Warning Communication Strategies – Hong Kong Experience

WMO/ESCAP Typhoon Committee Roving Seminar 2014

LEE Kwok-lun, Alan
Hong Kong Observatory
3 November 2014
What is a disaster?

Severe Weather =? Disaster
Severe weather + Human society => Natural disaster
Weather Services & Weather Warning

Hong Kong Observatory Responsibilities

- 24 hours monitoring
- Issuing warnings to the public in time
- Supporting the emergency departments and organizations
**Major Severe Weather Warnings**

**Tropical Cyclone Warning Signals**
- Standby Signal No.1
- Strong Wind Signal No.3
- Gale or Storm Signal No. 8
- Increasing Gale or Storm Signal No. 9
- Hurricane Signal No. 10

**Rainstorm Warning Signals**
- Amber Rainstorm Signal
- Red Rainstorm Signal
- Black Rainstorm Signal
Other Weather Warnings

- Thunderstorm Warning
- Landslip Warning
- Yellow Fire Danger Warning
- Cold Weather Warning
- Frost Warning
- Red Fire Danger Warning
- Very Hot Weather Warning
- Special Announcement on Flooding in the Northern New Territories
- Strong Monsoon Signal
- Tsunami Warning
Disaster Prevention and Mitigation

Casualties caused by Tropical Cyclones (1960-2013)

- 130 deaths in 1962
- 112 deaths in 1971
Rainstorm Warning Systems

Heavy rain has fallen or is expected to fall generally over Hong Kong, exceeding **30 millimetres** in an hour, and is likely to continue.

Heavy rain has fallen or is expected to fall generally over Hong Kong, exceeding **50 millimetres** in an hour, and is likely to continue.

Very heavy rain has fallen or is expected to fall generally over Hong Kong, exceeding **70 millimetres** in an hour, and is likely to continue.
“Graded” Warning System

- Enable the community to build up its response commensurate with the risk involved
  - Rainstorm warning

**possibility of rainstorm of significant impact**

**Amber** 黃

**students should stay in safe places (home or school)**

**Red** 紅

**all should stay put and outdoor workers seek shelter indoors**

**Black** 黑

Note: Be careful when selecting colours for a graded system
Landslip Warning

- Prompt the public to take precautionary measures to reduce their exposure to risk posed by landslips.
- A landslip warning will be issued by the Hong Kong Observatory in conjunction with Geotechnical Engineering Office when there is a high risk of many landslips as a result of persistent heavy rainfall.
Work Flow of the Computation of Landslip Warning System

Rainfall-landslide correlations

23/21 hours real-time rainfall + 1/3 hours forecast rainfall
(Spatial Distribution)

Spatial distribution of man-made slopes

Predicted No. of Landslides
(15 as Landslip Warning Level)
Disaster Prevention and Mitigation

GEO = Geotechnical Engineering Office

Pre-GEO

Post-GEO

Landslide risk increasing

有效的斜坡安全系統
降低了山泥傾瀉的風險
Reduction of landslides risk by effective slope safety system
Deliver the warning message effectively

- Significance of warning = transmit + communicate
- Take care to the public
  Disadvantaged groups
  - Simplify
  - Visualize (symbol, number/color), trigger public actions
- Intellectual clients
  - Smartphones, internet
  - Real time observation for the individual risk assessment and decision making
Weather Information Dissemination to the General Public

Dial-a Weather (1878200)

General Public

Internet (webpage, twitter, youtube)

TV, radio

Mobile phone (iPhone, Android, Windows phone, SMS)

Fax
Warnings in force: always shown on TV
Re-definition of service models

Traditional
• Limited information
• Text/Audio format
• Spoon-fed with data

Internet website
• Attractive and detailed
• Interactively “poll” the required information
• Multimedia
• Anytime and anywhere
• Personalized location service

Mobile platform
Mobile App - MyObservatory

A personalized location-based weather service
A complete suite of weather service via app

- Weather warning
- Forecast
- Observations
- Radar images
- Satellite images
- Lightning location
- Storm track
- UV Index
- Astronomy and tide information
- World major cities forecast
- HKO YouTube
Special Weather Tips (Web & App)

Content consists of:

• Heavy rain alert
• Gust forecast (extracted from thunderstorm warning)
• TC situation
• Other important messages related to significant change of weather situations
Yearly Page Views Statistics of HKO Website & MyObservatory

<table>
<thead>
<tr>
<th>Year</th>
<th>HKO Website (Million)</th>
<th>MyObservatory (Million)</th>
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截止九月底
Up to Sep
Usage of phone for weather information remained steady in spite of rise in internet usage.
Engaging Stakeholders

• Government Bureaux/Department
• Public utilities
• Media
• General publics
Contingency Plan for Natural Disasters for HK

Emergency Support Unit, Security Bureau

- Manage the rainstorm, typhoon, tsunami etc. natural disasters
- Gather up and relate the duties and responsibilities to the government departments or other companies during natural disasters
  - All departments already have the particular duties guideline
- Flow of messages


CONTINGENCY PLAN
FOR NATURAL DISASTERS
(INCLUDING THOSE ARISING FROM SEVERE WEATHER CONDITIONS)

Emergency Support Unit
Security Bureau
Government Secretariat
July 2009

File Ref. SEC 8/2/12 Part 30

Dissemination System
Relay of Warnings within the Emergency Response System

Hong Kong Observatory

- Drainage Services Department
- Security Bureau
- Civil Engineering and Development Department
- Home Affairs Department
- Education Bureau
- Information Services Department
- Office of the Communications Authority
- Other telecommunication companies
- Other government departments & media
- All public transport companies
- The Fire Services Communications Centre
- Transport Department
- The Fire Services Communications Centre
- Information Services Department
- Office of the Communications Authority
- Other telecommunication companies
- Other government departments & media
- All public transport companies
- Transport Department
Main Government Departments

- Security Bureau *(Emergency Support Unit)*
- Education Bureau *(arrangement for the school suspension)*
- Hong Kong Examinations and Assessment Authority *(arrangement for Public Examinations cancellation)*
- Transport Department *(public transport arrangement)*
- Civil Engineering and Development Department *(landslip matters)*
- Drainage Services Department *(flooding management)*
- Home Affairs Department *(open up temporary shelters)*
- The Fire Services *(Rescue operations)*
- Marine Department *(Maritime Rescue)*
Government Departments

- Liaison Meetings (usually annually)
- Communication Exercises
- Drills
- Pre-wet Season Seminars
- Interflow Visits
Liaison Meetings between Government Departments

Well before the TC & Rain Season

- Liaison meetings with essential departments
  - Understand requirements, build up rapport, establish communication mechanism & content
  - Review procedures and revise operation manuals

- Pre-wet season seminars for all government depts
  - Review the content of warnings and relevant precautionary measures
  - Introduce new services
  - Collect opinions
Liaison Meetings between Government Departments

• Geotechnical Engineering Office
• Drainage Services Department
• Transport Department
• Home Affairs Department
• Education Bureau
• Hong Kong Examination & Assessment Authority
• Security Bureau
Liaison Meetings between Government Departments

• Review existing procedures
• Propose new initiatives or requirements
• Update contact list
• Promote better working relationship
• Arranging Communication Exercise / Drill
• Outlook for the year: e.g. No. of TCs, annual rainfall, etc
Government Weather Information Server (GOWISE)

Weather Information Server 2

Welcome to the Weather Information Server 2. This server is dedicated to serving the needs of users by providing the latest weather forecasts and warnings of hazardous weather to support users making decisions on weather-related matters.

Note: The information in the server is intended for internal reference only. Do NOT disseminate the information to third party without the Observatory's permission.

The Weather Information Server 2 only supports Google Chrome 16.0 (or above), Mozilla Firefox 3.0 (or above) or Microsoft Internet Explorer 8 (or above).
Tailor-made weather service for government departments and relevant organizations.
Radar Pictures

- Animation for the past 3 hours (Interval between pictures: 6 minutes)
- Animation for the past 6 hours (Interval between pictures: 12 minutes)
For Transport Department

WIND AND SEA CONDITIONS OVER HONG KONG WATERS

Date/time: 25-10-2013 at 11:00 HKT (updated every 30 minutes)

<table>
<thead>
<tr>
<th>STATIONS</th>
<th>Latest 10-minute Mean Wind</th>
<th>Peak Gust in the Past Hour</th>
<th>State of Sea¹</th>
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<td>3</td>
<td>NORTH</td>
<td>4</td>
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<tr>
<td>CHEUNG CHAU</td>
<td>4</td>
<td>NORTH</td>
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<tr>
<td>WAGLAN ISLAND³</td>
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<td>5</td>
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<tr>
<td>EAST PING CHAU</td>
<td>2</td>
<td>NORTH</td>
<td>4</td>
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</table>

Remarks
1. Beaufort Wind Scale.
2. Estimate based on wind information.
3. The anemometer at WAGLAN ISLAND is well above sea level. Thus the wind force reported at the station may be higher than that near sea level.
4. "N/A" -- Data not available.

Locations of Stations
## Wind and Sea Conditions over Hong Kong Waters

**Weather Information Server 2**

<table>
<thead>
<tr>
<th>STATIONS</th>
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### Locations of Stations

[Map of Hong Kong Waters showing locations of various stations]
Public Utilities

- Liaison Meetings
- Briefing Sessions
- Interflow Visits
- Lunch
Forecasters visiting the Hong Kong International Terminals (HIT)
Typhoon Precautions
A Step-by-Step Overview

Preparation for an incoming typhoon at a container terminal is no easy task and requires hours of work. HIT News speaks to those involved about the steps that are taken before, during and after a typhoon reaches Hong Kong.

Typhoons affect Hong Kong every year between the months of May and October, bringing with them excessive rain and high wind speeds that in some cases can be in excess of 165 kilometres an hour.

A container terminal operator such as HIT has comprehensive and systematic precautionary measures in place for all adverse weather conditions including typhoons, strong winds, and heavy rainstorms.

At HIT, the process of dealing with a typhoon begins as one is forming near the 800km offshore boundary. The 800km boundary is the distance at which the Hong Kong Observatory (HKO) typically raises tropical cyclone warning signal number 1.

As a typhoon moves closer to the territory and warning signals are raised, the precautionary procedures at HIT kick in, and the different parties involved work together to ensure all is as safe as possible.

These activities are usually kick-started by an internal meeting held by the Operations and Engineering Departments to discuss precautionary measures. These departments look at the latest weather updates and estimate the time the typhoon will make landfall in Hong Kong.

Working backwards from the estimated arrival time of the storm, an action plan is formulated, providing a timeline from which to co-ordinate activities, from securing containers and equipment to deciding when to close the terminal.

Throughout the entire process, the safety of HIT's staff and contracted workers is a priority, with every step closely supervised and decisive action taken in accordance to the prevailing weather conditions.

According to Perry Pang, HIT's Manager, Operations Planning Services, "Given the many different operational activities happening in the yard and the volume of containers we handle, it is simply not feasible for us to begin the preparations only after the HKO has hosted the tropical cyclone warning signal number 1. There is no compromise on safety and we have to start early."

"We rely on the information from the HKO, which includes a three-day weather forecast for typhoons. As a supplement, we also check websites of other meteorological centres in the region that are in range of the typhoon," Perry said.

The precautionary measures at this early stage involve marshalling lashing materials around the terminal in preparation for the hoisting of signal number 1, ensuring that empty stacks containers in the terminal and depot, as well as the outer rows of idle stacks, can be lashed without delay.

"The progress and scale of the precautionary works all depends on the likelihood of the typhoon signal being raised to a higher level, so we keep close contact with the HKO to determine if the possibility is fair or low," Perry said.

He added, "We would still look at securing empty stacks even if the possibility of raising the typhoon signal is low."

After signal number 1 has been hoisted, the lashing work intensifies, and the stevedores who are responsible for lashing activities - known as typhoon lashing gangs - spring into action. Each typhoon lashing gang comprises six people and the additional manpower needed for typhoon safety precautions typically numbers around 100 stevedores.

Eyeing the Storm

With predictions that this year’s typhoon season could bring an above-average six to nine storms, HIT News went to the HKO offices to find out just what goes into predicting storm movements.

Two forecasters look at cloud, rain, lightning and other weather patterns on a bank of monitors bring a well in the control room at the Hong Kong Observatory (HKO).

This quiet room is the nerve-center from which tropical cyclones are monitored and from where the important decision to raise or lower tropical cyclone warning signals number 1 (standby) through 10 (hurricane) is decided.

Located in a colonial-era building dating back to 1883 this control room, one of two forecasting offices run by the HKO, is responsible for local and marine forecasting. The other office located at the airport oversees aviation forecasting. The HKO has a staff count of about 300, most of them working regular hours, but the forecasting office operates 24 hours a day, 365 days a year.

“We always monitor the northwest Pacific area for possible tropical cyclone development,” said Mia Lam, Assistant Director at the HKO. “If the tropical cyclone is outside our warning area we still analyse its intensity, forecast its movements, and put out a forecast twice a day on our website.”

The HKO’s warning area covers most of the South China Sea and extends to the longitude line 125 degrees east. “As soon as a tropical cyclone enters 125 degrees east we start our shipping warning, which is issued every three hours. It gives ships a three-day forecast, the position and intensity of the storm, as well as the risk of its influence in terms of wave and wind,” Lam said.

At this early stage there are still many factors that can affect the strength and direction of a storm, but if it continues towards Hong Kong and enters within 800km of the territory, the HKO intensifies its monitoring and gradually adds staff to the forecasting office. The forecasting office is typically manned by two forecasters, three supporting staff, and a senior officer, but during a typhoon the number of staff is almost doubled and the Observatory director is also present.

Still, the decision to hoist signals number one, and subsequent signals is not automatic. “We don’t necessarily put up signal number one when the storm comes within 800km. It depends on where it is heading. We may not even raise the signal, if it is not expected to affect Hong Kong,” said Lam.

Every year around March the HKO starts an outlook for the year with the number of tropical cyclones expected to come within 500km of the city. “We arrive at these numbers using the computer to calculate the general weather patterns by using the temperature and humidity at local and global extremes,” said Lam. Using these techniques, the HKO predicted an early typhoon season with six to nine storms for 2011.

“The way that we forecast the start of the typhoon season is by looking at our satellite records and analysing them against the phenomenon of El Niño and La Niña. During El Niño years the tropical cyclone season is going to start late, like last year, but for La Niña years it can start early. We are now still in the La Niña stage, though weathering...”

The HKO prepares for a year’s typhoon season with seminars and drills, bringing various groups such as the Education and Transport departments up-to-date with the latest operational procedures. HIT participates in HKO seminars, as well as communications tests, to ensure that in the event of a typhoon there is a smooth flow of information.

Lam noted that providing weather information for the public and for industry bodies, such as HIT, follows the same general principles of giving timely and accurate information for the sake of safety. One noticeable difference he pointed to is the general public has diversified needs, but a company such as HIT has quite specific requirements.

Compare, for example, the HKO website and online/mobile applications, with the Storm Alarm developed by the HKO together with HIT and other terminal operators.

The HKO website is a comprehensive database of weather information, catering to users who want simple bulletins as well as those who have a more sophisticated understanding of weather systems and want to view raw data. The HKO uses Twitter, Weibo, YouTube, and recently launched the smartphone application MyObservatory. The HKO also runs two international weather websites: World Weather Information Service and Severe Weather Information Centre

In contrast, the Storm Alarm, with its wind sensors stationed around the terminal, has the specific purpose of helping HIT to keep track of changing winds in the area that may affect operations. The two main tools used by the HKO to track tropical cyclones and forecast their movements are satellite, which looks at cloud patterns, and radar, which monitors rain.

Gust front crossing Hong Kong in half an hour on 5 May 2005

A: container accident
B: scaffolding collapse
Strong gusts associated with thunderstorms blew down stacks of containers on 9 May 2005
Media Reports

- Brought down trees and scaffoldings
- Severe traffic jam
- 0.5 million people affected
- 25 million USD economic loss
Specialized Service - New Gust Alarm
(Tailor-made for Container Terminal Operators & Related Government Departments)

- Four selectable regions for audio alert
- Table showing the max gust reaching the threshold values in the latest 20 minutes for easy reference

![Map of 10-min maximum gusts ending at 14:20HKT 18/04/2012]

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<th>Time (HKT)</th>
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<th>HK Island &amp; KLN</th>
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<td>14:00 18/04/2012</td>
<td>SC [80 km/h]</td>
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Pre - No. 8 Special Announcement

The Hong Kong Observatory announces that the Tropical Cyclone Warning Signal Number 8 is expected to be issued at or before 6 p.m. today (23 Jul 2012). Winds locally will strengthen further.

The Government advises members of the public with long or difficult home journeys or having to return to outlying islands to begin their journeys now. The Government is now making arrangements to release its employees accordingly.

Announcement by the Education Bureau (EDB): The EDB announces that classes of all schools are suspended today. Schools should implement contingency measures to ensure the safety of students. They should ensure that conditions are safe before allowing students to return home.

Dispatched by Hong Kong Observatory at 15:45 HKT on 23.07.2012
Timeline

Tropical Cyclone Signal Assessment Update

Precursor to Pre-No. 8 (Relevant stakeholders)

Pre-No. 8 (Public)

0.5 hrs

2 hrs
Warnings should be Timely

- Depend on how the recipient evaluates the product
- User expectation managed through education and outreach
Scheduled time of issuance: 1:30 a.m., 4:30 a.m., 7:30 a.m., 10:30 a.m., 1:30 p.m., 4:30 p.m., 7:30 p.m., 10:30 p.m. unless an update already issued within an hour before.

Forecast normally valid for the next 6 hours with an indication of the chance of signal change in two consecutive 3-hourly intervals, update when necessary.

Five categories of probability forecast:
- LOW ( < 30 % )
- MEDIUM LOW (30 - 44 %)
- MEDIUM (45 - 54 %)
- MEDIUM HIGH (55 - 69 %)
- HIGH ( >=70 % )
Information on the chance of tropical cyclone signal change (issued by the Hong Kong Observatory at 1:30 p.m. on 22 September 2013).

Tropical Cyclone Signal now in force: Signal No. 3

Latest assessment on the chance of tropical cyclone signal change between 1:30 p.m. and 4:30 p.m. today: The chance of replacing the existing signal by No. 8 is MEDIUM HIGH (55–69%).

Latest assessment on the chance of tropical cyclone signal change between 4:30 p.m. and 7:30 p.m. today: The chance of replacing the existing signal by No. 8 is HIGH (>=70%).

Next update time: 4:30 p.m. on 22 September 2013.

*************************************************
*           FOR INTERNAL USE ONLY               *
*   NOT FOR DISSEMINATION TO THE PUBLIC/MEDIA   *
*************************************************

Dispatched by Hong Kong Observatory at 13:30 HKT on 22.09.2013
Tropical Cyclone Signal Assessment Update

FOR INTERNAL USE ONLY
NOT FOR DISSEMINATION TO THE PUBLIC/MEDIA

Information on the chance of tropical cyclone signal change issued by the Hong Kong Observatory at 4:15 p.m. on 01 Aug 2013

Latest assessment on the chance of tropical cyclone signal change:

Latest assessment on the chance of tropical cyclone signal change between 4:30 p.m. and 7:30 p.m. today:

The chance of replacing the existing signal by No. 8 is LOW (<30%).

Latest assessment on the chance of tropical cyclone signal change between 7:30 p.m. and 10:30 p.m. today:

The chance of replacing the existing signal by No. 8 is LOW (<30%).

Next update time: 7:30 p.m. on 01 Aug 2013
Case Studies
Super Typhoon Utor (in 2013)

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* 香港  Hong Kong
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**Signal Assessment: Chance of**

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**Precursor**

| 23:10 | MEDIUM HIGH |

**Pre-No.8**

| 23:40 | MEDIUM HIGH |

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## TC Usagi

### Signal Assessment: Chance of Rainfall

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Liaison Meetings with Special Communities

• Aviation Community
• Shipping Community
• Fishermen Community
• Broadcast Media
Media / Journalists

- Liaison Meetings (usually annually)
- Luncheon - Informal gathering
- Training for Journalists
Media

- Publicize success stories
- Create good relationships with media and develop media packages for media to publicize meteorological and hydrological knowledge
Luncheon with the journalists
Training courses for the journalists
Rising expectation cancels the effect of a rising level of service, maintaining the gap.
User Focus: Communication, Education, Science, Technology, Warning systems

GAP

Service provided

Expectation

Service provided
Meteorological Services have to work on both science and human aspects.
~ Thank you ~