

Location-Based Rainfall Nowcasting Service for Public

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Hong Kong Observatory

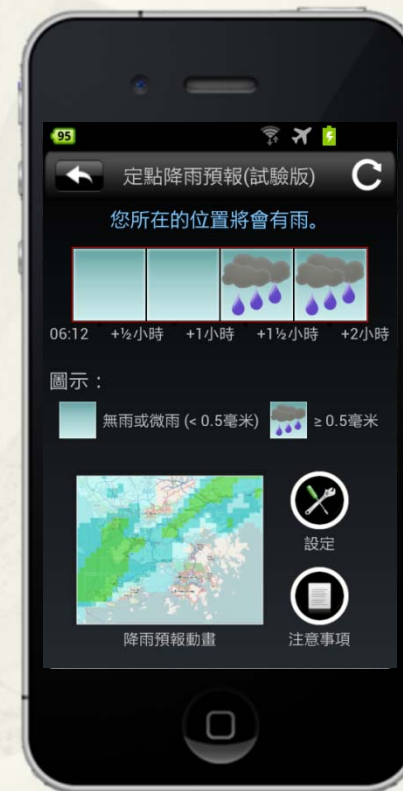
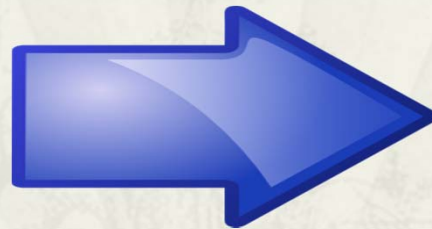
14th ECMWF Workshop on Meteorological Operational Systems

Location-based Rainfall Nowcast

The “SWIRLS”
Nowcasting System



“MyObservatory”
Smart Phone App



Location-Based Rainfall Nowcast
Service for the Public

Nowcasting System

**SHORT-RANGE WARNING OF INTENSE
RAINSTORMS IN LOCALIZED SYSTEMS**

SWIRLS

Short-range Warning of Intense Rainstorms in Localized Systems

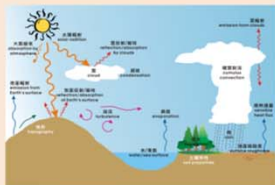
Computer Simulation of Physical Processes in the Atmosphere

Radar Tracking, Analysis and Forecast

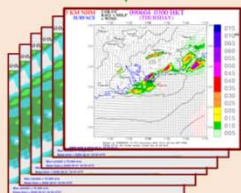
Nowcast Products & Services



Remote-sensing and conventional weather observation data

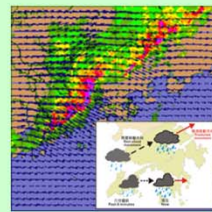


High-resolution storm model to directly simulate the evolution of precipitating clouds up to 15 hours ahead

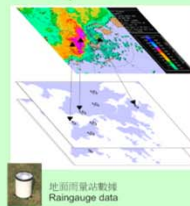


Computer-generated forecast rainfall maps for the next 15 hours based on simulation

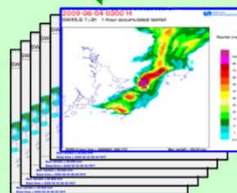
SWIRLS Nowcasting System



Automatic tracking and prediction of rainband movement from radar

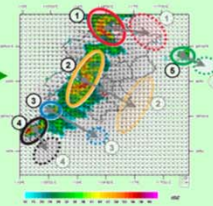


Real-time calibration of radar-detected rainfall rate using the dense raingauge network

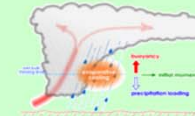
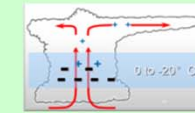


Computer-generated forecast rainfall maps up to 6 hours ahead based on radar

Special Editions of SWIRLS



Cell identification and radar signature analysis for severe storms



Computer-generated forecast map of squalls, lightning, hail and heavy rain

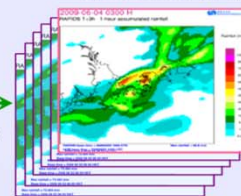
In support of Important International Events



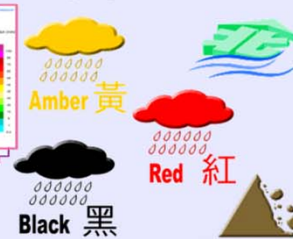
In support of Thunderstorm Warning System



In support of Rainstorm and Related Warning Systems



Forecast rainfall maps up to 6 hours ahead blended from radar nowcast and computer simulation results



Public dissemination of nowcast rainfall maps for the Pearl River Delta region via HKO Internet website



Forecast rainfall information visualized with 4-dimensional map of the globe

Quantitative Precipitation Estimates (QPE)

- * $Z = aR^b$
- * a 、 b parameters calibrated by linear regression based on automatic rain gauge data and 2km CAPPI reflectivity
- * Adopts local climatological value in the absence of sufficient data.

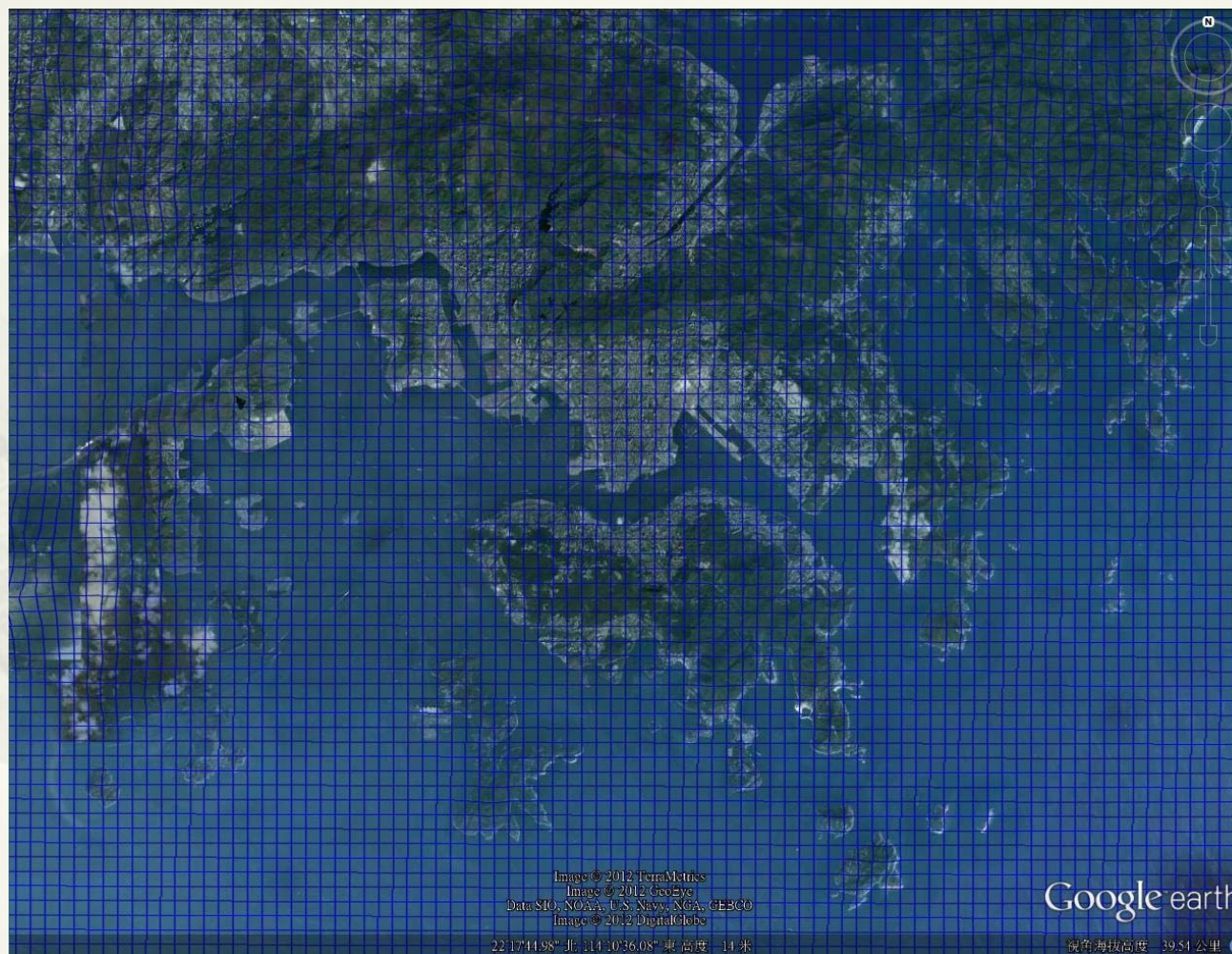
Quantitative Precipitation Forecast (QPF)

- * Radar Echo Tracking Algorithm
 - * Read-time Optical flow by Variational Methods for Echoes of Radar (ROVER)
- * Extrapolation of Echoes
 - * Semi-Lagrangian Advection (SLA)
- * Products
 - * Up to 6 hour Quantitative Precipitation Forecasts

SWIRLS Domain



SWIRLS Grid (partial)



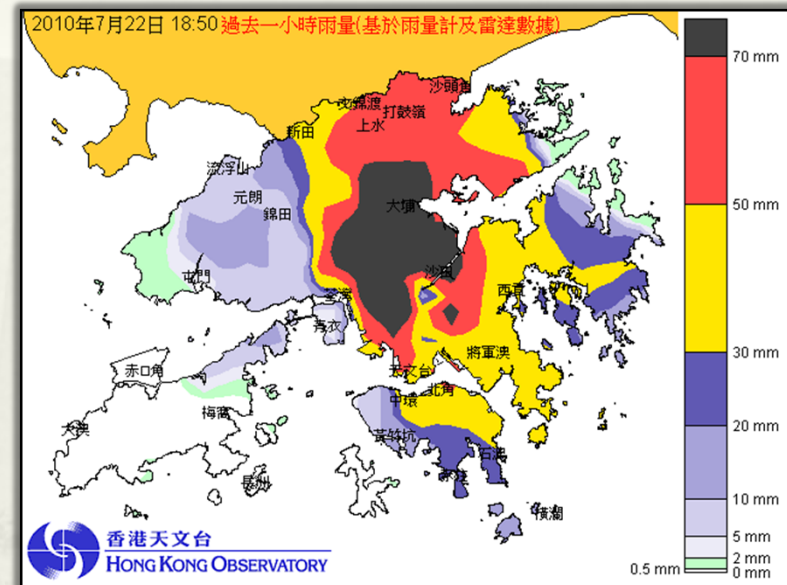


Smart Phone App

MYOBSERVATORY

Regional Weather

- * Due to complex terrain, weather varies greatly across regions, even in Hong Kong (~1,100 km²)
- * Thundery showers are highly localized.
- * City-wide information can no longer satisfies the public needs.



Geolocation:

- * GeoLocation Information provided from:
 - * Cellular Network
 - * Global Positioning System (GPS)
- * Most smart phone supports geolocation.

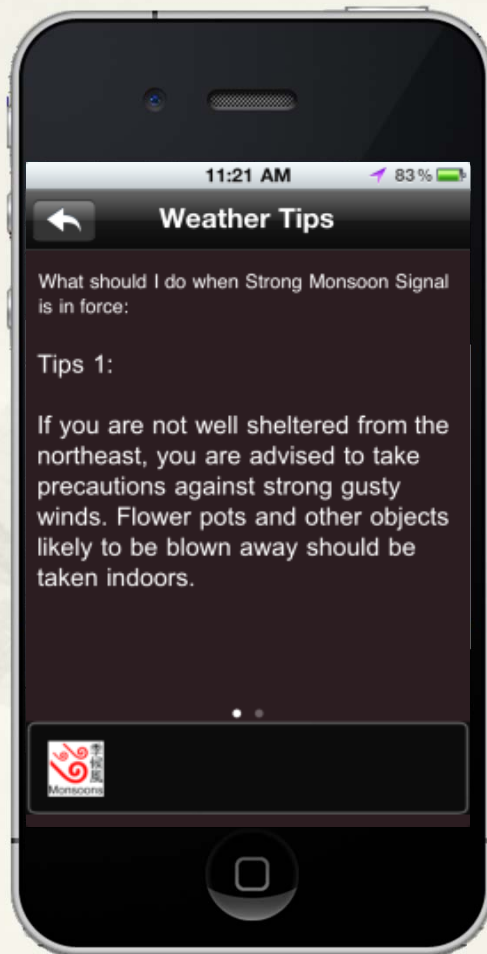


MyObservatory (launched in March 2010)



- * Weather Warnings
- * Provides Information of the Nearest Weather Stations (Temperature, R.H., Wind, Rainfall) based on detected user location
- * 7-day Forecast
- * UV Index and Forecast
- * YouTube Video Clip
- * Real-time Web Cam

MyObservatory



- * Satellite and Radar Images
- * Lightning Locations
- * Regional Weather
- * Astronomical and Tidal Information
- * Weather Forecasts at Major Cities
- * South China Coastal Weather Forecast
- * HKO Blog
- * Isohyet Charts
- * Weather Warning Notifications
- * Special Weather Tips

MyObservatory - Android (November 2010)



Evolving Service Model

Traditional



- Limited Space
- Text / Audio

Internet



- Detailed and Attractive
- User-selectable Information
- Multi-media

Mobile Platform



- Personalized
- Anytime, Anywhere



**LOCATION-BASED RAINFALL
NOWCAST SERVICE FOR THE PUBLIC**

Data Flow

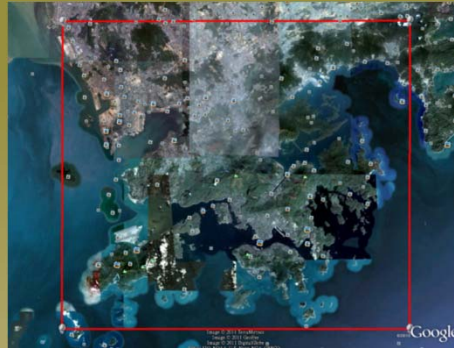


Output from SWIRLS

256 x 256 km

480 x 480 grid

Resolution: 0.5 km



Location-based Rainfall

Nowcast for the Public

Hong Kong

35 (EW) x 31 (NS) grid

Resolution: 2km

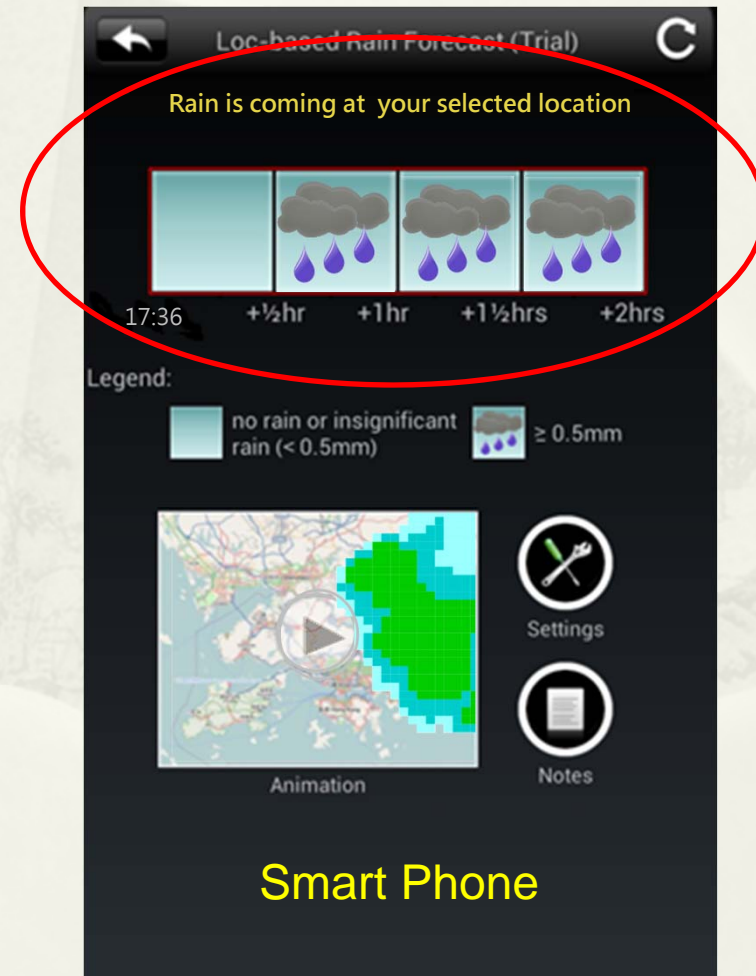


Disseminated to “MyObservatory”
(Smart Phone App) through servers

Updated every 12 minutes

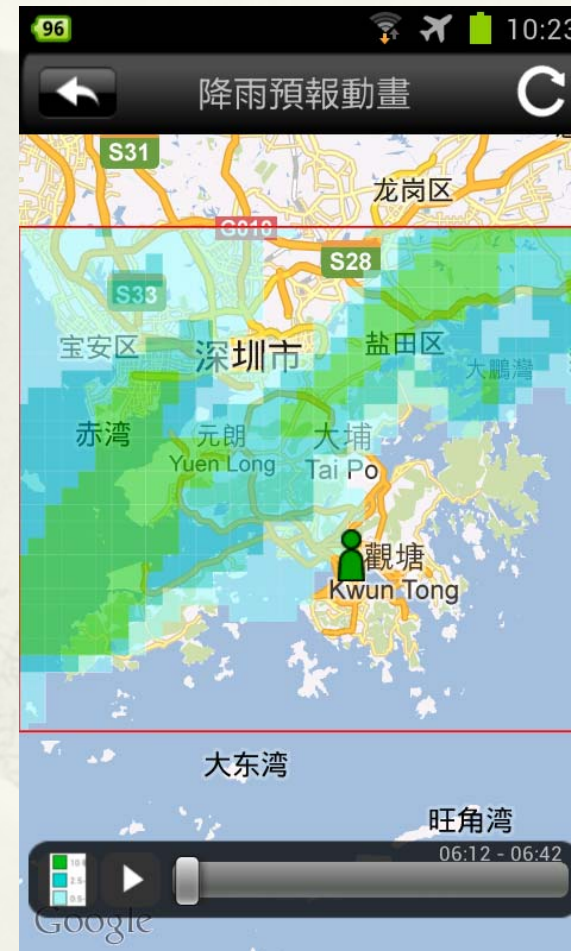
Service (Text & Icons)

- * Rainfall Forecast in half hour interval in the next two hours



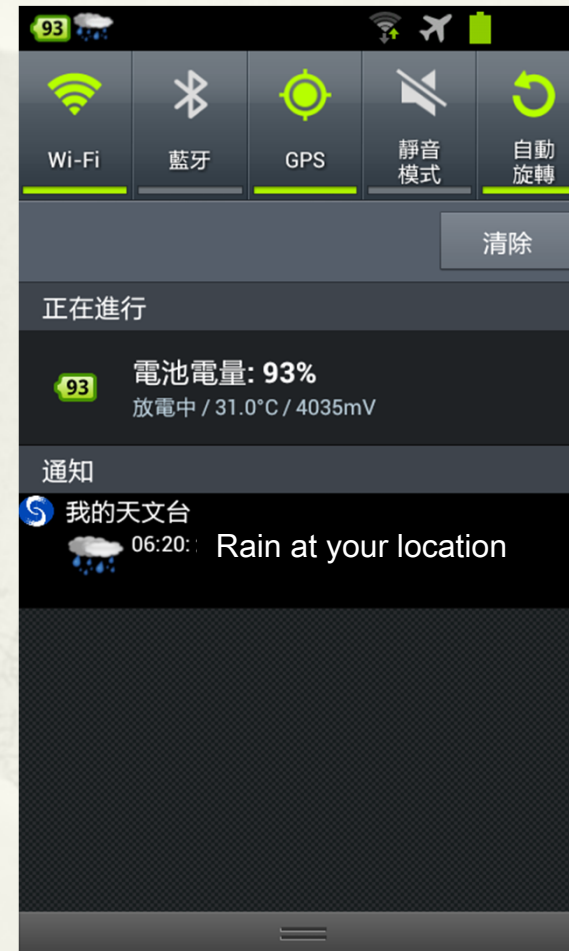
Service (Graphics)

- * Rainfall Intensity in 4 colours based on predicted 30-minute accumulated rainfall
 - * < 0.5 mm
 - * 0.5 mm - 2.5 mm
 - * 2.5 mm - 10 mm
 - * ≥ 10 mm



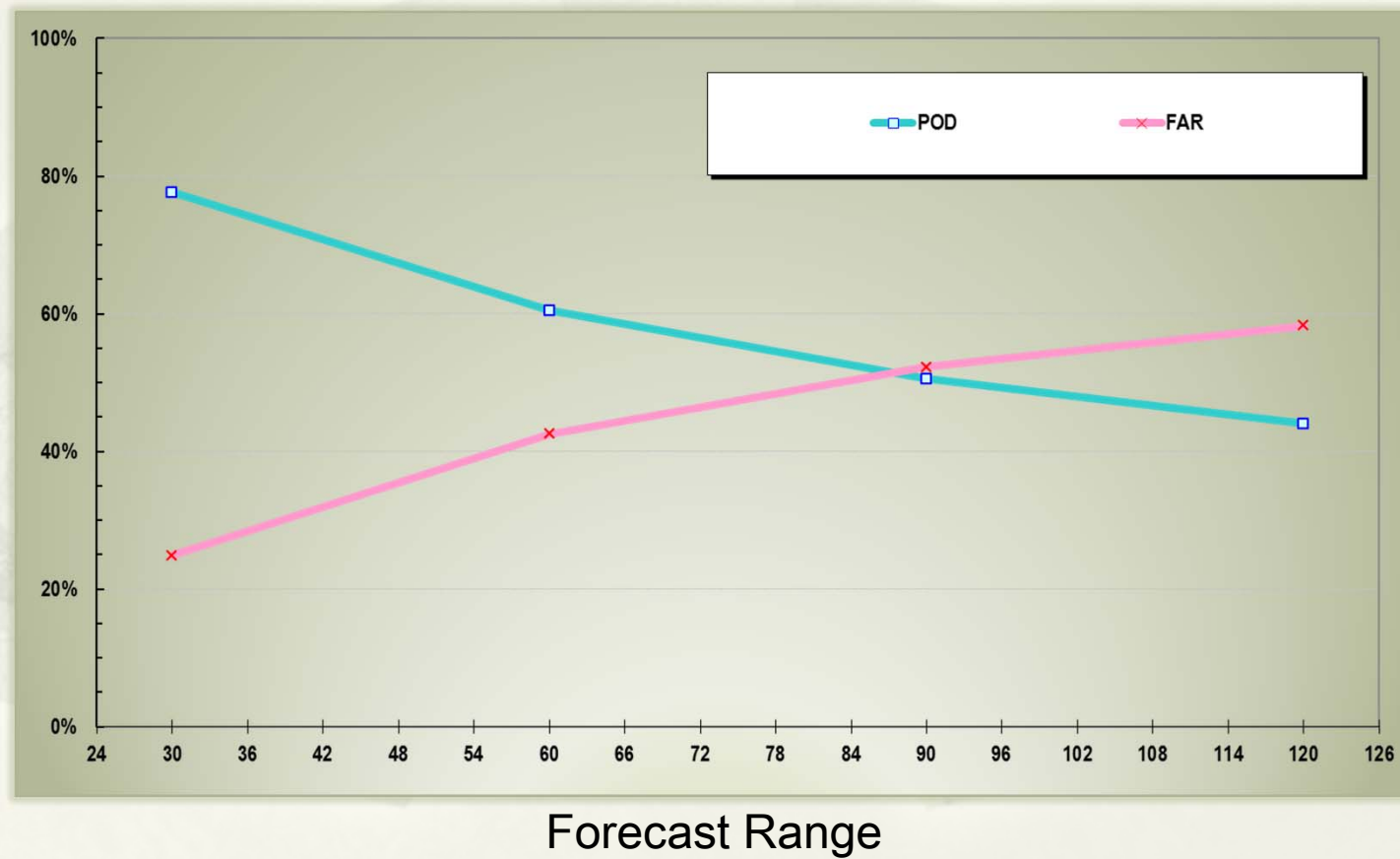
Service (Notification)

- * User Selection
 - * Notification?
 - * Enable/Disable Ringtone?
 - * Enable/Disable Vibration?
 - * Notification Display?
 - * Rainfall Forecast Checking Frequency
 - * Notification Update Frequency
 - * Setting of Distance Moved to Update
 - * Use Location Service?



Forecast Verification

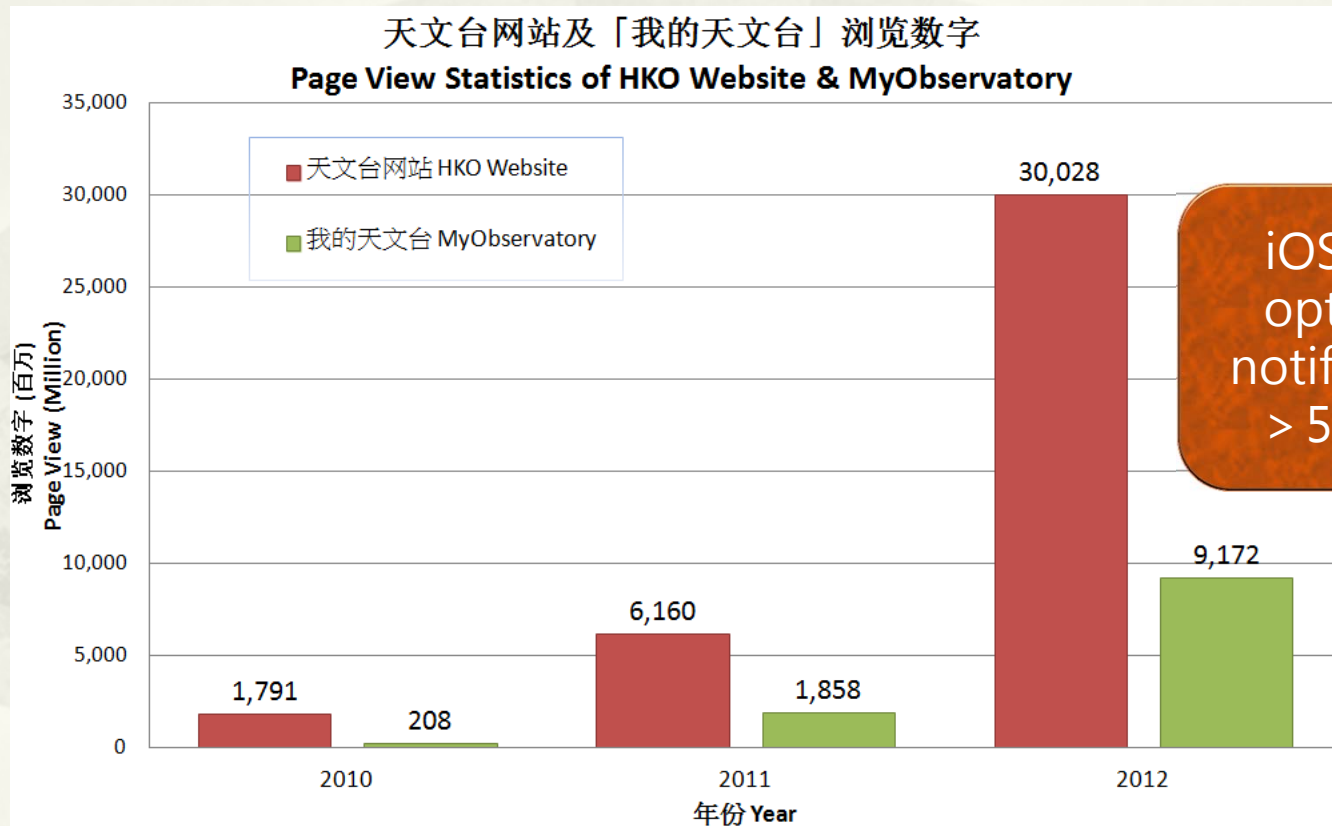
Threshold: 0.5 mm



Factors Affecting Accuracy

- * Noise of radar echoes caused by Anomalous Propagation (AP) or other sources
- * Limited sensitivity of radar, light rain not necessarily detectable
- * Low-level Stratiform cloud not necessarily captured by 2-km CAPPI reflectivity ◦
- * Growth and decay not forecast using the present algorithm
- * Error in extrapolation speed and direction

Usage of MyObservatory



Conclusions

- * Location-based Rainfall Nowcast Service developed and launched
- * Successfully transformed from research to operation