MEMBER REPORT

ESCAP/WMO Typhoon Committee
11th Integrated Workshop

Japan

Cebu, the Philippines
24 – 27 October 2016

CONTENTS

I. Overview of tropical cyclones that have affected Members' areas in 2016

1. Meteorological assessment

In 2016, 11 tropical cyclones (TCs) of tropical storm (TS) intensity or higher had come within 300 km of the Japanese islands as of 7 October. Japan was affected by 7 of these, with 6 making landfall. These 7 TCs are described below, and their tracks are shown in Figure 1.

(1) STS Chanthu (1607)
Chanthu was upgraded to TS intensity west of the Northern Mariana Islands at 18 UTC on 13 August. It moved northward and reached its peak intensity with maximum sustained winds of 55 kt and a central pressure of 980 hPa off the eastern coast of the Tohoku region at 00 UTC on 17 August. Keeping its northward track, Chanthu made landfall around Cape Erimo in Hokkaido Prefecture with STS intensity at around 0830 UTC on 17 August. It transformed into an extratropical cyclone around the Sakhalin Islands at 18 UTC on the same day. A peak gust of 43.2 m/s and a 24-hour precipitation total of 51 mm were recorded at Kushiro (47418).

Four injuries, flooding and landslides caused by heavy rain, damage to houses, power outages and transport disruption were reported from the Kanto region to Hokkaido.

(2) TY Mindulle (1609)
Mindulle was upgraded to TS intensity west of the Northern Mariana Islands at 00 UTC on 17 August. It moved northward and reached its peak intensity with maximum sustained winds of 65 kt and a central pressure of 975 hPa around Hachijojima Island at 18 UTC on 21 August. Keeping its northward track, Mindulle made landfall on Tateyama City in Chiba Prefecture with TY intensity at around 0330 UTC on 22 August. After moving over eastern and northern Japan, it made landfall on the central part of the Hidaka District in Hokkaido Prefecture just before 21 UTC on the same day. It transformed into anextratropical cyclone over the Sea of Okhotsk at 03 UTC on 23 August. A peak gust of 45.5 m/s was recorded at Katsuura (47674), and a 24-hour precipitation total of 291.5 mm was recorded at Oshima (47675).

Mindulle and Kompasu (1611) caused two fatalities and damaged houses and farm products. Cancellations of flights and ship departures were reported from eastern to northern Japan.

(3) TY Lionrock (1610)
Lionrock was upgraded to TS intensity south of Shikoku Island at 12 UTC on 21 August. After moving southwestward, it turned sharply east south of Minamidaitojima Island at 18 UTC on 25 August. It then accelerated northeastward and reached its peak intensity with maximum sustained winds of 90 kt and a central pressure of 940 hPa west of Chichijima Island at 06 UTC on 28 August. After gradually turning north-northwestward, it made landfall on Ofunato City in Iwate Prefecture with TY intensity at around 0830 UTC on 30 August and moved northwestward. It transformed into an extratropical cyclone over the Sea of Japan at 15 UTC on 30 August. A peak gust of 37.7 m/s and a 24-hour precipitation total of 130.5 mm were recorded at Miyako (47585).

This typhoon left 22 dead, 5 missing and 11 injured in the Tohoku and Hokkaido regions. Damage to houses, power cuts, water/communications outages, damage to farm products and transport disruption were also reported in these regions.

(4) TS Kompasu (1611)
Kompasu was upgraded to tropical storm (TS) intensity and reached its peak intensity with maximum sustained winds of 35 kt and a central pressure of 994 hPa east of Japan at 00 UTC on 20 August. After turning north-northeastward, it made landfall on Kushiro City in Hokkaido

Prefecture with TS intensity after 1400 UTC on 21 August before entering the Sea of Okhotsk. and transformed into an extratropical cyclone on at 18 UTC on the same day.

(5) TY Namtheun (1612)
Namtheun was upgraded to TS intensity south of Okinawa Island at 00 UTC on 01 September. It turned northward and reached its peak intensity with maximum sustained winds of 70 kt and a central pressure of 955 hPa east of Amami-Oshima at 18 UTC the next day. After moving northward, Namtheun landed around Nagasaki City at around 16 UTC on 4 September, and it weakened to TD intensity at two hours later.

An injury in Kagoshima Prefecture, damage to a building in Miyazaki Prefecture and two flight cancellations were reported.

(6) TY Malakas (1616)
Malakas was upgraded to TS intensity north of Yap Island at 18 UTC on 12 September. Moving northwestward, it reached its peak intensity with maximum sustained winds of 95 kt and a central pressure of 930 hPa south of Yonagunijima Island at 18 UTC on 16 September. After turning northeastward, Malakas made landfall on the Osumi Peninsula in Kagoshima Prefecture with TY intensity after 15 UTC on 19 September and again on Tanabe City in Wakayama Prefecture on the same day. Malakas transformed into an extratropical cyclone off the coast of the Tokai region at 12 UTC on 20 September. A peak gust of 66.8 m/s was recorded at Yonagunijima (47912), and a 24-hour precipitation total of 445.5 mm was recorded at Nobeoka (47822).

Flooding caused by heavy rain resulted in one fatality, and damage to houses and farm products was reported across a wide area stretching from western to eastern Japan.

(7) TY Chaba (1618)
Chaba was upgraded to TS intensity east of Saipan Island at 18 UTC on 27 September. Moving northwestward, it reached its peak intensity with maximum sustained winds of 115 kt and a central pressure of 905 hPa south of Kumejima Island at 09 UTC on 3 October. After turning northeastward, Chaba entered the Sea of Japan and transformed into an extratropical cyclone at 12 UTC 5 October. A peak gust of 56.8 m/s and a 24-hour precipitation total of 82.0 mm were recorded at Kumejima (47929).

Nine injuries, damage to houses, power outages and cancellations of flights and ship departures were reported in western Japan.
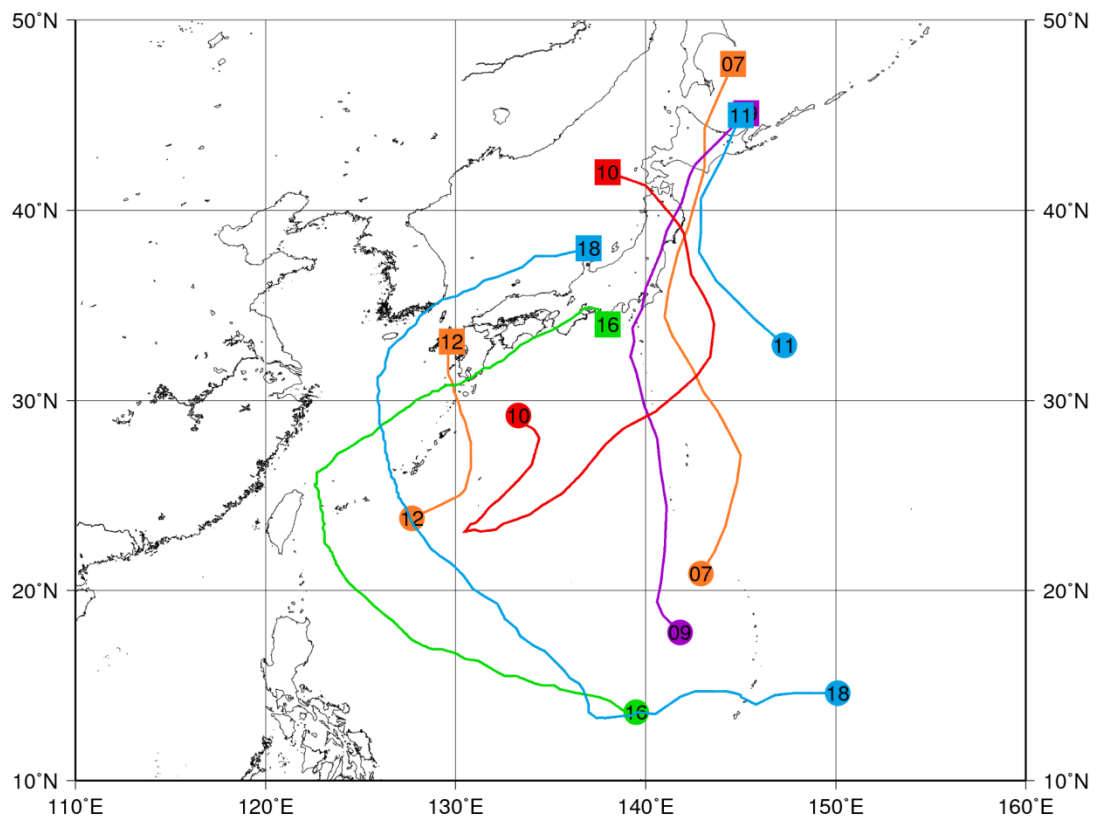
Figure 1 Tracks of the seven named TCs affecting Japan in 2016
Numbered circles represent genesis points of named TCs, and squares show dissipation points. The last two digits of the identification number for each named TC are also shown.
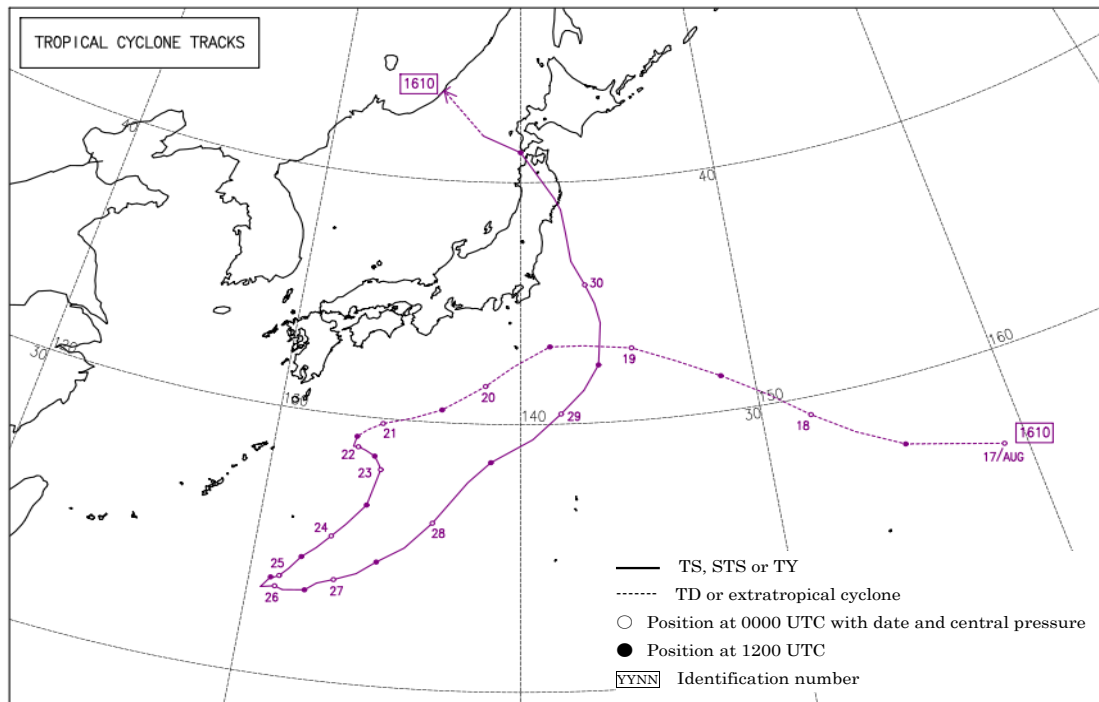
Figure 2 Track of Typhoon Lionrock (1610)
TY Lionrock caused serious damage to Japan in August 2016. It was the first named tropical cyclone to make landfall in the Tohoku region from the Pacific Ocean side since the Japan Meteorological Agency began publishing statistics in 1951.
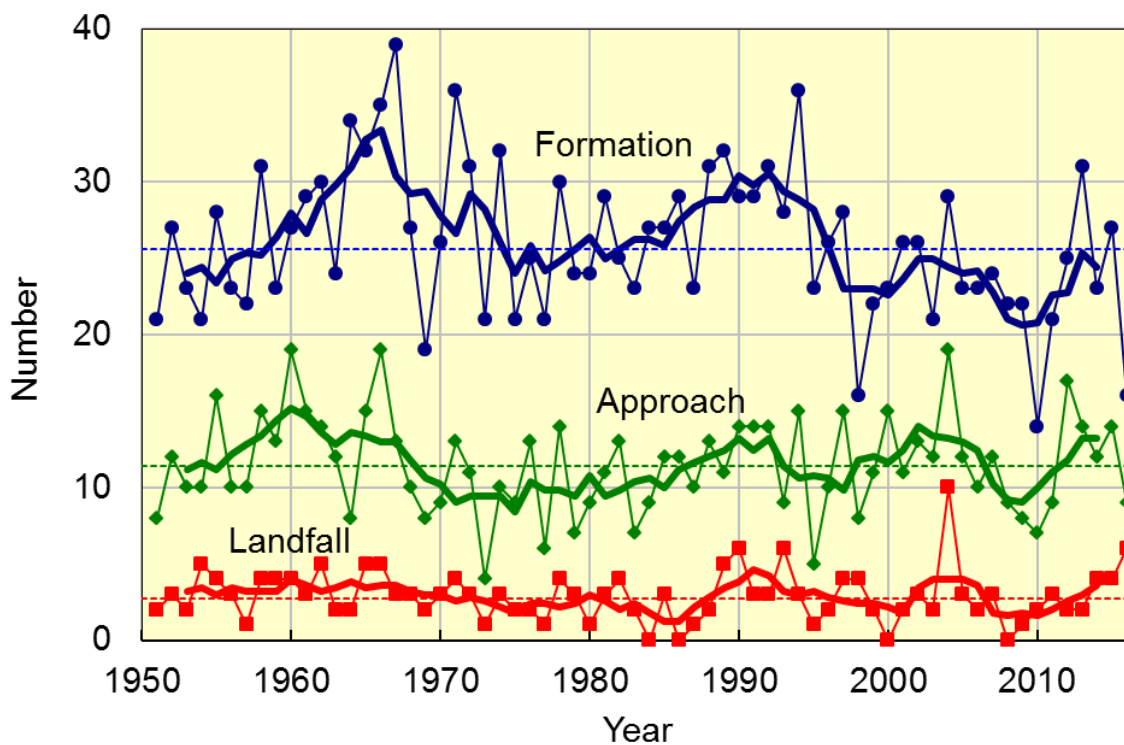
Figure 3 Numbers of tropical cyclones (TS intensity or higher) forming over the western North Pacific (top), approaching Japan (middle) and hitting Japan (bottom) as of 20 September 2016. The thin, solid and dashed lines represent annual means, five-year running means and normal values (1981 – 2010 averages), respectively. JMA describes

inter-annual variability and long-term trends regarding typhoon activity in its Climate Change Monitoring Report every year. The report is distributed to the Japanese public as well as 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

Japan has been hit by a series of tropical cyclones in 2016. Many have made landfall at full force, causing significant damage nationwide.

A total of 19 tropical cyclones of tropical storm (TS) intensity or higher had formed as of 6 October. Although this is around average for this time of year, 6 of them made landfall on Japan. This is the second-highest total since records began in 1951.

I. Overview of flooding

As of September 20 2016, the flooding detailed below had been reported. TY Lionrock caused the most damage.

1) Heavy rain associated with seasonal rain front
   Dates: 20 to 25 June 2016
   Places: Kumamoto Pref., Hiroshima Pref. (western Japan), others
   Damage: 6 fatalities, 1 missing, 10 injured, 21 houses destroyed, 65 houses seriously damaged, 179 houses moderately damaged, 336 houses inundated above floor level, 1,437 houses inundated below floor level
   Main causes of fatality: landslides, flooding

2) Heavy rain associated with TY Mindulle and TS Kompasu
   Dates: 20 to 24 August 2016
   Places: Hokkaido region (northern Japan), Chiba Pref., others
   Damage: 2 fatalities, 77 injured, 2 houses destroyed, 7 houses seriously damaged, 271 houses moderately damaged, 594 houses inundated above floor level, 1,862 houses inundated below floor level
   Main cause of fatality: flooding

3) Heavy rain associated with TY Lionrock
   Dates: 30 August to 6 September 2016
   Places: Hokkaido, Iwate Pref. (northern Japan), others
   Damage: 22 fatalities, 5 missing, 11 injured, 393 houses destroyed, 2,128 houses seriously damaged, 1,247 houses moderately damaged, 364 houses inundated above floor level, 1,257 houses inundated below floor level
   Main cause of fatality: flooding

4) Heavy rain associated with TY Malakas

   Date: 18 to 20 September 2016

   Places: Miyazaki Pref., Kochi Pref. (western Japan), others

   Damage: 1 fatality, 48 injured, 4 houses destroyed, 12 houses seriously damaged, 267 houses moderately damaged, 408 houses inundated above floor level, 1,291 houses inundated below floor level

   Main cause of fatality: flooding

5) Places affected by TY Lionrock

Hokkaido Region: Flooding from 20th August

As of 30th August

- Number of River over the level of Planned High Water
    - Class A River: 9 Rivers
    - Class B River: 12 Rivers
- Inundation:
    - House above Floor: 2 Houses
    - House under Floor: 33 Houses

Temporary Measures Setting Big Sandbags in Ashoro River

Overflow from Tokoro River and 170 ha Inundated area

Inundation — Ishikari River

Tokoro River

Ishikari River

Ashoro River

120 ha Inundated Area and 6 Houses

Before Draining

After Draining

Draining in Tokoro River

Tohoku Region: Flooding from 20th August

As of 30th August

- Number of River over the level of Planned High Water
    - Class A River: 0 Rivers
    - Class B River: 12 Rivers
- Inundation:
    - House above Floor: 1 Houses
    - House under Floor: 22 Houses

Iwaki

Takase
Mabechi

Yoneshiro

Collapsed River Bank and 50 ha Inundated Area in Aka River

Mogami
Aka

Kitakami

23 Inundated Houses in Kyoda River

Abukuma

Collapsed Revetment in Akamatsu River

0.6 ha Inundated Area in Kurose River

Kanto Region: Flooding from 20th August

As of 30th August

- Number of River over the level of Planned High Water
  - ✓ Class A River: 2 Rivers
  - ✓ Class B River: 17 Rivers
- Inundation:
  - ✓ House above Floor: over 77 Houses
  - ✓ House under Floor: over 400 Houses

Azuma River

Kasumi River

Furou River

Yanase River

Flood Fighting in Momiya River

Koise River

Tsurumi River → Retarding Basin

Flow from Tsurumi River to a Retarding Basin

II. Overview of 2016 sediment incidents

As of August 31 2016, a total of 1,121 sediment incidents had been reported (307 debris flows, 36 landslides and 778 slope failures). The fatality count stood at 17.

Overview of sediment disasters in 2016

1) Typhoon Lionrock (No. 10)

In August, Typhoon Lionrock (No. 10) followed a peculiar path. After moving southwest from the sea south of the Kanto region, it made a U-turn over the Pacific Ocean and moved on to make landfall on Iwate Prefecture.

A total of 115 sediment incidents were reported (98 debris flows and 17 slope failures).

2) Typhoon Malakas (No. 16)

A total of 155 sediment incidents were reported.
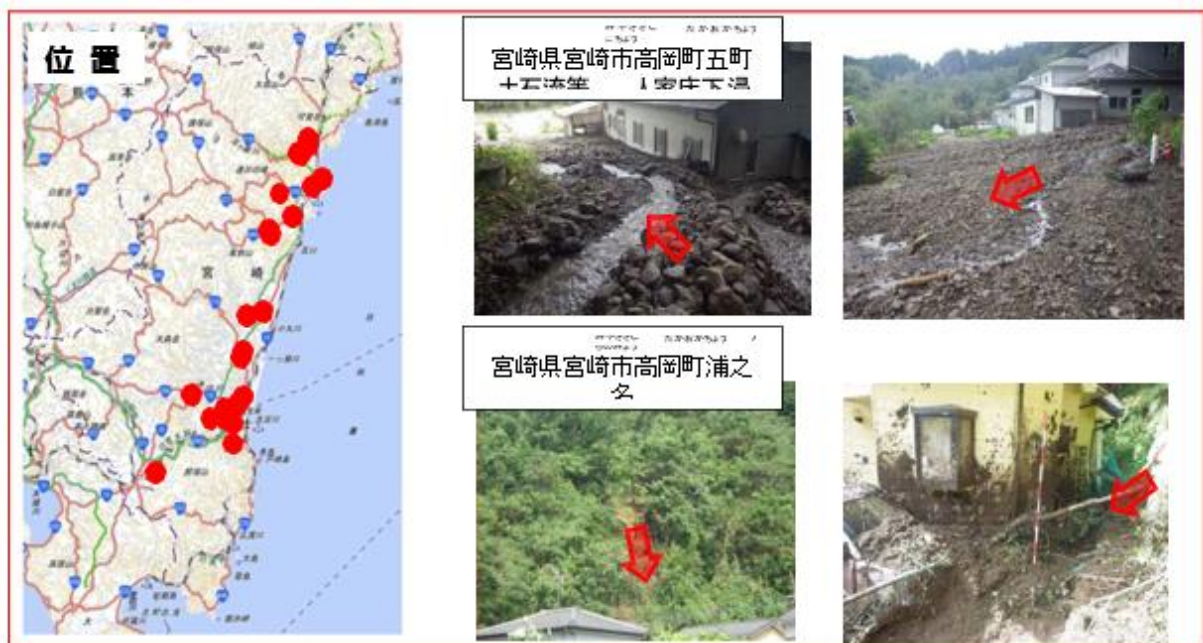
3. Socio-Economic assessment

Damage caused by major tropical cyclone disasters in 2016 (as of September 29)

As of September 29 2016, 10 of the year's 18 named tropical cyclones of tropical storm (TS) intensity or higher had approached Japan, with 6 actually making landfall (Nos. 7, 9, 10, 11, 12 and 16.).

In August, a series of tropical cyclones (Severe Tropical Storm Chanthu (No. 7), Tropical Strom Kompasu (No. 11), Typhoon Mindulle (No. 9) and Typhoon Lionrock (No. 10)) hit. These storms brought torrential rain that caused massive damage to the Tohoku region and Hokkaido, including flooding of houses and farmland, road collapses and debris flows. The strong Typhoon Lionrock (No. 10) was the first to make landfall on the Tohoku region from the Pacific Ocean side since the Japan Meteorological Agency first published statistics in 1951. It was also the first year in which the Hokkaido region was hit by three tropical cyclones.

Severe Tropical Storm Chanthu (No. 7) moved north on August 16 and 17 over coastal areas of the Kanto and the Tohoku regions, bringing widespread rainfall. It transformed to extratropical cyclone status after making landfall in Hokkaido on August 17. The storm brought heavy rain to the Kanto region (with 83 millimeters of rain per hour recorded in Utsunomiya, Tochigi Prefecture) as a cold front subsequent to the extratropical cyclone passed over the area. Rainfall totals exceeded 100 millimeters in many parts of the Kanto, Tohoku and Hokkaido regions. Tropical Storm Kompasu (No. 11) hit the Tohoku region and made landfall near Kushiro in Hokkaido on August 21, and Typhoon Mindulle (No. 9) gained strength as it moved northward over the Izu islands on the morning of August 22. It made landfall on Tateyama in Chiba Prefecture on the same day, and after moving across Honshu it made landfall again on the Hidaka area of Hokkaido on August 23. The resulting storm conditions and heavy rain left 2 people dead and 76 injured, 277 houses damaged and 1,972 buildings inundated.

Typhoon Lionrock (No. 10), accompanied by a storm area, made landfall on Iwate Prefecture on August 30 and then passed over the Tohoku region before heading out over the Sea of Japan. It brought heavy rain and storms to wide areas from

western to northern Japan, with particular severity in the Tohoku and Hokkaido regions. Up to 80 millimeters of rain per hour fell in the Miyako and Kuji areas of Iwate Prefecture, and record rainfall was observed in Hokkaido between August 28 and 31. The typhoon left 20 people dead in Iwate Prefecture and 2 in Hokkaido, as well as 5 missing and 11 injured over a wide area. Houses were damaged throughout Japan, and infrastructure-related issues (e.g., power cuts and water/communications outages) as well as traffic disturbances (e.g., train service suspension) were reported.

Typhoon Namtheun (No. 12) weakened after making landfall near Nagasaki on September 5, and was downgraded to a tropical depression status. A total of 349 millimeters of rain was recorded over the period between midnight on September 1 and 7 a.m. on September 5, and other areas in southern Kyushu and the Amami Islands also reported heavy rainfall, causing a minor injury in Kagoshima Prefecture and damage to a building in Miyazaki Prefecture. Iwaizumi Town in Iwate Prefecture, which was severely damaged by Typhoon Lionrock (No. 10), issued evacuation directives ahead of the approaching Typhoon Namtheun (No. 12), and had completed evacuation to hotels and other shelters by the end of September 4.

The very strong Typhoon Malakas (No. 16) approached Kyushu and made landfall on the Osumi Peninsula in Kagoshima Prefecture on September 20. It was downgraded to strong typhoon status after slightly weakening as it moved eastward along the southern coastline of Shikoku, and made landfall again on the Kii Peninsula around Tanabe in Wakayama Prefecture on the same day. The typhoon and its subsequent front line brought more than 200 millimeters of rain to eastern and western Japan, with some parts of western Japan recording almost 1.5 times the average rainfall for September. Many areas observed heavy rain; at Makurazaki in Kagoshima Prefecture, 115 millimeters fell between 12:19 and 0:19 on September 20. The heavy rain caused 1 fatality in Aichi Prefecture, a total of 48 injuries in 14 prefectures, and damage and/or flooding to 2,025 buildings and houses.

Typhoon Malakas (No. 16) was the sixth of 2016, bringing the number of named tropical cyclones to hit Japan in a year to the second highest on record. This was

the first time since 2004 that more than five tropical cyclones made landfall on Japan in a year.

In response to this series of tropical storms, the government held inter-ministerial meetings and dispatched a research team to Hokkaido and Iwate several times for discussions with local governments in the affected areas and on-site observation. An on-site liaison office run by central and local government staff was set up in Iwate Prefecture on September 2 to support efficient collection and sharing of information as well as effective emergency activities.

In response to the disaster conditions caused by storms and rainfall associated with named tropical cyclones 7, 11, 9 and 10 between August 16 and September 1, the government applied the terms of the Disaster Relief Act to Hokkaido and Iwate Prefectures and those of the Natural Disaster Victims Relief Law to Iwate Prefecture, which was severely affected. The tropical cyclones were also defined as extremely severe nationwide disasters, allowing the allocation of funding for disaster reconstruction projects toward early recovery in the affected areas.

II. Summary of progress in Key Result Areas

Asian Conference on Disaster Reduction (ACDR) 2016

The Asian Disaster Reduction Center (ADRC) convenes an annual international conference attended by disaster risk management officials from member countries and disaster experts from international organizations. The event is intended to promote the sharing of information and ideas, and to enhance partnerships among participating countries and organizations.

The Asian Conference on Disaster Reduction (ACDR) 2016 was held in Phuket, Thailand, on 25 and 26 February 2016. The event was organized jointly by the Government of Thailand, the Government of Japan, the United Nations Secretariat of the International Strategy for Disaster Reduction (UNISDR), and ADRC. The 98 attendees included high-level government officials from 24 countries as well as representatives of international and regional organizations, the academic community and the private sector.

The key ACDR2016 agenda items were:

1. Mega-disasters
2. Strengthening of DRR through capacity development training and education
3. Science and technology to support CBDRM: DRM upgrading at the local level

ACDR2016 began with opening remarks from ADRC Chairman Dr. Masanori Hamda, which were followed by remarks from Mr. Julio Surje of UNISDR, Dr. Masao Nishikawa (Japan's Cabinet Office Vice-Minister for Policy Coordination under the Cabinet Office of Japan) and H.E. Mr. Sutee Makboon (Deputy Minister of the Interior of Thailand). The keynote session featured presentations by Dr. Narayan Bahadur Thapa (Under-Secretary of Nepal's Ministry of Home Affairs), Dr. Masao Nishikawa (see above) and Mr. Suporn Ratananakin (Advisor to the Director-General of Thailand's DDPM).

ACDR 2016 attendees

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: Japan

Name of contact for this item:

Telephone: Email:

Urban search-and-rescue training in Singapore as an ADRC activity for disaster mitigation

The Singaporean Government holds an annual training course for search-and-rescue personnel. The course has hosted trainees from outside Singapore for the past ten years and provided training on the search-and-rescue expertise required in urban disaster situations. The training 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. In an effort to utilize their expertise and facilities, the ADRC has been inviting relevant personnel from member countries to the course since 2001. As of March 2016, a total of 53 people had attended the training. One officer from Mongolia is scheduled to attend the course that will be held in October 2016.

List of nations dispatching attendees over the past 5 years
FY 2010 (3): Bhutan, Mongolia, Maldives
FY 2011 (2): Bangladesh, Russia
FY 2012 (2): Mongolia, Thailand
FY 2014 (2): Bhutan, Maldives   *
FY 2015 (1): Azerbaijan

Report on urban search-and-rescue training in Singapore (2015)

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: Japan

Name of contact for this item: _____

Telephone: _____   Email: _____

Visiting Researchers from ADRC Member Countries

The Asian Disaster Reduction Center (ADRC) has been hosting Visiting Researchers (VR) from member countries since 1999. To date, 93 officials have taken part in the program to assimilate Japan's advanced expertise and technology on Disaster Risk Reduction (DRR). After finishing the program, attendees are expected to help strengthen DRR capacity in their home countries and further promote collaboration between their own nations and the ADRC. In 2016, the Center hosted six Visiting Researchers from the member countries shown below.

FY	Organization	Country
2016	Ministry of Emergency Situations	Armenia
	National Disaster Management Authority	Indonesia
	National Disaster Management Organization	Iran
	National Disaster Management Authority	Pakistan
	Office of Civil Defense	Philippines
	Department of Disaster Prevention and Mitigation	Thailand

Visiting Researchers

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: Japan   Name of contact for this item: _____

Telephone: _____   Email: _____

Asian Water Cycle Symposium 2016 in Tokyo, Japan

ICHARM and the University of Tokyo co-hosted the Asia Water Cycle Symposium 2016 on March 1 and 2 2016 with support from MLIT at the university's Takeda Hall in Tokyo. The event was held to provide a platform for discussions on action to address global issues related to floods and droughts based on effective use of Tokyo University's Data Integration and Analysis System (DIAS) for data archiving, model integration and climate change impact assessment, in addition to previous efforts by the Group on Earth Observations (GEO) and the Network of Asian River Basin Organizations (NARBO).

Part of the symposium was dedicated to mark ICHARM's 10th anniversary, with the attendance of overseas graduates from its educational programs to discuss capacity development issues for further training program improvement. Since ICHARM has served as the secretariat for the International Flood Initiative (IFI), the symposium also included an event for discussion of a new framework recently promoted by IFI to help reduce flood risk.

Around 170 people attended the symposium, including approximately 40 from overseas organizations. Consensus was reached on the promotion of a spiral-up-type framework in which disaster risk reduction efforts will be enhanced via science and technology coupled with holistic disaster prevention, mainstream disaster prevention, and support for sustainable development. The symposium also provided a platform for ICHARM to share its research results and findings with international experts.

Symposium schedule
Day 1 (Tuesday, 1 March)
1. Opening Session
2. Panel Debate: Floods and Drought in the Asia Pacific Region
3. Flood Session: Towards International Flood Initiative (IFI) Implementation in the Asia Pacific Region and GEO Water
  3.1 Opening Remarks Regarding IFI
  3.2 Current Situation and Countermeasures against Floods in Asia
    - AWCI member country reports
  - NARBO member reports
  3.3 Flood Early Warning System
  3.4 Flood Disaster Risk Reduction
  3.5 End-to-end Action Plan: IFI Deliberations in the Asia Pacific Region
4. Reception: Celebration of Ten Years of ICHARM

Day 2 (Wednesday, 2 March)
5. Drought Session
6. Capacity Building Session
  6.1 UNU Program
  6.2 ICHARM Capacity Building
7. Panel Discussion: Towards Water Disaster Risk Reduction in Asia and the Pacific Ocean Region
  7.1 Collection of Water Disaster Data and Related Statistics
  7.2 Inter-disciplinary and Trans-disciplinary Cooperation
  7.3 Promotion of Regional Cooperation
8. Summary Discussion Session

9. Closing

For presentation materials and more photos:
http://wci.t.u-tokyo.ac.jp/events/awcs2016/presentations.html

ICHARM Director Toshio Koike summarizes the discussion results

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							

Member:	Japan	Name of contact:	Yoshio Tokunaga
Telephone:	+81-29-879-6807	Email:	y-tokunaga@pwri.go.jp

New Products on the RSMC Tokyo-Typhoon Center's Numerical Typhoon Prediction Website

Since October 2004, the Regional Specialized Meteorological Centre (RSMC) Tokyo has operated the Numerical Typhoon Prediction (NTP) website (https://tynwp-web.kishou.go.jp/) as part of its contribution to the WMO/ESCAP Typhoon Committee. On 15 June 2016, the products detailed below were added to the site.

1) Tropical Cyclone Activity Prediction

RSMC Tokyo provides two-day and five-day Tropical Cyclone Activity Prediction Maps covering its area of responsibility using the ensembles from the European Centre for Medium-Range Weather Forecasts (ECMWF), the UK Met Office and their consensus. The maps displays tropical cyclone activity, which is defined as the probability that a TC will be present within 300 km of a certain location during the relevant forecast time window. The products are intended to help forecasters identify and monitor areas in which tropical cyclones could form within two- and five-day periods. Tropical cyclone activity prediction maps of other Numerical Prediction Centres are also to be displayed, if necessary NWP data are provided to RSMC Tokyo.
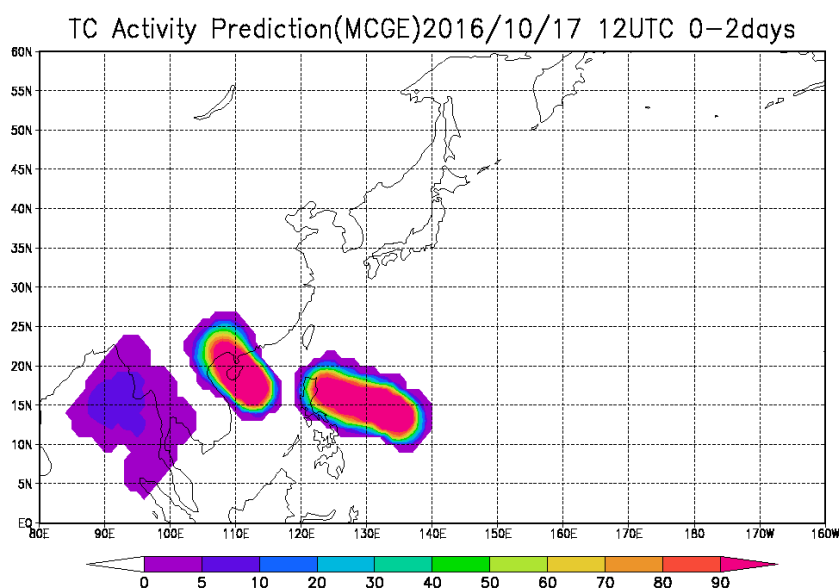
2 day TC activity prediction map based on Multi-center grand ensembles of ECMWF and UKMO on 17 October 2016.

2) TC Track Ensembles from ECMWF, NCEP and UKMO

TC track predictions from ECMWF, NCEP and UKMO ensemble systems are provided in addition to JMA's Typhoon Ensemble Prediction System (TEPS) to help forecasters develop TC track forecast scenarios in consideration of their uncertainty.

3) Weighted Consensus of Satellite TC Intensity Estimates

Weighted consensus TC intensity estimates produced using the Dvorak technique and warm core intensity observed by the Advanced Microwave Sounding Unit-A (AMSU-A) of the NOAA- and MetOp-series polar-orbiting satellites are also provided. These estimates are more accurate than the Dvorak technique, providing additional reliable

information for forecasters to estimate TC intensity.

4) Detailed Historical Logs of Dvorak Analysis
Detailed logs of Dvorak analysis, including Cloud Pattern, DT, MET, PT, Final-T and CI data, are provided to help forecasters understand TC intensity estimates from RSMC Tokyo.

5) Multi-scenario Storm Surge Prediction & Ensemble Ocean Wave Prediction
The new Multi-scenario Storm Surge Prediction product provides storm surge prediction based on RSMC Tokyo official advisories and five additional tropical cyclone track scenarios derived from TEPS using cluster analysis. As storm surge prediction is sensitive to tropical cyclone track scenarios, the product helps forecasters estimate uncertainty of storm surge prediction, taking into account track forecast errors.

Identified opportunities/challenges, if any, for further development or collaboration:
➢ Continuous improvement of the NTP website is considered beneficial to Members. Accordingly, Member feedback should be solicited for enhancement and effective development of the site.

➢ Verification results relating to products provided on the site should be published on a regular basis in the Annual Report on Activities of the RSMC Tokyo - Typhoon Center.

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:	Japan	Name of contact for this item:	Chiashi Muroi
Telephone:	+81-3-3211-8303	Email:	rsmc-tokyo@met.kishou.go.jp

16th Typhoon Committee Attachment Training at the RSMC Tokyo – Typhoon Center

The 16th ESCAP/WMO Typhoon Committee Attachment Training 2016 course was held at JMA Headquarters from 15 to 26 August 2016.

The RSMC Tokyo – Typhoon Center has run 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 in order to advance the tropical cyclone forecasting capacity of Committee Members. Forecasters from the Panel on Tropical Cyclones (PTC) have also been hosted since 2015 to enhance training collaboration between PTC and the Typhoon Committee. The 2016 attendees were Mr. Thatsana Chanvilay from Lao PDR, Ms. Shelly Jo Igpuara Ignacio from the Philippines, Ms. Ton Thi Thao from Vietnam, Mr. Nasser Said Abdullah Al Ismaili from Oman, Mr. Habib Rehmat from Pakistan, and Mr. Ponna Handi Chaminda De Silva from Sri Lanka.

The training focused on imparting practical knowledge and skills relating to operational tropical cyclone analysis and forecasting via lectures and exercises using the Satellite Analysis and Viewer Program (SATAID). The course covered a range of subjects including Dvorak analysis, interpretation of microwave data, quantitative precipitation estimation (QPE), quantitative precipitation forecasting (QPF) and storm surge forecasting. All attendees gave presentations to help JMA staff understand the current status of their meteorological and hydrological services.

In 2016, two-day sessions on warning coordination were introduced, with focus on how to determine warning thresholds using disaster statistics and meteorological datasets based on a past tropical cyclone event in Japan.
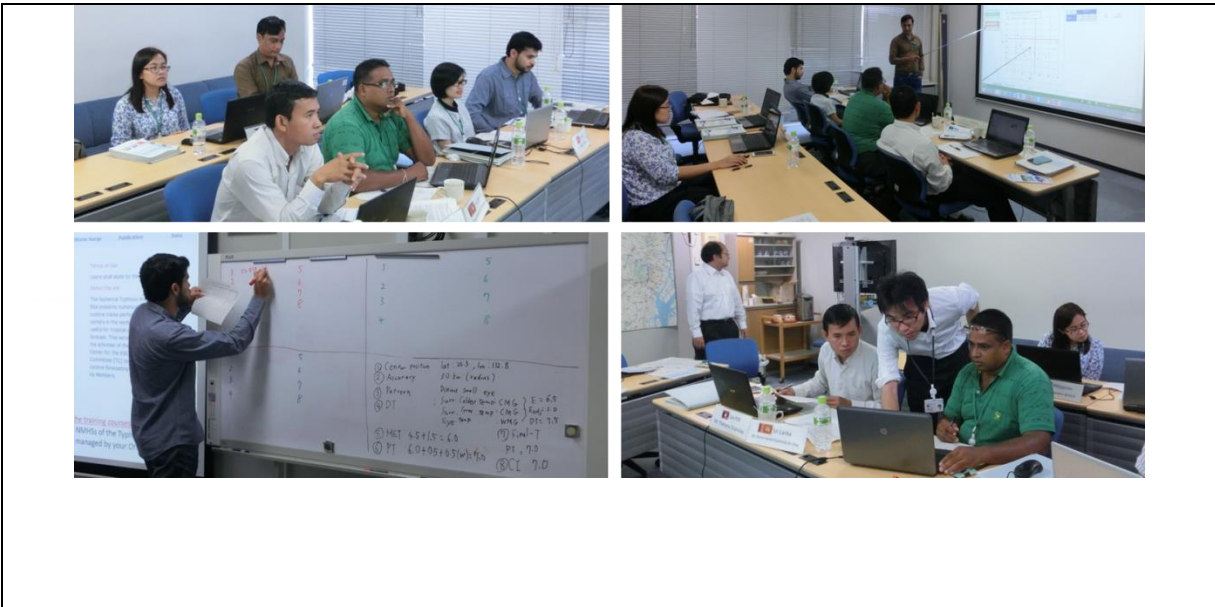
Identified Opportunities/challenges, if any, for Further Development or Collaboration:

Attendees reported in particular that practical exercises using SATAID helped them acquire operational skills in tropical cyclone analysis/forecasting. However, trainees also stressed their need for lectures/exercises on analysis and forecasting techniques for severe weather phenomena associated with tropical cyclones, such as radar-based heavy rainfall estimates and storm surges. Allocating more slots to lectures on QPE/QPF and storm surges may be preferable, but may also be practically challenging without further extension of the training period because the current curriculum is already densely packed.

From 2015 to 2016, PTC attendees were invited with financial support from Japan in accordance with a decision at the third joint session of PTC and the Typhoon Committee in Bangkok, Thailand. As there are currently no plans for Japan to extend this financial arrangement, ESCAP is encouraged to explore the possibility of providing necessary financial support to PTC Members in the future.

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							

Name of contact:

Member: Japan   Chiashi Muroi

Telephone: +81-3-3211-8303   Email: rsmc-tokyo@met.kishou.go.jp

Updates on JMA's numerical weather prediction system

1. Upgrade of JMA's global numerical weather prediction (NWP) system

JMA upgraded its Global Spectral Model (GSM) in March 2016. The model's parameterization schemes, including land surface processes, deep convection, cloud, radiation and sea ice, were revised to improve the representation of atmospheric characteristics. The results of experiments to evaluate these upgrades showed a positive impact on tropical cyclone (TC) track forecasts over the western North Pacific (Figure 1), and TC detection is also improved. Further verification additionally showed better accuracy in TC prediction.
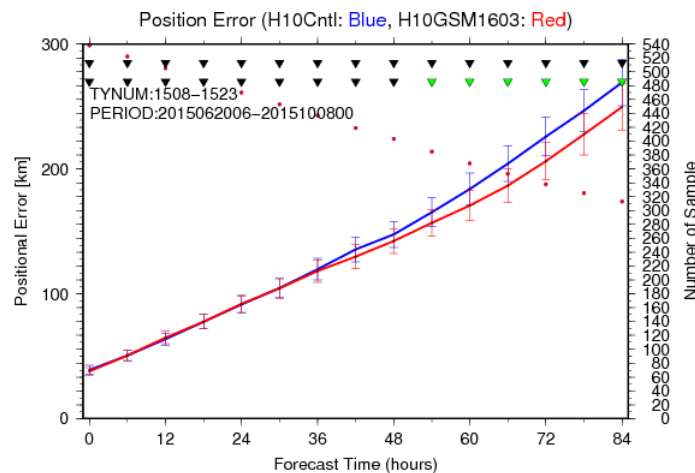

Figure 1 Average TC track forecast errors for the western North Pacific as a function of forecast time up to 84 hours. The red and blue lines represent positional errors for the upgraded and previous GSMs, respectively, and the error bars represent a 95% confidence interval. Red dots indicate the number of cases included in the statistics. The green triangles at the top indicate statistical significance in the difference.

2. Assimilation of Himawari-8 AMV and CSR data into JMA's global NWP system

JMA has also assimilated atmospheric motion vector (AMV) data and clear sky radiance (CSR) data from its new-generation Himawari-8 geostationary satellite in place of data from MTSAT-2 since March 2016. Thanks to the satellite's enhanced observation capacity as well as improved retrieval methods and upgraded quality control procedures, eight times more AMV data and two times more CSR data are now incorporated into JMA's operational global data assimilation system. An observing system experiment (OSE) on Himawari-8 AMV and CSR data was conducted for the period during which the 8th to 23rd named tropical cyclones of 2015 formed. The results showed that AMV and CSR data assimilation enhanced wind and water vapor analysis, resulting in better track forecasting for these tropical cyclones.

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							

Name of contact:

Member: Japan   Junichi Ishida

Telephone: +81-3-3211-8408   Email: j-ishida@met.kishou.go.jp

Promotion of Himawari-8/-9 data utilization

The Himawari-8 geostationary meteorological satellite managed by the Japan Meteorological Agency (JMA) began operation at 02 UTC on 7 July 2015.
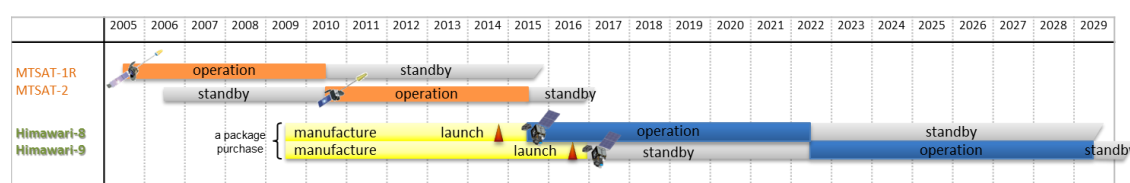
Himawari-8 is the world's first new-generation satellite of its kind, featuring significant improvements in terms of the number of observation bands, data capture periodicity and spatial resolution as compared to the previous generation. These enhancements are expected to support unprecedented prevention and mitigation of weather-related disasters in the East Asia and Western Pacific regions.

JMA runs two services for the provision of Himawari-8 imagery. One is the HimawariCast service, by which primary sets of imagery are disseminated for operational meteorological services via a communication satellite. The other is the HimawariCloud service, by which full sets of imagery are delivered to National Meteorological and Hydrological Services (NMHSs) via an Internet cloud service. In addition, JMA continuously provides Himawari-8 imagery in SATAID format via the WIS/GISC Tokyo server with its automatic downloader.

The World Meteorological Organization and the Japan International Cooperation Agency donate HimawariCast receiver equipment to NMHSs of developing countries in the Asia and Western Pacific region.

In connection with these activities, JMA has dispatched experts to a number of NMHSs in the Asia and Pacific regions in 2015 and 2016 to conduct training on Himawari-8 utilization. These staff check on NMHS status regarding Himawari-8 imagery acquisition, provide advice if necessary, and give presentations to support the enhancement of NMHS weather monitoring and forecasting capacity based on the use of such imagery.

JMA also plans to launch Himawari-9 on 1 November 2016 as the follow-on satellite to Himawari-8. The satellite will be put into in-orbit stand-by as backup for Himawari-8, with which it shares identical specifications. This will help to ensure the stability of the satellite observation system for the East Asia and Western Pacific regions for 15 years.

For further information, see JMA's Himawari-8 and 9 web pages.
http://www.jma.go.jp/jma/jma-eng/satellite/
http://www.jma-net.go.jp/msc/en/support/index.html

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: Japan   Name of contact for this item: Shiro Ohmori

Telephone: +81 3 3212 8341   Email: s-ohmori@met.kishou.go.jp

TCC products and publications related to tropical cyclones

The Tokyo Climate Center (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 Center also issues a quarterly newsletter called TCC News, which is available on the website. It features a variety of climate-related content 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 information on new TCC services. The next issue, TCC News No. 46 (to be published in December), will include a summary of the 2016 typhoon season in the western North Pacific (http://ds.data.jma.go.jp/tcc/tcc/news/).
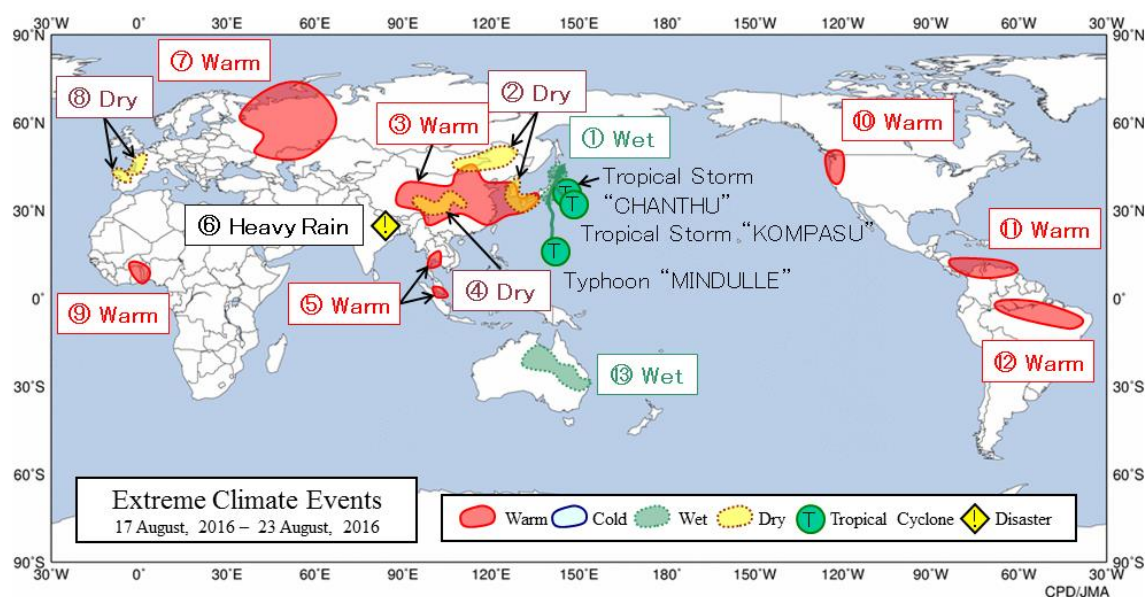

Figure Global extreme climate events (17 August – 23 August 2016)
The figure highlights areas where extreme climate events were identified from SYNOP messages, and also shows the tracks of tropical cyclones based on preliminary data from tropical cyclone centers worldwide.

Summary Table of relevant KRAs and components (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:	Japan	Name of contact for this item:	Kenji Kamiguchi
Telephone:	+81-3-3212-8341 (Ext. 3157)	Email:	climatemonitor@met.kishou.go.jp

Addition of storm surge/wave information

In June 2016, the Japan Meteorological Agency (JMA) began issuing multi-scenario storm surge predictions in cases where a typhoon is present in the relevant area during the forecast period. In the formulation of these predictions, cluster analysis is performed to extract 5 typical typhoon tracks from 25 members of the JMA Typhoon Ensemble System (TEPS). Storm surges are predicted using these tracks to help evaluate uncertainty stemming from typhoon track error. Along with storm surge prediction based on official typhoon tracks, six predictions are now provided.

JMA added 17 stations in Malaysia for storm surge time-series charts on 13 January, bringing the overall number of stations to 68. The Agency also simultaneously began to run the storm surge model daily on an experimental basis to support the provision of predictions for storm surges generated by monsoon winds or extra-tropical cyclones as well as by typhoons.

JMA began uploading week-range wave forecasts created using its global Wave Ensemble System (WENS) to the JMA Numerical Typhoon Prediction website (https://tynwp-web.kishou.go.jp/) on 27 August. The products consist of data on ensemble mean/3rd quantile/maximum wave heights, probability of wave heights exceeding 2, 3, 4, 5 and 6 m, and ensemble spread. Boxplot data and information on probabilities exceeding a certain level for selected stations are also provided on the site. WENS covers most of the global region and has a 1.25-degree grid resolution. It is run once a day at 12 UTC and enables prediction of ocean wave conditions up to 264 hours ahead with 27 members.
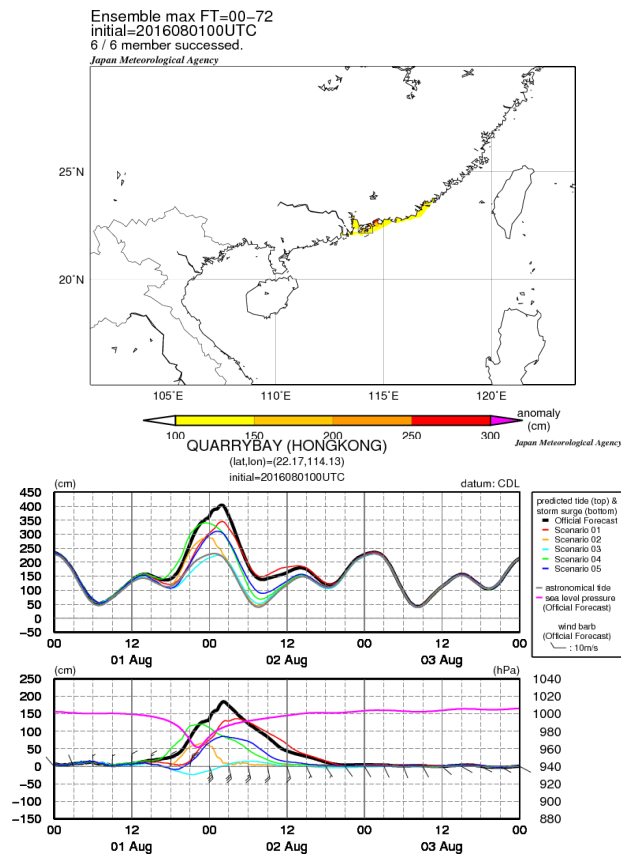
Example of multi-scenario storm surge prediction
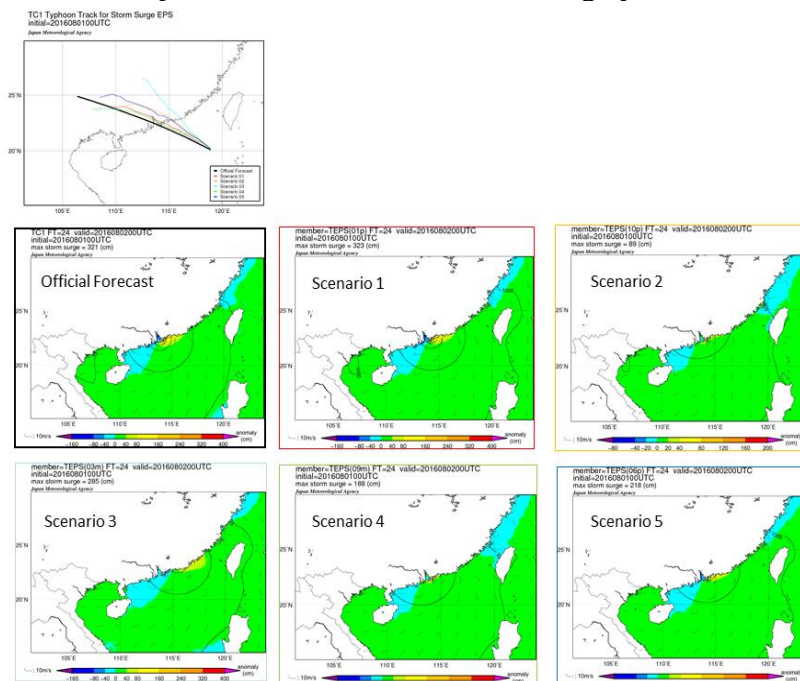
Calculated storm surge distribution maps

The map at the top shows the official forecast (black line) and five typical typhoon

tracks extracted from TEPS.
The maps in the middle and at the bottom show storm surge distribution calculated on the basis of each track (border colors indicate the corresponding track).

Predicted maximum storm surges among scenarios/forecast times (left) and time-series representations of predicted tide (top right) and storm surge (bottom right) at Quarry Bay (Hong Kong, China)

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							

		Name of contact	
Member:	Japan	for this item:	Nadao Kohno
Telephone:	+81 3 3212 8341 (Ext. 5139)	Email:	nkono@met.kishou.go.jp