SECOND REGIONAL WORKSHOP ON

IMPACT-BASED FORECASTS IN WMO RA II (ASIA)

SEOUL, REPUBLIC OF KOREA

19-21 NOVEMBER, 2018

FINAL REPORT

1.   INTRODUCTION

1.1   The 2nd Regional Workshop on Impact-based forecasts (IBF) in RA II (ASIA) was hosted by the World Meteorological Organization (WMO) and the Korean Meteorological Administration (KMA) on 19-21 November, 2018 at the Glad Hotel Yeouido, Seoul, Republic of Korea.

1.2   Dr. Jong Seok KIM, KMA Administrator and Ms. Miriam Andrioli, Chief Service Delivery Div. (SDD) of WDS Dept. in WMO participated in the opening with welcome speeches addressed to the local authorities and representatives of the participating countries.

1.3   In addition to her speech, Ms. Andrioli delivered a presentation emphasizing the importance of the NMHSs Service Delivery with a reference of its Strategy and Implementation Plan (WMO No. 1129) focusing on the role of the Public Weather Service Delivery (PWSD) Focal Points and inviting participating Member countries to update their submissions or nominate them. In addition she pointed out the WMO's supporting role to its Members to keep abreast of the new developments and innovations. In this regard she highlighted the WMO activities performed to facilitate the use of the Common Alerting Protocol (CAP) to disseminate warnings. She also explained the work performed by WMO on emerging services such as the Urban and Environmental Services and the positive results (almost 50 % of Members responses) received on the WMO Member Survey on Urban Services, encouraging participating countries that have not already done so to provide their valuable contribution to the questionnaire.

1.4   She highlighted the relevance of the Impact-based Forecast and Warning Services (IBFWS), referenced WMO´s constituent bodies Decisions on the subject, made a review of the IBFWS´ workshops already performed, in progress and planned in WMO RAs, including the Symposium to collect Members experiences with IBFWS to be held in late 2019 (as decided by EC-70), and focused on the development and provision of IBFWS worldwide. She also referenced the WMO Guidelines on Multi-hazard Impact-based Forecast and Warning Services (WMO No.1150) to the audience.

1.5   Finally, she described the expected objectives of the workshop as recommended by the Implementation-Coordination Team on Public Weather Service Delivery (CBS-OPAG ICT-PWSD) meeting (China, 2017) explaining that its outcomes will be considered by the CBS-OPAG/PWSD Task Teams and the WMO SDD as drivers for their future work as well as by the 2019 IBFWS´Symposium.

1.6   Mr. Gerald Fleming, Chair of the CBS-OPAG/PWSD, welcomed the audience and delivered two presentations (Item 3. to this Final Report).

1.7.   Dr. Chung Kyu PARK, WMO RAP Director, welcomed the audience on the second day of the workshop and delivered a presentation on the "Current Status of Impact Based Forecast in Regional Associations II & V (Asia and the South-West Pacific)".

1.8.   The workshop was attended by representatives of 18 WMO Member Countries (17 from RA II and 1 from RA V) and by representatives of local Universities.

1.9   Laos, Viet Nam and Thailand attendance was funded by the Climate Risk and Early Warning Systems (CREWS) Project as in the previous 1st Regional Workshop on Impact-based forecasts in WMO RA II held in 2017.

1.10.   The list of participants as provided by KMA is contained in **Appendix I** to this report.

2.   ORGANIZATION OF THE WORKSHOP

2.1   **Base line documentation**: Outcomes of the 1st Regional Workshop on Impact-based forecasts in RA II (ASIA), Seoul, Republic of Korea, 7-9 November, 2017. FINAL REPORT here

2.2   Working arrangements and full detailed information of the Sessions are described in the workshop program (**Appendix II).**

2.3   The Workshop included a Poster session with presentations from the KMA on the topic User-oriented Impact Forecasting Services in Korea.

3.   EXPERTS/LECTURERS' PRESENTATIONS

3.1   Mr. Gerald Fleming, Chair of the CBS-OPAG/PWSD, delivered two presentations on the Impact-Based Forecast Demonstration Projects with focus on the following subjects: "Overview of IBFWS Projects, approaches and Links to the WMO Competency Framework" and "Moving to the new paradigm".

3.2   Dr. Yang (Meteorological Service of Canada) delivered the presentation "Moving towards IBF system in the Meteorological Service of Canada".

3.3   Dr. Charlat (Meteo France) introduced the "Meteo France´s Vigilance Early Warning System".

3.4   Dr. Taylor (Bureau of Meteorology, Australia) presented (via teleconference) the subject "Assessment and forecast of hazard impact by BoM".

3.5   In addition, the Rep. of Korea participated with expert presentations delivered by Dr. Chae from the Koran Environmental Institute (KEI), on "IBF for heatwaves"; by Dr. Cho from NIMS on "The Heat-Health Warning System (HHWS) on a National and Urban scale"; by Dr. Oh from Nano climate & weather -Co. on the "Role of the private sector in the disaster management"; and by Prof. Kim from Korea National University (KNU), on "Development of heavy rainfall disaster impact forecasting model".
Finally, Ms. Yuki Mitsuka from the United Nations Economic and Social Commission for Asia and the Pacific (UN-ESCAP) presented the "UN-ESCAP´s work and programs related to IBF".

Note: All Power Point presentations here

4.   REVIEW OF THE CURRENT STATE, OUTCOMES, THE WAY FORWAD

4.1 Current state and challenges by country

Several Members' representatives provided an overview on the current state of the Early Warning and/or IBFWS systems in their respective countries followed by a Questions-Answers segment.

Note: All Power Point presentations [here]

4.1.1 India

India has participated in the 1st WMO/KMA IBFWS Workshop (Rep. Korea, 2017).

India Meteorological Department (IMD) provides IBFWS for selected hazards.

IMD´s representative delivered a presentation : the "Current status and strategies in India" which included information on the natural hazards affecting the country; the different national agencies managing them; the IMD forecasting and warning system; examples of the IBFWS provided, including the new 'Fog Alert' system (developed to inform train passengers about fog probability in route, its severity and probable impacts on train schedules (provided 6 to 24 hrs. in advance)); IBFWS currently in place for tropical cyclones and their associated hazards, including storm surges and strong winds; etc.

In addition, it was explained the Chennai Smart City concept which focus on urban climate action. The Chennai flood warning system consists in a disaster preparedness decision support system for coastal flooding in urban areas which includes C-FLOWS, an integrated Web-GIS based portal to assist the Tamil Nadu Government in their flood mitigation /relief operations.

It was also explained that Impact threshold based warnings have been provided since long to Registered / Designated users (such thresholds are in use at regional level and expected to be expanded at district level in the near future); also, the combination of phenomenon based and impact based weather warnings in place.

It was added that, in collaboration with UK Met Office and under the Weather & Climate Science for Service Partnership (WCSSP) – programme, further improvements in Risk based forecasting of High impact weather and climate events are planned on an extensive scale during the next 3 years.

Thunderstorm´s related IBFWS are expected to be implemented from the pre-monsoon season 2019, and the provision of dynamical IBFWS by 2024.

As a challenge, India´s representative highlighted the multiplicity of languages (15) in which forecasts and warnings need to be issued.

4.1.2 Maldives

Maldives benefitted from a WMO in-country IBFWS workshop in 2016 and participated in the 1st WMO/KMA IBFWS Workshop (Rep. Korea, 2017). It´s participation in the SWFDP-Regional Training Workshop on Severe Weather and IBFWS (Sri Lanka, December 2018) has also been confirmed.

-No IBFWS implemented yet; however, the representative stated the aim is to achieve this objective in future.

Maldives Meteorological Service's (MMS) representative explained the country is composed by 1200 islands being the lowest and flattest country in the world (only 1,5 meters a.s.l.) therefore, it is highly vulnerable to climate change and level rise.

Major hydrometeorological hazards are: torrential/heavy rain, flooding, thunderstorms, gusts winds, swell waves, storm surges, Tropical Cyclones (TCs) (indirectly).

MMS has an Alert system in place which includes color coding in accordance with the level of warning or advisory. Standard Operating Procedures (SOPs) are in place with the Maldives National Disaster Management Center and the Public Service media. Challenge: it was explained closer collaboration with other National Agencies would be highly desirable.

The representative identified the additional requirements: Island Research and further development of impact based framework; need of Public awareness programs to allow general public understand the phases of the early warning; Extend further the knowledge on vulnerability and exposure; Synergized SOPs (SSOPs) between the MMS and stakeholders. Finally, it was explained MMS has installed a new TV studio therefore a media/weather and therefore, a presenter training would be highly beneficial to improve forecasts and warnings´ dissemination.

MMS is ISO 9001:2015 QMS compliant.

MMS is in the process of using the Common Alert Protocol (CAP) based alert messages.

4.1.3 Mongolia

Mongolia participated in the 1st WMO/KMA IBFWS Workshop (Rep. Korea, 2017).

The National Agency for Meteorology and Environmental Monitoring (NAMEM) ´s representative described the **Dzud** phenomenon as the main weather hazard affecting the country along with extreme cold waves, forest wildfires, drought, desertification, dust storms and convection related hazards including flash floods.

Currently, the weather warning system includes 17 types of hazards and a four color coded system. A real-time weather disaster information system is in use for reporting and tracking severe weather events (updated every 15 minutes). The National Emergency Management Agency disseminates weather warnings among rural dwellers. NAMEM makes use of TV broadcasts but puts its emphasis on social media (Facebook) as it has proven to be very effective.

NAMEM´s representative remarked that the previous 1st WMO/KMA IBFWS Workshop (Seoul, 2017) has been instrumental in providing the necessary know-how to set up the basis for the development of the new Mongolian MeteoAlarm warning system (on operational basis as of January 1st, 2019).

NAMEM has an outreach and education program for primary schools.

4.1.4 Kazakhstan

The Kazakh National Hydrometeorological Center (KNHC) participated in the 1st WMO/KMA IBFWS Workshop (Rep. Korea, 2017).

No IBFWS is in place.

The representative explained the Center participates in the European Meteoalert system as part of the "Predicting severe weather in Central Asia" project. Strong collaboration with surrounding countries has been developed for the exchange of meteorological information. KNHC has received support from the World Bank.

The Center is responsible for the issuing of warnings for extreme weather at national level; a detailed explanation of the Criteria of Hazardous and Natural Disaster Hydrometeorological phenomena was presented. Warnings are distributed to the Administration of the President of Kazakhstan; Ministries including the Ministry of Education; Government Administration; to the Committee of Emergency; the Mass media (TV, radio, written journalism, etc.); to a Center for collecting and processing information (Almaty) and to the Kazhydromet´s regional branches. The Committee of Emergency is the authority responsible to notify warnings to the population (via mobile Apps and official web-site).

Other identified users of warnings are the Power industry, Agriculture, Oil and gas complex, Sailing, Air and road transport, Water supply and construction, Ecology and tourism sectors.

Avalanche forecasts have been developed and are issued on regular basis.

A national weather radarization program is in progress; a complete national coverage is expected to be achieved within the next 5 years with the purchasing of new weather radars.

4.1.5 Indonesia

The country is challenged by all types of geological and hydrometeorological hazards. The year 2017 registered a total 2341 disasters, 95% of them of hydrometeorological origin.

Indonesia Agency for Meteorology Climatology and Geophysics (BMKG) has worked in collaboration with BoM (Australia) and WRN (Weather Ready Nations) to develop its IBFWS. An IBFWS Road Map is ongoing. The BMKG representative explained the WRN concept has been used to develop the MOSAIC platform designed to improve the use of weather forecasts and warnings by the general public. However, increasing stakeholders´ awareness to allow the platform implementation is still a challenge. The Impact Based Simulation in BIMA was described.

The IBFWS paradigm shift is in place in BMKG, which includes a strong linkage between forecasters and Disaster Management Agencies. BMKG works in collaboration with Disaster Management Agencies both at national and provincial level.

Regarding dissemination methods, a digital forecast system is being developed for the 34 Indonesian provinces; it will be used in mobile Apps and social media (Twitter and YouTube proved to be successful means of dissemination for warnings within the country).

The BMKG´s representative presented the Road Map for Indonesia (includes 6 phases) on Impact Based Forecast which extends until 2021.

Regarding the Common Alerting Protocol (CAP), it was explained that BMKG will start providing IBFWS information to the National Disaster Agency (BNPB) using this dissemination method as of January 2019.

4.1.6 Lao PDR

Lao PDR participated in the 1st WMO/KMA IBFWS Workshop (Rep. Korea, 2017).

The representative of the Department of Meteorology and Hydrology (DHM) informed the country is highly affected by typhoons and monsoons and their derived hazards.

United Nations performed a socio-economic assessment in 2018 in view of devastation caused by the succession of extreme hydrometeorological events in the last years. In addition, the audience was informed that financial support has been provided to DHM by the World Bank; furthermore, a thorough list of several donor countries and institutions was provided during the presentation along with their respective contributions.

Regarding the Early Warning System (EWS) in place and its dissemination methods, the DHM representative indicated that EW bulletins for local storms, heavy rain, strong wind, landslides, flash floods and floods were issued and transmitted to government's offices and the general public (via telephone, fax, newspaper, TV, radio, Facebook, WhatsApp, etc.) during 2018.

Among the most relevant challenges the Lao PDR´s representative indicated the existence of only one (1) weather Radar in the territory and the lack of sufficient budget.

4.1.7 Pakistan

It´s the first time the Pakistan Meteorological Department (PMD) participates in an IBFWS event.

The PMD´s representative highlighted a noticeable decrease in the rainfall rates and an increase in the temperature values due to anthropogenic causes (increased population, increased urbanization and transport use, uneven heating processes and deforestation, among other factors). An increase in linked events such as the Asian Brown Cloud (pollution) and snow melting were underlined. The Sindh region and the city of Karachi have been mentioned as the most affected by these changes.

A thorough presentation on the PMD capacities and activities was delivered. Warning services are focused on flooding.

4.1.8 Myanmar

This Member benefitted from the "WMO/WB Stakeholder Workshop to implement IBFWS in Myanmar" (Nay Pyi Taw, Myanmar, 2015 and 2016); participated in the 1st WMO/KMA IBFWS Workshop (Rep. Korea, 2017). In addition, it´s participation in the SWFDP-Regional Training Workshop on Severe Weather and IBFWS (Sri Lanka, December 2018) has been confirmed.

-No IBFWS is in place yet.

The Department of Meteorology and Hydrology (DMH) ´s representative described the major hydrometeorological hazards affecting the country (TCs, heavy and scanty rainfall, storm surges, extreme temperatures, river floods, flash floods and coastal floods). The current Meteorological Warning System and its disseminating processes were described (a color code is in use). Warnings for TCs derived hazards (landslides,

flash floods, heavy rain, strong winds and storm surge) are issued. Related advice is provided to mountain dwellers.

A strong collaboration with other National agencies (including Red Cross), other NMHSs and Institutions was highlighted.

The Common Alerting Protocol (CAP) is in use for the dissemination of MHEW.

4.1.9 Vietnam

Vietnam participated in the 1st WMO/KMA IBFWS Workshop (Rep. Korea, 2017).

The Viet Nam Meteorological and Hydrological Administration´s representative described the activities of the National Centre for Hydro-Meteorological Forecasting (NCHMF) and its technological and modelling (Ensemble Forecasting System –EFS-) capabilities, including a full description of the Regional Forecasting Support Center (RFSC) Hanoi (which provides regional forecasting support to the SWFDP-Southeast Asia project).

Major hydrometeorological hazards have been identified as TCs, heavy rainfall, thunderstorms, hail, gusts winds, extreme heat/cold, floods and flash floods, landslides, drought and dry spells, salinity intrusion and storm surges. A complete forecasting system is in place and warnings are provided (color code is in use).

The audience was informed of future developments on Forecast Technology (NWP) as follows:

–system of **non-static meso-scale** numerical forecast models with high-resolution non-hydrostatic models (2-5km);

–**typhoon high-solution track** and intensity forecast system for South China Sea;

–short and medium-range ensemble forecast system based on multi-models, initial disturbance analysis;

–**climate and climate change** will be addressed by regional climate models and global climate models;

-Improvement of the quality of hydrometeorological models using automatic rain gages;

-Setting up early warning and alert systems; and,

-Taking part in the Southeast Asia Flash Flood Guidance System.

4.1.10 Buthan

Buthan has participated in the 1st WMO/KMA IBFWS Workshop (Rep. Korea, 2017), in addition, it´s attendance to the SWFDP-Regional Training Workshop on Severe Weather and IBFWS (Sri Lanka, December 2018) has also been confirmed.

-No IBFWS in place.

Challenge: the National Centre for Hydrology & Meteorology representative´s expressed the need for capacity development towards IBFWS**.**

Main hydrometeorological hazards have been identified as flash floods (and its derived infrastructural effects), wind storms, thunderstorms, hail and snowfall, among other threats.

The WRF model is run up to 72 hs (assistance from FMI, Finland has been received). Forecasts up to 3 days are provided as well as special forecast (for specific public events) and warnings. Weather warnings are currently disseminated via traditional and digital /social media (mobile Apps, official web-site, Facebook) along with sirens activated from a control center. Good collaborative work has been established with the related Disaster Management Agencies.

4.1.11   UAE

The representative expressed that the Workshop allowed a first approach to the IBFWS matrix development. At the same time, he indicated that an IBFWS prototype should be accessible and used by all NMHSs and requested to facilitate the development of weather mobile Apps to all WMO's Member countries.

4.1.12   Rep. of Korea

Korea Meteorological Administration (KMA) is currently implementing IBFWS, and legal IBF related provisions are in place since 2017; a formal team to work on IBFWS has been established. KMA´s representative Dr. Park, delivered a presentation on the "Current status and plan for IBF in the Rep. of Korea" during which a description of the current weather warning system was provided along with details on IBF pilot projects implemented at local level during the last two years (including lessons learned, the collection of weather impact (conventional and non-conventional) data, the development of hazard impact models and graphic products, stakeholders engagement, the use of text mining and text network analysis, etc.).

KMA initiated a nation-wide test of heat-wave impact in 2018.

Identified challenges by KMA: need to encourage multi organization research focused on typhoon, cold waves, heavy rain and heavy snow and their related impacts. Need to increase loss and damage data bases and need to better handling general public´s preferences for deterministic forecasts and its low tolerance to failed forecasts.

4.1.13   Japan

Dr. Fukuda and Dr. Sakanashi (Japan Meteorological Agency –JMA-) provided presentations on "Effective Early Warning System in Public Weather Service" and "Determination of risk-based warning criteria", respectively.

The Disaster Counter-measure Act is in place since 1961 (as a result of Typhoon Vera - 1959- disaster). JMA has high experience on EWS and IBFWS being the pillars of its performance the scientific accuracy, analysis of hazards cascading effects, inter-agencies' coordination, user-oriented services, user education and outreach to improve the general public's understanding of the services provided and its technical/scientific limitations, etc.

JMA works jointly with Municipalities (1700 separate areas) to develop landslides, inundation and flood potential indexes; local governments are responsible for collecting loss and damage information. Municipalities follow instructions on evacuation processes (reference to JMA´s warnings included) provided in official Guidelines on this

behalf. JMA provides probability-based information on severe weather risks (up to 5 days).

4.1.14   China

Dr. Jiang from the China Meteorological Administration (CMA) presented the subject "Progress in Meteorological Hazard Risk Operation in China" explaining that the risk-based warning service is a crucial component of the CMA´s public meteorological service including disaster prevention and mitigation. CMA has a highly developed warning system with a standardized warning service for 897 municipalities within the country. The presentation included details on the status of the Risk Operation, some case studies and related effectiveness of the services, and the future Work Plan. A thorough mapping of hydrometeorological (and geological) hazards was presented explaining that China ranks 23rd among the world most vulnerable countries to extreme weather and climate events; an overview of the related impacts was provided along with details on the processes involved in the Weather Impact Forecast Service for Hydrological and Geological Hazards which include: risk surveys and mappings, definition of thresholds, QPE and QPF to ensure more accurate precipitation information, risk assessments, risk warnings, validation and social-economic benefits assessment.

Among the current challenges are the delivery of smart services and a better understanding of risk-based warnings.

4.1.15   Hong Kong, China:

IBFWS are in place including multi-channel dissemination and a well-established and modern communication strategy.

Dr. Yeung (Hong Kong Observatory –HKO-, Hong Kong, China) delivered a presentation on the "Development of IBF Services in the HKO". A full description of the typhoon Mangkhut event and the HKO´s risk related actions was provided.

The following IBFWS´challenges were expressed: "How to define impact severity for multi-hazard risk?" and, "small likelihood for extreme impacts. How to "calibrate"?.

The presentation included references to the WMO SWIC (Severe Weather Information Centre) 2.0 Beta version, run and supported by HKO, the trial support to the UNOCC – United Nations Operations & Crisis Centre-, and future developments including activity Weather Impact Analysis by Artificial Intelligence, Collecting Traffic Impacts by Deep Learning and Crowd-Sourcing for severe weather and Impacts, among other items.

4.2   Outcomes and the way forward

The Workshop produced outcomes and recommendations as result of a Discussion Session (moderated by Gerald Fleming) on the following topics:

1.   Challenges to implement IBFWS in each Member country;
2.   Data sources for IBFWS;
3.   How to build strong partnerships with stakeholders;
4.   Collaboration between advanced and beginner Member countries in terms of IBFWS (mentoring); and,
5.   Public-Private Partnerships (PPP).

4.2.1   Summary of the groups 'discussions:

1.   Identified challenges to implement IBFWS

- Need to improve the observation system and NWP models (better accuracy, fine resolution gridded forecasts and ensemble forecasts, impact modelling, improved work on the probabilistic to deterministic forecasts transition, etc.). The need of support from the Research sector was also mentioned.

- Constant revision of meteorological parameters is required as changes have been observed in them due to population growth and global warming.
- Need of better understanding and training on IBFWS, of standardized terminology and methodology on IBF, of multi-disciplinary exercises to develop basic tools for IBFWS, need of vulnerability and exposure information including socio-economic and geographical mapping for meteorological extremes, and better understanding of (primary and derived) hazards. Need of comprehensive IBF data bases at country level, and development of thresholds.

- In the above regard and particularly for the case of developing countries it was expressed (quoting): "cooperate with intra-governmental organizations such as disaster management/emergency services to build a foundation on making an impact matrix, (see how natural hazards impact each of the agencies own framework). Thus building primary, secondary and tertiary matrices with ideas from all the stakeholders".

- Improved work on the IBFWS' related paradigm shift.

- Improve general public´s and stakeholder's education and awareness for them to better understand the Risk based warnings/IBFWS concepts stating that "no understanding - no response".

- Difficulties to achieve a comprehensive IBFWS that embrace all the complexities of the weather and orography).

- Lack of sufficient financial support.

2.   Data sources for IBFWS

- Quoting - "Need to collect past impact data for each hazard, challenges are: delays in data availability due to manual collection and archival practices; data sharing not adequate sometimes even within the jurisdiction of a country; data are abundant quite often, but their quality and reliability often pose severe problems; data policy required to be evolved in several countries; digitization of historic data base is required".

- Establish national disaster statistic database; collect information from social media, news, personal experience, etc.

- Optimize the use of CCTV image, crowdsourcing (including quality control mechanism or validation), and use of Community based weather impact reports.

- Application of new technologies. Infrastructure, and multi-agency collaboration for data sharing is required.

- CMA provided the following contribution to this Item: "... in case of emergency there are designated information meteorologist that are deployed to the site (mostly rural agro-related areas). They relay information and report back to the administration. China has an official met application meaning there is a single authentic source where users can submit their own reports, pictures, etc. Authoritative LGO's who report certain conditions that the forecasters could oversee due to the lack of observation systems in that specific location".

3. How to build strong partnerships with stakeholders

- By sharing the warning information among different departments or agencies.
- Through better communication and provision of training to the Media.
- Through the establishment of SOPs with the Media for appropriate dissemination of forecasts and warnings.
- By improving collaboration with related fields (geography, health, hydrology, agriculture, mathematics, computation, etc.); and,
- international co-operation.
- By improving the forecasts and warnings' contents by incorporating more details to meet the users´ demands (Public/Private/ Commercial/ Special)
- By communicating with users in an easy to understandable language.
- By establishing high level and direct regular communication with policy makers and stakeholders to increase their awareness; and, by improving communication and partnerships with the various agencies involved in the disaster management.
- By using the Common Alerting Protocol (CAP) as a mean of communicating/ disseminating warning information among disaster managers and users.
- Some Member countries require governmental regulations in place to establish multi-agency partnerships.
- CMA´s contribution (quoting): "China has a regional, local and also national level collaboration within the agencies mandated through systematic process by municipal bureaus and government agencies".

4. Collaboration between advanced and beginner Member countries in terms of IBFWS (mentoring)

The present Workshop was considered by the attendees as a very good example of collaboration among countries with different IBFWS´ implementation levels and capacities.

Inputs to this Item have been as follow:

- Organize annual workshop and related pilot programs for the transfer of knowledge and experiences.

- Participate in IBFWS related international workshops.
- Training through traditional or digital procedures (webinars).
- Encourage collaboration among neighboring countries and to establish bilateral arrangements on IBFWS training.

5.   Public-Private Partnerships (PPP)

It was suggested WMO could provide PPP related information and encourage the sharing of knowledge among Members as the topic is new to or has not been sufficiently explored by some countries.

It was stated that different business models apply to each NMHS what leads in turn to different PPPs approaches. Also that (quoting) "Need better cooperation between public and private sectors to strengthen the common goal, to understand each other. Sometimes a private sector might have better resources than the local met office itself, but both sectors can work together to mobilize resources and have a beneficial symbiosis. After all everyone is working towards the same main goal, as UN-ESCAP said 'leave no one behind".

The following question was posed (quoting) "How we react or anticipate the services (including IBF) provided by global private company?".

KMA provided an overview of their policy (procedures) on PPP.

The workshop "Building the Last Mile with Public Private Partnerships" – held in Livingstone, Zambia in March 2016, was mentioned by the participants in reference to this Item.

5.   CLOSURE OF THE WORKSHOP

5.1   With closing remarks by the KMA authorities, the 2nd Regional Workshop on Impact-based forecasts in RA II (ASIA) closed at 15:30 hours on Wednesday, November 21st, 2018.

List of participants

The 2nd Regional Workshop								
	Role	**Country**	**Title**	**NAME**	**First Name**	**Last Name**	**Contact**	**E-mail**
1	Presenter	France	Ms.	Anne CHARLAT	Anne	CHARLAT	33 4 26 73 73 23 33 6 47 97 84 83	anne.charlat@meteo.fr anne.charlat@yahoo.fr
2	Presenter	U.K.	Ms.	Joanne ROBBINS [TBD]	Joanne	ROBBINS		[TBD]
3	Presenter	Ireland	Mr.	Gerald FLEMING	Gerald	FLEMING	353 87 2200 815 353 87 2200 815	gfleming@eircom.net
4	Presenter	Japan	Mr.	Junya FUKUDA	Junya	FUKUDA	81 3 3212 8341 81 90 9772 1884	jfukuda@met.kishou.go.jp
5	Presenter	Canada	Dr.	Paul Chenggang YANG	Paul Chenggang	YANG	1-514-421-4633 1-514-449-8644	Paul.yang@canada.ca
6	Presenter	WMO	Dr.	Chung Kyu PARK	Chun Kyu	PARK		cpark@wmo.int
7	Presenter	WMO	Ms.	Miriam ANDRIOLI	Miriam	ANDRIOLI		mandrioli@wmo.int
8		Saudi Arabia	Mr.	Rashad Ahmed MUKHTAR	Rashad Ahmed	MUKHTAR	00966126532197 00966555363661	rashmukholo@gmail.com
9		Saudi Arabia	Mr.	Khaled Hamaid ALSAHAFI	Khaled Hamaid	ALSAHAFI	0096124237707 00966562424222	khaled.sahafi@gmail.com
10	Presenter	Hong Kong	Mr.	Hon Yin YEUNG	Hon Yin	YEUNG	852 2926 8434 852 9345 1180	hyyeung@hko.gov.hk
11		China	Dr.	Xiaogong SUN	Xiaogong	SUN	(86)010-68409503	xgsun@cma.gov.cn
12		China	Dr.	Zhaoming LIANG	Zhaoming	LIANG	(86)010-58995735	liangzm@cma.gov.cn
13	Presenter	Lao	Ms.	Akhom THAMALANGSY	Akhom	THAMALANGSY	856 2125010 856 20 56225536	akhomet@yahoo.com
14		Thailand	Mr.	Worapojn KHUNAWIWATTANANGKUN	Worapojn	KHUNAWIWATTANANGKUN	6653 277919 6683 9466428	nwpmodel@gmail.com
15	Observer	Indonesia	Mr.	Achmad Fachri RADJAB	Achmad Fachri	RADJAB	62216544701 628121877637	fachriradjab@gmail.com
16	Observer	Myanmar	Ms.	Aye Aye SOE	Aye Aye	SOE	9567 3411032 959 420709003	ayeayesoe.dmh@gmail.com
17		Bahrain	Mr.	yaser Ahmed ALALI	yaser Ahmed	ALALI	0097317321177 0097333223391	yaser.alali@mtt.gov.bh
18		India	Ms.	Sunitha Devi SANTHAMMA	Sunitha Devi	SANTHAMMA	91 11 43824313 91 9423018646	s.devi@gmail.com, sunitha@imd.
19		Kazakhstan	Ms.	Laura SAILYBAYEVA	Laura	SAILYBAYEVA	7 717 2 7983 83 8 778 503 9822	laurasailybayeva@gmail.com
20	Presenter	Tajikistan	Mr.	Sattor Saidov LBRAHIMOVICH	Sattor Saidov	LBRAHIMOVICH	9922215191 992918240348	sattorsaidov@mail.ru
21		Bhutan	Mr.	Ranjit TAMANG	Ranjit	TAMANG	00975 02 335578 0975 17858241	rtamang@nchm.gov.bt
22	Presenter	Mongolia	Mr.	Batjargal MAKHVAL	Batjargal	MAKHVAL	976 11 326603 976 11 99089422	bachaa_1212@yahoo.com
23	Presenter	China	Ms.	Yan JIANG	Yan	JIANG	86-010-58994470 13717566015	jiangyan@cma.gov.cn
24		Maldives	Mr.	Nasooh ISMAIL	Nasooh	ISMAIL	960 3323084 960 7985418	nasooh.ismail@gmail.com
25	Presenter	Pakistan	Mr.	Jan MUHAMMAD	Jan	MUHAMMAD	92-21-99072758 92-336-3564464	jan.muhammad@caapakistan.com.pk
26		Viet Nam	Ms.	Ha Thi Thu LE	Ha Thi Thu	LE	84 02432673199 904290269	Lethuha24061980@gmail.com
		Australia		Video conference [TBD]				
sum								

Day & Date	Commence Time	Agenda/Item	Presenter/Chair/Comment
Day 1 Mon., 19 November	08:30 ~ 09:00	Registration	
	09:00 ~ 09:20	Introduction of Workshop Opening and Welcome Address	- KMA Administrator - WMO SDD Chief
	09:20 ~ 09:40	Group Photo	
	Session I : Introduction of Multi-Hazard Early Warning and Impact-based Forecasting		
	09:40 ~ 10:10	WMO Public Weather Service Delivery	Ms. Miriam Silvina ANDRIOLI (WMO)
	10:10 ~ 10:30	Coffee Break	
	10:30 ~ 12:20	1. Background to IBFWS - Overview of countries who have undertaken IBFWS projects - WMO competency Framework and relationship to the development of IBFWS 2. Moving to a new paradigm in forecasting-strategies for the development of IMFWS	Mr. Gerald FLEMING (WMO expert, Ireland)
	12:20 ~ 14:00	Lunch	
	14:00 ~ 15:50	1. The multi-Hazard Early Warning System 2. Collaboration systems and communication skills with relevant organizations	Mr. Junya FUKUDA (WMO expert, Japan)
	15:50 ~ 16:10	Coffee Break	
	Session II-A : Operation of Impact-based Forecasting		
	16:10 ~ 17:00	Moving toward Impact-based Forecasting in Meteorological Service of Canada	Dr. Paul Chenggang YANG (WMO expert, Canada)
	17:00 ~ 18:00	Meteo-France IBF Forecast	Ms. Anne CHARLAT (France)
	18:20 ~ 20:00	Banquet hosted by the KMA Administration	

Day & Date	Commence Time	Agenda/Item	Presenter/Chair/Comment
Day 2 Tue., 20 November		**Session II-B : Operation of Impact-based Forecasting**	
	08:30 ~ 09:20	Video Conference : How does the Australian Bureau of Meteorology assess and forecast hazard impact?	Mr. James TAYLOR (Australia)
	09:20 ~ 09:50	Current Status of IBF in RA II / V	Dr. Chung Kyu PARK (WMO)
	09:50 ~ 10:10	Coffee Break	
	10:10 ~ 11:00	Towards impacts based forecast for heatwave	Dr. Yeora Chae (KEI, Korea)
		Session III-A : National Report on Weather Warning System and IBF	
	11:00 ~ 12:30	Development of Impact-based Forecast Services at the Hong Kong Observatory	Mr. Hon Yin YEUNG (Hong Kong)
		Current status and plan for Impact-based forecasting in Korea	Dr. Young-youn PARK (Korea)
		Development of Meteorological disaster risk vocational work in China	Ms. Yan JIANG (China)
	12:30 ~ 14:00	Lunch	
		Session III-B : National Report on Weather Warning System and IBF	
	14:00 ~ 16:00	Current status and strategies in India for provision of impact based weather forecasting services	Mrs. Sunitha Devi SANTHAMMA (India)
		Current capacity of the MWO in Maldives, Maldives meteorological service, and other points	Mr. Nasooh ISMAIL (Maldives)
		Impact-based forecasting in NMS of Mongolia	Mr. Batjargal MAKHVAL (Mongolia)
		The forecast system in Kazakh National Hydrometeorological center	Laura SAILYBAYEVA (Kazakhstan)
		Saudi Arabia / UAE / Lao / Thailand / Kazakhstan	
	16:00 ~ 16:20	Coffee Break	
		Session IV-A : Hazard Impact Modelling and Disaster Management	
	16:20 ~ 17:10	UN-ESCAP's work and programs related to impact forecasting	Ms. Yuki Mitsuka (UN-ESCAP)
	17:10 ~ 17:40	Role of private sector on the	Dr. Jaiho OH

Day & Date	Commence Time	Agenda/Item	Presenter/Chair/Comment
		disaster management	(Nano Climate & Weather Co., Korea)
	17:40 ~ 18:10	The Korean Heat-Health Warning System (HHWS) on a National and an urban scale	Mr. Changbum CHO (NIMS, Korea)
	18:30 ~ 20:00	Dinner	

Day & Date	Commence Time	Agenda/Item	Presenter/Chair/Comment
Day 3 Wed., 21 November	Session III-C : National Report on Weather Warning System and IBF		
	08:30 ~ 09:30	Utilizing a Climate Model Data approach to analysis/ Assess the Future Scenarios of Meteorological Events Using Geo-Spatial Techniques	Mr. Jan MUHAMMAD (Pakistan)
		Multi Hazard Impact-based Early Warning System	Ms. Aye Aye SOE (Myanmar)
		Viet Nam / Indonesia / Tajikistan	
	Session IV-B : Hazard Impact Modelling and Disaster Management		
	09:30-10:20	Development of Heavy Rainfall Disaster Impact Forecasting Model	Prof. Byung Sik KIM (KNU, Korea)
	10:20 ~ 10:40	Coffee Break	
	Session V : Discussion		
	10:40 ~ 12:30	Group Discussion	
	12:30 ~ 13:30	Lunch	
	13:30 ~ 15:00	Group Discussion & Presentation	
	15:00 ~ 15:10	Closing Remarks	
	15:30 ~ 18:00	Technical Tour	