MEMBER REPORT

ESCAP/WMO Typhoon Committee
9th Integrated Workshop

Japan

Bangkok, Thailand
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I. Overview of tropical cyclones which have affected/impacted Japan's area in 2014

1. Meteorological Assessment

In 2014, ten tropical cyclones (TCs) of tropical storm (TS) intensity or higher had come within 300 km of the Japanese islands as of 6 October. Japan was affected by seven of these, with three making landfall. These seven TCs are described below, and their tracks are shown in Figure 1.

(1) TY Neoguri (1408)

Neoguri was upgraded to TS intensity south of the Mariana Islands at 18 UTC on 3 July. Moving northwestward, it reached its peak intensity with maximum sustained winds of 100 kt and a central pressure of 930 hPa at 18 UTC on 6 July. Gradually turning northward, Neoguri moved between Miyako Island and Kumejima Island with TY intensity early on 8 July. Turning eastward, it made landfall on Kyushu Island with severe tropical storm (STS) intensity late on 9 July, then continued eastward along the southern coastal area of Honshu Island the next day. Gradually turning northward, it transformed into an extratropical cyclone at 00 UTC on 11 July.

A peak gust of 50.2 m/s was recorded at Naha (47936), and a 24-hour precipitation total of 438.0 mm was recorded at Nago (47940).

A mudslide caused one fatality, and two other people died after falling into a flooded river and a canal. Damage to houses and farm products, power outages and transport disruption were also reported across wide areas of Japan.

(2) TY Matmo (1410)

Matmo was upgraded to TS intensity northeast of the Palau Islands at 12 UTC on 17 July. Turning northwestward, it reached its peak intensity with maximum sustained winds of 70 kt and a central pressure of 965 hPa at 00 UTC on 21 July. After crossing Taiwan Island with TY intensity on 22 July, Matmo was downgraded to TS intensity over the coast of southeastern China at 12 UTC the next day.

Cancellations of flights and ship departures were reported in Okinawa Prefecture.

(3) STS Nakri (1412)

Nakri was upgraded to TS intensity east of the Philippines at 12 UTC on 29 July. It gradually turned northwestward on 30 August before turning northeastward the next day and moving over the East China Sea. Nakri was upgraded to STS intensity over the same waters at 18 UTC on 31 July. Turning northwestward again, it reached its peak intensity with maximum sustained winds of 55 kt and a central pressure of 980 hPa north of Okinawa Island six hours later. Decelerating northeastward on 2 August, Nakri was downgraded to TS intensity west of Jeju Island at 12 UTC the same day.

A peak gust of 37.6 m/s was recorded at Okinoerabu (47942), and a 24-hour precipitation total of 409.0 mm was recorded at Kochi (47893).

A swollen river caused by heavy rain resulted in one fatality. Damage to houses and farm products, power outages and transport disruption were also reported across a wide area stretching from Kyushu to Hokkaido.

(4) TY Halong (1411)

Halong was upgraded to TS intensity east of Guam Island at 00 UTC on 29 July. Moving westward, it reached its peak intensity with maximum sustained winds of 105 kt and a central pressure of 920 hPa north of the Yap Islands at 12 UTC on 1 August. After turning northward, Halong moved east of Minamidaitojima Island on 7 August. Turning northeastward the next day, it made landfall on Shikoku Island with TY intensity late on 9 August. After crossing the Kinki region, Halong was downgraded to STS intensity at 06 UTC the next day. Moving northward, it transformed into an extratropical cyclone over the Sea of Japan at 00 UTC on 11 August.

A peak gust of 52.5 m/s was recorded at Murotomisaki (47899), and a 24-hour precipitation total of 381.0 mm was recorded at Sukumo (47897).

High waves caused one fatality, and damage to houses and farm products, power outages and transport disruption were also reported across wide areas of Japan.

(5) TS Fung-wong (1416)

Fung-wong was upgraded to TS intensity east of the Philippines at 18 UTC on 17 September. Moving northwestward, it hit Luzon Island with TS intensity on 19 September. Decelerating westward, Fung-wong reached its peak intensity with maximum sustained winds of 50 kt and a central pressure of 980 hPa over the South China Sea at 18 UTC the same day. Turning northward on 20 September, it moved along the eastern coast of Taiwan Island the next day.

Cancellations of ship departures were reported in Okinawa Prefecture.

(6) STS Kammuri (1417)

Kammuri was upgraded to TS intensity northeast of the Mariana Islands at 12 UTC on 24 September. Moving westward then northwestward, it was upgraded to STS intensity southeast of the Ogasawara Islands at 21 UTC on 26 September before being downgraded to TS intensity nine hours later. Kammuri moved northward east of the islands with TS intensity on 27 September and turned northeastward the next day.

Cancellations of ship departures were reported in Tokyo Prefecture.

(7) TY Phanfone (1418)

Phanfone was upgraded to TS intensity north of the Chuuk Islands at 06 UTC on 29 September. Moving northwestward, it reached its peak intensity with maximum sustained winds of 95 kt and a central pressure of 935 hPa east of Okinotorishima Island at 06 UTC on 2 October. Phanfone moved east of Minamidaito Island and accelerated northeastward on 5 October. It made landfall on the Tokai region with TY intensity late the same day and transformed into an extratropical cyclone on 6 October.

A peak gust of 45.5 m/s was recorded at Omaezaki (47655), and a 24-hour precipitation total of 400.0 mm was recorded at Owase (47663).

High waves caused one fatality, and another person died after falling into a flooded river. Damage to houses and farm products, power outages and transport disruption were also reported across wide areas of Japan.

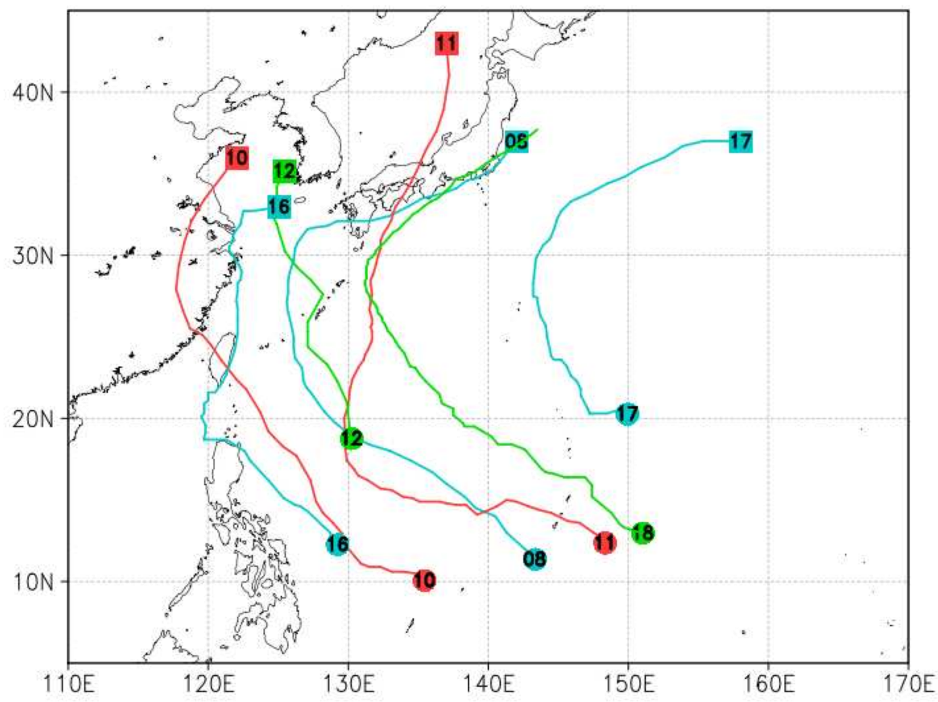


Figure 1 Tracks of the seven named TCs affecting Japan in 2014
The numbered circles represent the genesis point of each named TC, while the squares show the dissipation point. The numbers indicate the last two digits of the identification number for each named TC.

Figure 2 Impacts of T1408 in Nagiso Town in Nagano Prefecture
Mudslide debris (photo: JMA)

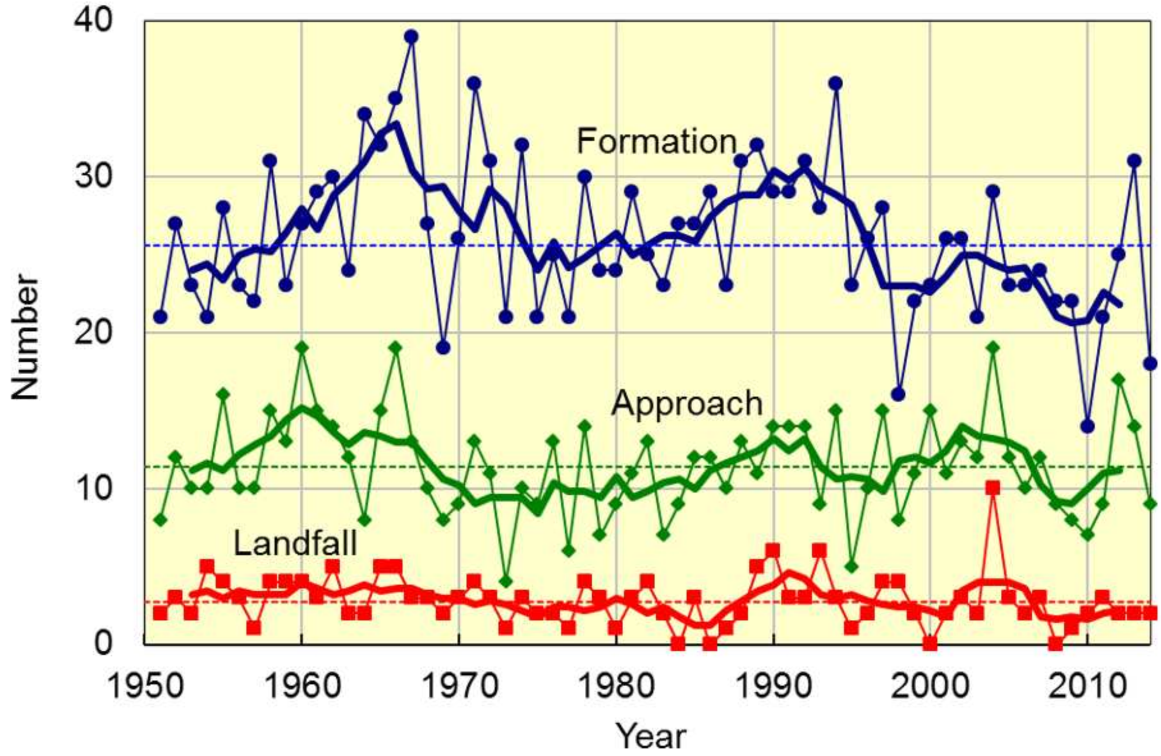


Figure 3 Tropical cyclones (TS intensity or higher) forming over the western North Pacific (top), those approaching Japan (middle) and those making landfall on Japan (bottom) as of 30 September 2014. The thin, solid and dashed lines represent annual/five-year running means and normal values (1981 – 2010 averages), respectively. JMA describes inter-annual variability and long-term trends regarding typhoon activity in its Climate Change Monitoring Report every year. This is distributed to the Japanese public and to NMHSs via the Tokyo Climate Center's website (http://ds.data.jma.go.jp/gmd/tcc/tcc/products/gwp/gwp.html).

2. Hydrological Assessment

Hiroshima sediment disasters caused by torrential rain in August 2014 and pre/post-disaster response

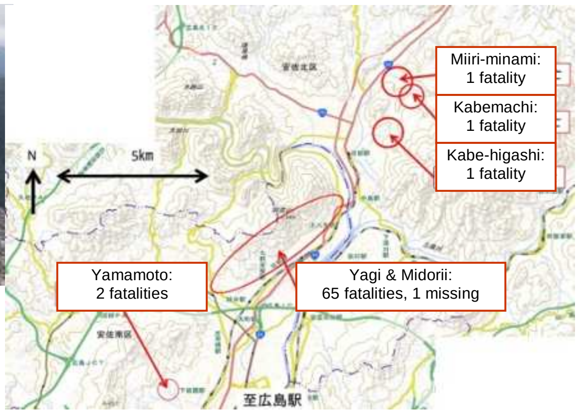
1. Outline of sediment disasters and response

In the early hours of August 20, some parts of Hiroshima Prefecture were hit by extremely heavy rainfall of up to 87 mm per hour for a cumulative total of 247 mm. This extreme event caused sediment disasters in a variety of locations to the north of Hiroshima City, including 107 debris flows and 59 slope failures. As of September 10, the toll included 73 fatalities, 1 person missing and 5,000 seriously damaged houses.

The National Institute for Land and Infrastructure Management under the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) immediately dispatched sediment disaster experts and the Technical Emergency Control Force (TEC-FORCE) to the affected areas to provide technical assistance for the prevention of secondary accidents during victim search operation by police officers, fire fighters and Self-Defense Forces personnel. TEC-FORCE also used its expertise to support other emergency efforts involving the placement of large sandbags and the installation of devices such as debris-flow sensors and monitoring cameras.

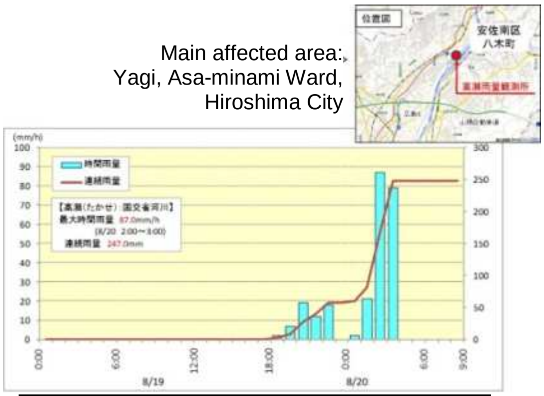
MLIT also asked all prefectural governments to immediately check their public

Yagi and Midorii, Asa-minami Ward, Hiroshima City



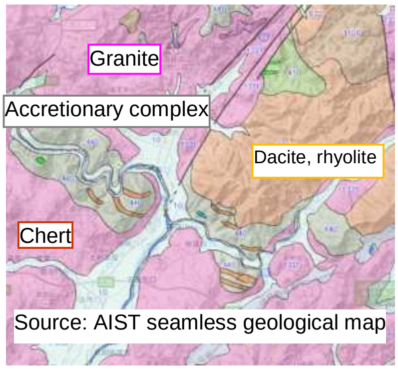
alert and evacuation systems for sediment-related hazards covering locations of high sediment-disaster risk all over the country, including around 53 million high sediment-disaster risk sites and 35 million sediment-disaster alert areas.

Field investigation of mountain streams



Rainfall in the affected area from Aug. 19 to 20

2. Topography and geology of affected areas



Source: AIST seamless geological map

Many of the affected areas were located in alluvial fans at the lower end of mountain streams. These fans are typical evidence of repeated local debris flows and slope failures, and suggest that such phenomena are likely to recur under certain conditions.

The geology of the affected areas is also generally characterized by the presence of granite (the fine-grained biotite and medium-grained hornblende-biotite types), although the top of Mt. Abu, located behind Yagi in Asa-minami Ward, is a partial accretionary complex matrix containing chert block (mudstone and fine-grained sandstone containing gravel). Erosion in these areas creates granite soil, which is prone to failure on slopes.

3. Debris flows

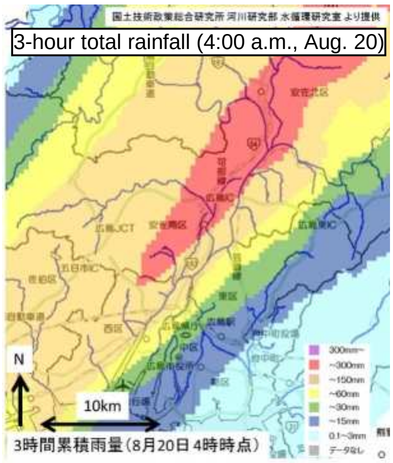
The Yagi area was hit by multiple simultaneous debris flows rushing down streams on Mt. Abu over a height difference of 400 m and an inward depth of 1 km. These flows hit adjacent houses on a slope with a gradient of about 10 degrees without slowing down. The devastating nature of the damage is considered attributable to residential construction up to the stream outlet at an elevated location on the mountainside, and to the sheer power of the debris flows as evidenced by fallen trees and rocks with diameters over 5 meters found in affected areas.

The human damage caused by this event was the greatest of any recorded sediment disaster since the one in Shimane Prefecture in 1983, and also the greatest since the one in Nagasaki Prefecture in 1982 in terms of disasters in one local municipality caused by a single heavy rainfall event.

4. Evacuation

A heavy rain warning was issued to the affected areas at 21:26 on August 19. Several hours later at 1:15 a.m. on August 20, a sediment disaster alert was issued. Debris flows are thought to have occurred in the Yagi area between 3:30 and 4:00 a.m. shortly before an evacuation advisory was issued at 4:30 a.m., which was followed by an evacuation order at 7:58 a.m.

The rainfall observed before the disaster was extremely heavy and localized. The maximum hourly rainfall was recorded at 87 mm in the affected areas as compared to 46 mm in the Naka Ward area of downtown Hiroshima only about 10 km away. The disaster zones were also hit by torrential rainfall between midnight and dawn, which may have hindered evacuation efforts.



3. Socio-economic Assessment

In 2014, 16 typhoons had formed as of 19 September and 7 of them had approached Japan, with Typhoon No. 8 and Typhoon No. 11 making landfall.

Typhoon No. 8

The large and strong Typhoon No. 8, Neoguri, moved northward and passed between Okinawa's main island and Miyako Island on 8 July, causing record rainfall in the area. Damp warm southerly wind around it in combination with a rain front brought localized downpours even in areas distant from the typhoon. The heavy rainfall associated with Neoguri directly affected 58 people, including 34 injuries and 3 fatalities, and caused flooding below floor level and other damage to 1,508 houses.

Typhoon No. 11

Typhoon No. 11, Halong, hit Kochi Prefecture on 10 August and passed through the Shikoku and Kinki regions with gradually accelerating wind speed. As the typhoon moved across Japan, a rain front hovered over the area from the Sea of Japan in the western part of the country to the north. A damp warm air mass around the typhoon merged with the rain front, resulting in heavy rainfall over a wide area from western to northern Japan. From the Shikoku region to the Tokai region, cumulative rainfall reached 600 millimeters. In some cities in Kochi Prefecture, total precipitation amounted to 1,000 millimeters between 7 and 11 August. The typhoon also brought unstable atmospheric conditions that resulted in the formation of F1 tornados in Tochigi Prefecture.

Typhoon No. 12

Without making landfall on Japan, Typhoon No. 12, Nakri, approached Okinawa's main island between 31 July and 1 August before moving northward with a 50-kt wind area over the East China Sea. A rain front and damp warm atmospheric conditions from the south brought heavy rain to the Chugoku and Tohoku regions. One severe rainfall event in Yamaguchi Prefecture brought over 100 millimeters of rain per hour.

Typhoon No. 11 with its subsequent tornados and Typhoon No. 12 caused six fatalities and damaged 6,664 houses across the country.

To address the situation, the Government of Japan organized meetings with relevant ministries/agencies and dispatched government investigation teams headed by the Senior Vice-Minister for Disaster Management to the affected areas. The government also designated the situation as an Extremely Severe Disaster, thereby allowing the allocation of subsidies for projects to support early recovery. The Disaster Relief Act and the Act on Support for Livelihood Recovery of Disaster Victims also applied to the affected areas, and Japan Self-Defense Forces were sent to perform search-and-rescue work for missing or isolated people.

II. Summary of progress in Key Result Areas

Asian Conference on Disaster Reduction (ACDR) 2014

ACDR 2014 was held in Tokyo, Japan, from 4 to 6 March 2014. The conference was organized jointly by the Government of Japan, the United Nations Secretariat of the International Strategy for Disaster Reduction (UNISDR) and the Asian Disaster Reduction Center (ADRC). It was attended by 119 people, including high-level government officials from 26 countries, as well as representatives of 26 international and regional organizations, the academic community and the private sector.

The event was opened by Mr. Yasutoshi Nishimura, Senior Vice-Minister of the Cabinet Office of Japan, who was followed by Dr. Shigeru Itoh, Chairman of the ADRC, and Ms. Yuki Matsuoka, Head of the UNISDR Office in Japan. Mr. Nishimura began by thanking all attendees for their support in the wake of the Great East Japan Earthquake, then discussed the importance of the experience gained and lessons learned from the disaster. He indicated that the outcomes of the conference were expected to be incorporated into the Post-2015 Framework for Disaster Risk Reduction (HFA2). The keynote presentation by Dr. Satoru Nishikawa, Vice-President of the Japan Water Agency, highlighted Japan's experience and how related issues might be addressed in HFA2, and outlined expectations for the upcoming 3rd WCDRR. Prof. Osamu Murao of Tohoku University also gave a talk titled Lessons Learned from the Great East Japan Earthquake and the Current Recovery Efforts.

The key topics addressed at ACDR 2014 were as follows:
1. HFA progress challenges for HFA2
2. Strengthening of local capacity for disaster risk reduction (DRR)
3. Human resource development and training
4. Utilization of space technology for DRR

ACDR 2014 attendees

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							✓

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Urban Search-and-rescue Training in Singapore as an ADRC activity for disaster reduction

The Singaporean Government holds an annual training course for search-and-rescue officers. The course has hosted trainees from outside Singapore for the past ten years and provides training on the search-and-rescue expertise required in urban disaster situations. The training facility complex of the Civil Defense Academy (CDA) run by the Singapore Civil Defense Force (SCDF) is one of the highest-level facilities of its kind in Asia. As part of efforts to utilize its expertise and facilities, the ADRC has hosted relevant officers from member countries on the training course since 2001. Two officers from the Maldives and Bhutan attended in 2013.

Recent trainee numbers and home countries
FY 2009 (2): Armenia, Sri Lanka
FY 2010 (3): Bhutan, Mongolia, Maldives
FY 2011 (2): Bangladesh, Russia
FY 2012 (2): Mongolia, Thailand
FY 2013 (2): Bhutan, Maldives

Urban search-and-rescue training in Singapore (2012)

Summary Table of relevant KRAs and components (Tick boxes as appropriate; multiple choices OK.)

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

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Hosting of Visiting Researchers from ADRC Member Countries

The Asian Disaster Reduction Center (ADRC) has hosted Visiting Researchers (VR) from member countries since 1999. To date, 79 officials have taken part in this program to learn about Japan's advanced Disaster Risk Reduction (DRR) expertise and technology. After the program, attendees are expected to help strengthen DRR capacity in their home nations as well as further promoting cooperation between their countries and the ADRC. In 2014, the ADRC hosted eight Visiting Researchers from the member countries shown below.

FY	Organization	Country
2014	Ministry of Emergency Situations	Azerbaijan
	Ministry of Home and Cultural Affairs	Bhutan
	National Disaster Management Center	Maldives
	Ministry of Social Welfare, Relief and Resettlement	Myanmar
	Ministry of Home Affairs	Nepal
	Office of Civil Defense	Philippines
	Disaster Management Center	Sri Lanka
	Ministry of Water and Environment	Yemen

Visiting Researchers

Summary Table of relevant KRAs and components (Tick boxes as appropriate; multiple choices OK.)

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

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Revision of the Coast Act to enhance coastal disaster management

Japan's Coast Act was established to "secure the preservation of national land by protecting coasts from hazards caused by tsunamis, storm surges, high waves and other movements of seawater or ground and by promoting the improvement and conservation of the coastal environment as well as the proper use of coasts by the public."

There is currently a keen awareness in Japan of an urgent need to enhance coastal disaster management in preparation for potential large-scale tsunamis triggered by earthquakes expected in the Nankai Trough and elsewhere in the near future and storm surges caused by typhoons. Urgent measures also need to be taken to support the nation's coastal protection structures, most of which were built during Japan's period of high economic growth and are expected to require maintenance soon.

As a way of addressing these issues, the Coast Act was revised to further strengthen coastal disaster management and ensure appropriate coastal maintenance.

For enhanced coastal disaster management, more resilient seawalls and other structures (such as forests grown with conventional seawalls to help reduce disaster-related damage) are designated to protect seaside areas. The revised law also includes provisions concerning the establishment of a system for safer, more secure operation of water gates and land locks. There is now a need to develop guidelines detailing procedures and drills for such operation in the event of a disaster and for the securement of operator safety.

The new version of the Coast Act also contains provisions defining appropriate maintenance and management of coastal protection structures to address deterioration over time. It clearly outlines the responsibilities of coastal administrators in regard to the maintenance and management of such structures, and obliges them to develop guidelines for this work as a form of preventive maintenance.

<u>Summary Table</u> of relevant KRAs and components (Tick boxes as appropriate; multiple choices OK.)

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

Member: Japan

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The Regional Training Workshop on Weather Radar Basis & Routine Maintenance and Real-time Radar Rainfall Estimation & Forecasting (Bangkok, Thailand, 24 February – 7 March 2014) was implemented within the framework of the ASEAN Sub-Committee on Meteorology and Geophysics (SCMG). The workshop, jointly proposed by Thailand and Malaysia in collaboration with the Government of Japan as an ASEAN dialogue partner, was funded by the Japan-ASEAN Integration Fund (JAIF). It was also recognized as an activity under the WMO RA II WIGOS Project for Observing Systems Integration for Supporting Disaster Risk Reduction.

The aim of the workshop was to enhance the capacity of National Meteorological and Hydrological Services for the maintenance of weather radar, real-time rainfall estimation and forecasting based on weather radar observation.

A total of 20 participants from seven ASEAN countries (Indonesia, Lao PDR, Malaysia, the Philippines, Singapore, Thailand and Viet Nam) attended a broad range of presentations related to weather radars. Topics covered the basics, structures and maintenance as well as applications of weather radar observation in the form of Quantitative Precipitation Estimation and Forecasting (QPE/QPF). The presentations were given by experts from Kyoto University, Japan Radio Company Ltd. (JRC), the Japan International Cooperation Agency (JICA) and the Japan Meteorological Agency (JMA).

During the workshop, attendees and presenters discussed experiences, expressed views and exchanged information regarding the operation of weather radar systems in their own countries. This interaction highlighted the importance of developing a radar composite map covering the whole ASEAN region to improve the quality of services provided. It was also recognized that radar data quality improvement is a challenge common to all members in the region, and that harmonizing hardware and software is key to the future success of weather radar operation.

Summary Table of relevant KRAs and components (Tick boxes as appropriate; multiple choices OK.)

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

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14th Typhoon Committee Attachment Training at the RSMC Tokyo – Typhoon Center

The RSMC Tokyo – Typhoon Center has organized ESCAP/WMO Typhoon Committee Attachment Training courses every year since 2001 with the support of the WMO Tropical Cyclone Programme (TCP) and the Typhoon Committee to enhance the capacity of Committee members for typhoon analysis and forecasting. The 14th Attachment Training course was held at JMA Headquarters from 23 July to 1 August 2014.

In line with this year's increase in the number of trainees from two to three, the course was attended by Mr. Vanhdy Douangmala from Lao PDR, Ms. Nurul Salwa Abdul Ghani from Malaysia and Ms. Maria Ana Glaiza Ganace Escullar from the Philippines.

The training focused on improving skills in tropical cyclone analysis and forecasting through practical training, including hands-on learning using the Satellite Analysis and Viewer Program (SATAID). It included presentations on a variety of subjects, including Dvorak analysis, interpretation of microwave data, quantitative precipitation estimation (QPE), quantitative precipitation forecasting (QPF) and storm surge forecasting.

The trainees also attended daily tropical weather briefings provided by Tokyo Typhoon Center forecasters and discussed the outlook for tropical cyclone activity in the western North Pacific region using MTSAT images, numerical weather prediction (NWP) output and other resources.

The training helped the attendees to deepen their understanding of operational tropical cyclone monitoring, analysis and forecasting.

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

The trainees reported that the course, especially its satellite analysis part, was very beneficial. One attendee said that the training on analysis of tropical cyclone formation would provide benefits from early warning and preparation.

Feedback also indicated that the training should be longer to give more time for discussion of the presentations. It was further recommended that more people attend the course to support exchanges on views and experiences. Attendees also expressed a desire to send representatives to the attachment training on an ongoing basis in order to improve their typhoon analysis and forecasting services.

To deepen attendees' understanding and improve their abilities, extension of the training course and other enhancements should be considered.

Summary Table of relevant KRAs and components (Tick boxes as appropriate; multiple choices OK.)

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

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JMA/WMO Workshop on Effective Tropical Cyclone Warnings in Southeast Asia

The JMA/WMO Workshop on Effective Tropical Cyclone Warning in Southeast Asia was held in collaboration with the World Meteorological Organization (WMO) from 11 to 14 March 2014 at the Headquarters of the Japan Meteorological Agency (JMA) in Tokyo.

The workshop was intended to promote understanding among participating countries regarding the latest tropical cyclone (TC) analysis/forecasting techniques and products, to identify challenges faced by these countries in improving their operational forecasting and warning services, and to discuss ways to address the provision of external assistance and other challenges. The session was attended by 51 people, including representatives of WMO and the Japan International Cooperation Agency (JICA), distinguished presenters from the National Hurricane Center (NHC), the Central Pacific Hurricane Center (CPHC) of the US National Oceanic and Atmospheric Administration's National Weather Service and the Joint Typhoon Warning Center (JTWC), and TC experts from JMA and nine National Meteorological and Hydrological Services (NMHSs) in South and Southeast Asia (Bangladesh, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Thailand, the Philippines and Viet Nam).

The representatives of the nine NMHSs provided Country Reports highlighting their current tropical cyclone operational service capacities as well as challenges and needs relating to the further enhancement of warning capacity. Attendees from NHC, CPHC, JTWC and JMA gave a series of presentations on storm surge forecasting methods and other tropical cyclone operational techniques. The event further addressed the importance of warning development based on effective communication with emergency managers. In this regard, JMA reviewed recent efforts to improve its warning services in accordance with past tropical cyclone disasters; the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) outlined its response to Typhoon Haiyan and lessons learned from the experience; and

NHC detailed its improvement plan for storm surge forecasts and warnings based on lessons learned from Hurricane Sandy.

The workshop's materials and a summary report are available at http://www.jma.go.jp/jma/jma-eng/jma-center/rsmc-hp-pub-eg/2014_Effective_TC_Warning/documents.html.

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

The workshop's discussions centered on the need for more effective regional cooperation initiatives such as training on satellite and weather radar-based monitoring/analysis techniques and further enhancement for forms of real-time forecast support including NWP guidance products from RSMCs. It also highlighted the importance of providing easy-to-understand warnings in text and/or graphical formats based on coordination with emergency managers, as well as continued efforts to increase public awareness in order to ensure the effectiveness of warnings. The event further encouraged ongoing enhancement of technical cooperation activities on storm surge forecasting, including the technical transfer of JMA's storm surge modeling methods.

<u>Summary Table</u> of relevant KRAs and components (Tick boxes as appropriate; multiple choices OK.)

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

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Recent developments for JMA's global NWP system

1. Upgrade of JMA’s global numerical weather prediction system

In a March 2014 upgrade of JMA’s numerical weather prediction (NWP) system, the number of vertical levels in the operational Global Spectral Model (GSM) was enhanced from 60 (L60) to 100 (L100) and the model’s top level was raised from 0.1 to 0.01 hPa. The parameterization schemes for variables such as the boundary layer, radiation, non-orographic gravity waves and deep convection were also revised to improve the representation of atmospheric characteristics. At the same time, data assimilation considerations were additionally improved (see 2.(2)). The results of experiments conducted in relation to these GSM upgrades showed a positive impact on TC track forecasts over the western North Pacific. This effect was even stronger over other areas such as the eastern North Pacific, the Atlantic and the Southern Hemisphere. Further verification showed improved cyclone detection over that of the previous GSM.

JMA also upgraded its Typhoon Ensemble Prediction System (TEPS), which is run up to four times a day with a forecast range of 132 hours and specializes in TC forecasting. The upgrade included enhancement of horizontal resolution in the forecast model from TL319 to TL479, revision of its physical processes (such as stratocumulus and radiation schemes) and an increase in the ensemble size from 11 to 25. The results of experiments conducted in relation to the upgrades for the period from 2011 to 2013 showed a positive impact on TC track and intensity forecasts. Probabilistic verification results for the upgraded TEPS were also better than those for the previous TEPS.

2. Improvement of the global NWP data assimilation system

JMA continues to develop the global data assimilation system toward better initial condition analysis, which is expected to lead to enhanced NWP forecasting for tropical cyclones. As part of these efforts, the following improvements have been applied:

(1) Utilization of Metop-B data in JMA’s Operational Global and Mesoscale NWP Systems (November 2013)

EUMETSAT’s Metop-B operational polar-orbiting meteorological satellite was launched in September 2012 and became the prime operational satellite in April 2013. Available data from Metop-B are obtained by Advanced Microwave Sounding Unit-A (AMSU-A), Microwave Humidity Sounder (MHS), GNSS Receiver for Atmospheric Sounding (GRAS) and Advanced Scatterometer (ASCAT) in addition to the set of retrieval data (atmospheric motion vector (AMV) information) from the Advanced Very High Resolution Radiometer (AVHRR). An observation system experiment (OSE) involving the use of the global NWP system for August 2013 revealed that the wind speed bias at around 500 hPa in the tropics and both the bias and the root mean square error (RMSE) of wind speed at around 300 hPa in the Southern Hemisphere were reduced. The quality of TC track forecasts was also improved. JMA began assimilating data from Metop-B in addition to those from Metop-A on 28 November 2013.

(2) Utilization of ground-based GNSS zenith total delay, the GNSS radio occultation bending angle and AMSU-A Ch14 (March 2014)

When the operational Global Spectral Model (GSM) was upgraded, the following three observation data considerations were also introduced:

- Ground-based Global Navigation Satellite System (GNSS) zenith total delay

- Bending angle of GNSS radio occultation in replacement of refractivity
- AMSU-A Ch14

The impact of these data was investigated as part of the GSM upgrade described in Section 1 above.

(3) Utilization of Aqua/AIRS and Metop-A, B/IASI and Typhoon bogus improvement (September 2014)

An observing system experiment (OSE) with hyperspectral infrared sounder data such as AIRS from the Aqua satellite operated by NASA and IASI from the Metop-A and B satellites operated by EUMETSAT was conducted using channels selected for their temperature sensitivity. In the experiment, the impact of typhoon bogus improvement was also evaluated. The results showed a positive impact in that the RMSE of geopotential height at 500 hPa was reduced, especially in the Southern Hemisphere. As the profile of the typhoon bogus is adjusted to the model resolution, typhoons with a steep pressure gradient around the center are well represented in the analysis field. As a result, TC intensity forecasts were also improved as shown in the figure below. These two changes were implemented in the global data assimilation system in September 2014.

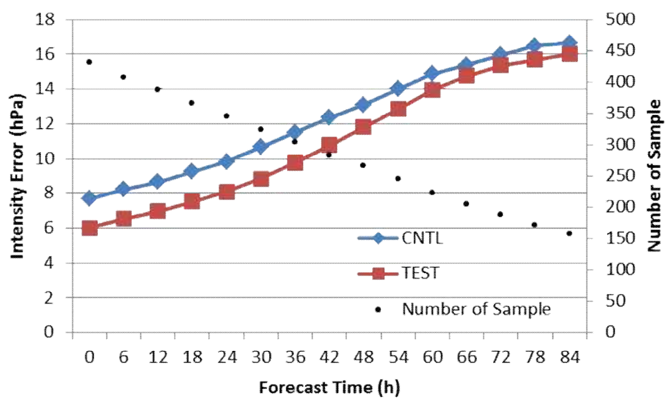

Figure: Mean error of TC intensity forecasts for summer 2013. The blue and red lines represent results from the current operational system (CNTL) and those from the modified system (TEST), respectively. Black dots indicate the number of samples.

Summary Table of relevant KRAs and components (Tick boxes as appropriate; multiple choices OK.)

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

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Successful launch of Himawari-8

The next-generation geostationary meteorological satellite of the Japan Meteorological Agency (JMA), Himawari-8, was successfully launched using H-IIA Launch Vehicle No. 25 on 7 October 2014 from the Tanegashima Space Center in Kagoshima, Japan. The satellite entered geostationary orbit on 16 October 2014 as planned.

The satellite is expected to start operation in mid 2015 after the completion of in-orbit testing and the checking of the overall system including related ground facilities.

Himawari-8 will be located at around 140 degrees east, and will observe the East Asia and Western Pacific regions as a successor to the current MTSAT-2 satellite. The satellite will feature a new imager with 16 bands as opposed to the 5 bands of the MTSAT series. Full-disk imagery will be obtained every 10 minutes, and rapid scanning at 2.5-minute intervals will be conducted over several regions, one of which will be for targeted observation of tropical cyclones. Its horizontal resolution will also be double that of the MTSAT series. These significant improvements will bring unprecedented levels of performance in monitoring for tropical cyclones as well as rapidly developing cumulonimbus and volcanic ash clouds.

JMA will distribute all imagery derived from the satellite to National Meteorological and Hydrological Services (NMHSs) via an Internet cloud service. The Agency also plans to start a HimawariCast service involving the dissemination of primary sets of images for operational meteorological services via a communication satellite. Its current online imagery distribution services (WIS Portal (GISC-Tokyo) and the JMA Data Dissemination System (JDDS)) will be continued. For updates, see http://www.data.jma.go.jp/mscweb/en/himawari89/.

Summary Table of relevant KRAs and components (Tick boxes as appropriate; multiple choices OK.)

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

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In 2014, the Japan Meteorological Agency (JMA) added 40 stations for data to be used in storm surge time-series forecasts. The first 10 (9 in the Philippines and 1 in US Guam) were added on 9 June, and the other 30 (20 in Viet Nam, 5 in Hong Kong and 5 in the Republic of Korea) were added on 24 September for a new overall total of 50. On 24 September, map images of horizontal storm surges were also improved to explicitly show the maximum surge height.

These forecasts are provided on JMA's Numerical Typhoon Prediction website (https://tynwp-web.kishou.go.jp/) when one or more typhoons are present in its region of coverage.

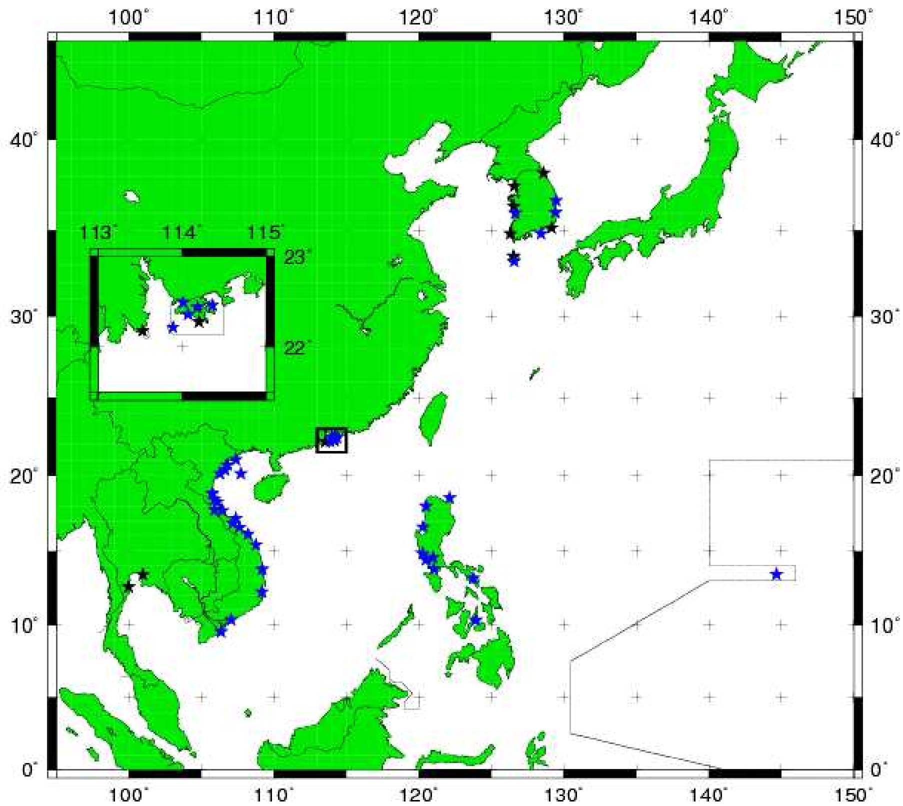

Figure 1 Location of stations for storm surge time-series forecasting (shown by stars). Black and blue represent existing stations and those added in 2014, respectively.

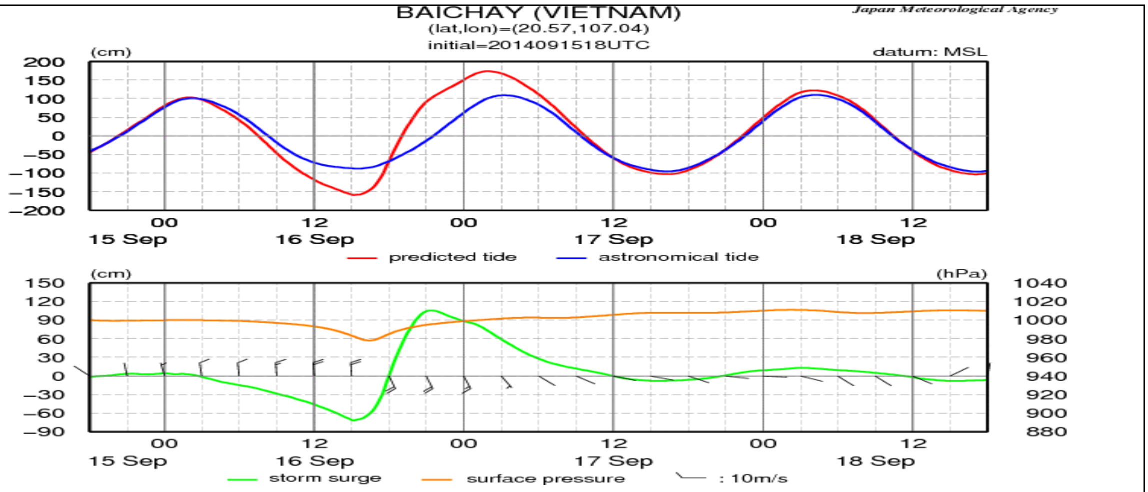

Figure 2 A storm surge time-series chart showing conditions predicted for Bai Chay, Viet Nam, in association with Typhoon Kalmaegi (1415). The upper figure shows predicted (red line) and astronomical (blue line) tides, while the lower figure shows predicted storm surges (green line), surface pressure values (orange line) and wind barbs from the storm surge model.

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

JMA plans to run a service providing storm surge predictions with different typhoon course scenarios. The product is expected to be useful in compensating for storm surge uncertainty caused by typhoon track errors. Scenario setting methods and product image specifications are currently under consideration, and the product is expected to be ready for release in 2015.

Summary Table of relevant KRAs and components (Tick boxes as appropriate; multiple choices OK.)

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

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Release of TCC products and publications related to tropical cyclones

The Tokyo Climate Centre (TCC) issues weekly reports on extreme climate events around the world, including extremely heavy precipitation and/or weather-related disasters caused by tropical cyclones (http://ds.data.jma.go.jp/gmd/tcc/tcc/products/climate/).

The Centre also issues a quarterly newsletter called TCC News, which is available on its website. The publication covers various climate-related topics including the El Niño outlook, JMA's seasonal numerical prediction for the coming summer/winter, summaries of Asian summer/winter monsoons, reports on extreme climate events around the world, and introductions to new TCC services. The autumn issue carries an article on tropical cyclone activity over the western North Pacific for the year (http://ds.data.jma.go.jp/tcc/tcc/news/index.html).

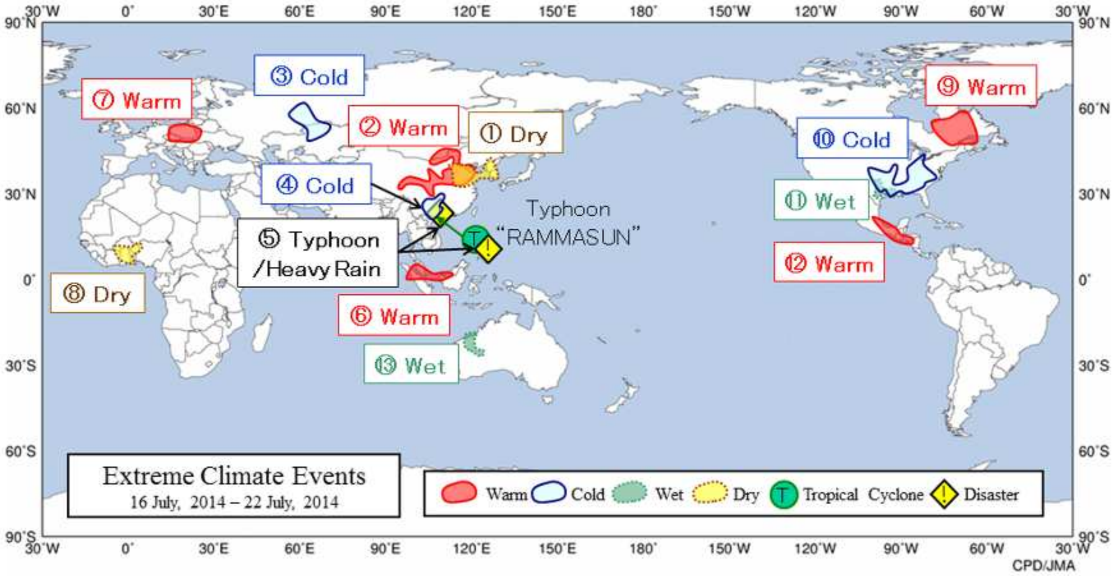

Figure: Distribution of global extreme climate events (16 – 22 July 2014)
The figure highlights areas where extreme climate events were identified from SYNOP messages, and also shows the tracks of tropical cyclones based on preliminary data from tropical cyclone centers worldwide.

Summary Table of relevant KRAs and components (Tick boxes as appropriate; multiple choices OK.)

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

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Global distribution showing tropical cyclone activity forecasting skill on short- to medium-range time scales

In line with the Annual Operating Plan (AOP) of the Working Group on Meteorology (WGM) of the ESCAP/WMO Typhoon Committee for 2013, MRI/JMA began evaluating tropical cyclone (TC) genesis and subsequent track (TC activity) forecasts on a medium-range timescale using TIGGE data under the North Western Pacific Tropical Cyclone Ensemble Forecast Project (NWP-TCEFP; Yamaguchi et al. (2014a)). Operational global medium-range ensemble forecasts of TC activity are systematically evaluated to further examine the skill of such forecasting and determine its potential for future operational use (an AOP for 2014). The global ensembles used are ECMWF, JMA, NCEP and UKMO for the period from 2010 to 2013. The verification metric is the Brier Skill Score, which is calculated within a three-day time window applied over a forecast period of two weeks to examine skill on short- to medium-range time scales. BSS is calculated for seven TC basins worldwide to provide a global map of TC activity probability forecast skill.

Operational global medium-range ensembles have been found capable of providing guidance on TC activity forecasts extending into the second week (Yamaguchi et al. (2014b)). BSSs for the Western North Pacific, the Eastern and Central Pacific and the North Atlantic basins are higher than those for other basins, and ECMWF has the highest values in general. Meanwhile, BSS and reliability have been found to be sensitive to the choice of wind threshold values in the definition of model TCs.

References

Yamaguchi, M., T. Nakazawa, and S. Hoshino, 2014: North Western Pacific Tropical Cyclone Ensemble Forecast Project, *Tropical Cyclone Research and Review*. (Under review)

Yamaguchi, M., F. Vitart, S. T. K. Lang, L. Magnusson, R. L. Elsberry, M. Kyouda, and T. Nakazawa, 2014: Global map on the skill of tropical cyclone activity forecasts on short- to medium-range time scales. (Under compilation)

Summary Table of relevant KRAs and components (Tick boxes as appropriate; multiple choices OK.)

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

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