



CAS/CAeM AVIATION RESEARCH DEMONSTRATION PROJECT (AvRDP) SCOPE

Side Event Wed

25 July 2018

AvRDP OBJECTIVES

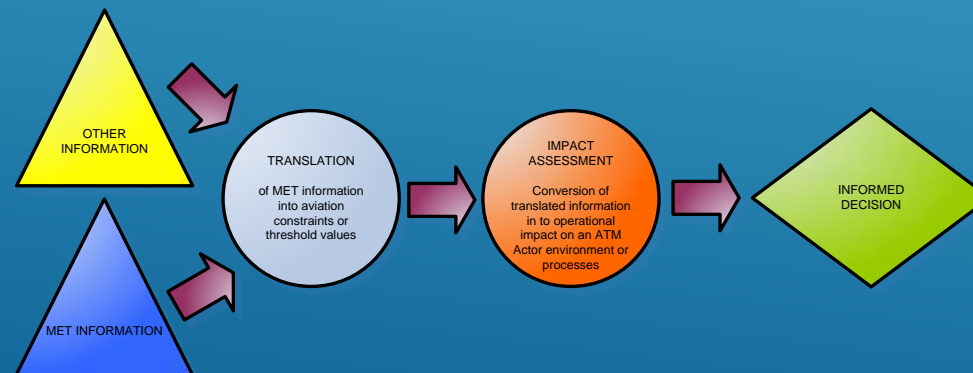
A joint effort between CAS and CAeM, in 5 years (2015-2019)

- ▶ Phase I (MET Capability enhancement) to conduct research in **nowcasting and mesoscale modelling** at a number of **international airports** located in Northern and Southern Hemisphere with a view to supporting the development of the next generation aviation initiative, the Aviation System Block Upgrade (ASBU) under the new Global Aviation Navigation Plan (GANP) of International Civil Aviation Organization (ICAO). Key concepts under ASBU are the development of seamless **Trajectory-Based-Operation (TBO**, or “gate-to-gate”).
- ▶ Phase II (MET-ATM translation) to collaborate with the respective Air Traffic Management (ATM) to **translate** the Meteorological (MET) information into ATM Impact products so as to **demonstrate the benefits** of the MET information (nowcast and mesoscale modelling) in the aviation industry;
- ▶ Capacity Building to help in **capacity building** via the knowledge gained in AvRDP other WMO Members who need to enhance their aviation MET services so as to meet the ASBU initiative.

** Not just enhancing flight efficiency but also safety and environment-friendly by optimizing trajectory and hence reducing fuel waste*

PHASE II: TRANSLATE MET INFORMATION INTO ATM IMPACT

- Airport Capacity in network operation
- Airspace Capacity
- Arrival/Departure Delay
- Aircraft de-icing, runway clearance, engine icing in freezing fog
- Lightning strike affecting ground ops.



3RD AvRDP SSC (6-7 NOV 2017, MeteoFrance)

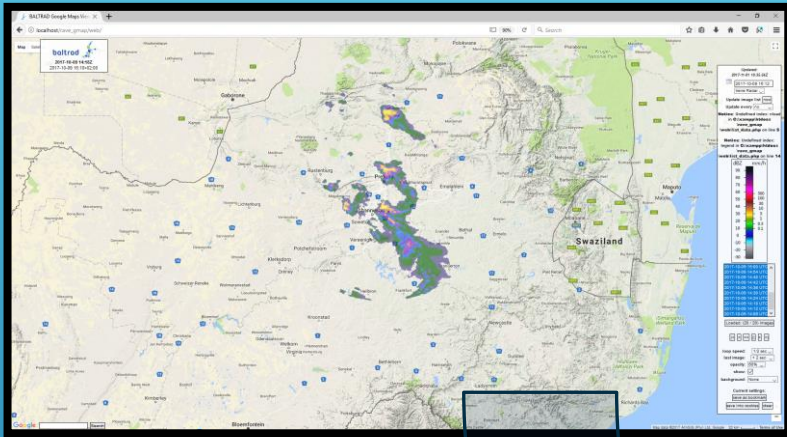
4 new airports: LED (Russia), IGI (India), NRT (Japan), SIN (Singapore)

- ▶ Extend Phase II of the project to summer 2018
- ▶ Verification activities be focused on convection
- ▶ Guidance material for meteorologists on how to evaluate convection be prepared.
- ▶ Training Workshop: 2018 (HKO, 8 – 10 Oct) focusing on Aviation Impact (MET-ATM translation)
- ▶ Project Implementation Plan for 2019

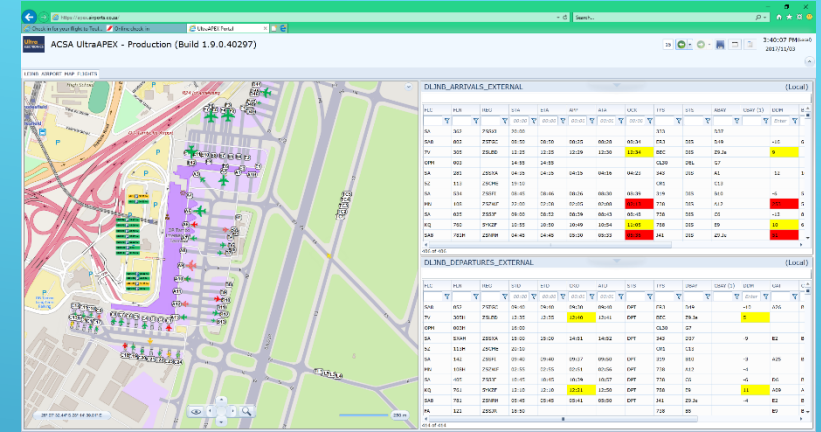
AvRDP AIRPORT STATUS

- ▶ **Most participating airports have finished Phase I and moving on to Phase II**
 - ▶ Enhanced co-operation with ATM needed
- ▶ **4 New Airports to participate**
 - ▶ **Russia Pulkovo Airport (LED) – focusing on low cloud and fog**
 - ▶ **Singapore Changi Airport (SIN) – focusing on lightning and tropical convection**
 - ▶ **Japan Narita Airport (NRT) – focusing on convection, low ceiling and winds**
 - ▶ **India New Delhi Airport (IGI) – focusing on convection and fog**
 - ▶ **Newly engaged airports will proceed to Phase II as early as possible to subsequently be timely aligned with the other airports who had joined the project earlier on.**

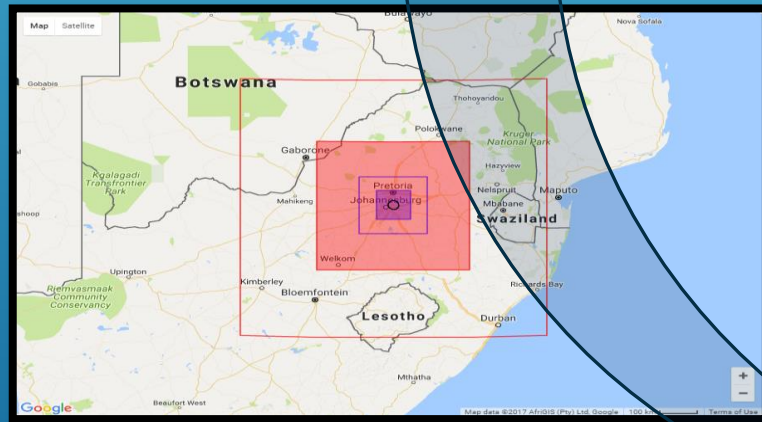
JNB (JOHANNESBURG AIRPORT)



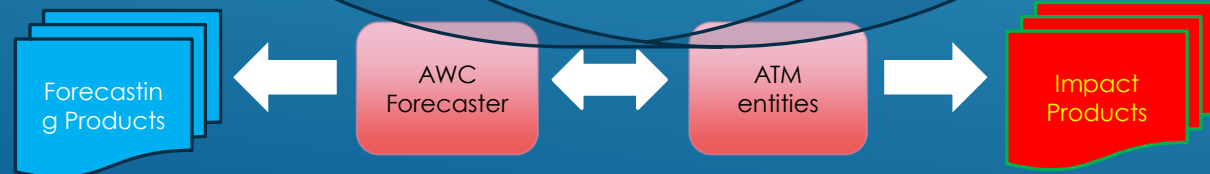
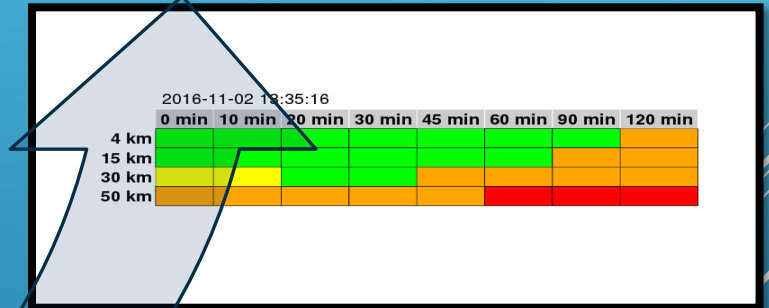
Radar-based Com-SWIRLS
Nowcasting system
Updates every 6 min
Lead-Time extrapolation = 2 Hour
Resolution = 1 km
Operational end of 2017



Liaising with ATM on integrating MET-ATM



UKMO down to 300 m resolution
Storm moved over OR Tambo Int. Airport
Severe impact on airport operations



Likelihood	High		2	6	10
	Medium		1	5	9
	Low			4	8
	Very Low			3	7
		Minimal	Minor	Significant	Severe
		Impact			

Risk Matrix Table

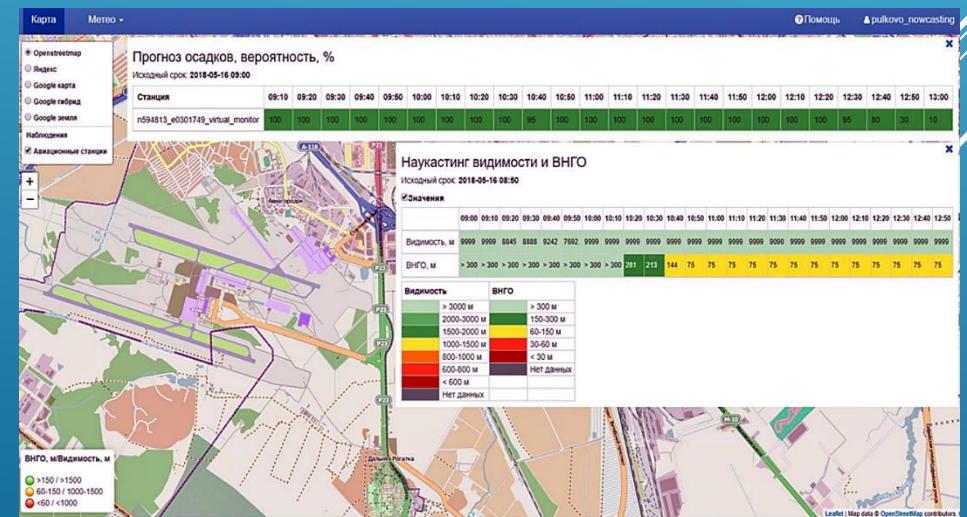
LED (PULKOVO AIRPORT)

- **Stage 1 (1st IOP, finished):** 01.02.18 – 31.05.18
 - Additional equipment (AWS station) was installed at the aerodrome meteorological observational site
 - MeteoExpert nowcasting system (visibility, ceiling and precipitation, 4h ahead at 10-min intervals) was installed and put into operational use since 16.02.2018
 - Observations and nowcasts data are archived in MeteoCube database and visualized on the forecasters workstation and at the specialized website
 - Nowcasting verification scheme was developed.



Aerodrome Pulkovo forecaster's working desk

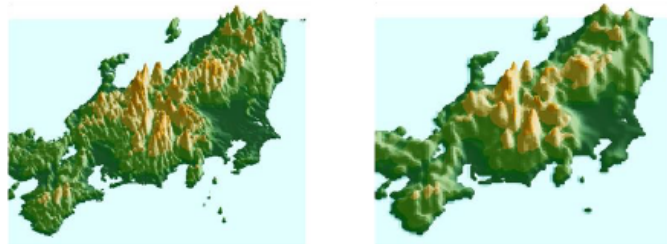
- **Stage 2 (2nd IOP + Phase II):** 01.08.2018 – 01.12.2018
 - Development and operational use of advanced nowcasting scheme using additional weather stations and temperature profiler MTP-5 (to collect high density, rapidly updated observations for nowcasting system).
 - Development of the technology for nowcasts data translation into the ATM systems (preliminary to ATM Simulator) by the means of MeteoServer system to identify the requirements and benefits from end user's perspective



MeteoExpert nowcasting system (website configuration)

NRT (NARITA/HANEDA AIRPORT)

	Local Forecast Model (LFM)	Meso-Scale Model (MSM)
Grid size and/or number of grids	2 km/ 1,581 x 1,301	5 km/ 817 x 661
Vertical levels/Top	58/ 20.2 km	76/ 21.8 km
Forecast range (Initial time)/number of ensemble members	9 hours (hourly)	39 hours (00, 03, 06, 09, 12, 15, 18, 21 UTC)
Initial condition	3D-Var Analysis	4D-Var Analysis
Operation	2012 -	2001 -



Terrain of the central region of the Main Island of Japan used for the LFM (left, 2-km horizontal resolution) and for the MSM (right, 5-km horizontal resolution)

2km, hourly output

Overview of ATM CIEL (ATM Categorized Impact of weather ELEMENT prediction)

Contents

The degree to which weather conditions affect **ATC capacity (CAPA)**, not air traffic flow.

It's considered JCAB's operation.

High	Need to <i>reduce CAPA</i> significantly
Medium	Need to <i>reduce CAPA</i>
Slight	Need to <i>reduce CAPA</i> slightly
None	Not need to <i>reduce CAPA</i>

ATM Categorized Impact of weather ELEMENT prediction

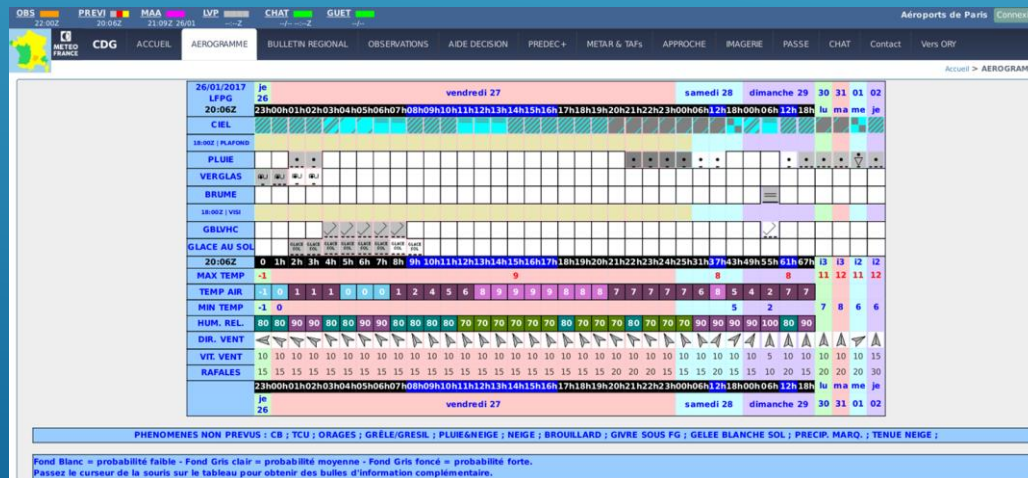
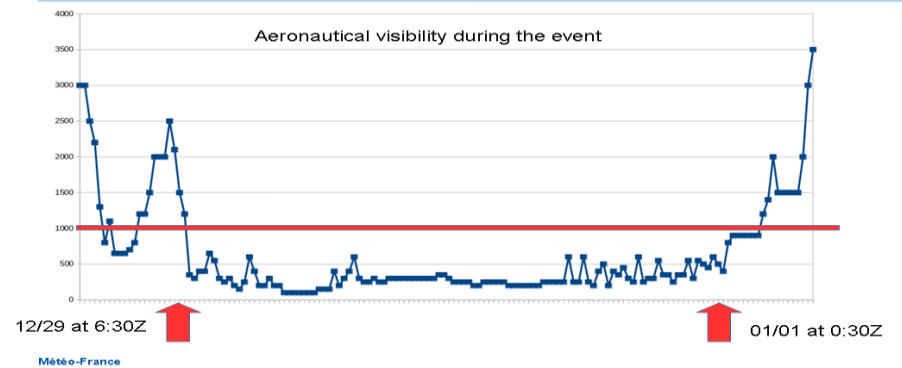
Sector/Time(UTC)	19			20			21								
	30	40	50	0	10	20	30	40	50	0	10	20	30	40	50
T03 ▲	CB					CONV									
T03_W_NW Conv															
T03_W_NE Conv															
T03_W_SW Conv															
T03_W_SE Conv															
T07 ▲				CB										CONV	
T07_NW Conv															
T07_SW Conv															
T07_EAST Conv															
RJAA ▲	TS														TS CONV
RJAA-1 Conv															
Wind															
Cross															
Gust															
VIS															
CIG															
TS															
SN															
blw3000 Wind															
RJAA-2 Conv															
RJTT ▲	BD-CROSS														CONV
RJTT-1 Conv	TS CONV														
Wind															
AC_Cross															

10 min interval

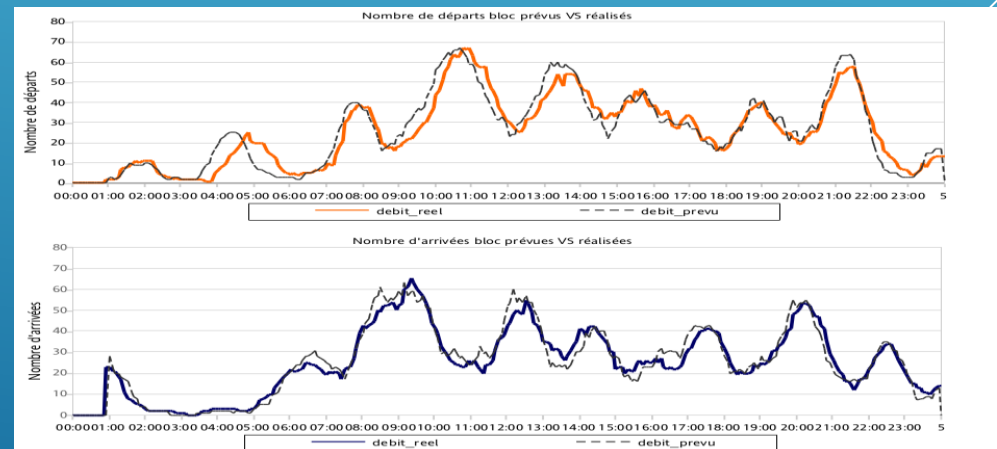
CDG - ATM IMPACT PARAMETER AIRPORT CAPACITY

- ▶ Impact of winter weather, including fog, industrial snow and freezing rain using the 1.3 km resolution, hourly updated, rapid output (15min), NWP Nowcasting system AROME-PI.
- ▶ A statistical model PEIP which determines on-ground aircraft icing probability has also been developed.
- ▶ Integrated AROME-PI forecast with ATM via the [CDM@CDG](#) tool for diagnostic and assessing the airport conditions for decision-making.

Continuous and persistent fog + industrial snow



Weather predictions from CDM@CDG tool



Departure and Arrival Rate well predicted

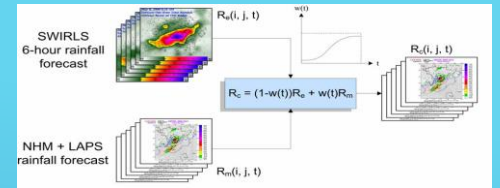
ATM Impact Parameter (3) – airspace capacity reduction

Weather radar overlaid with lightning

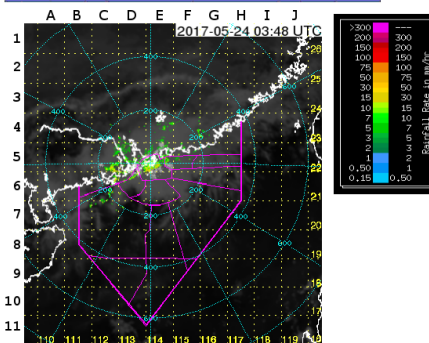
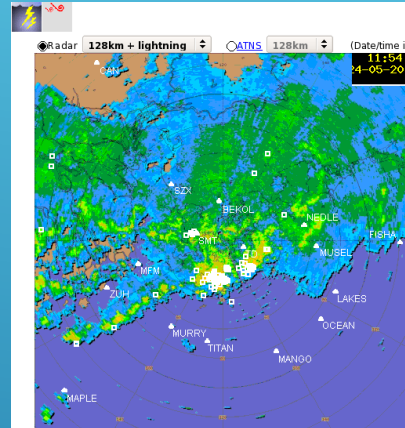
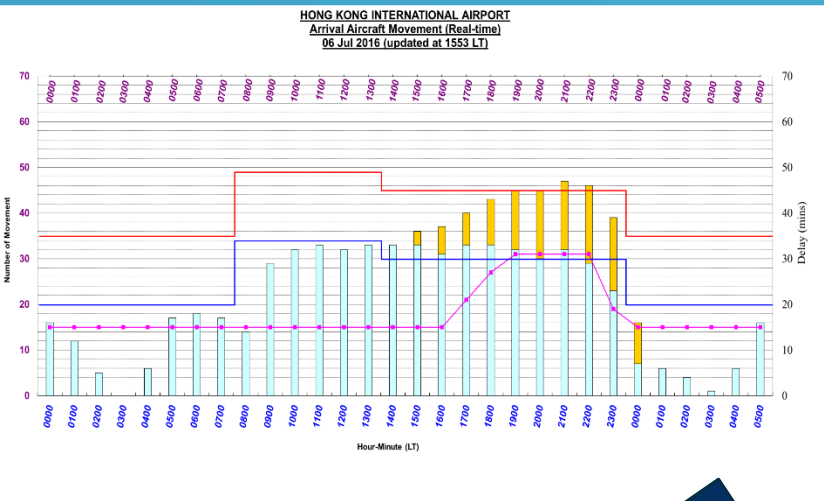


0-1 hr nowcast

Flight/route specific convection nowcast



Blended nowcasting and non-hydrostatic model to forecast 0 to 6 hrs ahead



Satellite animation

0-6hr blended nowcast over various significant areas

Significant Convection Monitoring and Forecast

Forecast valid from 03 UTC 24 May 2017 to 15 UTC 24 May 2017

03:48 - 04:48 UTC

Prepared at 0348UTC 24 May 2017

Forecast for HKIA

UTC	04	05	06	07	08	09	10	11	12
Overall									
07 Headwind									
25 Headwind									
Crosswind									
Visibility									
Ceiling									

TS/CB forecast for adjacent areas

UTC	04-05	05-06	06-07	07-10
20nm of ARP				
ABBAY				
BETTY				
CANTO				

Prepared at 0357UTC

Capacity Related Information VHHH (FOR ARRIVALS)
 VALID: 240300 to 240800 UTC
 CAPACITY LEVEL: 3
 AIRPORT ACCEPTANCE RATE: 19 flights per hour
 EXPECTED DELAY: Up to 40 mins
 REASON: Single Runway Operation
 REMARK: Due North Runway blocked.
 Prepared at: 0306UTC 24 May 2017

3 hrly forecasts based on global model

Airport Capacity Notification sent to regional airports

AVIATION SCIENCE CONFERENCE STATEMENT

- ▶ Conference recognized the tremendous amount of ongoing cross-disciplined research in the field of Aeronautical Meteorology. This **collaborative scientific excellence** should be leveraged to enable the future global ATM system.
- ▶ The role of MET as a key enabler to aviation's vision for a globally interoperable, harmonized ATM system of the future that is safer, more efficient and more environmentally responsible will only be realized through the **accelerated transition of scientific research and technological advancement into operations** based on aviation users' needs, new and improved community partnerships, trust, transparency and openness.
- ▶ As the potential impacts of climate change and variability on aviation operations become better understood, the research community should continue to advance relevant science and **communicate in a style that is well understood by the user.**

**Conference outcomes to be used to guide the Roadmap of the
CAS/CAeM/CBS Inter-commission Aviation Research Project**

AvRDP SSC Membership



Aviation Research Demonstration Project (AvRDP)
A joint project between CAS and CAeM

Home | Participants | Documentation | Meeting | Forum | WSN 16

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.

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

Name	Representation
Peter LI, Chair	HKO rep of CAeM
Stephanie LANDMAN (replacing Erik BECKER)	SAWS rep of JNB
Janti REID	ECCC rep of YYZ & YFB
Stephanie DESBIOS	MeteoFrance rep of CDG
Fengyun WANG	CAAC rep of SHA
Sharon LAU	HKO rep of HKG
RK JENAMANI	IMD rep of IGI
Larisa NIKITINA	Roshydromet rep of LED
Jun RYUZAKI	JMA rep of NRT
Chui Wah YAP	MSS rep of SIN
Peter M. CHADWICK	CAD rep of HKG (ATM expert)
Baode CHEN	SMS rep of CMA
Matt Strahan	NOAA rep of NextGen
Stefane BELAIR	ECCC rep of NMRWG
Rep of NMRWG	rep of NMRWG
Barbara Brown	NCAR rep of JWGFVR
Herbert PUEPEL	Ex-WMO C/AeM and AustroControl
Dennis HART	EuroControl rep of SESAR (TBD)

Q & A

