MEMBER REPORT

ESCAP/WMO Typhoon Committee

9th Integrated Workshop

Hong Kong, China

Bangkok, Thailand

20 – 24 October 2014

CONTENTS

I. Overview of tropical cyclones which have affected/impacted Member's area in 2014

1. Meteorological Assessment (highlighting forecasting issues/impacts)

Four tropical cyclones affected Hong Kong, China from January to September 2014 (their tracks as shown in Figure 1 and position errors of forecasts issued by the Hong Kong Observatory (HKO) in Table 1): Tropical Storm Hagibis (1407) in June, Super Typhoon Rammasun (1409) in July, a tropical depression over the northern part of South China Sea and Typhoon Kalmaegi (1415) in September. Kalmaegi necessitated the issuance of the only Gale and Storm Signal in Hong Kong in 2014.

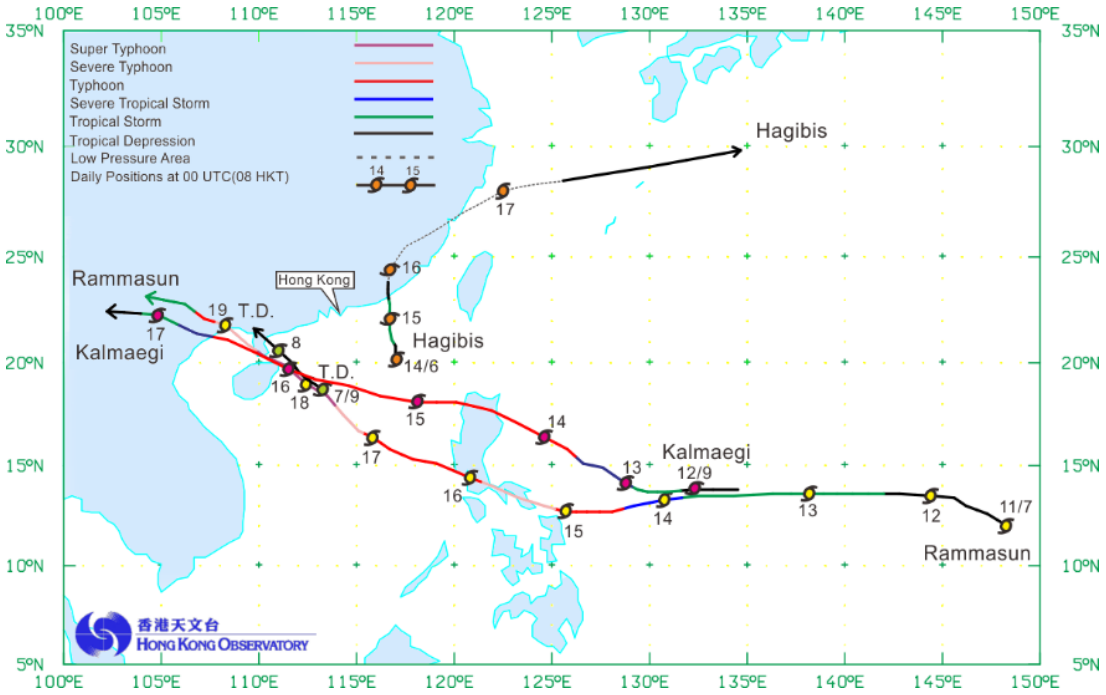

Figure 1 - Hong Kong Observatory best tracks of tropical cyclones that affected Hong Kong, China from 1 January to 30 September 2014.

Table 1 Performance summary of track forecast issued by HKO as

verified against HKO's best track analyses for the four tropical cyclones that affected Hong Kong in 2014

	24-hr position forecast error (km)	48-hr position forecast error (km)	72-hr position forecast error (km)
Hagibis (1407)	55	130	*
Rammasun (1409)	70	73	104
Tropical Depression	23	#	#
Kalmaegi (1415)	92	109	237

* 72-hr forecast not available for Hagibis as its life span was less than 72 hours within the warning area of HKO

\# 48-hr and 72-hr forecasts not available for the tropical depression as its life span was less than 48 hours

The performance was generally satisfactory with 72-hr forecast error less than 250 km. The performance in the case of Rammasun was most impressive with 72-hr forecast of around 100 km only.

2. Hydrological Assessment (highlighting water-related issues/impact)

Rammasun and Kalmaegi brought more than 50 mm of rainfall to many places of the territory during their passages.

In the case of Kalmaegi, a maximum sea level of 3.28 m (above chart datum) and a maximum storm surge of 1.20 m (above astronomical tide) were recorded. There were flooding and backflow of sea water in some low lying areas in Hong Kong.

3. Socio-Economic Assessment (highlighting socio-economic and DRR issues/impacts)

Two people swept away by freak waves during the passage of Hagibis were rescued. Six canoeists reported missing were later found, with one of them injured.

There were 51 reports of fallen trees and many incidents of blown down objects during the passage of Rammasun. A lamp post at a flyover collapsed under strong winds, damaging two private cars. At the Hong KongInternationalAirport, 57 flights were cancelled, 413 delayed and 6 aircraft were diverted.

The tropical depression in September did not cause any significant damage in Hong Kong. A person swept away by freak waves was later rescued.

At least 29 people were injured during the passage of Kalmaegi. There were near 130 reports of fallen trees, five reports of flooding and many incidents of fallen objects. The storm surge triggered by Kalmaegi caused backflow of sea water in some lying areas where residents in village houses had to be evacuated. About 300 hectares of farmland were also affected. At the Hong KongInternationalAirport, over 50 flights were cancelled, more than 480 delayed and 20 aircraft were diverted.

4. Regional Cooperation Assessment (highlighting regional cooperation successes and challenges)

HKO organized and chaired an ad-hoc meeting of Typhoon's Committee's Taskforce on TC Intensity Analysis for Upgrading Tropical Depression on 13 May 2014. The meeting, attended by representatives from CMA, JMA and Typhoon Committee Secretariat, reviewed past cases and discussed measures to improve coordination of tropical cyclone monitoring within the region.

The WMO Tropical Cyclone Forecaster Website, operated by HKO on behalf of WMO, was enriched with training materials from the Sixth RA I Training Course on TCs and PWS held in November 2013 in La Réunion; the JMA/WMO Workshop on Effective TC Warning in Southeast Asia held in March 2014 in Japan; and the Common Alerting Protocol (CAP) Implementation Workshop held in June 2014 in Sri Lanka.

HKO will host the Typhoon Committee Roving Seminar in early November 2014. The theme of the seminar is on "Warning Communication". Invited experts will share their experiences with

participants in designing an effective early warning system, liaising with the media and the public regarding tropical cyclone warning information and utilizing web technology and social networking platforms for warning communication.

TC Members' Report
Summary of Progress in KRAs

Title of item (1):
Tropical Cyclone Surveillance Flight

Main text:

Reconnaissance flights in collaboration with the Hong Kong Government Flying Service (GFS) continued in 2014 to collect meteorological observations for tropical cyclones over the South China Sea. Four flights were conducted for the tropical cyclone season of 2014 including Rammasun (17July), a tropical depression (8September), and Kalmaegi (15 and 16 September). In particular, measurements made around deep convection close to the centre of Kalmaegi augmented satellite-based wind estimates in determining the strength and extent of the system.

Data collected provided valuable information on tropical cyclone location, wind distribution in the vicinity of the system, monitoring storm intensity, as well as assessing impacts on local weather.

Identified opportunities/challenges, if any, for further development or collaboration:

Contract for the supply of a dropsonde system to be installed on the new GFS fixed-wing aircraft for obtaining vertical atmospheric profiles within tropical cyclones was awarded in 2014. The aircraft would be delivered towards the end of 2015. Operational exchanges of reconnaissance data regional meteorological services and the ECMWF are being arranged.

Summary Table of relevant KRAs and components:

KRA =	1	2	3	4	5	6	7
Meteorology	✓	✓		✓		✓	
Hydrology							
DRR							
Training and research							
Resource mobilization or regional collaboration						✓	

Member: Hong Kong, China

Name of contact for this item: Mr K K Hon

Telephone: (852) 2926 8331

Email: kkhon@hko.gov.hk

TC Members' Report
Summary of Progress in KRAs

Title of item (2):
Mesoscale and high-resolution regional prediction systems for tropical cyclones

Main text:

HKO operates a mesoscale numerical prediction suite, the Atmospheric Integrated Rapid-cycle (AIR) forecast system based on the Non-hydrostatic Model, providing forecasts over East Asia and the western North Pacific at 10-km resolution up to 72 hours ahead, as well as over southern China and the northern part of the South China Sea at 2-km resolution up to 15 hours ahead (RAPIDS-NHM).

In 2014, the forecast domain of the 10-km Meso-NHM was extended to provide increased spatial coverage together with forecast lead time following hardware upgrade. It will benefit track and intensity prediction of tropical cyclones as well as forecasting of the associated adverse weather. Parallel run of the enhanced system is currently underway.

Meanwhile, real-time trial run of the Aviation Model (AVM), a high-resolution numerical weather prediction system in support of aviation weather services at the Hong Kong International Airport (HKIA), continued in 2014. The AVM produces hourly-updated, fine-scale forecasts for the HKIA region up to 6 – 9 hours ahead.

At a horizontal resolution of 200 m, the inner domain of the AVM was able to effectively capture terrain-induced wind features as well as low-level turbulence as observed by remote-sensing instruments during tropical cyclone passage.

Identified opportunities/challenges, if any, for further development or collaboration:
Developments on data assimilation, particularly for remote-sensing instruments, will continue in the coming years to further improve model performance. Specialized forecast products will be developed in support of both public weather services as well as aviation users.

Summary Table of relevant KRAs and components:

KRA =	1	2	3	4	5	6	7
Meteorology	✓	✓				✓	
Hydrology							
DRR							
Training and research						✓	
Resource mobilization or regional collaboration							

Member: Hong Kong, China Name of contact for this item: Mr K K Hon

Telephone: (852) 2926 8331 Email: kkhon@hko.gov.hk

TC Members' Report
Summary of Progress in KRAs

Title of item (3):
Climate Service Support for Policy Planning and Disaster Risk Management

Main text:

HKO continued to provide climate data and expert advice in support of the following government departments in Hong Kong: (a) Drainage Services Department on the study of River Flood Risk and the review of the master drainage plan in Hong Kong; (b) Geotechnical Engineering Office of the Civil Engineering and Development Department on the Probable Maximum Precipitation Updating Study; (c) Building Department on the consultancy study for the Review of the Code of Practice on Wind Effects in Hong Kong; and (d) Water Supplies Department on the study of climate change impacts on the water resources of Hong Kong. Information provided included tropical cyclone records, extreme wind speed, rainfall and sea level data, as well as HKO's expert advices on climate change issues and their potential implications for Hong Kong. Latest climate change assessments from the UN IPCC Fifth Assessment Report (AR5) and the updated temperature and rainfall projections in Hong Kong in the 21st century based on the AR5 results were also prepared and communicated to government departments and other professional bodies via working groups, briefing sessions and conference lectures.

Identified opportunities/challenges, if any, for further development or collaboration:

Conduct further studies on the projection of extreme temperature, extreme rainfall and sea level rise in Hong Kong and Pearl River Delta regions based on IPCC AR5 results.

Summary Table of relevant KRAs and components:

KRA =	1	2	3	4	5	6	7
Meteorology							
Hydrology							
DRR		✓	✓	✓			
Training and research							
Resource mobilization or regional collaboration							

Member: Hong Kong, China

Name of contact for this item: Dr T C Lee

Telephone: 852 2926 8360

Email: tclee@hko.gov.hk

TC Members' Report
Summary of Progress in KRAs

Title of item (4):
Communication of Information for Strengthening Resilience of Communities to Typhoon-related Disasters

Main text:

The provision of tropical cyclone forecast tracks to the public was enhanced in 2014 with more frequent update of the forecast tracks for distant tropical cyclones. Moreover, the Tropical Cyclone Track Information webpage on HKO website was enhanced with the capability to overlay HKO radar imageries. The new feature will help the public appreciate the extent of the rainbands associated with the tropical cyclones in the proximity of Hong Kong.

To enable the delivery of timely weather information such as tropical cyclone warnings to a wider spectrum of users, the MyObservatory mobile app, highly popular on iOS and Android platforms, was extended to Windows Phone platform. The app delivers tropical cyclone warnings directly to users' smartphones in about 5 to 15 minutes after the warnings were issued, making it one of the most effective means to alert users of severe weather associated with tropical cyclones. Over 4 million copies of the app have been downloaded.

HKO continued to reach out to various sectors of the society, such as the transport sector, to better understand their concerns and needs in respect of tropical cyclone information and warning services. Talks and visits to HKO were arranged for relevant government department andpublic transport operators before the tropical cyclone season in 2014.

Briefing sessions on emergency response plans were organized for local residents living in places vulnerable to flooding due to storm surge. During the approach of Typhoon Kalmaegi (1415) in September 2014, localized storm surge alerts were activated and appropriate precautions were taken by the relevant government departments against possible flooding caused by storm surges.

Identified opportunities/challenges, if any, for further development or collaboration: Nil.

Summary Table of relevant KRAs and components:

KRA =	1	2	3	4	5	6	7
Meteorology	✓	✓		✓	✓		
Hydrology							
DRR							
Training and research							
Resource mobilization or regional collaboration							

Member: Hong Kong, China

Name of contact for this item: Mr LS Lee / Mr Y C Cheng

Telephone: (852) 2926 8371 / (852) 2926 8358

Email: lslee@hko.gov.hk / yccheng@hko.gov.hk

TC Members' Report
Summary of Progress in KRAs

Title of item (5):
System and Product Development to Support Tropical Cyclone Operation

Main text:

A major upgrade of the storm surge prediction system based on the Sea, Lake, and Overland Surges from Hurricanes (SLOSH) storm surge numerical prediction model of NOAA was undertaken in 2014. In the upgrade, the latest version of SLOSH acquired from NOAA was adopted, the basin of Hong Kong waters was updated with the latest coastline information, and the capability of probability storm surge prediction based on ECMWF EPS tropical cyclone forecast tracks was implemented. Besides, a web interface was developed to facilitate the operation of the system by the forecasters. The upgraded system, named as "Operational Storm Surge Prediction System" has been put into operational trial in the 2014 tropical cyclone season.

A new tool, namely TC Analysis and Forecast Information Page, which serves as a portal fortropical cyclone analysis and forecast information from major warning centres as well as NWP models, was launched for use by weather forecasters. The tool enables the forecasters to analyse the possible evolution of tropical cyclones through convenient access to tropical cyclone information gathered from various sources.

More new NWP products including time series plots of weather parameters based on the deterministic models of CMA (China Meteorological Administration), UKMO (Met Office), NCEP (National Centers for Environmental Prediction) and KMA (Korea Meteorological Administration) at grid points near Hong Kong; JMA (Japan Meteorological Agency) EPS meteograms for the new 00UTC model run and a suite of prognostic charts generated from high-resolution UKMO's Unified Global Model (grid of 0.556 degree latitude x 0.833 degree longitude), were made available to forecasters for predicting the evolution of weather as tropical cyclones approach.

Annual report on model performance in TC forecasting has been provided to ECMWF for discussing the verification results of track and intensity forecasts over

the years; and feedback on model performance in challenging TC cases. Besides using ECMWF model data, verification of track forecasts from deterministic models and EPS of JMA, NCEP, UKMO and CMA were made available in real-time basis for reference by forecasters.

Following the upgrade of JMA Typhoon EPS with ensemble size increasing from 11 to 24 and resolution from TL319 to TL479, the webpage showing tropical cyclone EPS tracks was enhanced to display the new products.

The Integrated Meteorological Information Display (MET-GIS), a GIS-enabled visualization and data analysis system developed in-house at HKO, was enhanced further to display D'vorak images from MTSAT and with a new tool to measure tropical cyclone spiral bands for conducting D'vorak analysis.

Identified opportunities/challenges, if any, for further development or collaboration:

Nil.

Summary Table of relevant KRAs and components [please tick boxes, can be more than one, as appropriate]:

KRA =	1	2	3	4	5	6	7
Meteorology						✓	
Hydrology							
DRR							
Training and research							
Resource mobilization or regional collaboration							

Member: Hong Kong, China

Name of contact for this item: Mr S T Chan / Mr H Y Mok

Telephone: (852) 2926 8434 / (852) 2926 8451

Email: stchan@hko.gov.hk / hymok@hko.gov.hk

TC Members' Report
Summary of Progress in KRAs

Title of item (6):
Enhancement of Radar Nowcasting Technique in Tropical Cyclone QPF

Main text:

SWIRLS, the operational rainstorm nowcasting system of HKO, has been enhanced to include a new module for tropical cyclone rainfall forecasting. The new algorithm was developed in a project under the Typhoon Committee Research Fellowship (TCRF) in 2012. With both the reflectivity and rotational motion fields translated simultaneously by the large-scale cyclone motion vector, the new method can reproduce better shape-preserving spiral rainbands and cyclone structure in the general direction of cyclone motion. Verification using historical cases shows that the new algorithm can improve the skills of the quantitative precipitation forecast associated with tropical cyclones.

Identified opportunities/challenges, if any, for further development or collaboration:

Development or tuning of SWIRLS and its tropical cyclone module, using larger scale radar mosaic, would be pursued under TCRF or other regional collaboration projects.

Summary Table of relevant KRAs and components:

KRA =	1	2	3	4	5	6	7
Meteorology						✓	
Hydrology						✓	
DRR							
Training and research						✓	
Resource mobilization or regional collaboration							

Member: Hong Kong, China

Name of contact for this item: Mr W K Wong

Telephone: (852) 2926 8416

Email: wkwong@hko.gov.hk

TC Members' Report
Summary of Progress in KRAs

Title of item (7):
Further Expansion of the "Community Weather Information Network (Co-WIN)"

Main text

The "Community Weather Information Network (Co-WIN)", started in 2007 in collaboration with the Hong Kong Polytechnic University, saw further expansion as more community weather stations were installed in schools and community organizations. The number of Co-WIN members has exceeded 140.

The "Community Weather Observing Scheme" (CWOS), an initiative of Co-WIN launched in 2011, also saw further development. In early 2014, a "Weather Observation and Investigative Study Competition" was organized to encourage young people to develop an interest in weather observations through the sharing of weather photos and videos on the CWOS platform. The CWOS website (http://co-win.org) underwent a facelift in August 2014 with new functions incorporated and features to allow users to share weather photos and observations more conveniently.

Identified opportunities/challenges, if any, for further development or collaboration: CWOS will be further developed to facilitate more participation at the community level through various mobile platforms.

Summary Table of relevant KRAs and components:

KRA =	1	2	3	4	5	6	7
Meteorology							
Hydrology							
DRR					✓		
Training and research							
Resource mobilization or regional collaboration							

Name of contact

Member: Hong Kong, China for this item: Mr K H Tam

Telephone: (852) 2926 8414 Email: khtam@hko.gov.hk

TC Members' Report
Summary of Progress in KRAs

Title of item (8):
TV Documentary on Tropical Cyclone and Extreme Weather Risks for Public Education

Main text:

To promote public awareness on tropical cyclones, climate change and other severe weather events, HKO in collaboration with Radio Television Hong Kong have partnered for the fourth time to produce a TV documentary series introducing the ever-changing weather phenomena: "Meteorology Series IV". Against a background of climate change arising from modern civilization, the topics covered by the four episodes range fromtropical cyclone hazards, meltdown of the cryosphere, rainstorms and flooding, to drought and water resources. Through first-hand filming of extreme weather conditions in Hong Kong and different parts of the world, including the Philippines, Viet Nam, Lesotho in southern Africa and Greenland within the Arctic Circle, the series explores the underlying causes of the changes in severity and frequency of extreme weather phenomena and their associated impacts on mankind, and invites the viewers to reflect on the relationship between the development of human civilization and its impacts on Mother Nature.

Identified opportunities/challenges, if any, for further development or collaboration:

Production of DVD (Chinese and English versions) on the "Meteorology Series IV" is underway. After completion in Q1 2015, the DVD will be sent to Typhoon Committee Members for reference.

Summary Table of relevant KRAs and components:

KRA =	1	2	3	4	5	6	7
Meteorology					✓		
Hydrology					✓		
DRR					✓		
Training and research							
Resource mobilization or regional collaboration							

Member: Hong Kong, China Name of contact for this item: Ms Sandy Song

Telephone: (852) 2926 8336 Email: mksong@hko.gov.hk

TC Members' Report
Summary of Progress in KRAs

Title of item (9):
Short video on tropical cyclone-related hazards to enhance public awareness (under Typhoon Committee Working Group Disaster Risk Reduction)

Main text:

A project under WGDRR, HKO is producing a short educational video to promote public awareness on typhoon-related hazards, with an aim to making the information more understandable to the public. The video, about 5 minutes in duration, will include footage of various hazards associated with tropical cyclones (wind, waves, storm surge etc.), as well as clear messageson the appropriate response actions to take.

Identified opportunities/challenges, if any, for further development or collaboration:

Story board formulation of the video is underway. After completion in early 2015, the video will be shared with Typhoon Committee Members.

Summary Table of relevant KRAs and components:

KRA =	1	2	3	4	5	6	7
Meteorology					✓		
Hydrology					✓		
DRR					✓		
Training and research							
Resource mobilization or regional collaboration							

Member: Hong Kong, China

Name of contact for this item: Ms Sandy Song

Telephone: (852) 2926 8336

Email: mksong@hko.gov.hk

TC Members' Report
Summary of Progress in KRAs

Title of item (10):
Capacity building for NMHSs in numerical prediction of tropical cyclones

Main text:

As part of the WMO RA II Pilot Project to Develop Support for NMHSs in Numerical Weather Prediction, HKO co-organizes the Asian Consortium for NWP Forecast (ACNF), which comprises NWP operators and product providers to support and assist NMHSs in RA II in the development of NWP-based products andservices.

In December 2014, HKO will host a workshop on "Data Assimilation and Mesoscale Ensemble Forecasting" for RA II and ACNF members under the WMO VCP framework. Lectures and practical sessions will be provided by experts to enhance technical capacity of the participating NMHSs in the development of data assimilation and mesoscale ensemble techniques, as well as application and interpretation of probabilistic products, for the improvement of tropical cyclone forecasting.

Identified opportunities/challenges, if any, for further development or collaboration:

The workshop in December 2014 will promote the sharing of experience and expertise among the participating NMHSs in RA IIand ACNF members in the development and application of NWP for tropical cyclone forecasting.

Summary Table of relevant KRAs and components:

KRA =	1	2	3	4	5	6	7
Meteorology						✓	✓
Hydrology							
DRR							
Training and research						✓	✓
Resource mobilization or regional collaboration							✓

Member: Hong Kong, China

Name of contact for this item: Mr K K Hon

Telephone: (852) 2926 8331

Email: kkhon@hko.gov.hk

TC Members' Report
Summary of Progress in KRAs

Title of item (11):
Training Workshop on Techniques in Communicating Message to the Media and the Public

Main text:

Two identical half-day Training Workshops on "Techniques in Communicating Message to the Media and the Public" were organized for HKO staff on 12 and 17 February 2014 to enhance participants' ability in using 'storytelling' techniques to effectively present and communicate succinct messages to the media and the public in the delivery of weather information and warning messages, particularly in tropical cyclone situations.

Identified opportunities/challenges, if any, for further development or collaboration:

More media and communication experts would be commissioned to provide in-house training, particularly for weather forecasters and presenters, to enhance their communication skills with a view to enhancing the impact of weather and warning messages.

Summary Table of relevant KRAs and components:

KRA =	1	2	3	4	5	6	7
Meteorology						✓	
Hydrology							
DRR						✓	
Training and research						✓	
Resource mobilization or regional collaboration							

Member: Hong Kong,China

Name of contact for this item: Ms Queenie Lam

Telephone: (852) 2926 8441

Email: cclam@hko.gov.hk

TC Members' Report
Summary of Progress in KRAs

Title of item (12):
Public Talk on Tropical Cyclone Impact and Forecast

Main text:

A public talk on "Tropical Cyclone Impact and Forecast" was held on 7 September 2014. Through a better understanding of tropical cyclone characteristics and the application of state-of-the-art tropical cyclone forecasting techniques, public awareness on the risks and potential impacts of tropical cycloneswas raised.

Identified opportunities/challenges, if any, for further development or collaboration:

More public talks would be organized to promote the understanding of forecast uncertainties and to increase public awareness of the impact of tropical cyclones.

Summary Table of relevant KRAs and components:

KRA =	1	2	3	4	5	6	7
Meteorology					✓		
Hydrology							
DRR		✓		✓	✓		
Training and research							
Resource mobilization or regional collaboration							

Member: Hong Kong, China Name of contact for this item: Mr Terence Kung

Telephone: (852) 2926 8319 Email: tkung@hko.gov.hk

TC Members' Report
Summary of Progress in KRAs

Title of item (13):
Study on wind observations from offshore platforms and surveillance flights

Main text:

A study on wind observations from oil rig platforms, ships, buoys and aircraft for tropical cyclone monitoring was conducted, with advices from RSMC Tokyo, RSMC La Réunion, UKMO and Bruce Harper, the author of WMO TD-No. 1555, sought and referenced. The key findings were presented to the ad-hoc meeting of Typhoon Committee Taskforce on TC Intensity Analysis for Upgrading Tropical Depression in May 2014.

Identified opportunities/challenges, if any, for further development or collaboration:

Nil.

Summary Table of relevant KRAs and components:

KRA =	1	2	3	4	5	6	7
Meteorology						✓	✓
Hydrology							
DRR							
Training and research							✓
Resource mobilization or regional collaboration							✓

Member: Hong Kong, China
Name of contact for this item: Mr S T Chan

Telephone: (852) 2926 8434
Email: stchan@hko.gov.hk