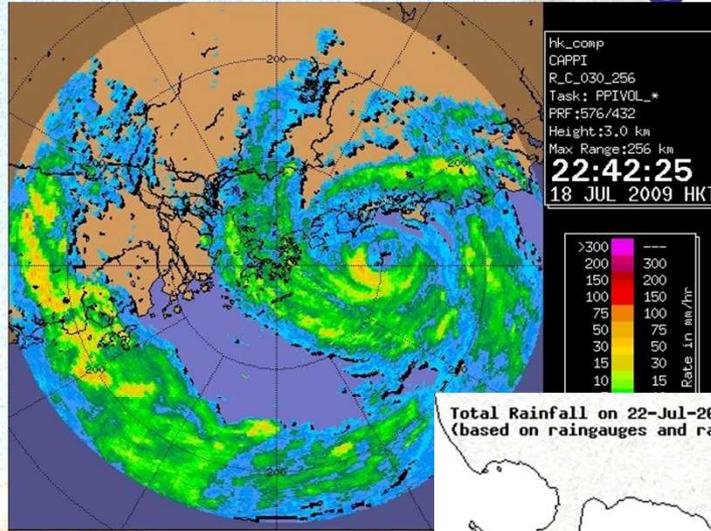
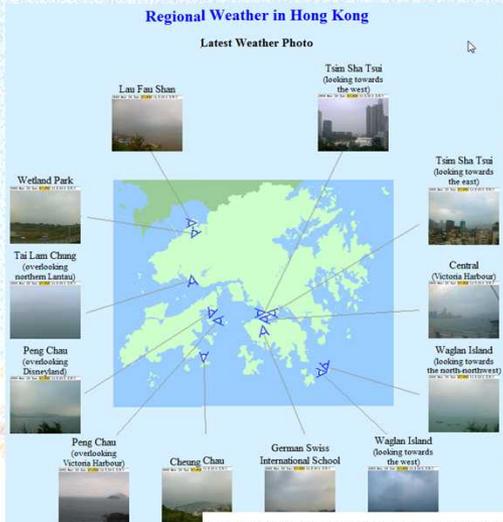


# Application of NWP products and meteorological information processing system in Hong Kong

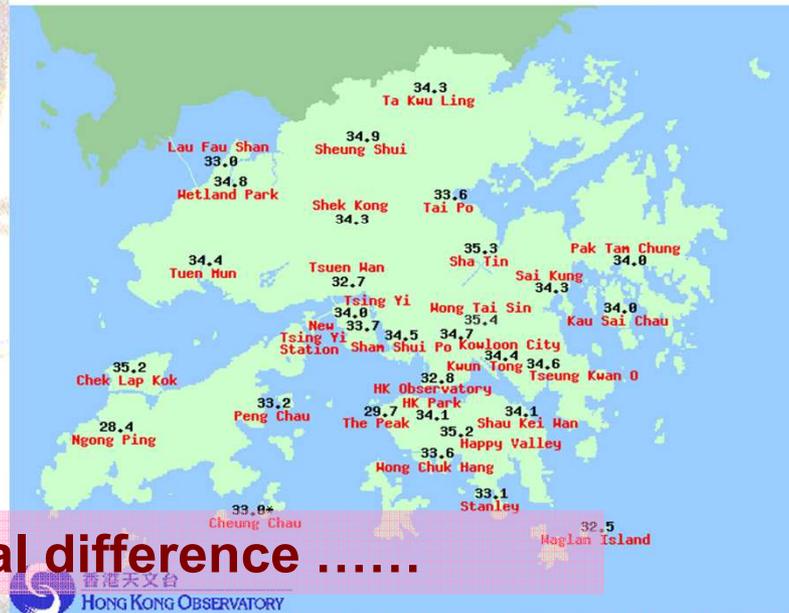
Y.S. Li  
Scientific Officer  
Hong Kong Observatory  
([ysli@hko.gov.hk](mailto:ysli@hko.gov.hk))



# Regional weather in Hong Kong

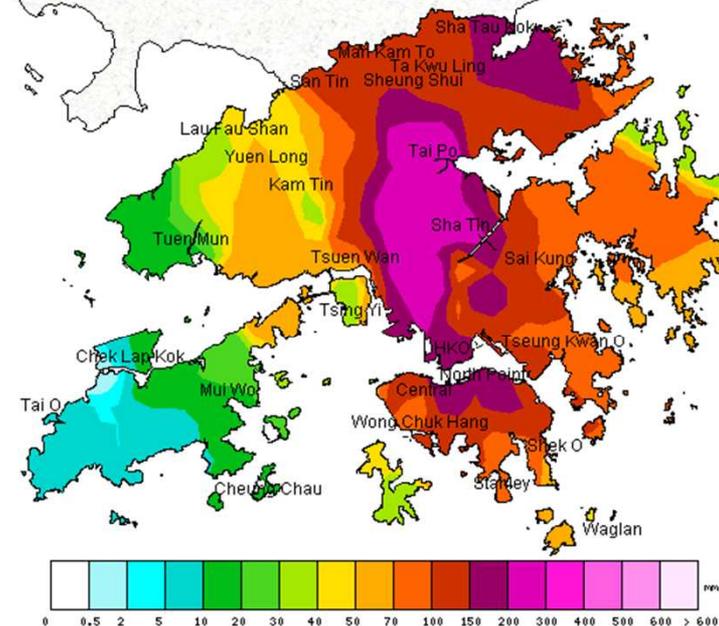


Maximum Air Temperature recorded from 00:00 HKT to 21:50 HKT, 19 SEP 2010 (°C)

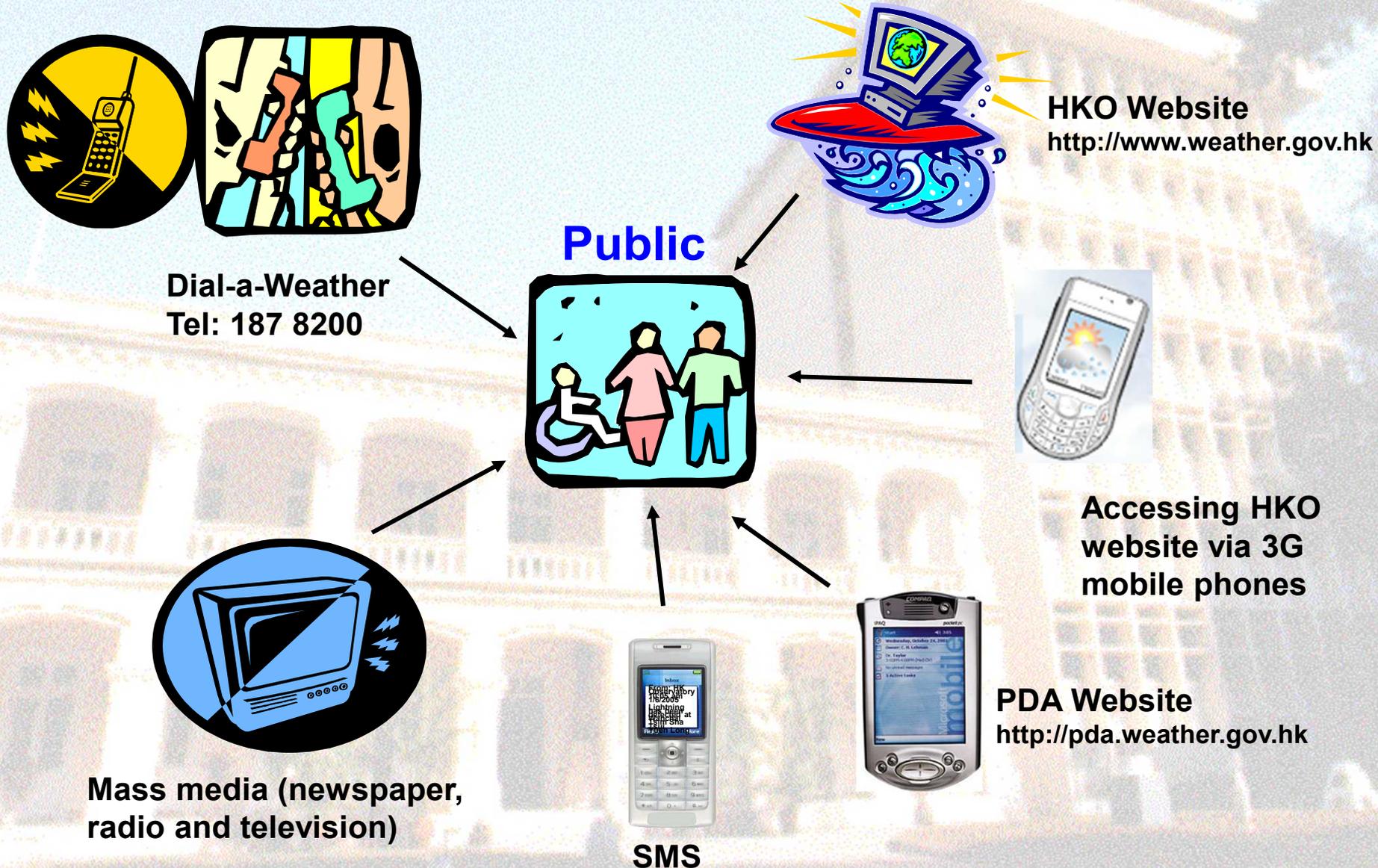


Regional difference .....

Total Rainfall on 22-Jul-2010 (based on raingauges and radar data)



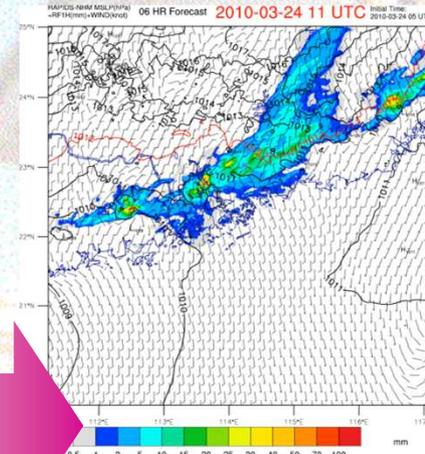
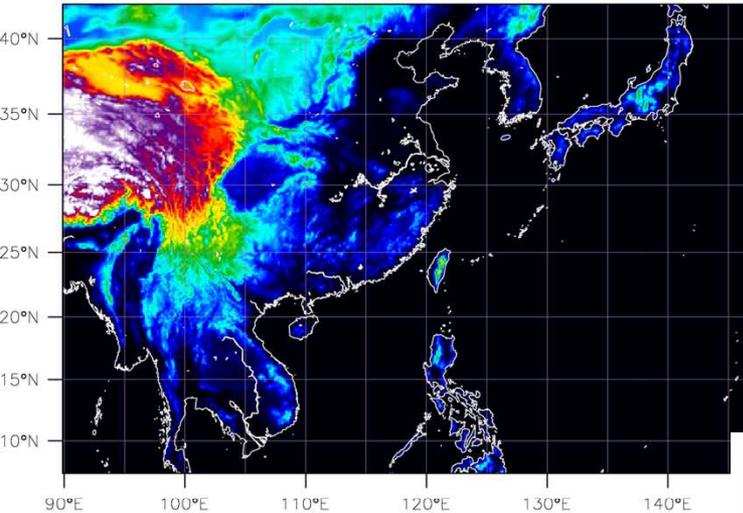
# Dissemination of weather information



# HKO's Regional Model

AIR (Atmospheric Integrated Rapid cycle forecast model system)

Meso-NHM Topography

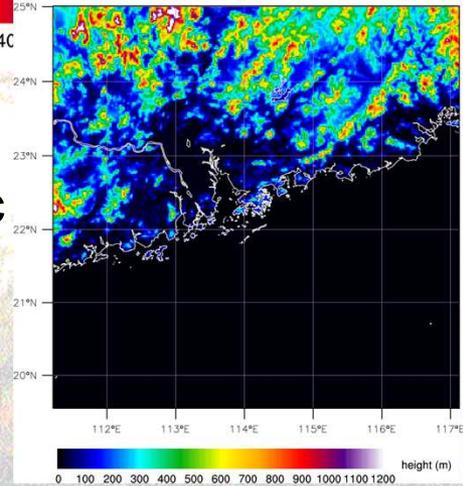


1-15 hours at hourly intervals

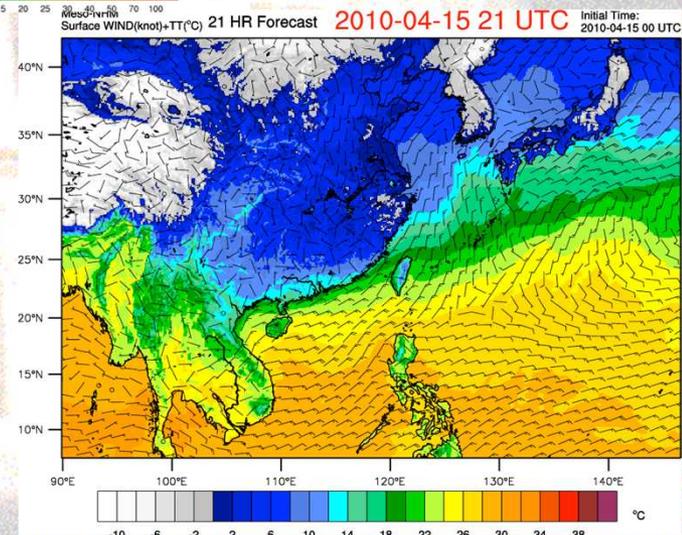
up to 3 days at 3-hrly intervals

0 500 1000 1500 2000 2500 3000 3500 4000

RAPIDS-NHM Topogra...



10km and 2km  
Non-hydrostatic  
model

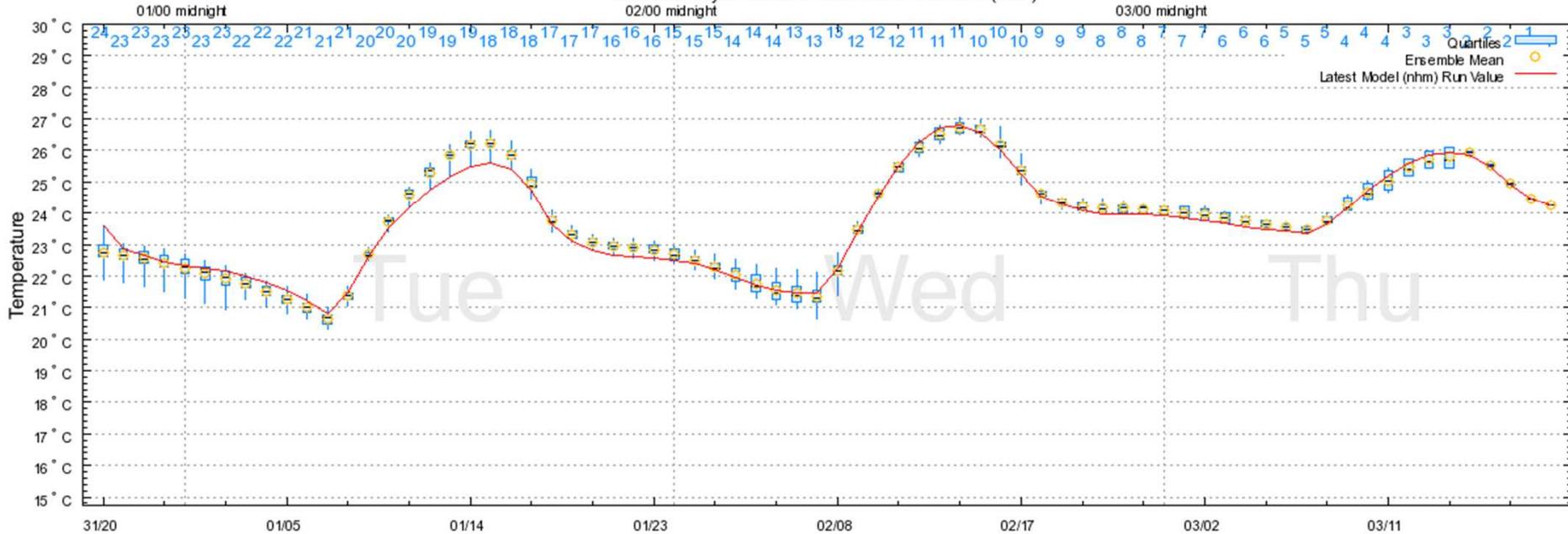


# Meso-NHM Time-lagged Ensemble

Model: **Meso-NHM** Element: **T + RF** Initial Time (UTC): **< 2011-10-31 12 >**

**NHM Time-lagged Ensemble valid from 2011103120 to 2011110319 (HKT)**

based from cycle run 2011102812 to 2011110312 (UTC)



# Regional Temperature Forecasts

## Meso-NHM Kalman Filtered Regional Temperature Forecast

[Bias Charts](#) | [Past Data](#) | [Today](#) | [Tomorrow](#) | [Day after Tomorrow](#)

[Linear Regression](#)

### Min Temp for TOMORROW 01/11/2011

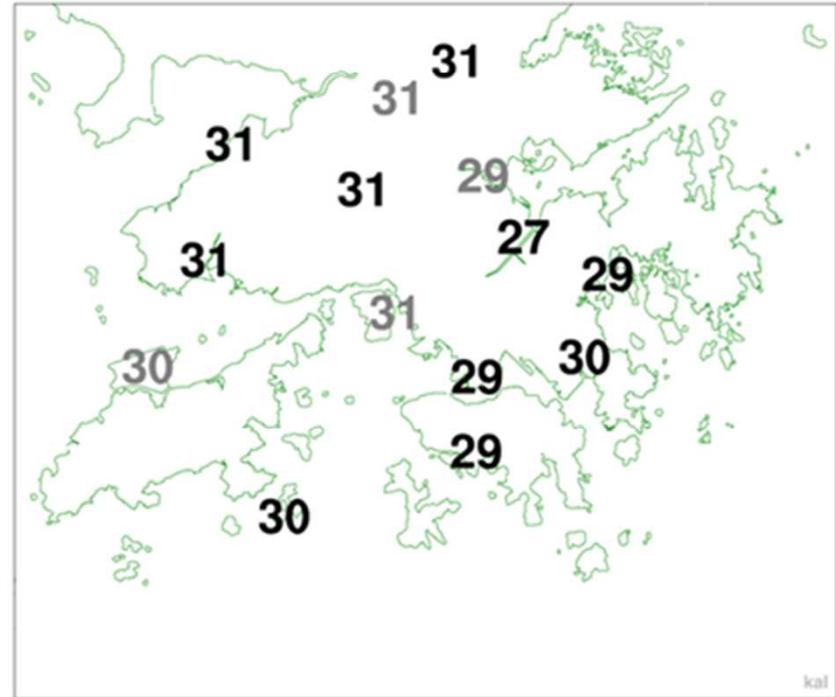
forecast to occur at 07 HKT



Time-lagged Ensemble 2011103115 UTC

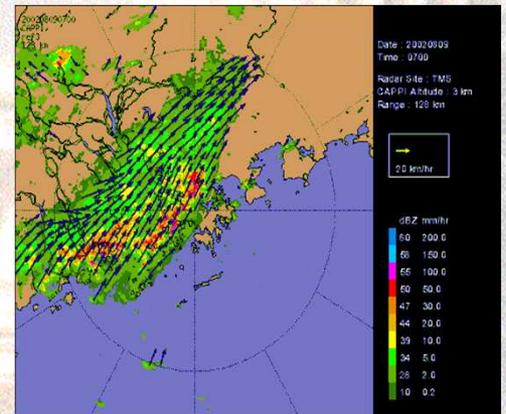
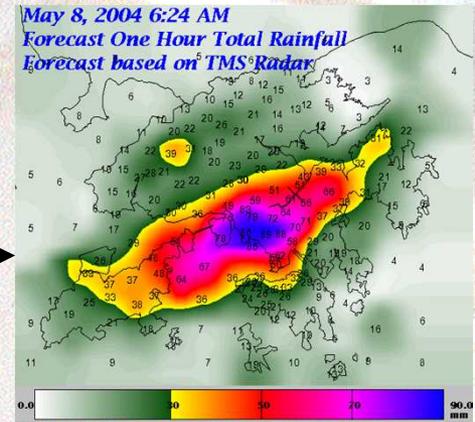
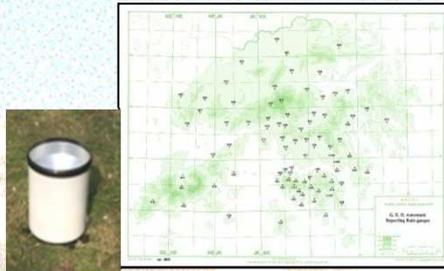
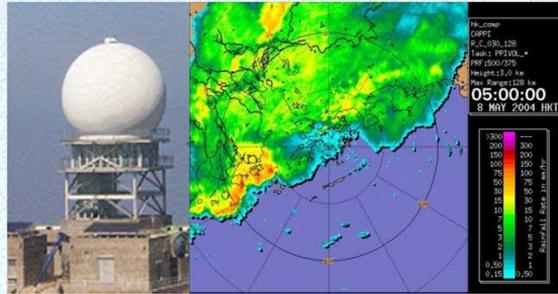
### Max Temp for TOMORROW 01/11/2011

forecast to occur between 14-15 HKT



Time-lagged Ensemble 2011103115 UTC

# Nowcast Tool – SWIRLS




Time is 2005 0508 1100

Actual Rainfall

Forecast Rainf...

Tephigram

Instability Indl...

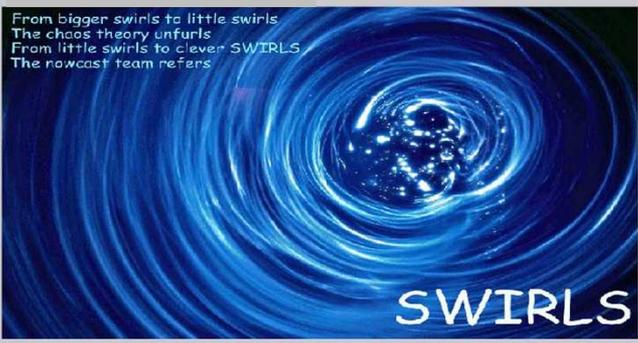
TREC Wind

Group Tracking

Multi-Products

**Operational Mode**

From bigger swirls to little swirls  
 The chaos theory unfolds  
 From little swirls to clever SWIRLS  
 The nowcast team refers



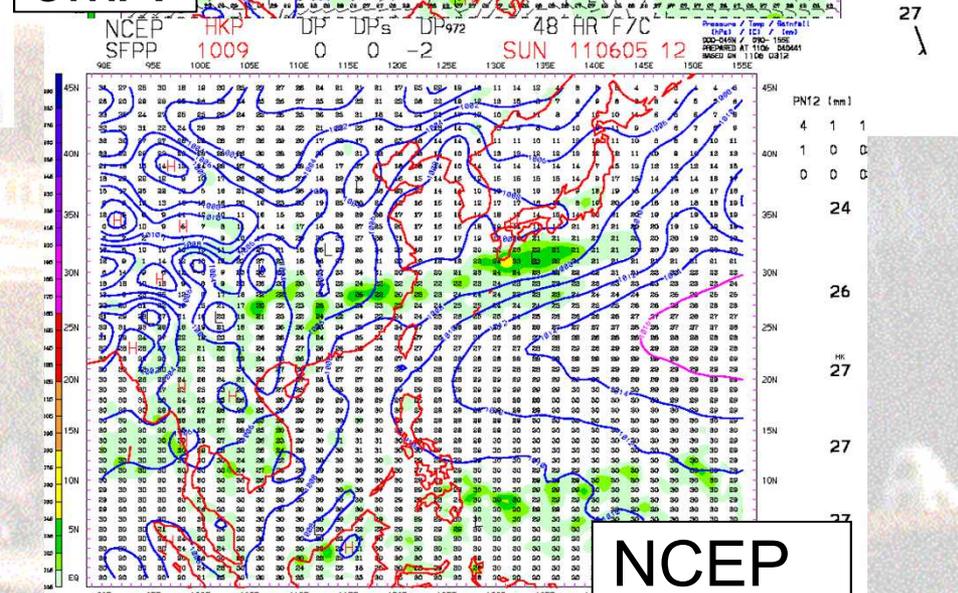
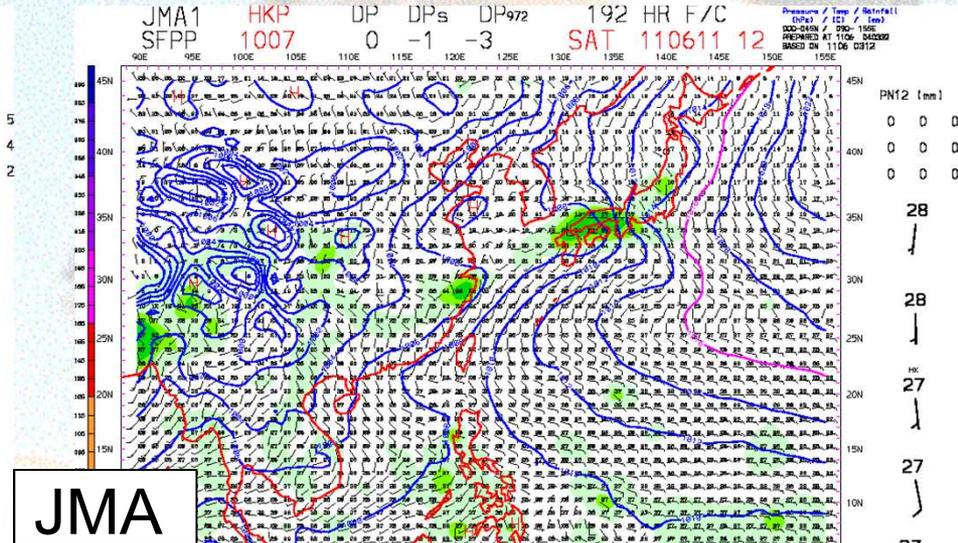
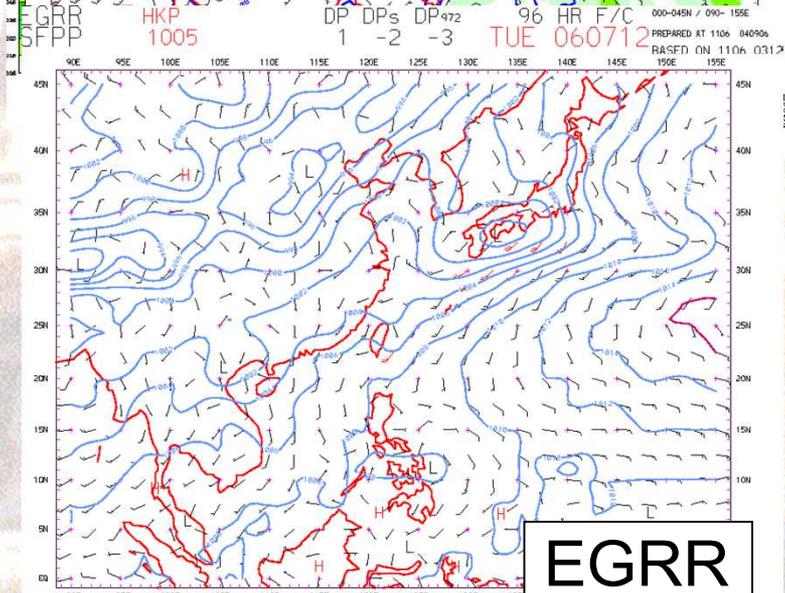
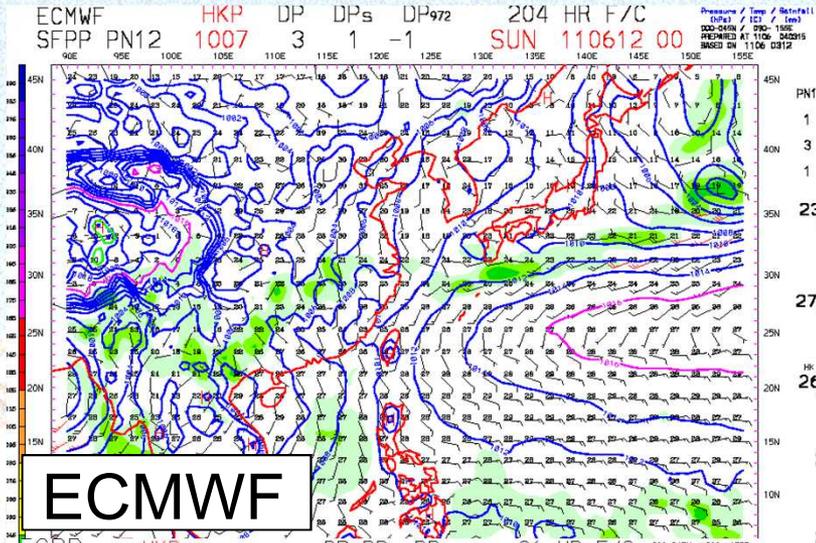
**SWIRLS**

Short-range Warning of Intense Rainstorm in Localised Systems(Ver 1.2)

Forecast Amber!

Disable Alarm
 About Swirls

# Application of NWP products



# NWP Viewer

NWP Viewer 2.2.1 - Mozilla Firefox

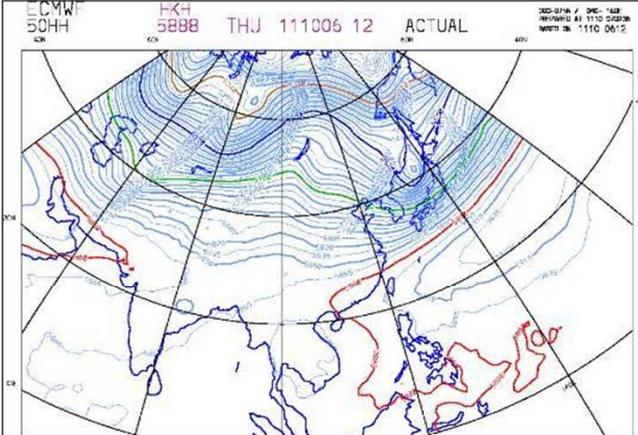
檔案 (F) 編輯 (E) 檢視 (V) 歷史 (S) 書籤 (B) 工具 (T) 說明 (H)

http://hla16/-autop/wxinfo/nwp\_viewer/viewer\_2.2.1.html?2011100612

NWP Viewer 2.2.1

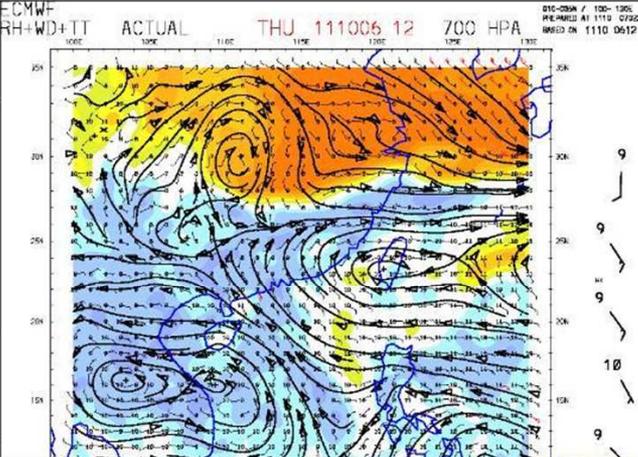
ECMWF 5CHH HKH 5888 THU 111006 12 ACTUAL

3RD-DEPA / 3RD-1428  
PREPARED AT 1110 0612  
BASED ON 1110 0612



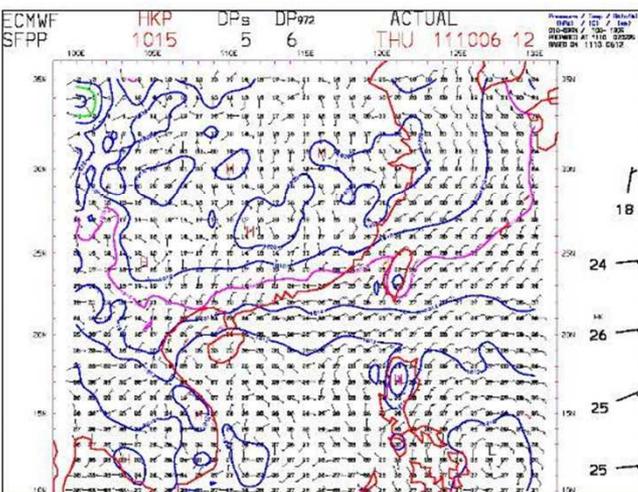
ECMWF RH+WD+TT ACTUAL THU 111006 12 700 HPA

010-030N / 130-130E  
PREPARED AT 1110 0612  
BASED ON 1110 0612



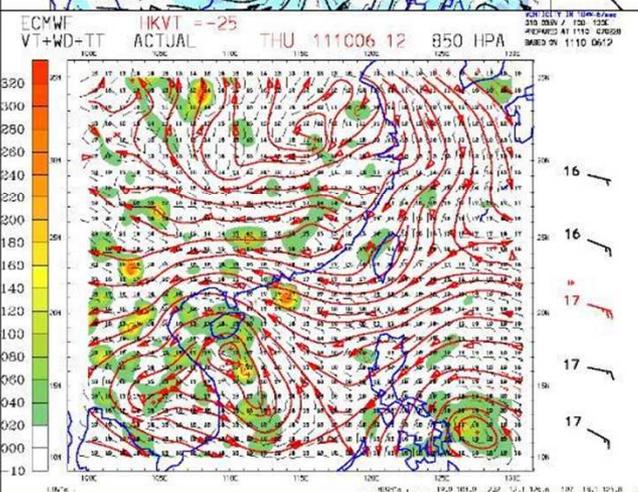
ECMWF SFPP HKP 1015 DP5 5 DP972 6 THU 111006 12 ACTUAL

010-030N / 130-130E  
PREPARED AT 1110 0612  
BASED ON 1110 0612



ECMWF VT+WD-TT ACTUAL THU 111006 12 850 HPA

010-030N / 130-130E  
PREPARED AT 1110 0612  
BASED ON 1110 0612



← 3  
→ 3  
← 6  
→ 6  
← 12  
→ 12  
← 24  
→ 24  
2  
1 3  
Latest  
Previous

完成



# Application of NWP products

NWP Model Time Cross and Tephigram for Hong Kong

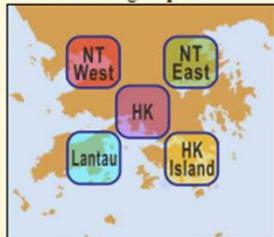
Model: **ECMWF**  
JMA

Element: **Tephigram**  
Timecross

Date: **20111027**  
 20111026  
 20111025  
 20111024  
 20111023  
 20111022  
 (YYYYMMDD)

Time: **00** UTC  
12

Please select grid point:



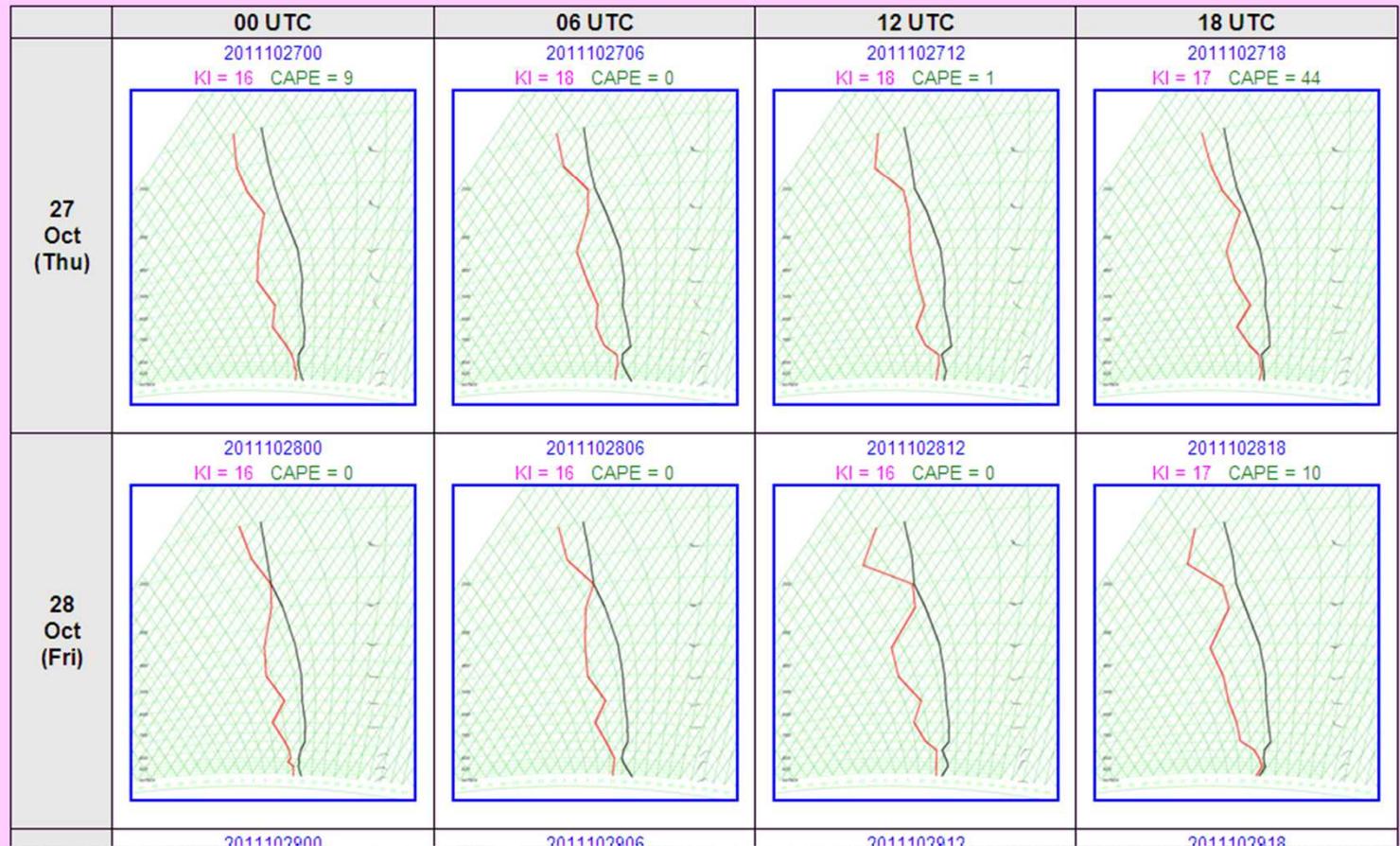
- Related links:
- 1. [NWP Time Series](#)
  - 2. [King's Park Tephigram](#)
  - 3. [King's Park Time Cross](#)
  - 4. [Wind Profiler](#)

## Tephigrams at HK, Grid (22.375N, 114.125E)

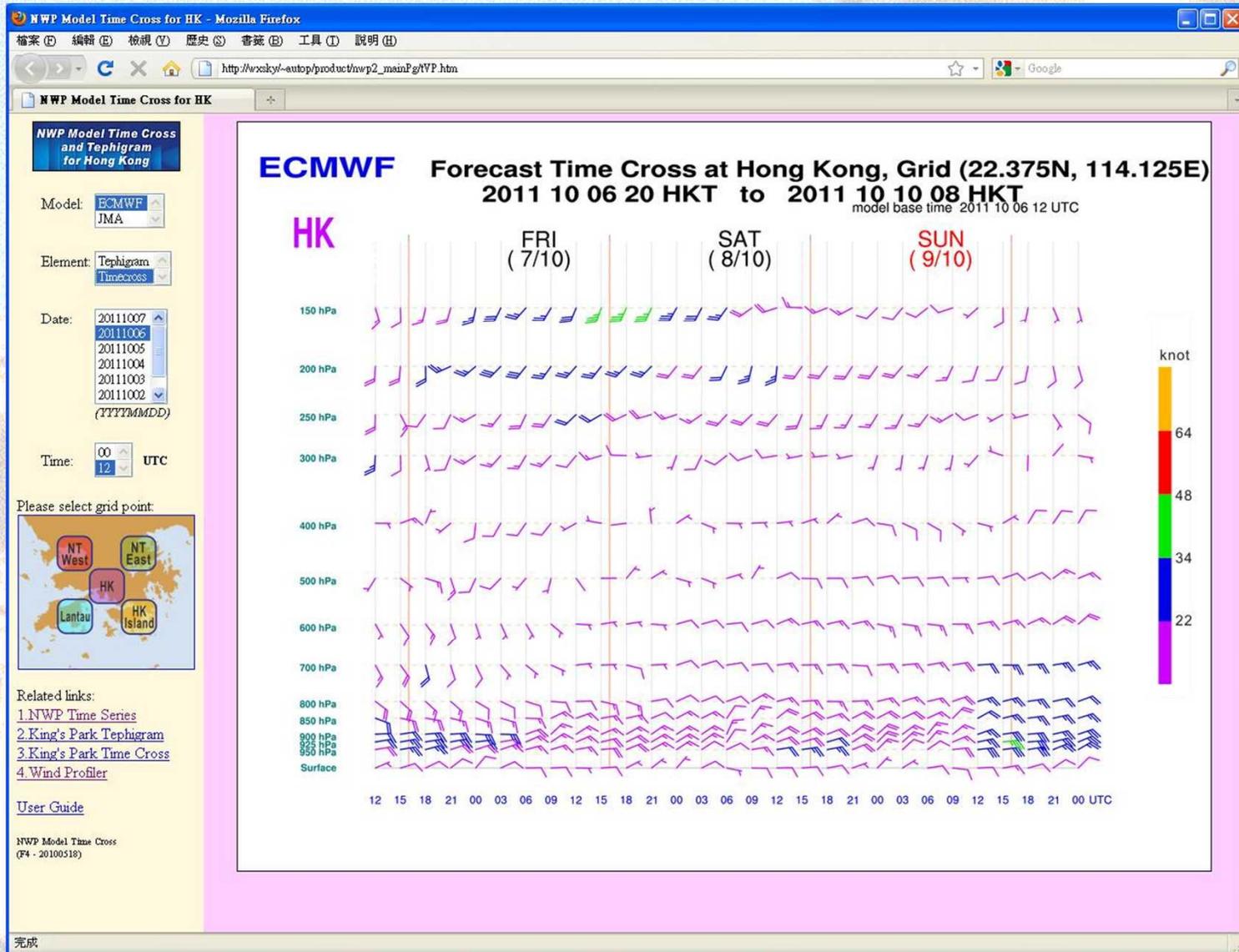
Model : **ECMWF**

Model base time : 2011102700 UTC

(Note: Please click the image to enlarge.)

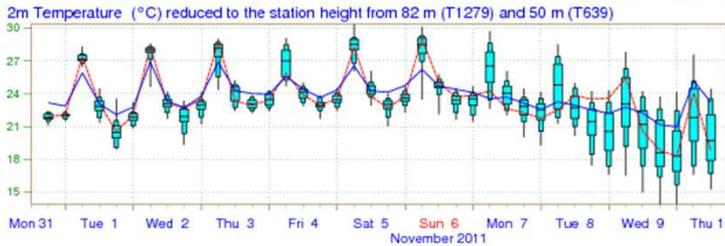
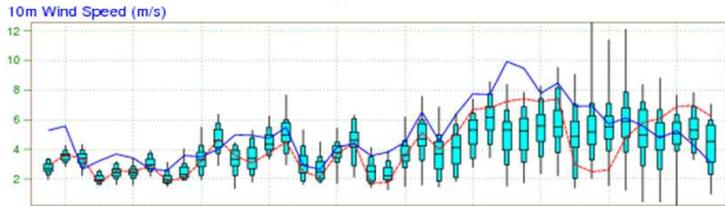
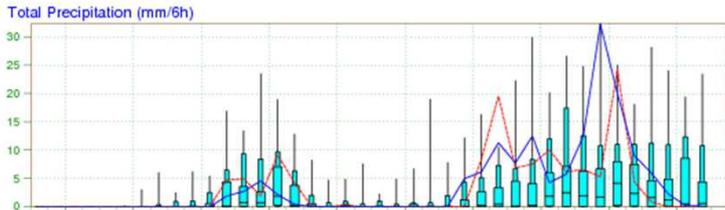
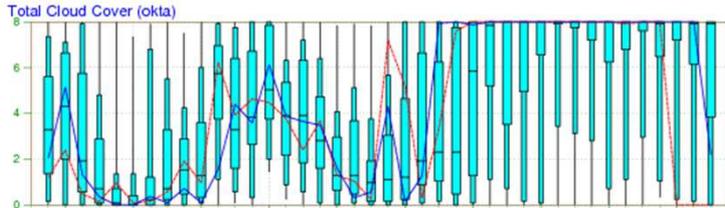


# Application of NWP products



# EPS Meteogram

EPS Meteogram  
Victoria 22.34°N 114.07°E (EPS land point) 0 m  
Deterministic Forecast and EPS Distribution Monday 31 October 2011 12 UTC




 max  
90%  
75%  
median  
25%  
10%  
min  
 EPS Control(31 km) High Resolution Deterministic(16 km)

EPS Meteogram for Hong Kong

Date: 20071200  
20071201  
20071130  
20071129  
20071128  
20071127  
(TTTTMMDD)

Time: 00 UTC  
12 UTC

Please select grid point:

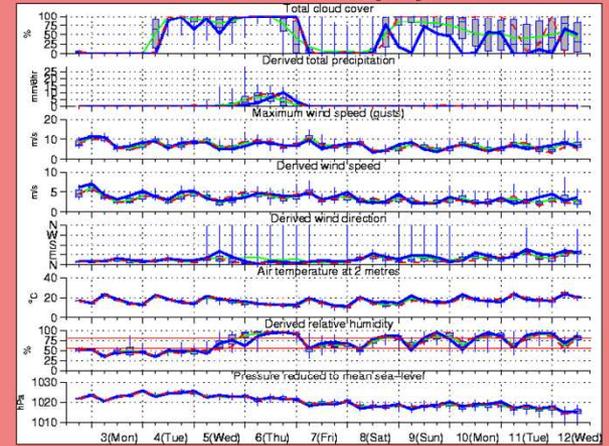


Legend:

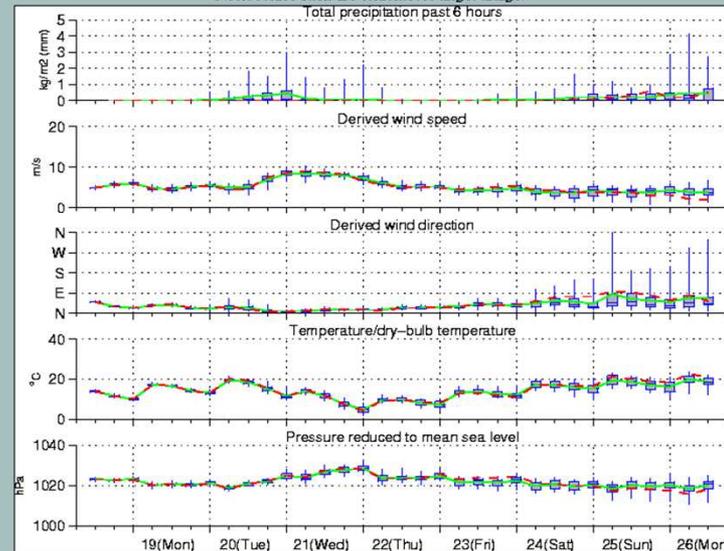
- E - ECMWF EPS Grid Point
- J - JMA EPS Grid Point


 Max  
75%  
50%  
25%  
Min  
 Deterministic  
Control  
Mean

ECMWF EPS Meteogram - NW HK - 22.70N, 113.91E at 2007120212 UTC  
Note: Please click the element for larger image.

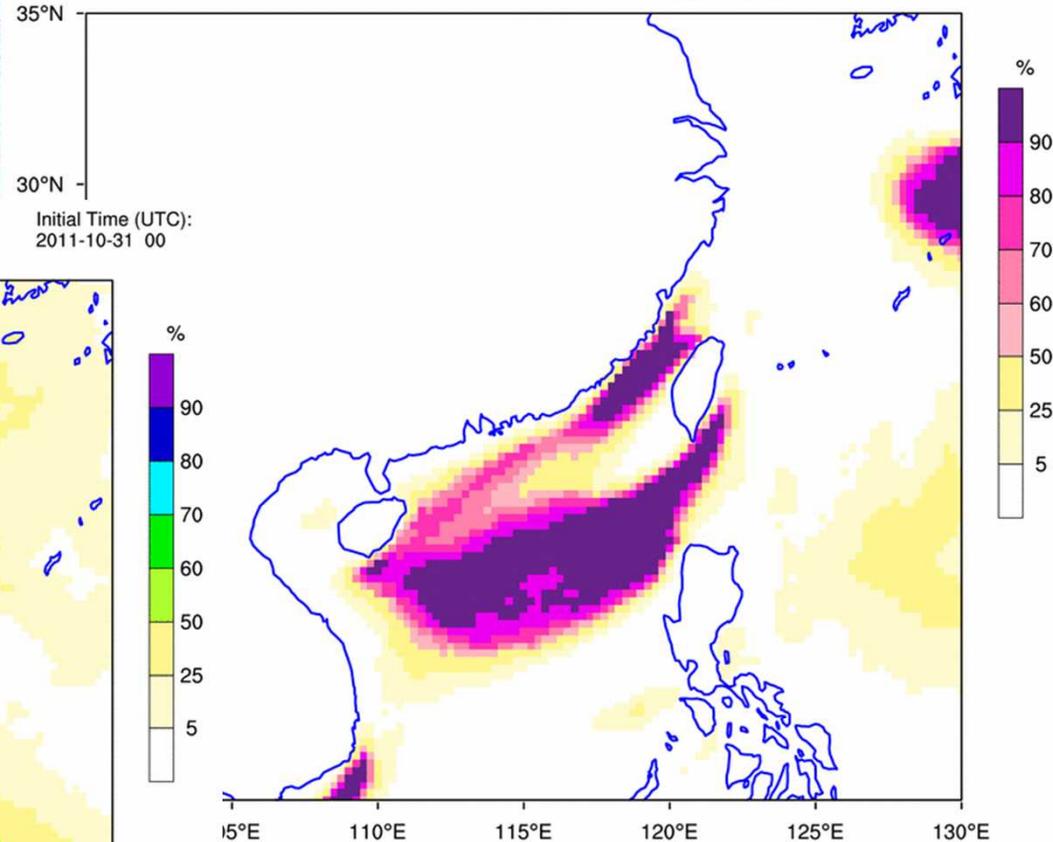


JMA EPS Meteogram - NE HK - Sea Point 22.5N, 114.75E at 2005121812 UTC  
Note: Please click the element for larger image.

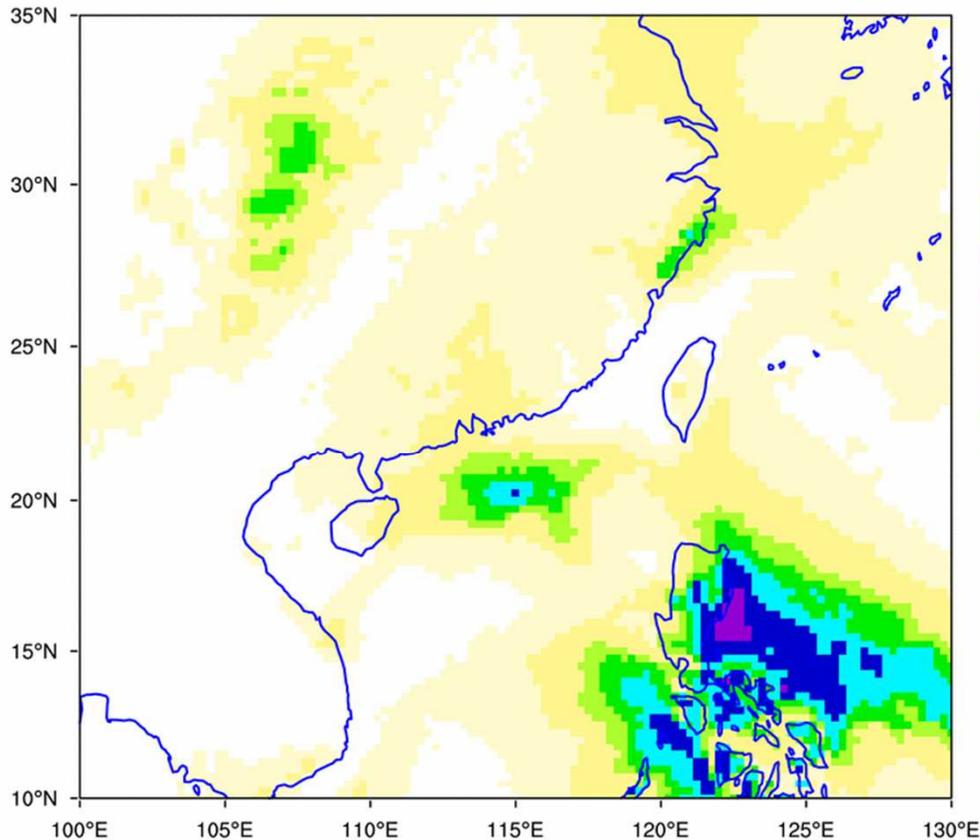


# Probability Forecasts

ECMWF Prob of 10m wind speed  $\geq 10$  m/s (%) **PoW  $\geq 10$  2%** 24 HR F/C 2011 11 01 00 UTC (TUE) Initial Time (UTC): 2011-10-31 00



ECMWF Prob of total pptn over past 24hr  $\geq 10$  mm (%) **PoTP  $\geq 10$  22%** 108 HR F/C 2011 11 04 12 UTC (FRI) Initial Time (UTC): 2011-10-31 00



# NWP Time Series Generator

## NWP Time Series Generator

### Model

ECMWF 0.125 deg

### Base Time

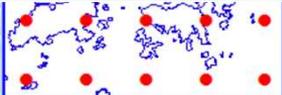
2011102800

### Parameter

CAPE

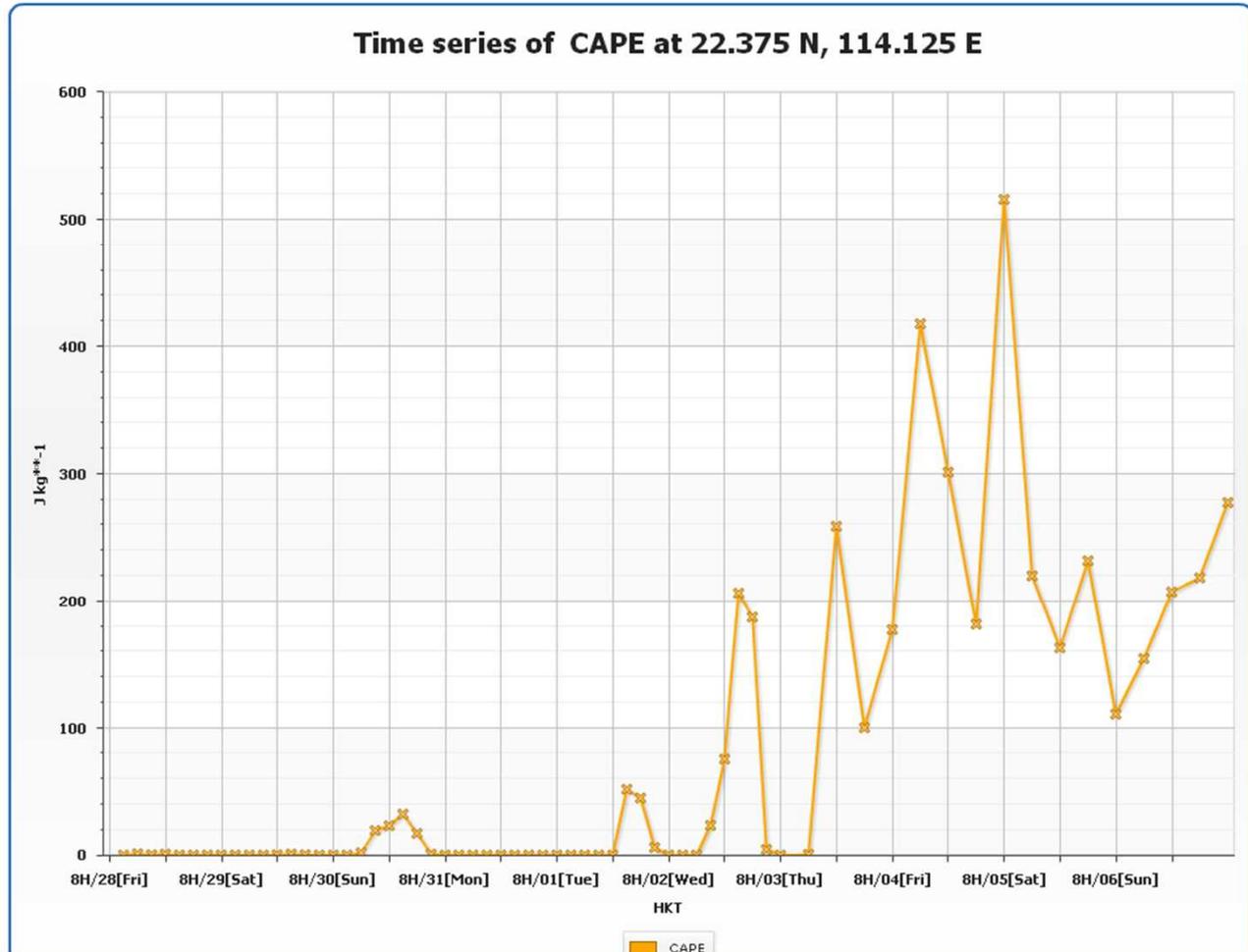
### CAPE

- Total column water vapour
- Total cloud cover
- Low cloud cover
- Medium cloud cover
- High cloud cover
- Total precipitation
- Convective precipitation
- Large scale precipitation
- Mean sea level pressure
- 2 m temperature
- 2 m dewpoint temperature
- 10 m wind speed
- 10 m wind direction
- 10 m wind gust in the past 6 hrs
- 925hPa wind speed (testing)



[ECMWF Terms and Conditions](#)

Time series of CAPE at 22.375 N, 114.125 E



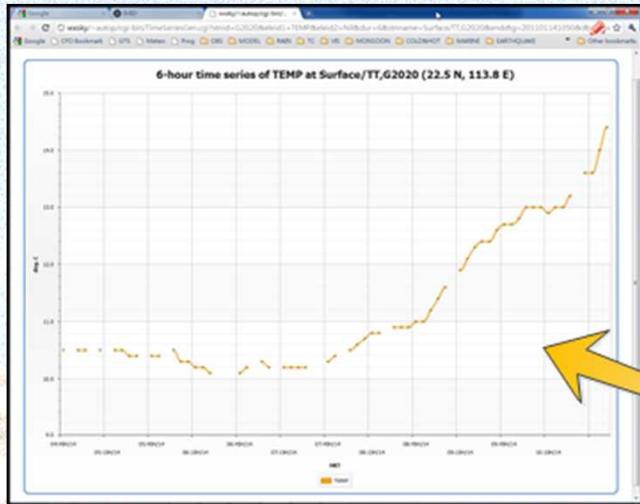


# Integrated Meteorological Information Display System

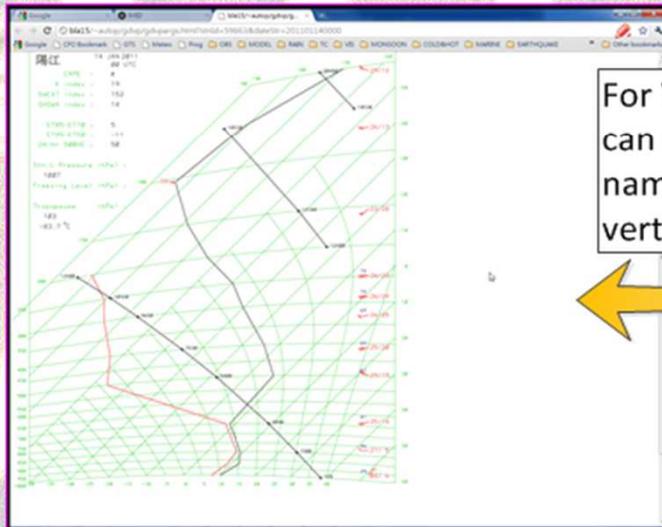
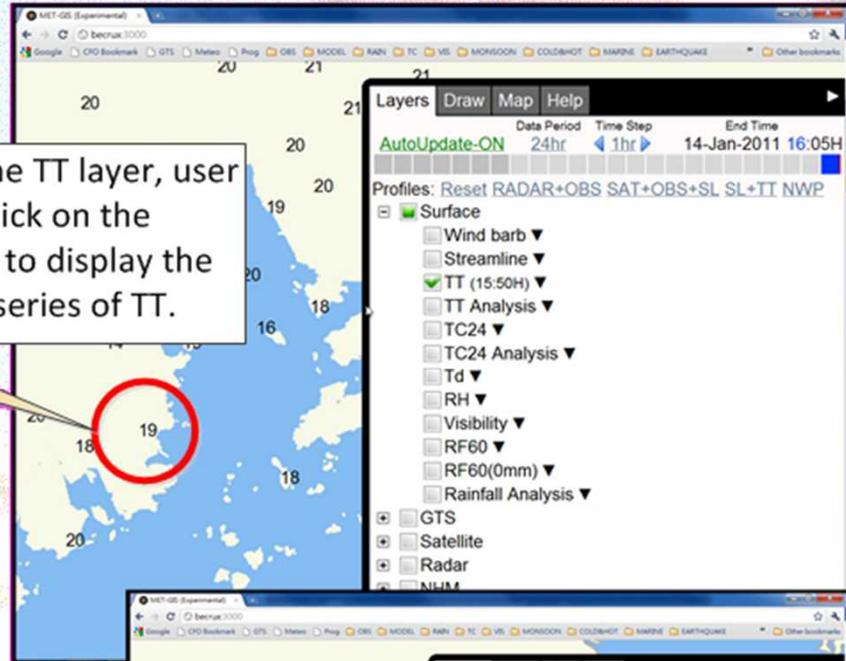
## Actions:

- Hold the left mouse button to drag the map.
- Double-click the left mouse button to zoom-in or use the mouse wheel to zoom-in or zoom-out.
- Hold the left-shift key and the left mouse button to define a zoom area.

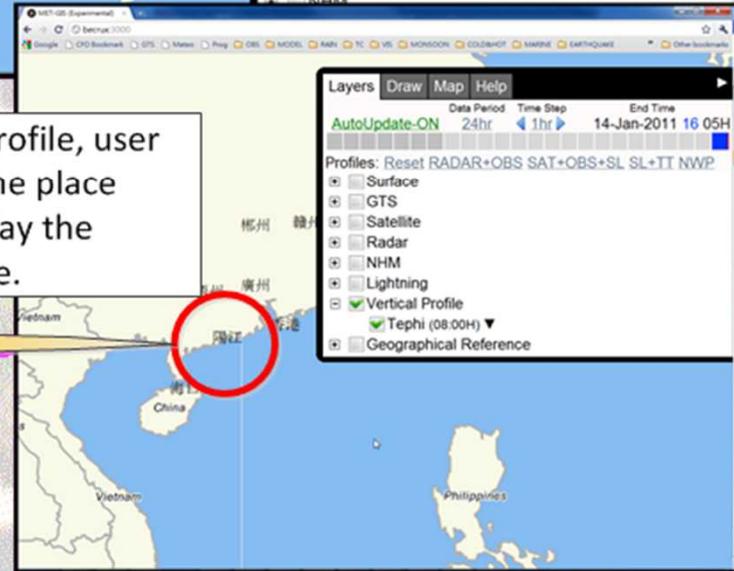
# Integrated Meteorological Information Display System



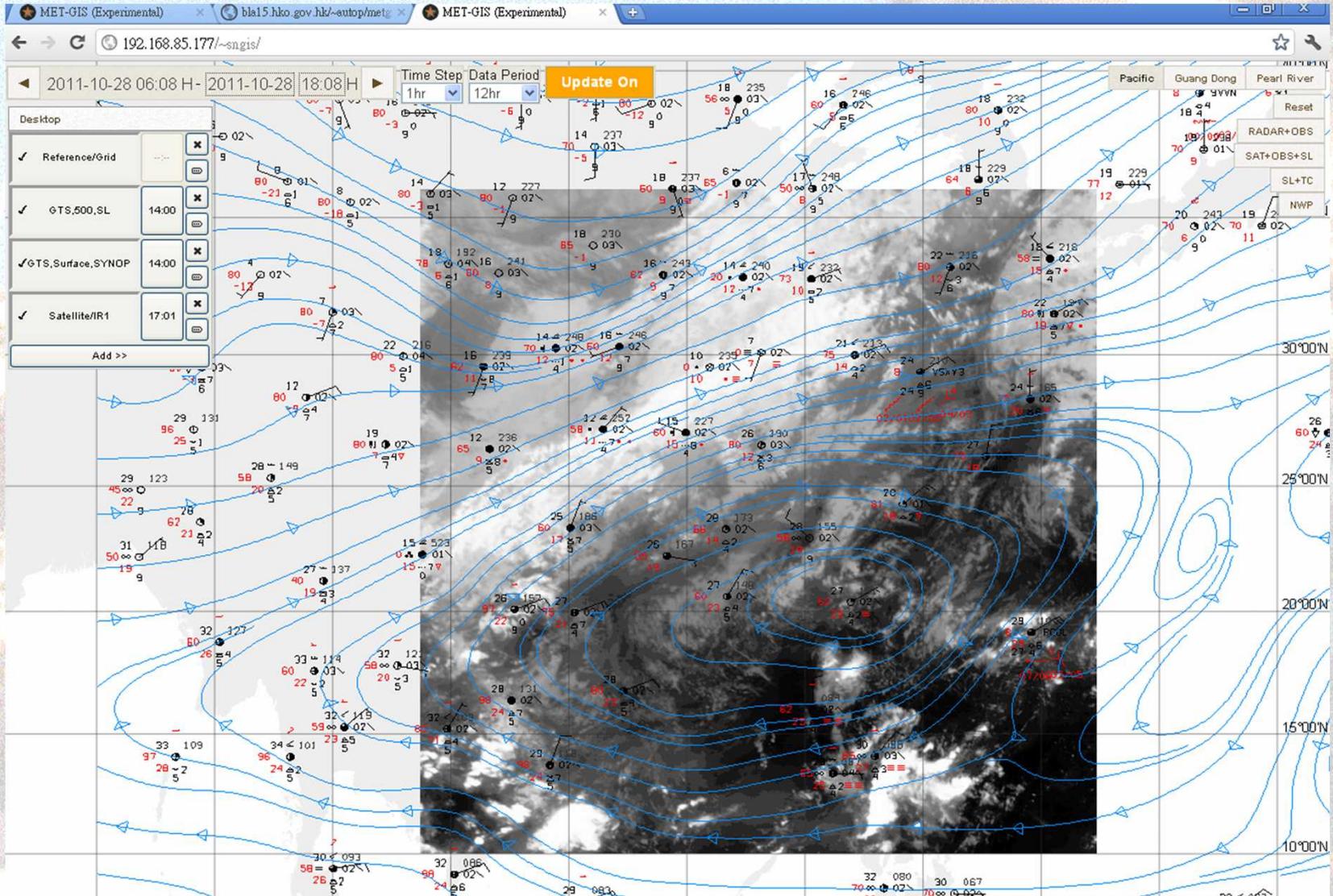
For the TT layer, user can click on the value to display the time series of TT.



For Vertical Profile, user can click on the place name to display the vertical profile.

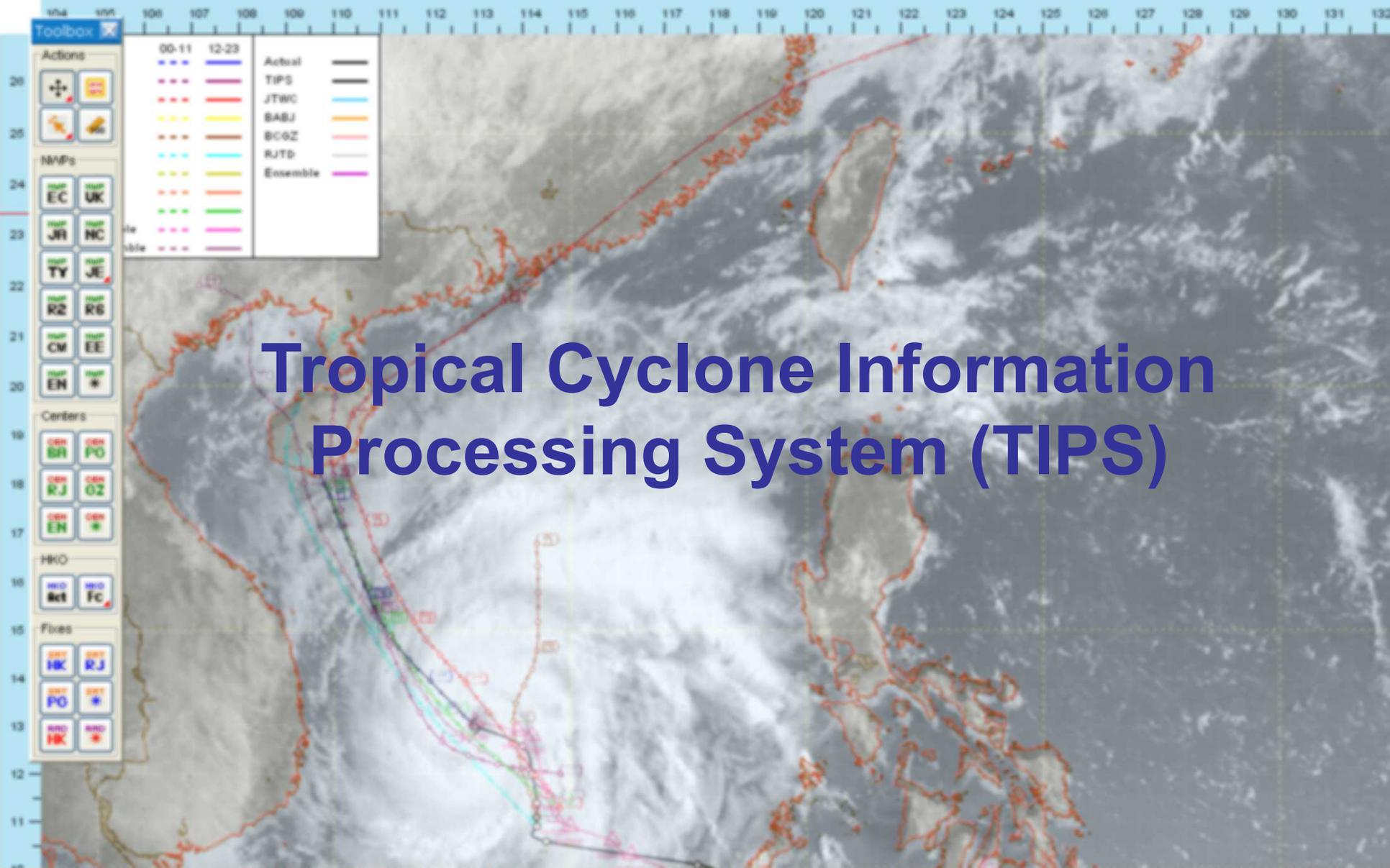


# Integrated Meteorological Information Display System



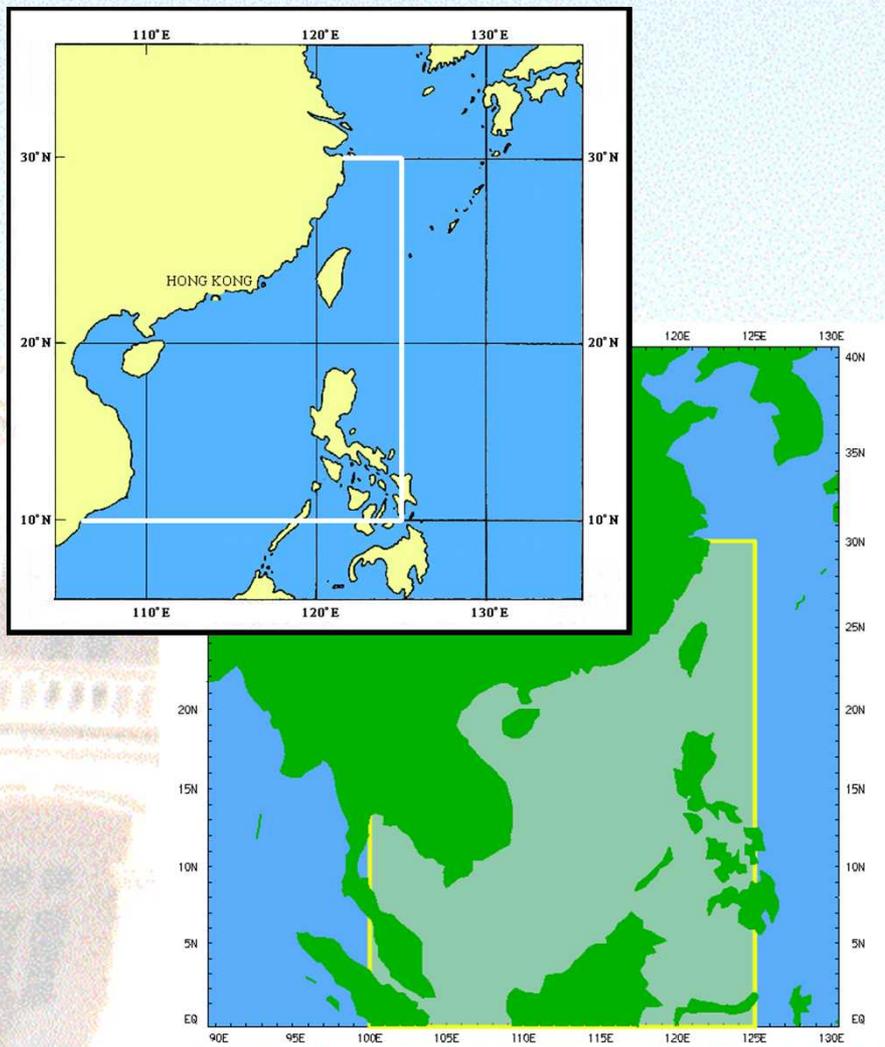
# Challenges

- Quick User Interface Response
- Short Data Update Time
- Data with Time Dimension
- Extensibility
- Maintainability



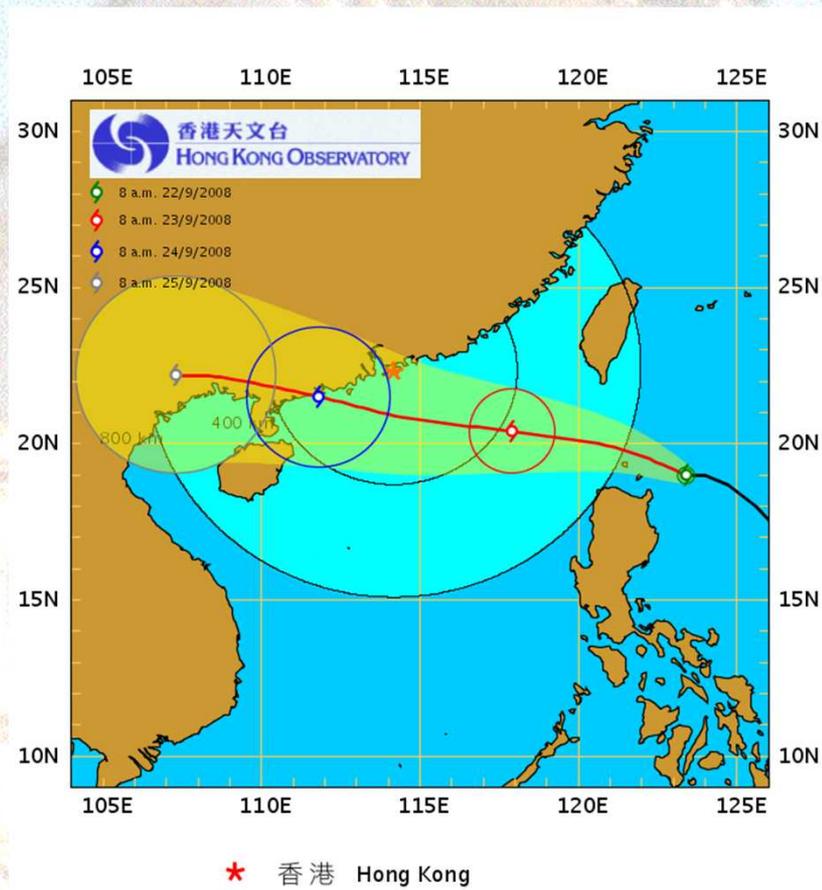
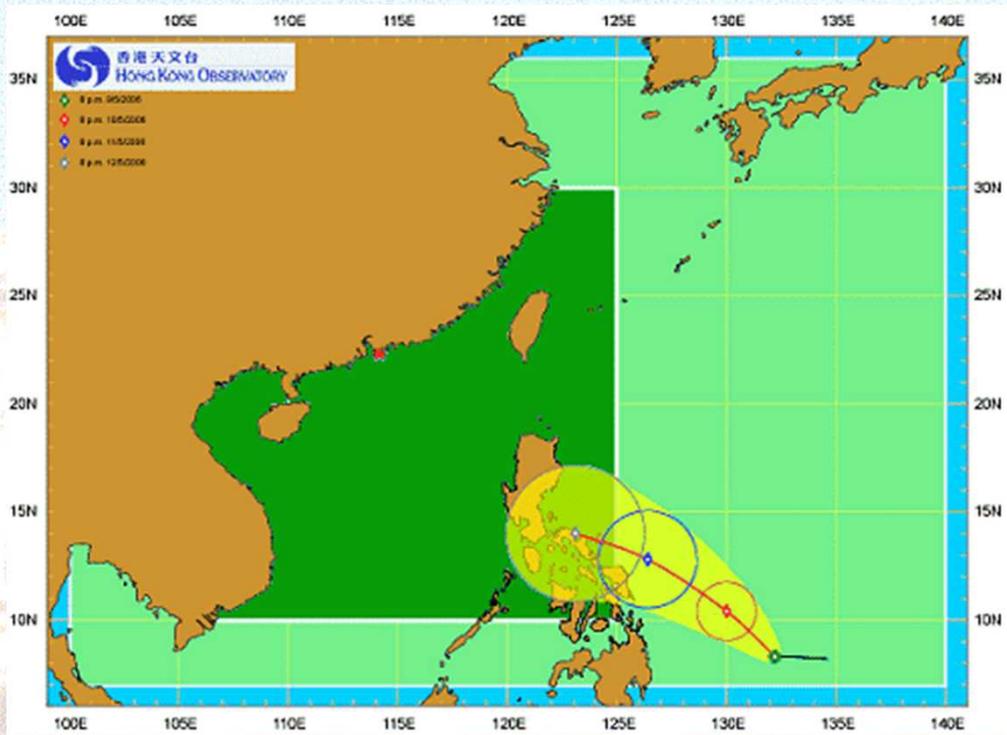
# Tropical Cyclone Information Processing System (TIPS)

# TC Warning Bulletins/Messages



- TC within 10-30N, 105-125E, issue 3-hourly shipping warning
- TC within 0-30N, 105-125E, issue additional GMDSS urgent messages
- Provide a short synopsis including actual position, intensity, max wind speed, movement, high wind radii, etc)
- Provide 24-hourly TC forecast position and intensity up to 72 hours ahead for shipping warning

# TC Products for the Public over the Internet



- Provide TC tracks twice a day

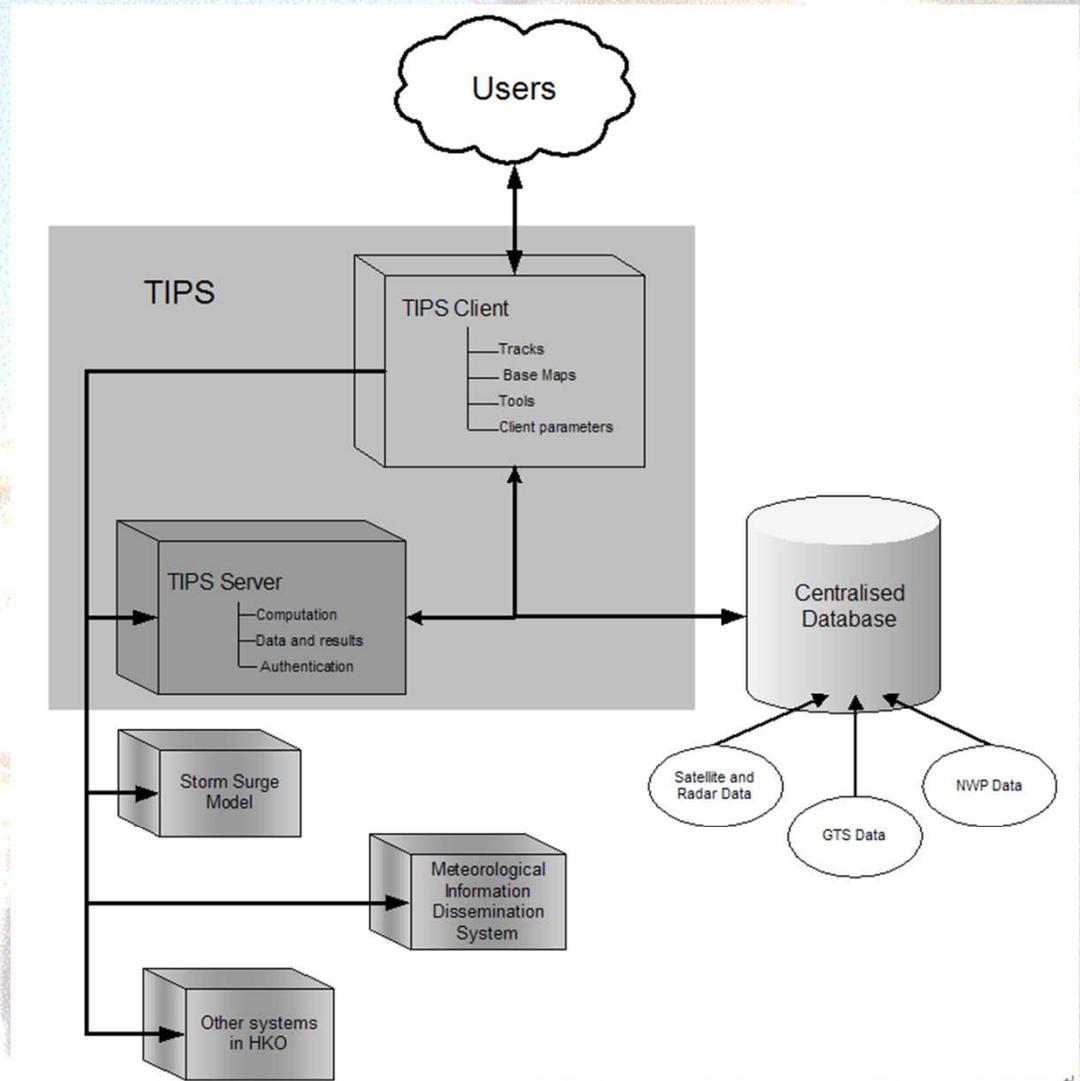
- Provide TC tracks in every 3 hours

## Major functions of TIPS

- Integrate all TC related information and data
- Assimilate TC track data for computation of an ensemble track for operational forecasting
- Compute key parameters for evaluating local impact to facilitate warning decisions
- Generate and dispatch forecast and warning products to the local public and other weather centres

# System Design

- Modular design
- Client-server architecture
- Programming language – Java



# Data sources

- Subjective forecast positions from HKO and other meteorological centres
- TC analysis data, such as satellite and radar fixes
- NWP model forecast positions (HKO, CMA, JMA, ECMWF, UKMO and NCEP)
- Satellite and radar images

# Toolbox

Toolbox

Actions

NWPs

EPSs

Centers

HKO

Fixes

NWPs

NWP EC	NWP UK
NWP JA	NWP NC
NWP R2	NWP R6
NWP CM	NWP NH
NWP EN	NWP *



Global / regional models

- EC – ECMWF
- UK – EGRR
- JA – JMA
- NC – NCEP
- R2 – 20-km ORSM
- R6 – 60-km ORSM
- CM – CMA
- NH – 10 km Meso-NHM
- EN – Model ensemble

EPSs

EPS EC	EPS UK
EPS JA	EPS TE
EPS CM	EPS KM
EPS *	



EPS

- EC – ECMWF
- UK – EGRR
- JA – JMA (one week ensemble)
- TE – JMA (typhoon ensemble)
- CM – CMA
- KM – KMA

3-day forecasts available at T+50  
5-day forecasts available at T+90

Centers

CEN BR	CEN PG
CEN RJ	CEN GZ
CEN EN	CEN *

HKO

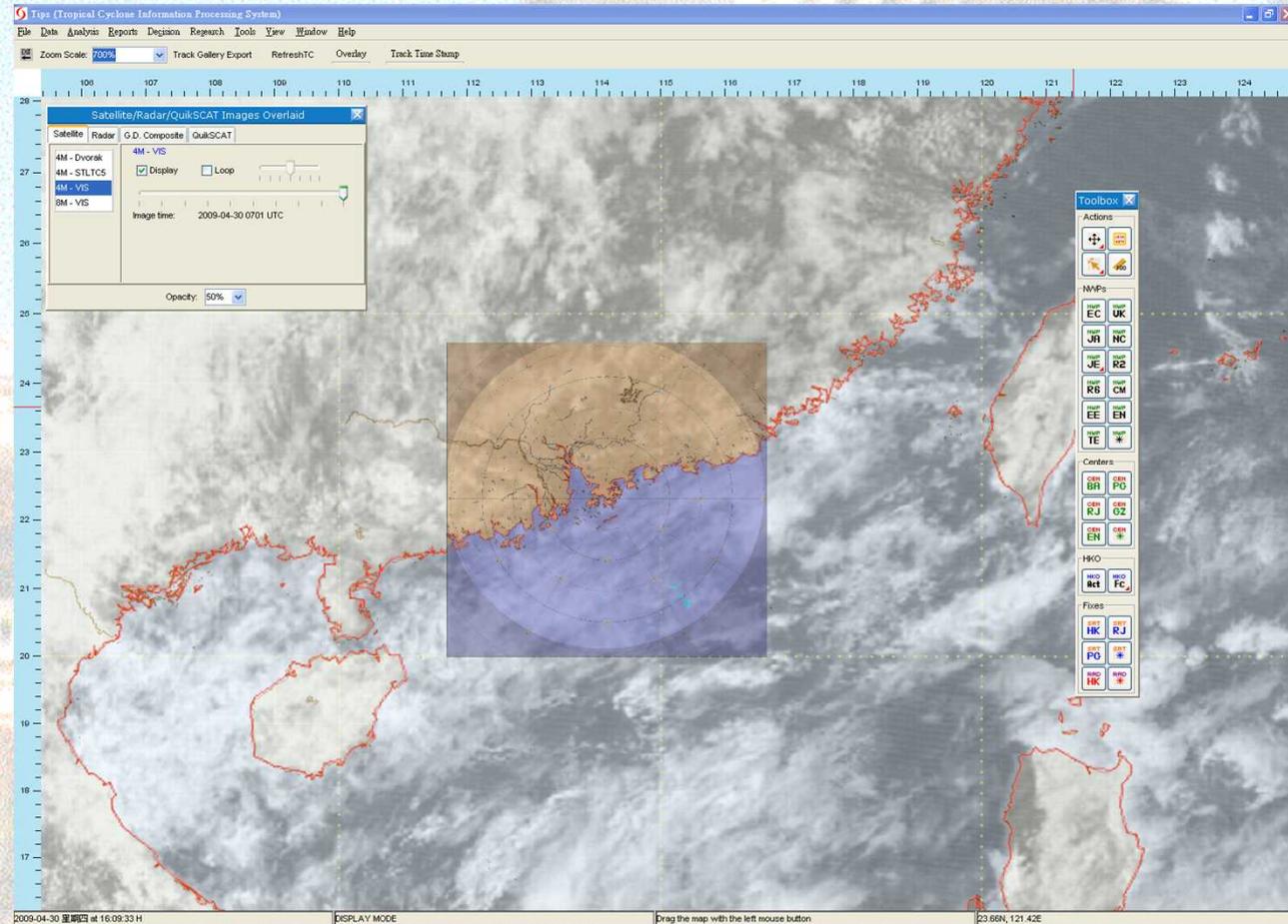
HKO Act	HKO Fc
HKO PF	

Fixes

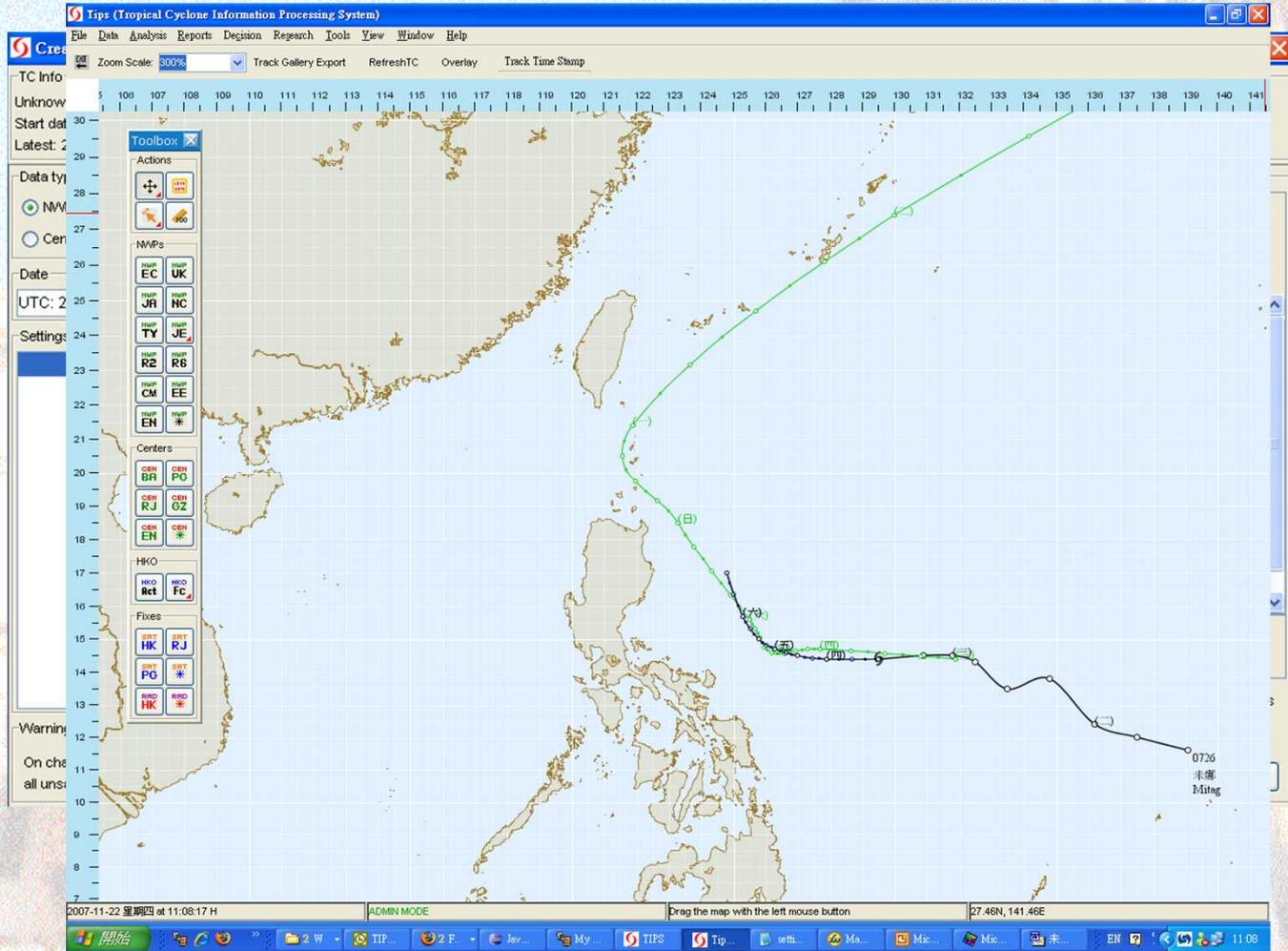
SAT HK	SAT RJ
SAT PG	SAT *
RAD HK	RAD *

# Display of different data sources

- Subjective forecast positions from HKO and other meteorological centres
- TC analysis data, such as satellite and radar fixes
- NWP model forecast positions
- Satellite and radar images

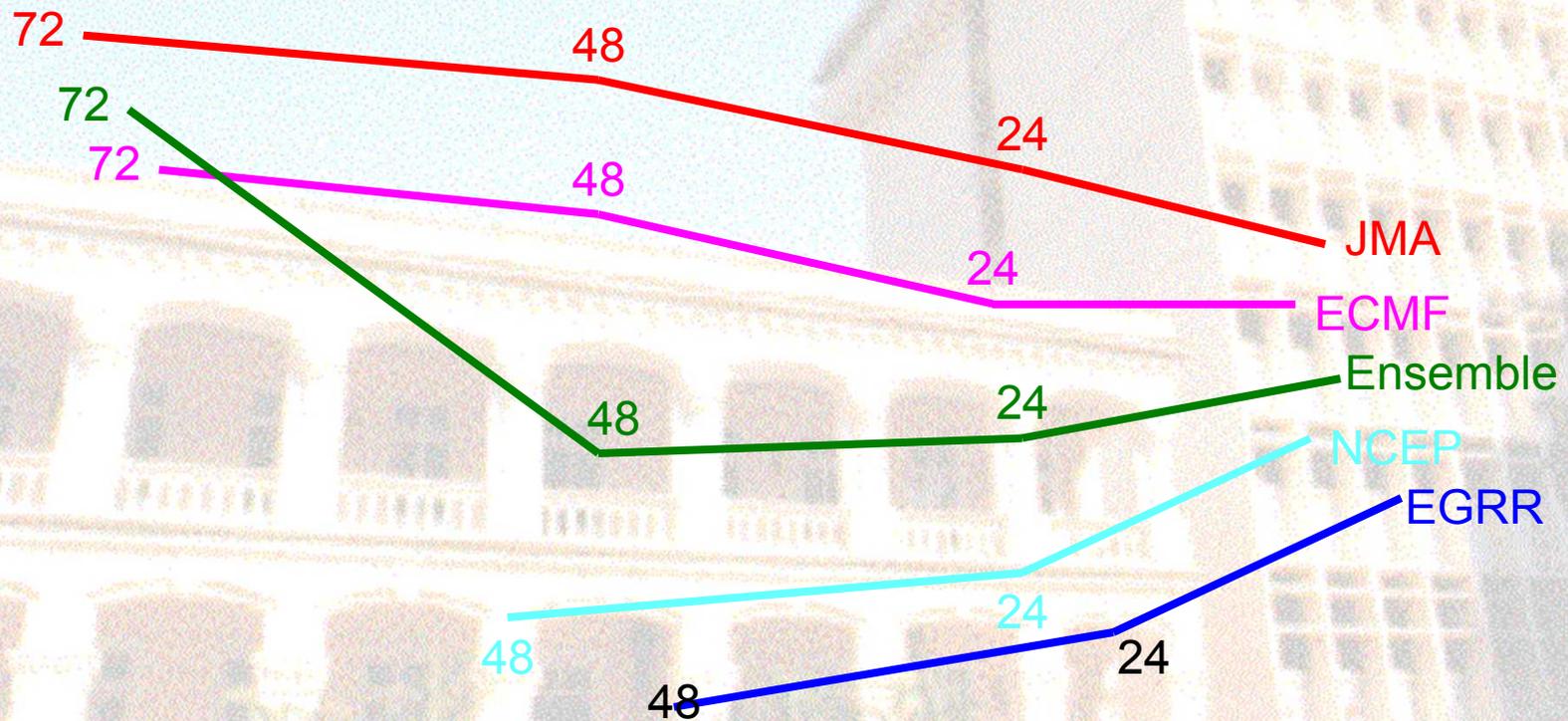


# Calculation of Ensemble Track with data from NWP models



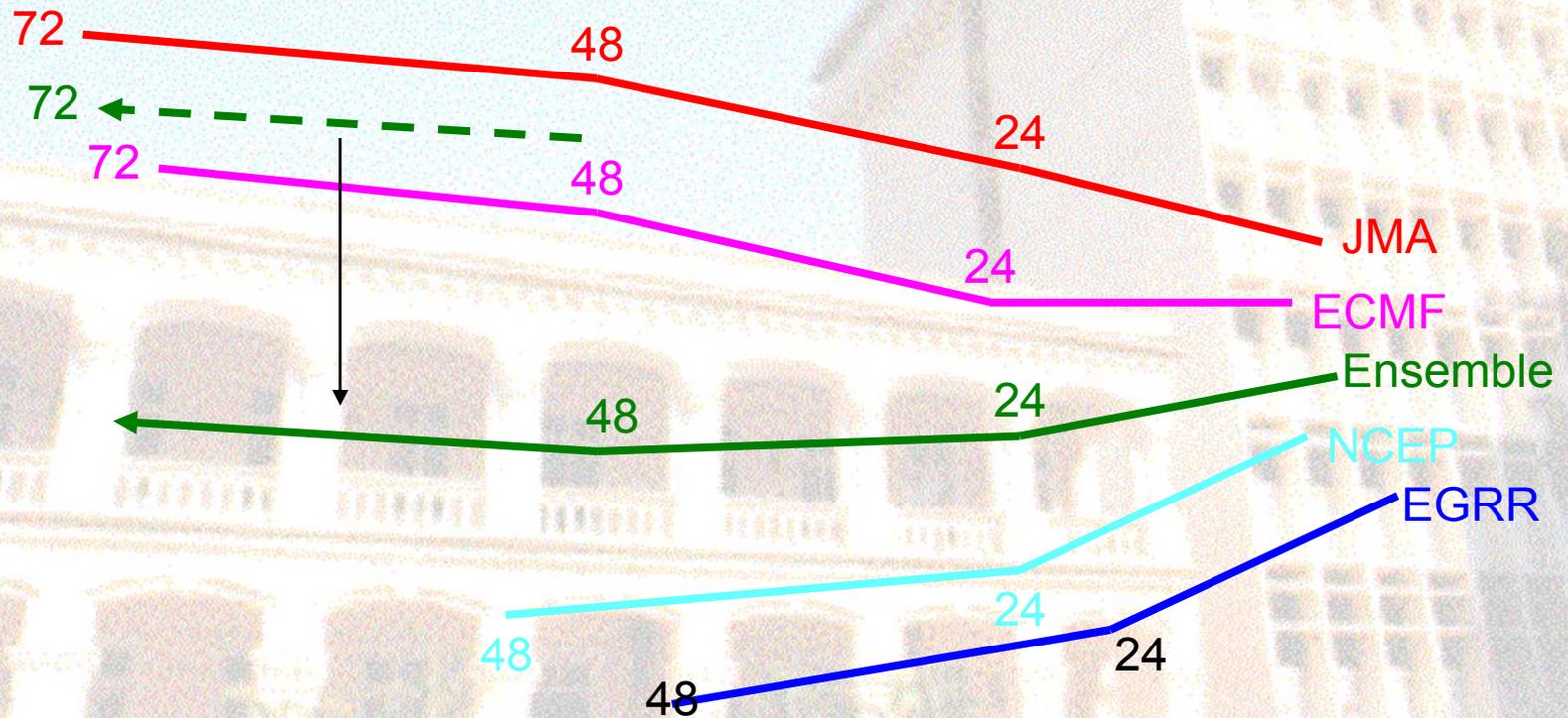
# Calculation of Ensemble Track

## Motion Vector Consensus



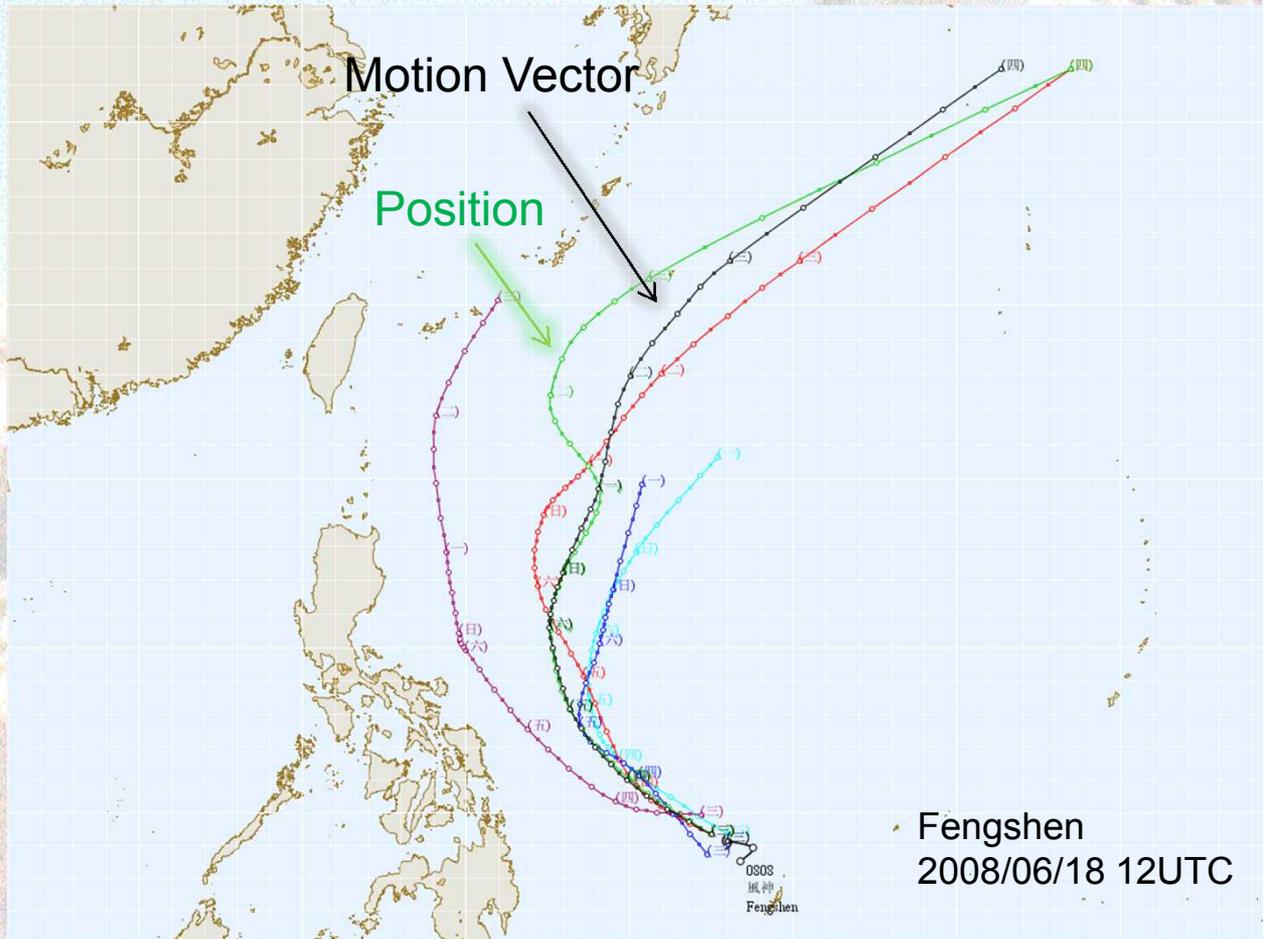
# Calculation of Ensemble Track

## Motion Vector Consensus



# Calculation of Ensemble Track

- Motion Vector Consensus - Example



# Create Working Track

- Press “Drag a point” button
- Drag the working track
- Speed and direction in the table will be changed accordingly



Create or edit working (HKO) tracks - Simple Mode

TC Info

T HKO ID: 0808 (0806) Fengshen 風神

Start date: 2008/06/17 12 UTC; End date: 2008/06/23 00 UTC

Latest: 2008/06/23 00 UTC 17.20N 117.80E

Working Track Data

Show past 5 working tracks

UTC: 2008/06/23 00 hr

Fc hrs	Lat	Lon	Speed(fts)	Dir(deg)
0	17.2	117.8	11	326
6				
12				
18				
24	20.9	116.8	10	345
30				
36				
42				
48	23.7	118.0	8	23
54				
60				
66				
72	25.0	119.4	5	47

Fc 0 hr - Past 6 hrs moving speed & direction

Fc 12 hrs - Forecast 12 hrs moving speed & direction

Fc 24, 48, 72 hrs - Forecast 24 hrs moving speed & direction

Interpolate from HKO track

Interpolate from NWP ensemble

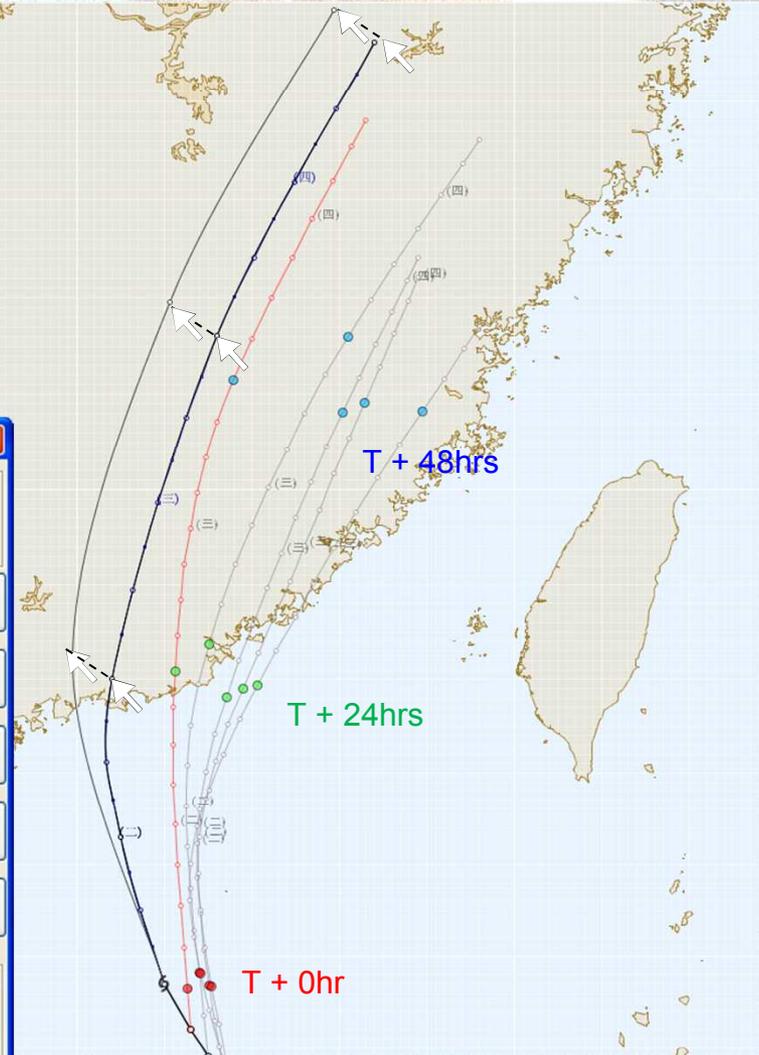
Create from last point

Create from scratch

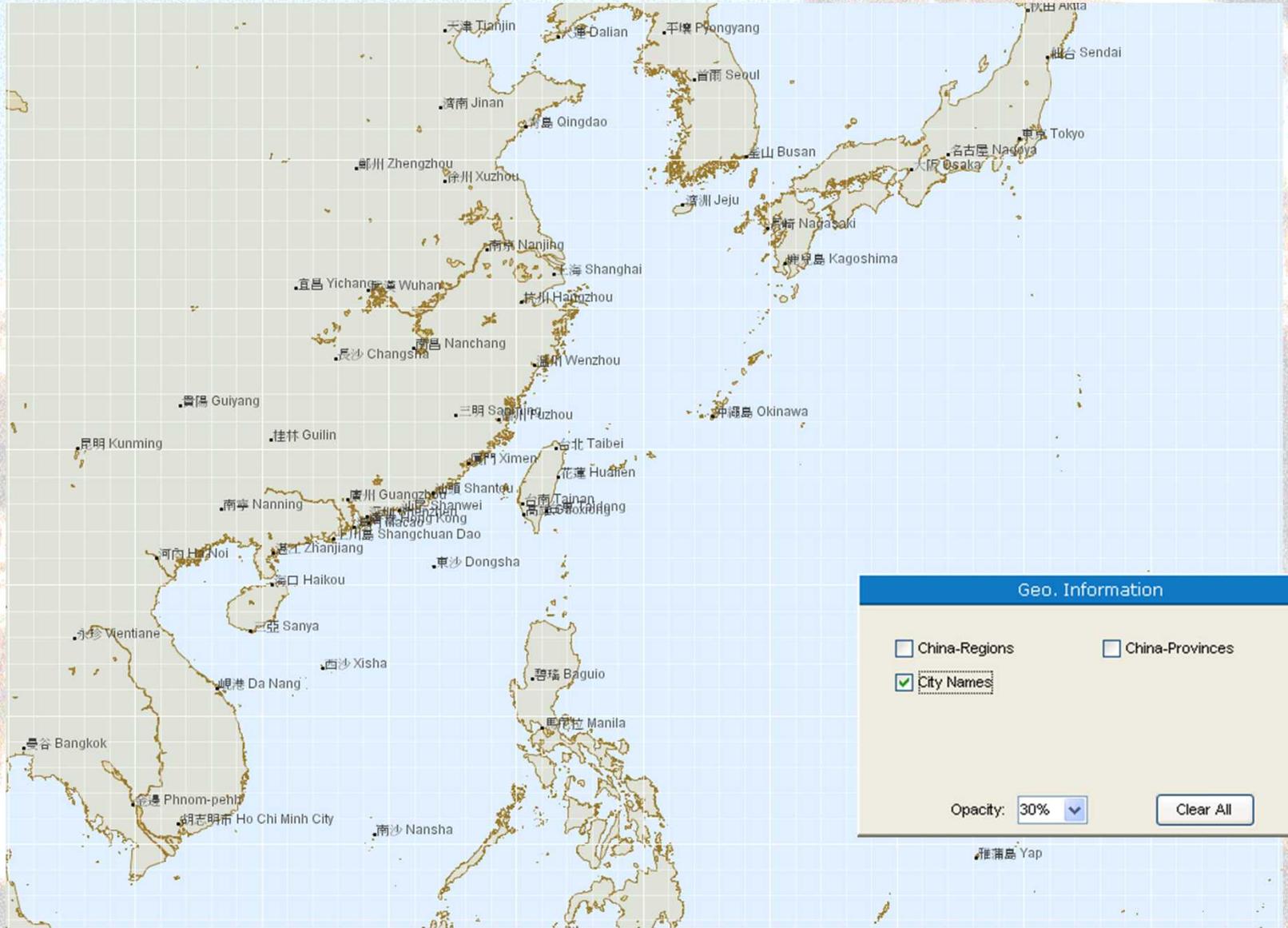
Save selected to Database

Fc Interval (hr)

24



# Geographic Information



Geo. Information

China-Regions       China-Provinces

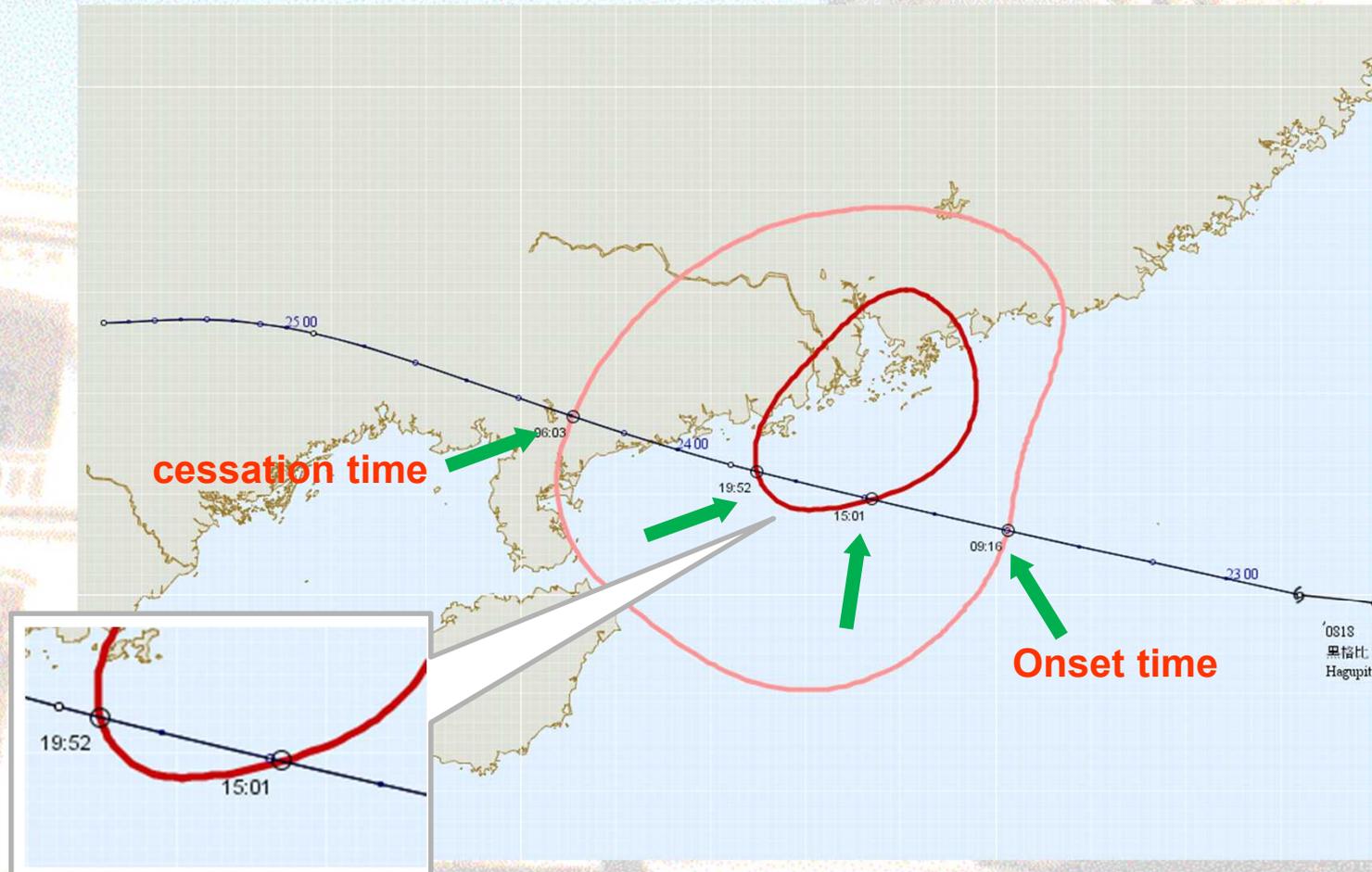
City Names

Opacity: 30%

雅浦島 Yap

# Decision Support

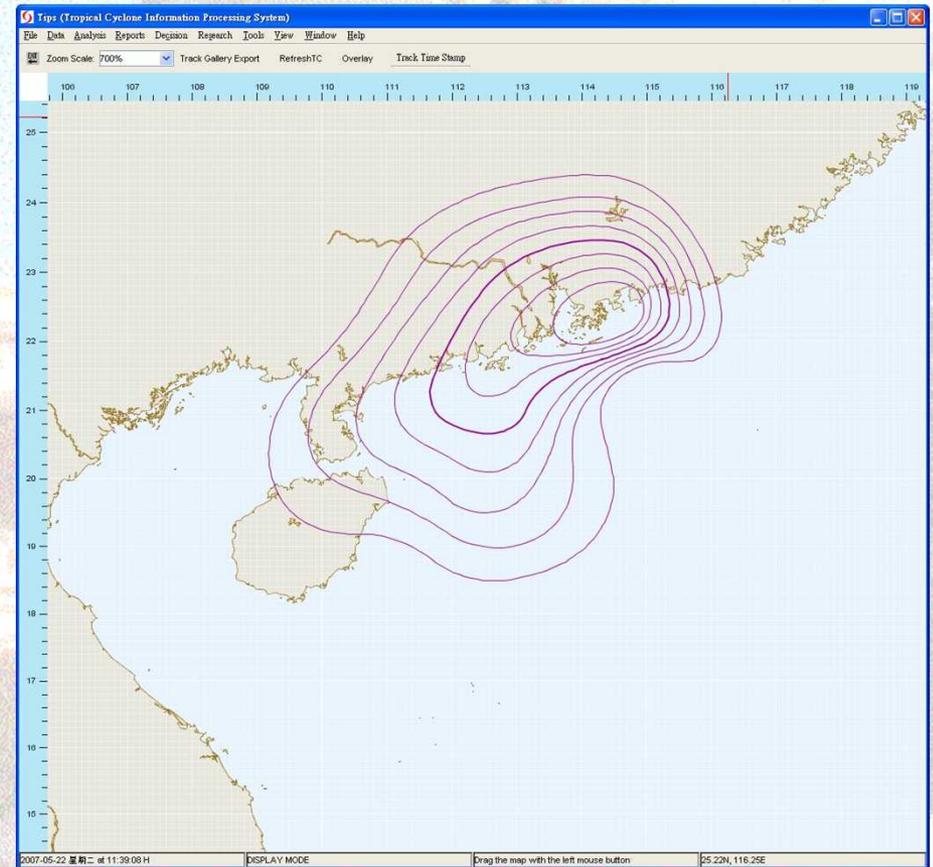
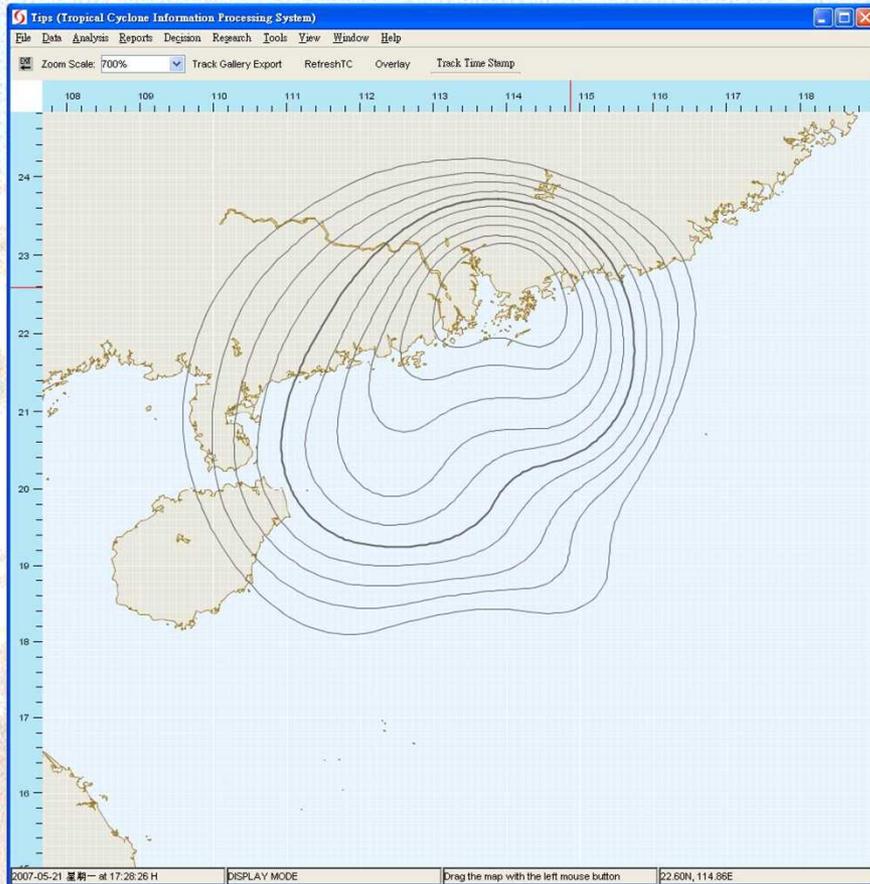
Critical information: distance and time of TC's closest approach to HK, location and time of landfall, onset and cessation of strong and gale force winds, storm surge, etc.



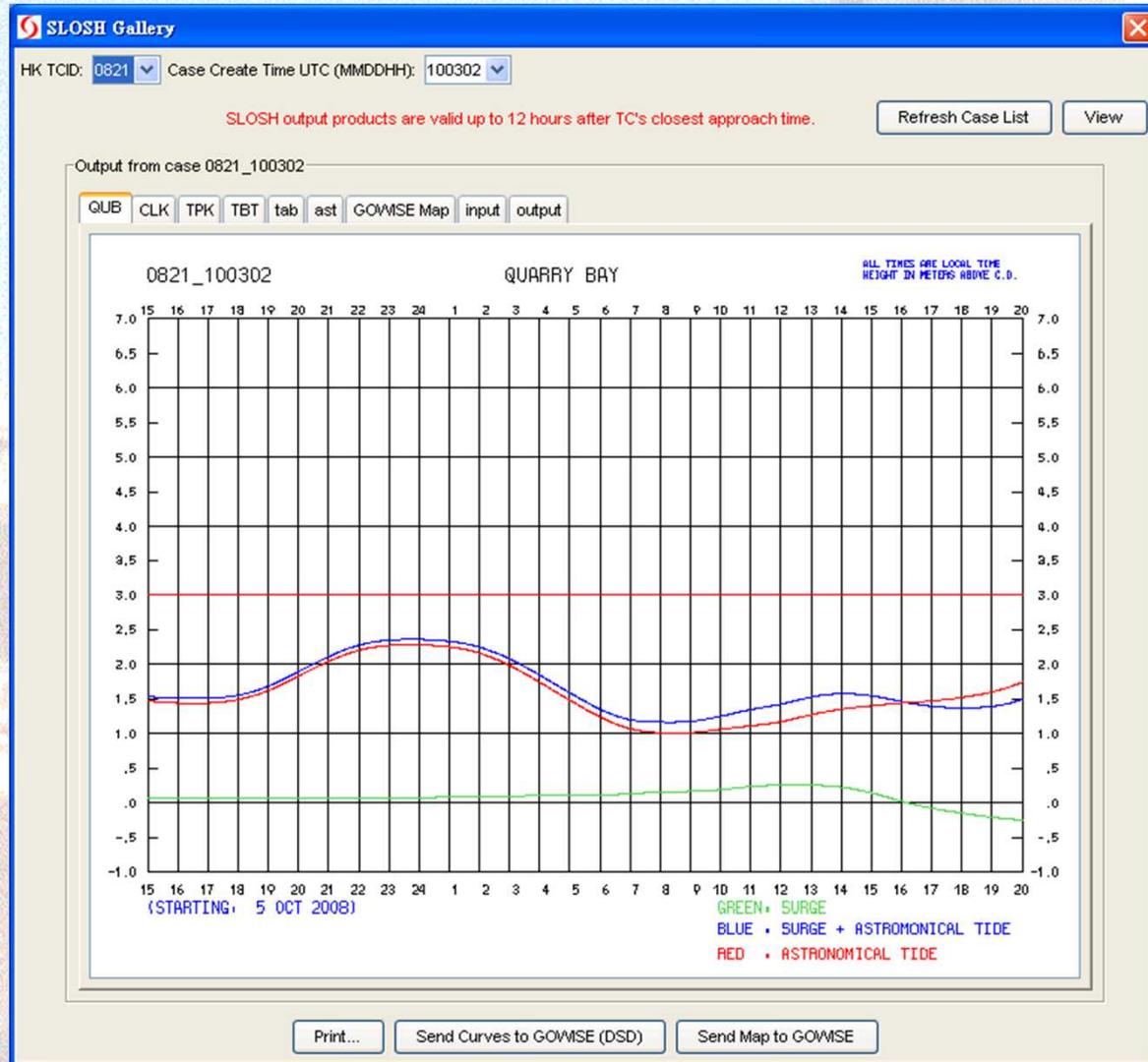
# Probability Forecast of Strong/Gale Winds

Strong wind probability isopleths

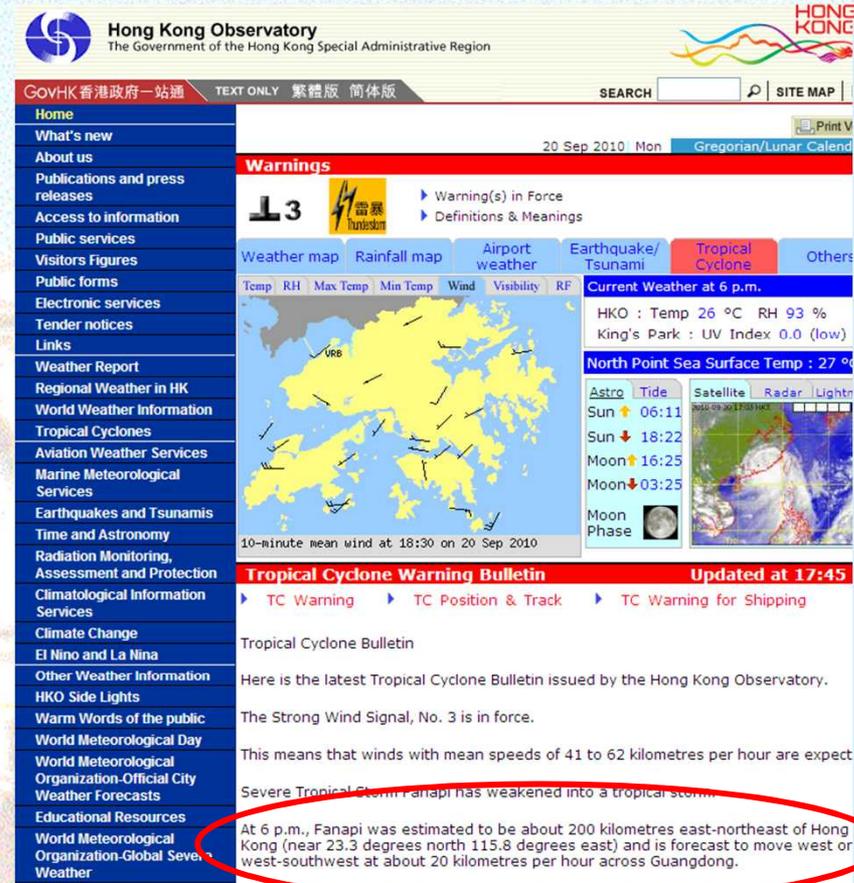
Gale wind probability isopleths



# Prediction of Local Storm Surge Levels



# Generation of Forecast Bulletins and Warning Products for the Public



**Hong Kong Observatory**  
The Government of the Hong Kong Special Administrative Region

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**Warnings**

Warning(s) in Force  
Definitions & Meanings

Weather map | Rainfall map | Airport weather | Earthquake/ Tsunami | Tropical Cyclone | Others

Temp RH Max Temp Min Temp Wind Visibility RF

**Current Weather at 6 p.m.**  
HKO : Temp 26 °C RH 93 %  
King's Park : UV Index 0.0 (low)

**North Point Sea Surface Temp : 27 °C**

Astro Tide | Satellite Radar | Lightn

10-minute mean wind at 18:30 on 20 Sep 2010

**Tropical Cyclone Warning Bulletin** Updated at 17:45

TC Warning | TC Position & Track | TC Warning for Shipping

Tropical Cyclone Bulletin

Here is the latest Tropical Cyclone Bulletin issued by the Hong Kong Observatory.

The Strong Wind Signal, No. 3 is in force.

This means that winds with mean speeds of 41 to 62 kilometres per hour are expected.

Severe Tropical Storm Fanapi has weakened into a tropical storm.

At 6 p.m., Fanapi was estimated to be about 200 kilometres east-northeast of Hong Kong (near 23.3 degrees north 115.8 degrees east) and is forecast to move west or west-southwest at about 20 kilometres per hour across Guangdong.

## Tropical Cyclone Track Information (Beta Version)

Tropical Cyclone:

Name: Severe Tropical Storm CONSON  
Date: 13 Jul 2010  
Position: 14.3 N, 124.1 E

Time: 11 HKT  
Maximum sustained wind: 110 km/h



Map | Satellite | Terrain

## Tropical Cyclone Warning for Shipping

Date and Position  
Classification  
Maximum winds

[Tropical Cyclone Warning](#) | [Track and Positions of Tropical Cyclones](#)  
[Current Weather](#) | [Local Weather Forecast](#) | [7-day Weather Forecast](#)  
[South China Coastal Waters](#) | [Marine Forecast](#)  
[Severe Weather Information Centre](#)

Bulletin issued at 16:00 HKT 20/Sep/2010

**Tropical Cyclone Warning**

At 200600 UTC, Severe Tropical Storm Fanapi (1011) with central pressure 980 hectopascals was centred within 60 nautical miles of two three point four degrees north (23.4 N) one one six point three degrees east (116.3 E) and is forecast to move west at about 13 knots for the next 24 hours.

Maximum winds near the centre are estimated to be 55 knots.

Radius of over 33 knot winds 60 nautical miles.  
Radius of over 47 knot winds 30 nautical miles.  
Radius of over 2 metre waves 120 nautical miles.

**Legend**

- Tropical Depression
- Tropical Storm
- Severe Tropical Storm
- Typhoon
- Severe Typhoon
- Super Typhoon

**Low Pressure Area**

The colors of the symbols indicate the classification of the system.

- Analysed
- Forecast
- Past track
- Forecast

Forecast position and intensity at 210600 UTC  
Two two point seven degrees north (22.7 N)  
One one one point three degrees east (111.3 E)  
Maximum winds 35 knots.

Forecast position and intensity at 220600 UTC  
Two one point eight degrees north (21.8 N)  
One zero nine point zero degrees east (109.0 E)  
Maximum winds 20 knots.

Forecast position and intensity at 230600 UTC  
Dissipated over land.



**Thank You!**