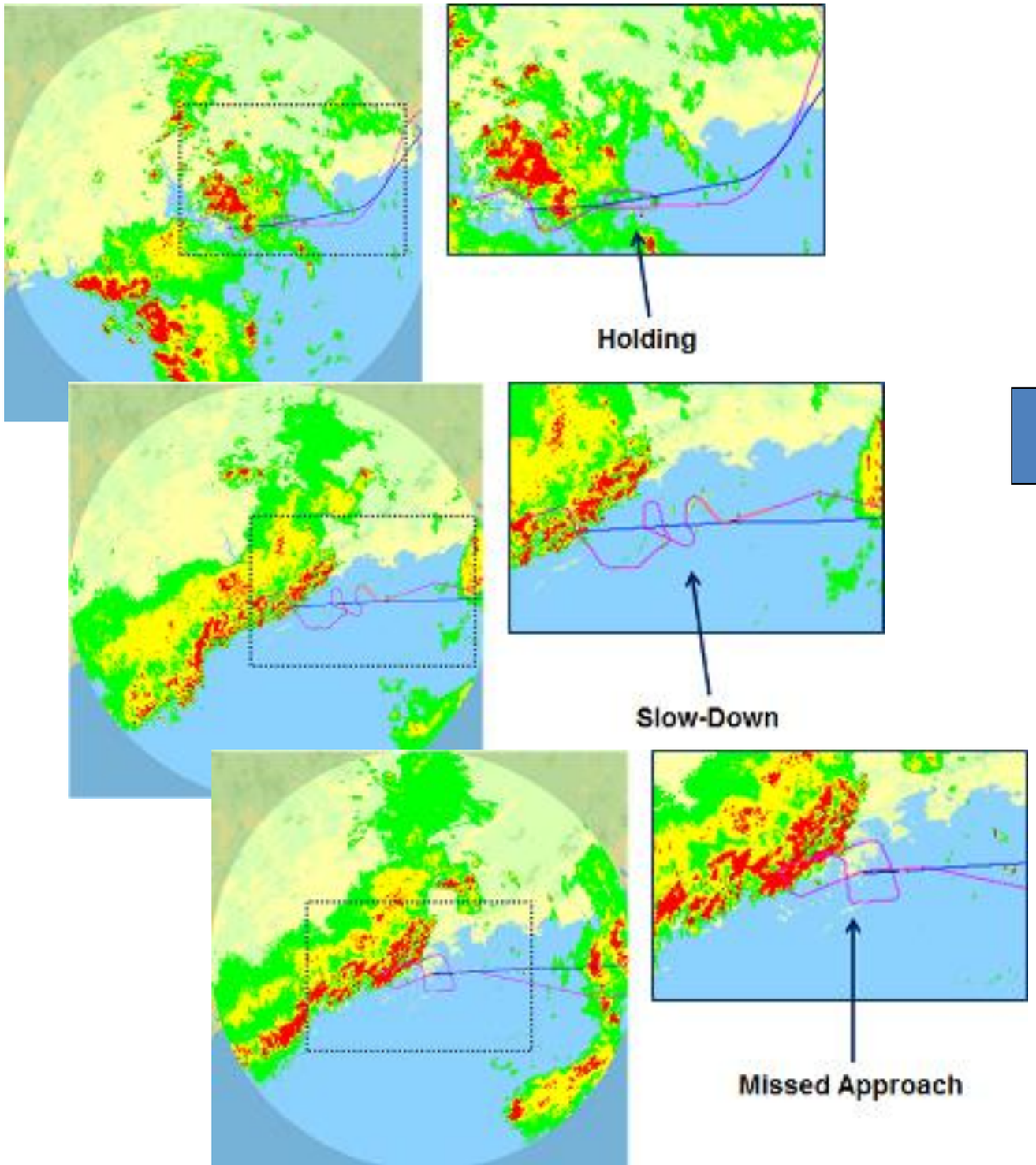
Last Update: 2016-06-03 17:37

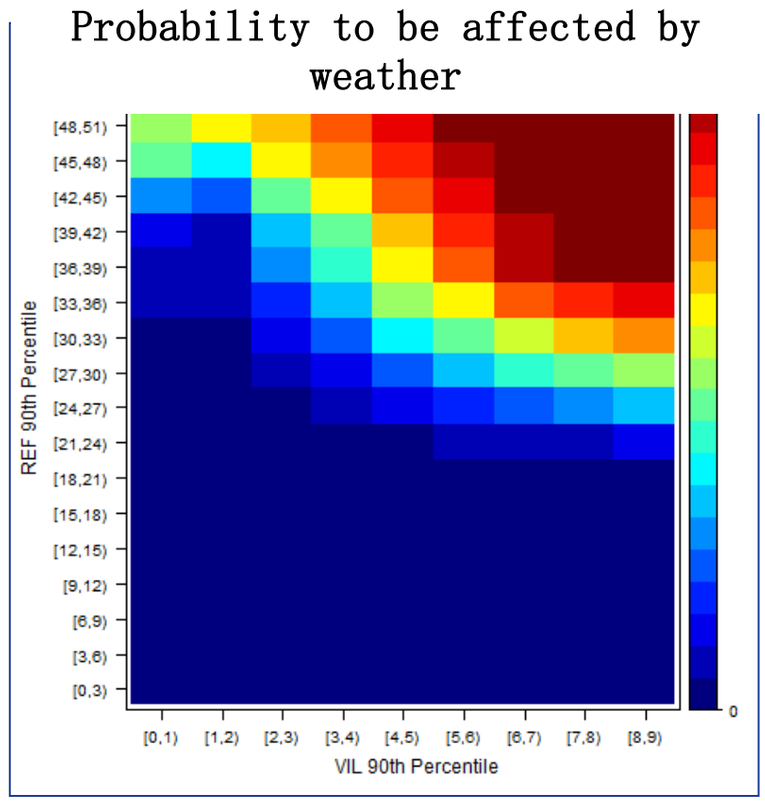
[Re: Hong Kong departures via DOTMI destined for ZSPD expect delay]

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

+ …

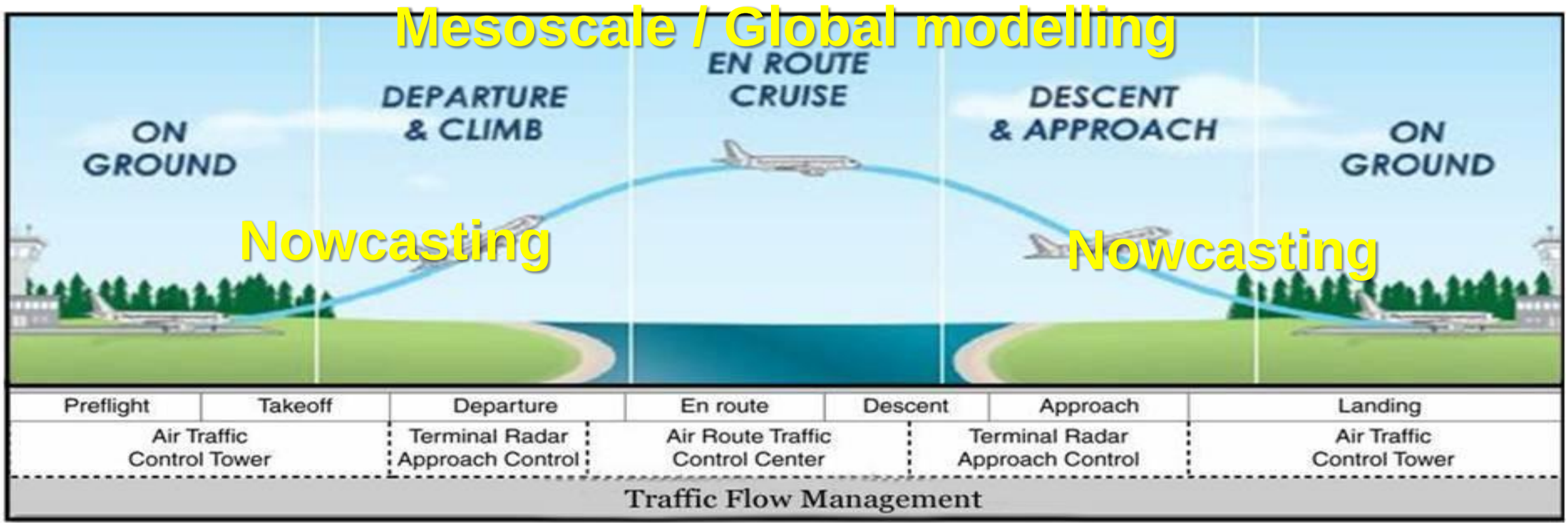
Capacity Forecast

Users said

WE NEED BETTER MET SUPPORT!

Trajectory-Based Operation (TBO)

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

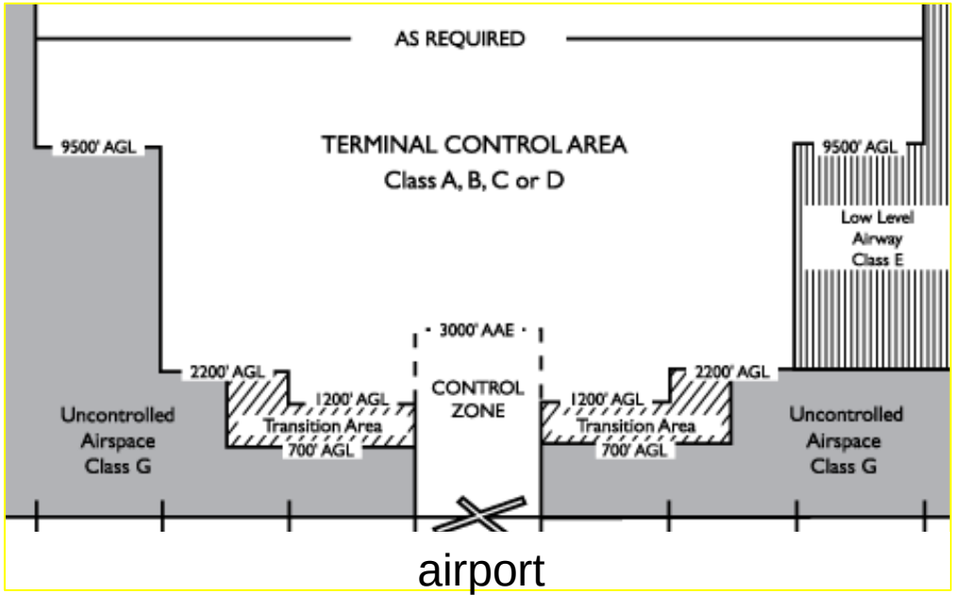


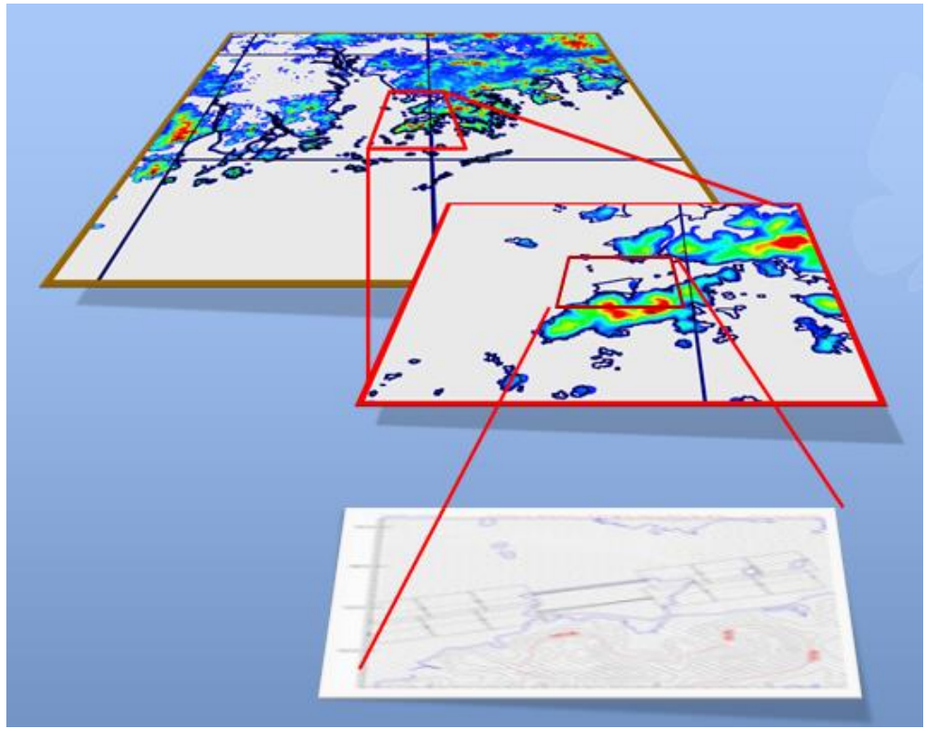
Terminal Control Area: Location specific

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.

French - Français Spanish - Español Russian - Русский Arabic

ICAO Meteorology Divisional Meeting

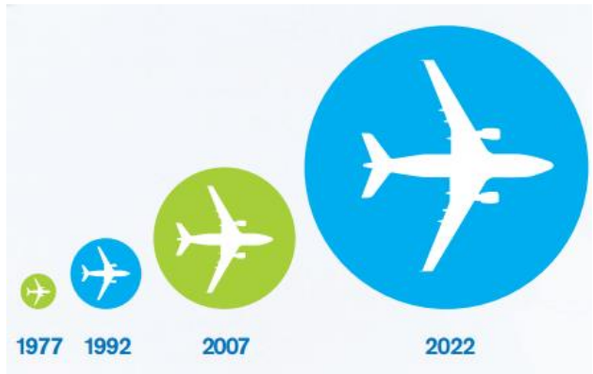
(in part conjointly with the Fifteenth Session of the World Meteorological Organization (WMO) Commission for Aeronautical Meteorology (CAeM) including Technical Conference)

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

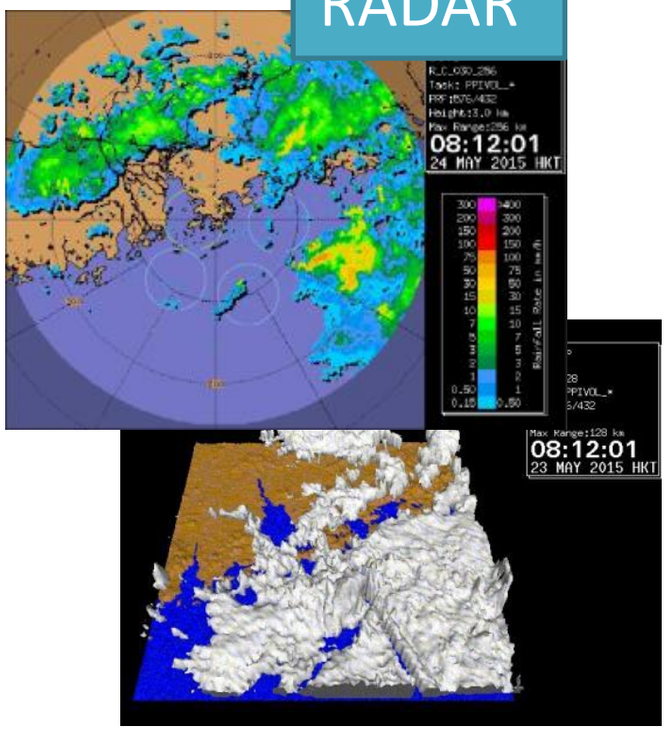
Kickoff meeting cum CBS Nowcasting Workshop (24-26 June 2015, Shanghai, China)

HKG IOP Data summary

	Observations											Nowcasting, NWP Model and Forecast										ATM data			
	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)	
HKG	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺		☺		☺	☺	☺	☺	☺	☺	☺		☺	☺	☺	

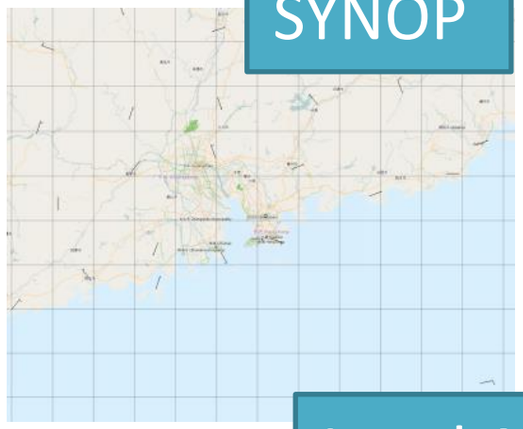
Observational Data collected

RADAR

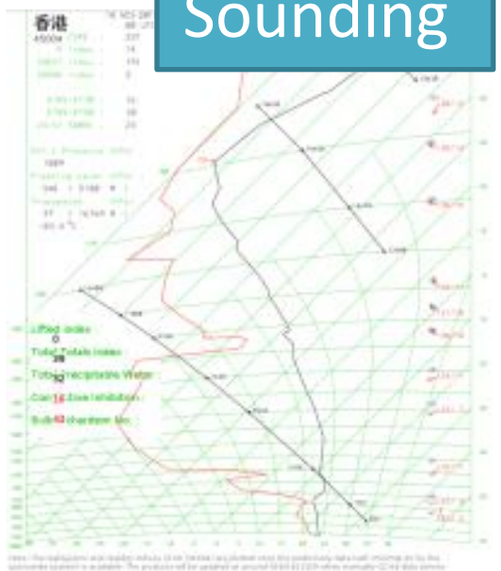


METAR

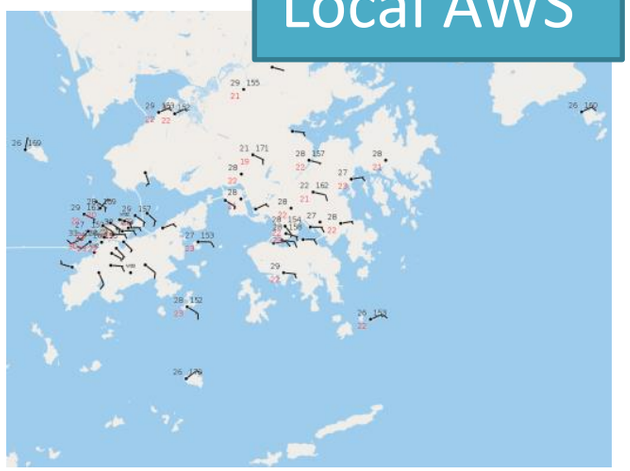
SYNOP



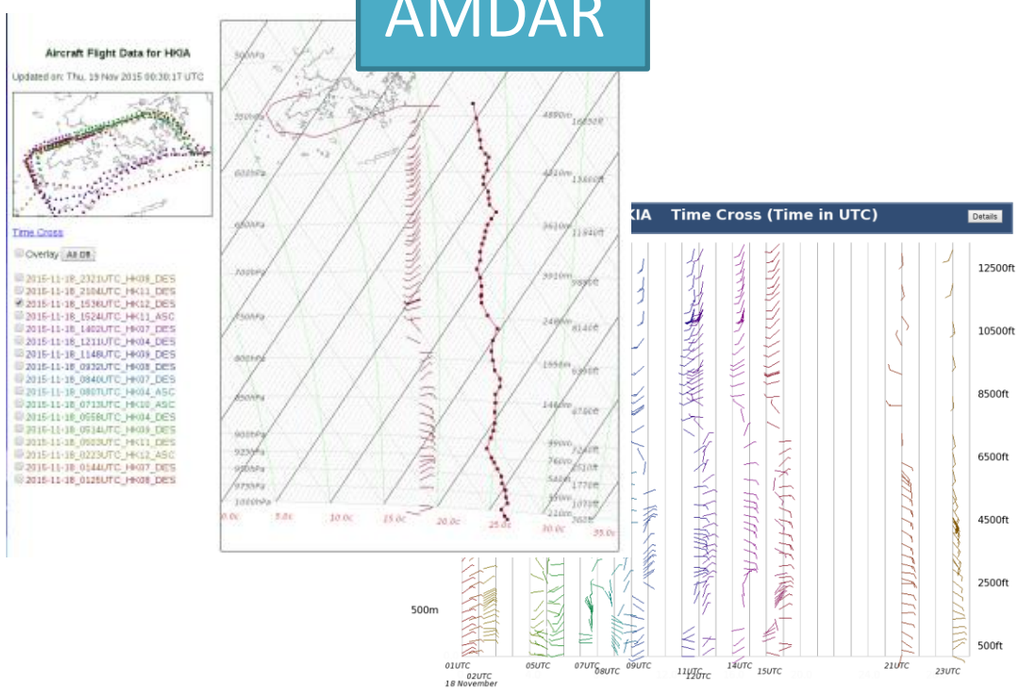
Sounding



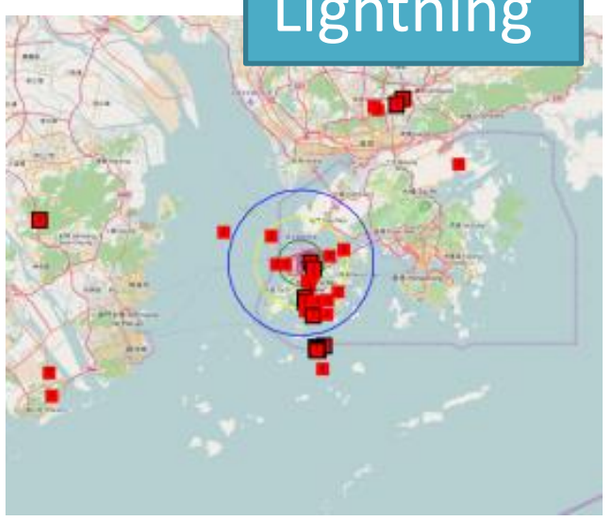
Local AWS



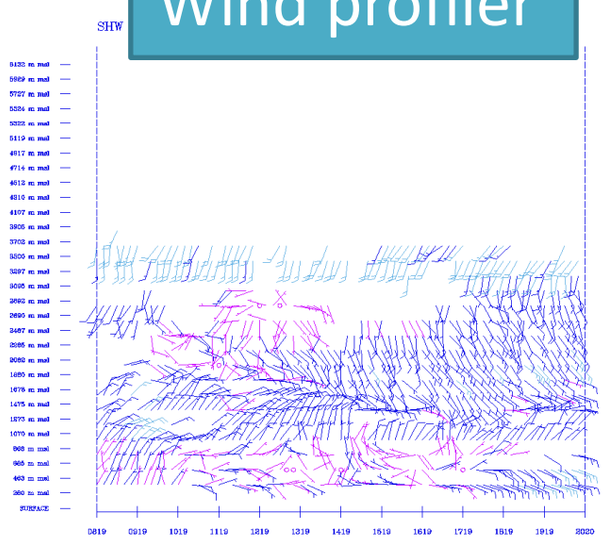
AMDAR



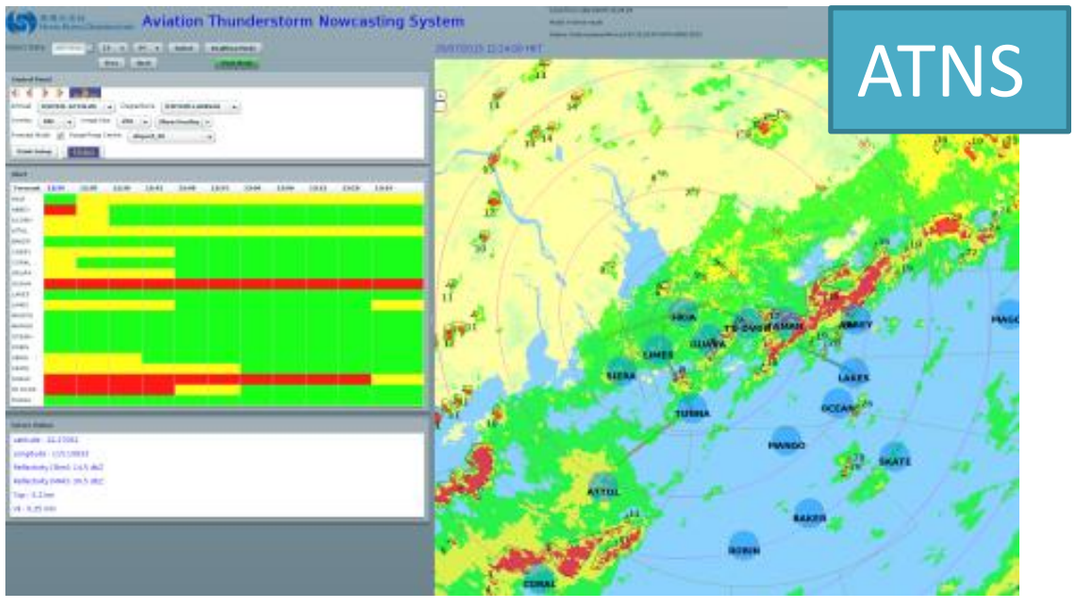
Lightning

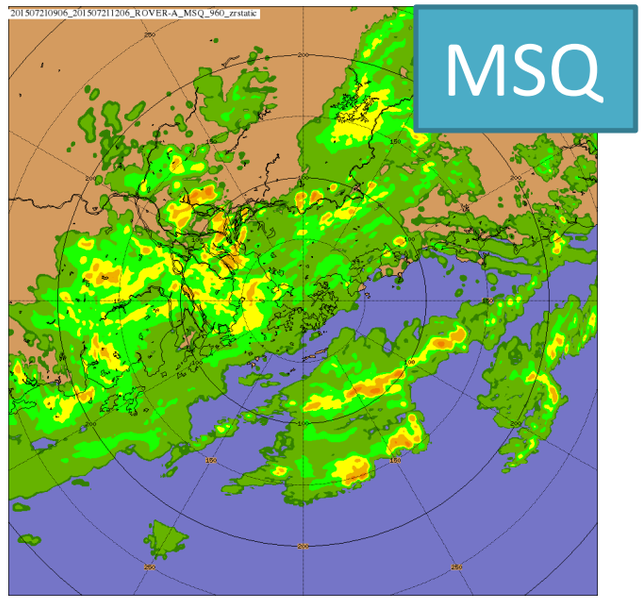


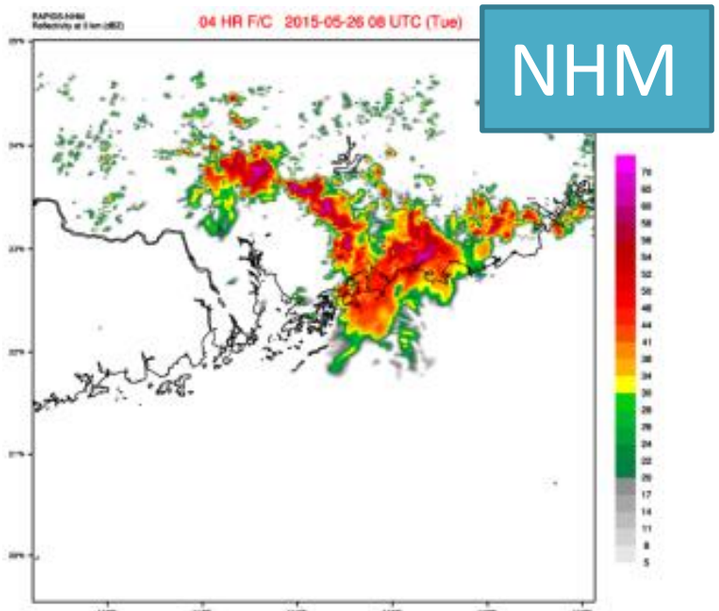
Wind profiler



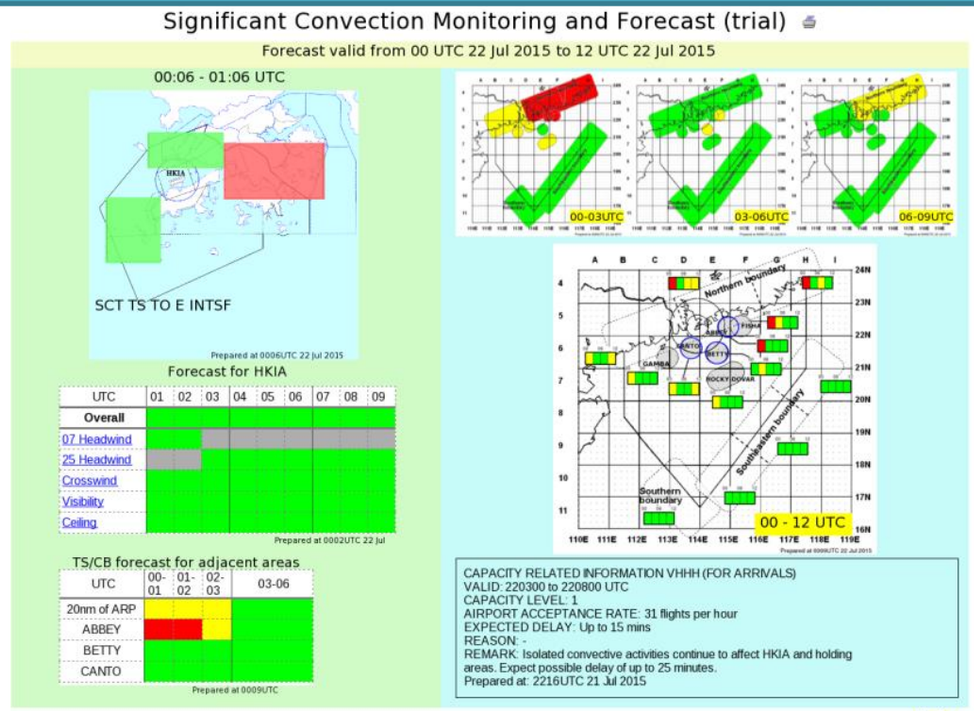
Nowcasting / Model / ATM data collected



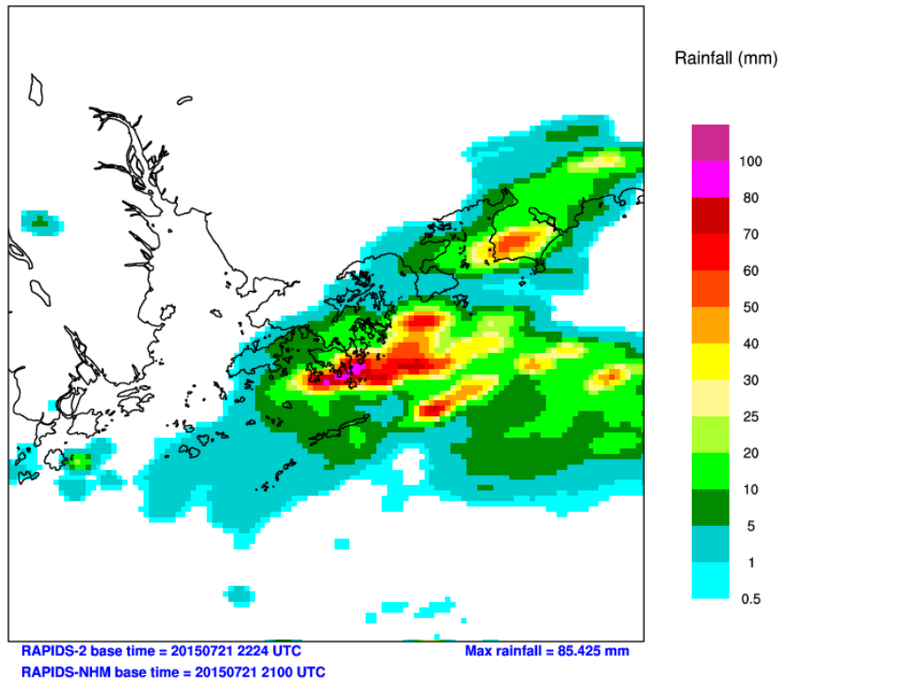




SIGCONV and Capacity Notification



RAPIDS

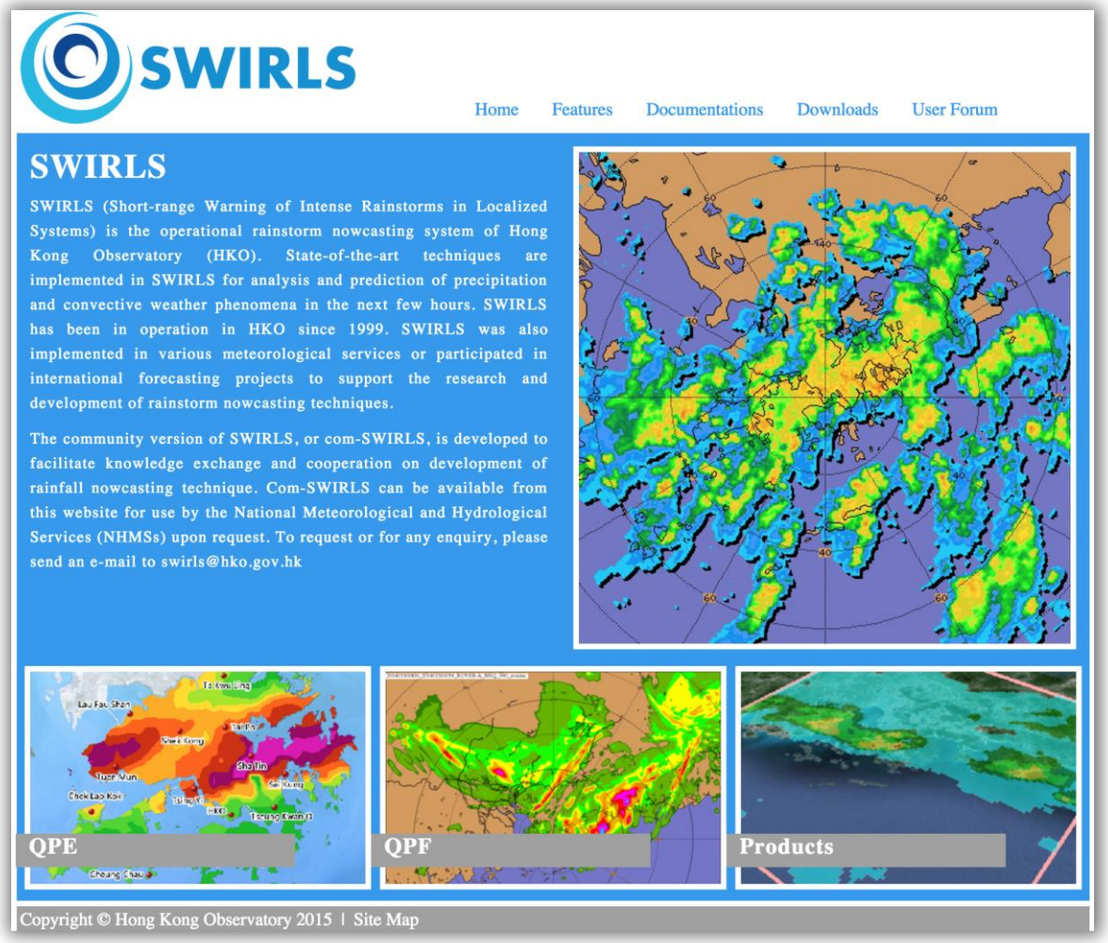


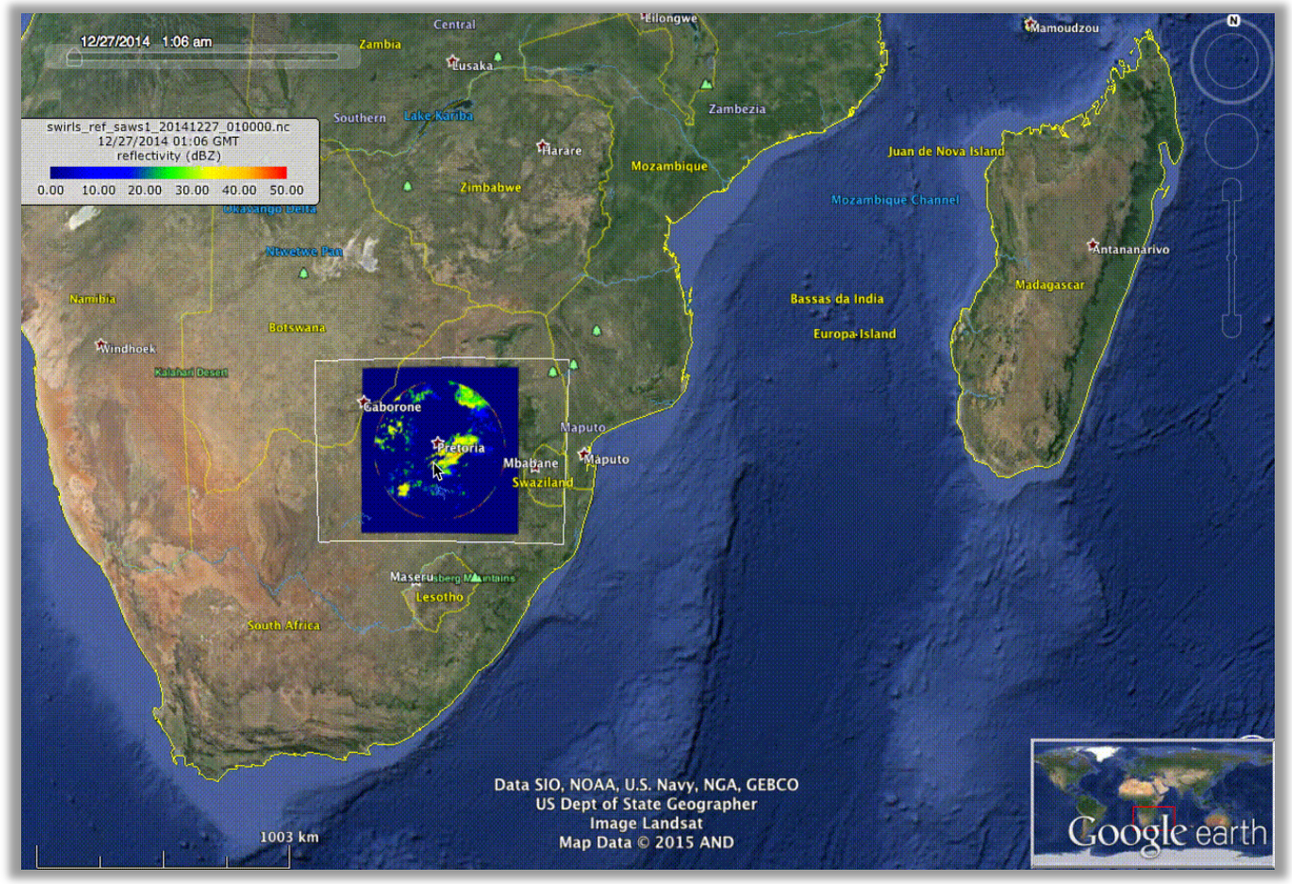
Community SWIRLS (com-SWIRLS) - an radar-based nowcasting system

- 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

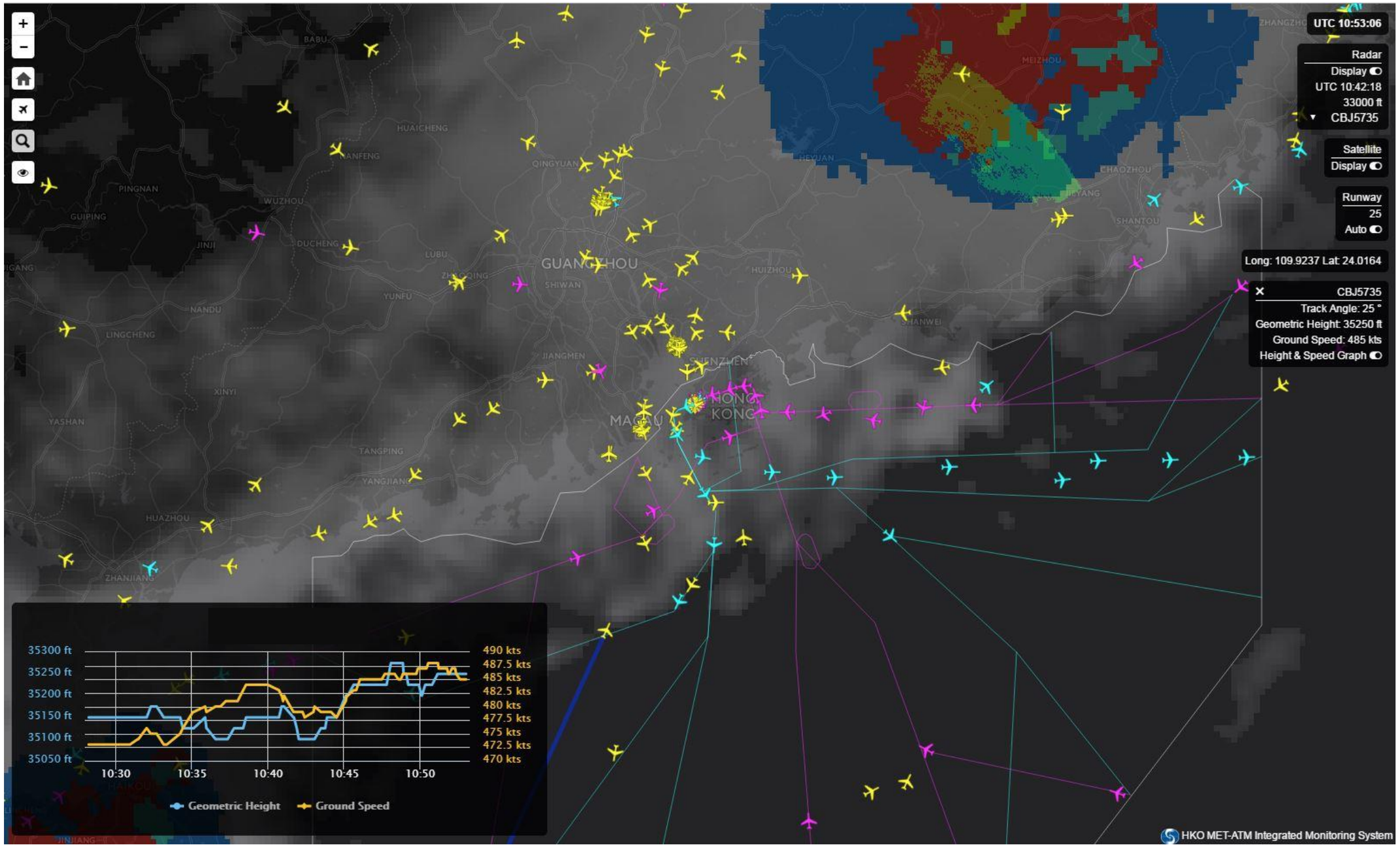
- com-SWIRLS software and training materials available for registered users





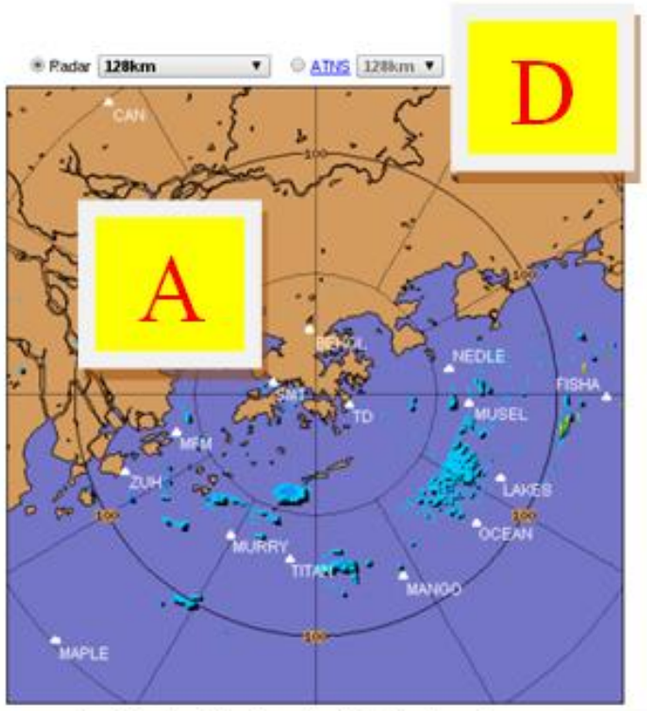
Com-SWIRLS in action (SAWS radar data)

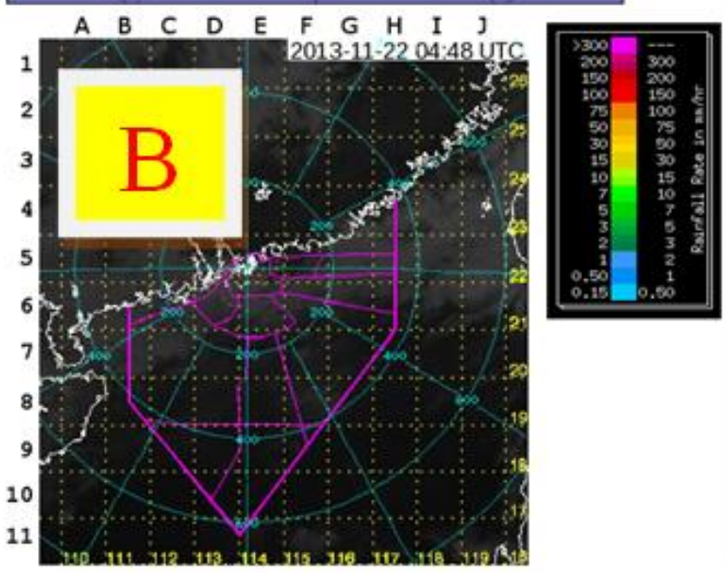
ADB-S collected



ABS-B overlaid with weather radar and satellite

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





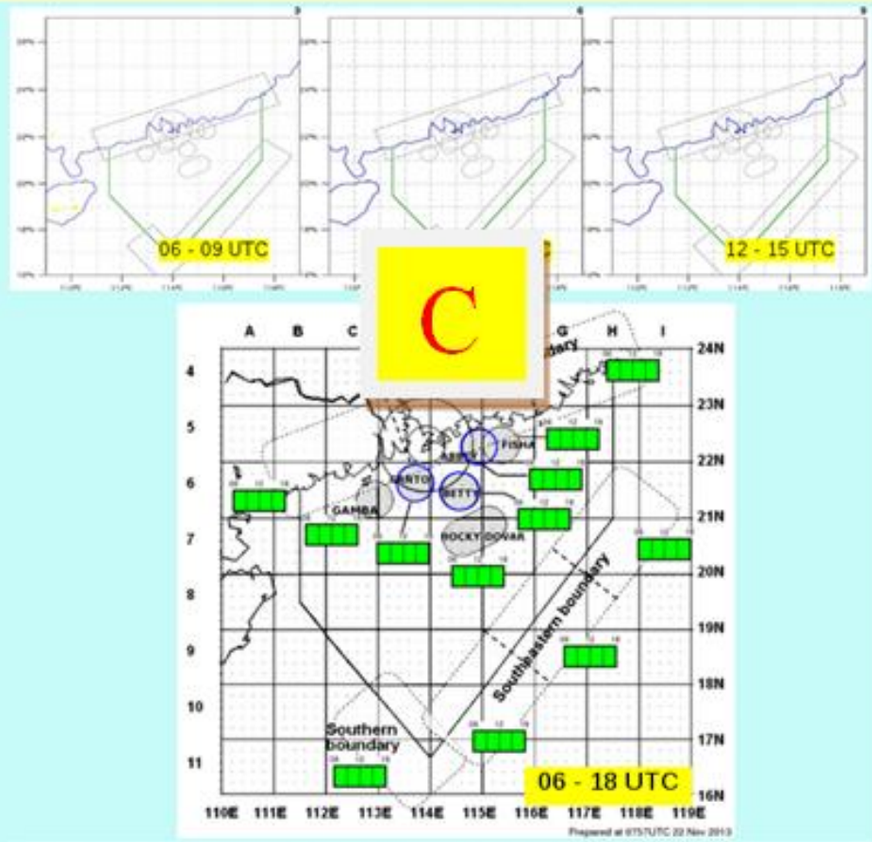
AMIDS

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
Overall									
07 Headwind									
25 Headwind									
Crosswind									
Visibility									
Ceiling									

F

Prepared at 0733UTC 22 Nov 2013

TS/CB forecast for adjacent areas

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

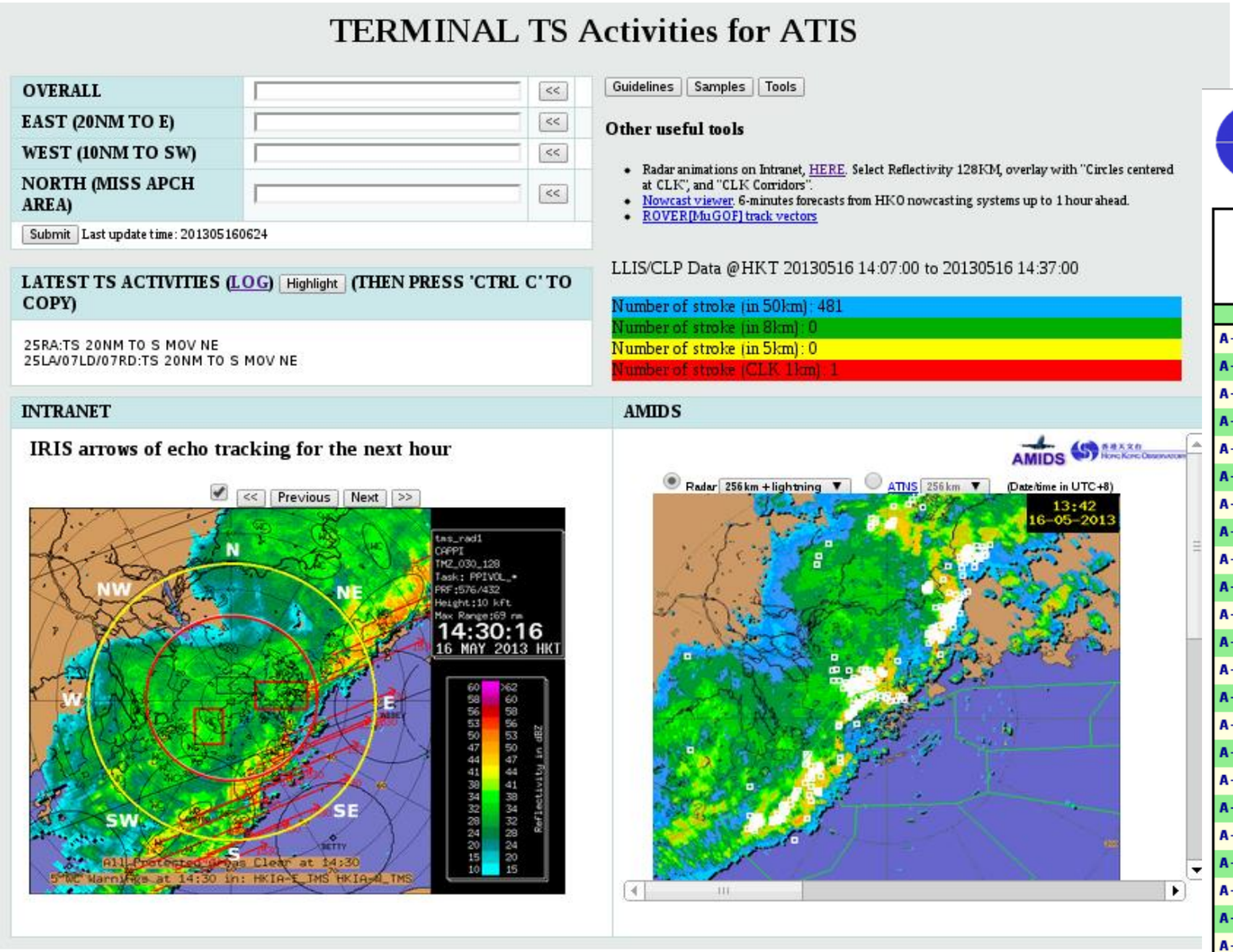
G

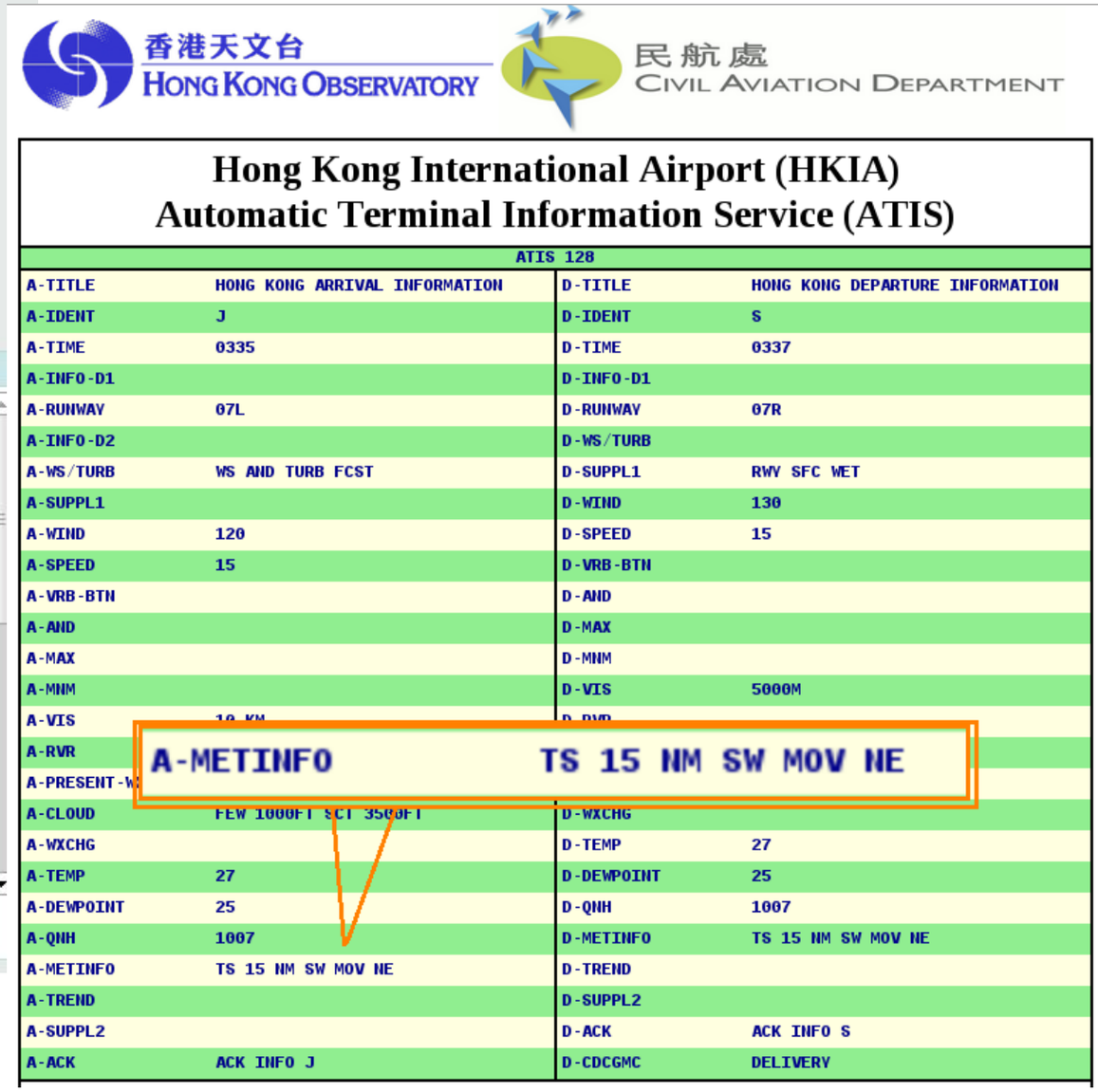
Prepared at 07

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





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-RVR	
A-RVR		D-PRESENT-WX	
A-PRESENT-WX		D-CLOUD	
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
WMO/WWRP & CAeM AvRDP Training Workshop	20-22 July 2016 Hong Kong, China	• Invited experts as trainers • MWOs as participants
WMO/WSN16 (with special session on AvRDP)	25-29 July 2016 Hong Kong, China	• CAeM representative • AvRDP Airports, • Invited speakers on Aviation Meteorology, Verification and ATM experts

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

Contact person: 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?