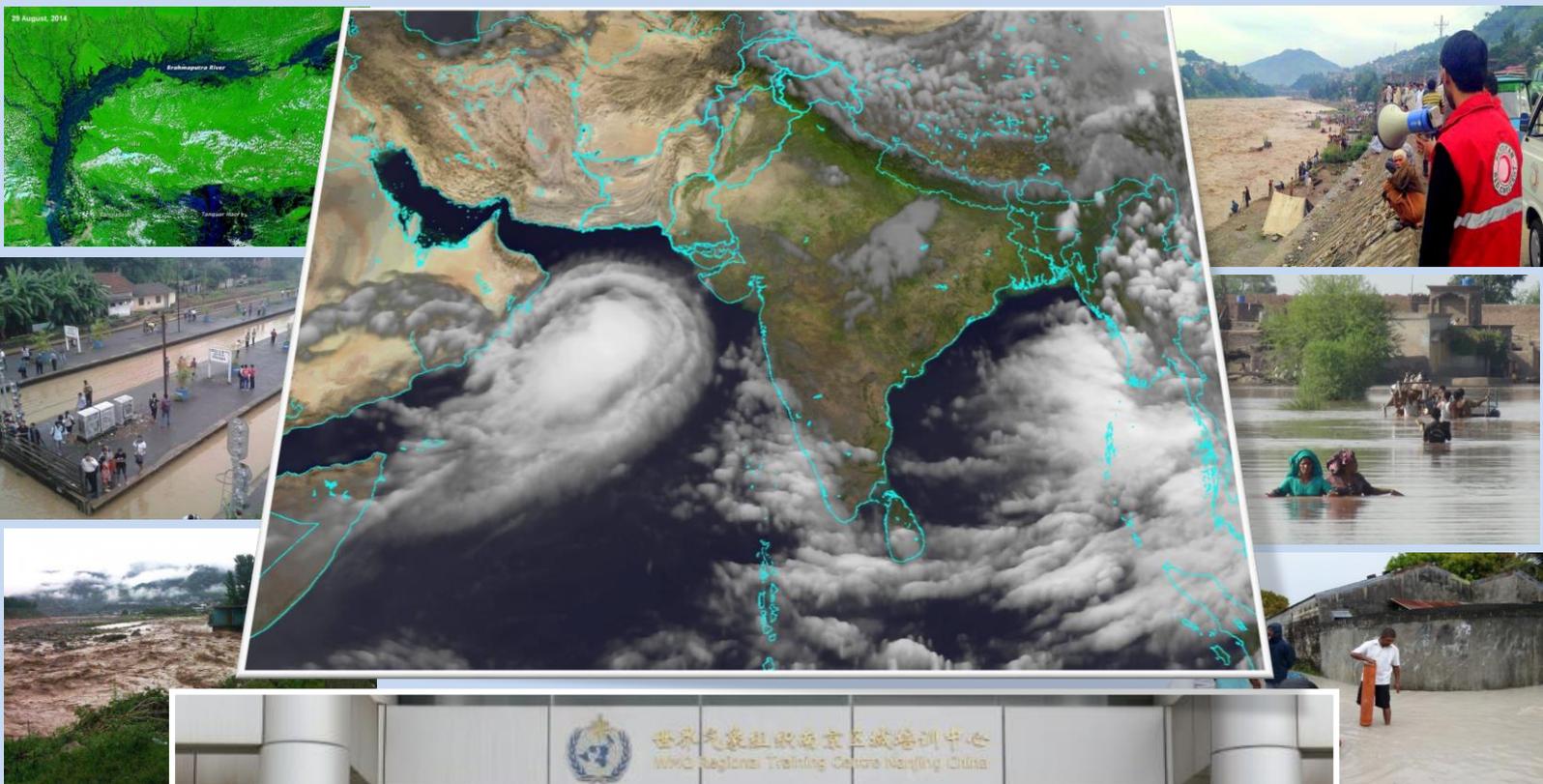


PANEL NEWS



Biannual Issue # 38 October 2014



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MESSAGE FROM THE SECRETARY OF PTC

Dear Colleagues!

According to WMO Regional Climate Centre, Tokyo, September, 2014 was the hottest on record. January-September global temperature data tied with 1998 as the warmest period on record according to NOAA. High ocean surface temperatures plays a major role, in advance of the anticipated development of the warming El-Niño event. Cyclonic activity also depends upon the tendency of ocean-surface-temperature. North Indian Ocean through the period April to September, 2014 observed four cyclonic disturbances. Only one of which converted into Cyclonic Storm “Nanauk” on 11th June, 2014. The keen monitoring and timely dissemination of warning bulletins proved the readiness of RSMC New Delhi. PTC region is mostly affected by the monsoon season every year. During this monsoon season, overall rainfall was below normal but the amount of rainfall remained excessive during September causing floods.



While going through the Panel News No.38, the activities carried out by the NMHSs of the PTC region revealed the true commitment and dedication of scientific community, mitigation & response organizations towards enhancing their capabilities against natural hydro-meteorological disasters. Adaptation of strategies suggested by WMO and supported by global and regional weather and climate research centres are additive. Integration of Standard Operating Procedure (SOP) into Multi-hazard Early Warning System at regional level, continuation of SAARC STORM Program, holding of seminars/workshops to discuss cyclones behavior and to fill gaps in forecasting, monitoring & tracking, community-based trainings and drills etc. are examples of our commitment towards the achieving the objects of the PTC. I appreciate all these with the wish to continue in future too till the safety of a single person.

The Panel News provide an opportunity to our readers to keep abreast and to motivate them for further harnessing with hydro-meteorological activities. I am confident that the forthcoming Joint Session of PTC and Typhoon Committee (scheduled in Bangkok) shall provide the delegates an excellent opportunity, in the presence of prominent experts, to share their experiences, expertise and lessons-learnt to further guide and drive a future line-of-action against water-based natural disasters. Therefore, active participation of PTC Member countries is desirable.

A handwritten signature in blue ink that reads "Arif Mahmood".

(ARIF MAHMOOD)
Secretary of PTC

PTC & PANEL NEWS CORRESPONDENTS

Members of WMO/ESCAP Panel on Tropical Cyclones for the Bay of Bengal and the Arabian Sea

Bangladesh, India, Maldives, Myanmar, Oman, Pakistan, Sri Lanka & Thailand

- **Chairman** : Mr. Md. Shah Alam (Bangladesh)
- **Vice Chairman** : Mr. Ali Shareef (Maldives)

PTC Secretariat:

PTC Secretariat is being hosted by Pakistan and is located in the premises of Pakistan Meteorological Department at Met. Complex, Sector H-8/2, Islamabad. Pakistan.

- **Secretary of PTC** : Mr. Arif Mahmood
- **Meteorologist – PTC Secretariat** : Mr. Imran Akram

PANEL NEWS CORRESPONDENTS:

- **Bangladesh:** Mr. Shamsuddin Ahmed, Deputy Director, BMD
- **India** : Dr. M. Mohapatra, Director (Cyclone Warning), IMD
- **Maldives** : Mr. Ali Shareef, Assistant Director General, Maldives Met Service
- **Myanmar** : Mr. U. Aung Kyi, Staff Officer, International Affairs Section, DMH
- **Oman** : Mr. Khalid Khamis Saif Al-Jahwari, Assistant Director, Forecasting & Observing Practices, DGMAN
- **Pakistan** : Mr. Nadeem Faisal, Deputy Director, Climate Data Processing Centre, PMD
- **Sri Lanka** : Mr. D.J.A. Weerawardena, Director, Department of Meteorology, Sri Lanka
- **Thailand** : Mr. Tanya Thongnunui, Meteorologist, Studies and Research Division, TMD

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EDITORIAL

Dear Readers!

During compiling and finalizing the news material for the Panel News No.38, I was pleased to see that Panel News Correspondent of almost all PTC Members contributed news material for publication in this issue which shows their interest and struggle to keep the momentum of productive efforts against natural disasters for the safety of lives and properties of our peoples.

PTC Secretariat also continued its pivotal role in coordinated efforts. During August, 2014, an Expert Mission was organized to visit Maldives, Myanmar and Sri Lanka under SSOP Project funded by the ESCAP Trust Fund for Tsunami, Disaster and Climate Preparedness in Indian Ocean and Southeast Asian Countries, as well as, an international workshop on Dvorak technique and tropical cyclone forecasting in Muscat, Oman (28th September to 2nd October, 2014) during the period. The alarming situation of increased frequency and severity of hydro-meteorological disasters has shattered the meteorological community to enhance their monitoring and warning capabilities by cooperation among PTC members, integration of early warning system with multi-hazard early warning system at national and regional levels, to educate masses as to how act during natural disaster, strengthening the infrastructure and to plan the construction of safe-zones. It has observed that some work towards achieving these objectives has started but still long way to go.

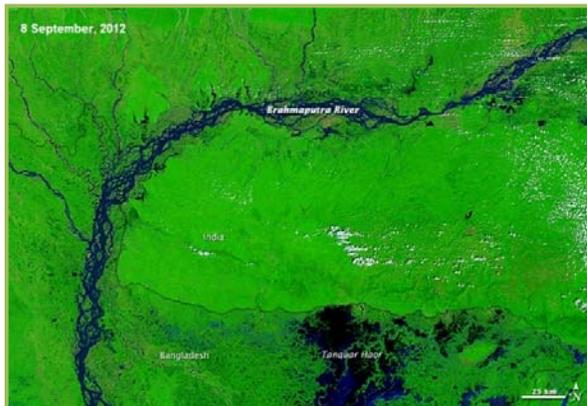
This issue of Panel News has highlighted some of the activities carried out by respective NMHS, disaster management organizations and relevant institutions within PTC member countries to share these among our valued readers, policy-makers, planners and concerned people to become motivated and to boost their efforts against future natural disasters. Here, I would like to request the Panel News Correspondents to continue submitting news material for upcoming Panel Newsletters with the zeal to achieve the goals and objectives of PTC.

NEWS FROM PTC MEMBERS

Bangladesh

Flood 2014

Citizens of Bangladesh are quite familiar with floods. Situated on a wide deltaic plain at the confluence of several large rivers, the low-lying country is one of the most flood-prone in the world. But even by local standards, the onslaught in the summer of 2014 has been unusual. A combination of heavy monsoon rainfall in the country's main river basins and the arrival of melt-water from the Himalayas has triggered severe flooding in Bangladesh's Lalmonirhat, Kurigram,



Nilphamari, Rangpur, Gaibandha, Bogra, Sirajganj, Jamalpur, and Sherpur districts. On 29th August, 2014, Moderate Resolution Imaging Spectroradiometer (MODIS) on NASA's Terra satellite captured the left-side image, which shows flooding along the Brahmaputra River and Tanquar haor, a large wetland region. The image on right shows the same area on 8th September, 2012, a more typical year. Both are false-color images made from a combination of infrared and visible light (MODIS bands 7-2-1). Water varies in color from blue to black; vegetation is bright green; and bare ground is brown. This band combination makes it easier to spot changes in river dimensions. According to estimates, more than 275,000 people had been displaced and more than 31,000 homes had been destroyed and 188,000 damaged. As of 4th September, 2014, most



rivers in Bangladesh had crested, but flooding remained severe in many areas.

India

SIGNIFICANT WEATHER

The period from April to September, 2014 over India mainly consisted of Pre-monsoon season (April & May) and monsoon season (June to September). The significant weather events during this period are described below:

PRE-MONSOON SEASON (APRIL & MAY, 2014)

- Moderate to severe thunder squalls accompanied with hailstorm occurred over Maharashtra, Madhya Pradesh and Andhra Pradesh on a few days during the season. Moderate to severe thunder squall also occurred on a few days over east & northeast and one or two days over northwest India.
- Moderate Heat wave condition prevailed at isolated places for some days over the east and northwest part of the country in the month of April. Also Moderate to severe heat wave condition prevailed over east, north, central and some parts of South India during the month of May and June
- The country as a whole received rainfall 130mm against the normal of 131.3mm. The seasonal rainfall was deficient/scanty over Assam, Meghalaya, Arunachal Pradesh, Nagaland, Manipur, Mizoram, Tripura, West Madhya Pradesh, Saurashtra & Kutchh, Diu, Konkan & Goa, Andaman & Nicobar Island Gujarat Region & Daman and Lakshadweep area. It was normal / excess over remaining parts of the country.

MONSOON SEASON (JUNE TO SEPTEMBER, 2014)

This year southwest monsoon advanced over Andaman & Nicobar Islands on 18th May 2014, which was two days earlier than its normal date. The monsoon set over Kerala was on 6th June against the normal date of 1st June. It advanced into entire country by 17th July against normal date of 15th July. Withdrawal of southwest monsoon from north-western parts of the country commenced from 23rd September against normal date 1st September. It withdrew from the entire country on 18th October 2014. Incessant heavy rains and floods over Odisha, Chhattisgarh, Madhya Pradesh, Uttar Pradesh and Assam & Meghalaya were observed during the first half of the monsoon season. The floods and associated huge casualty and damage occurred over Jammu & Kashmir during 1st week of September. Excess rainfall was observed over south interior Karnataka. Most parts of the country observed normal rainfall. However the country as a whole received 777.5mm rainfall against the normal rainfall of 886.9mm. Thus the rainfall was 12% below normal during the monsoon season.

CYCLONIC DISTURBANCES OVER NORTH INDIAN OCEAN (APRIL TO SEPTEMBER, 2014)

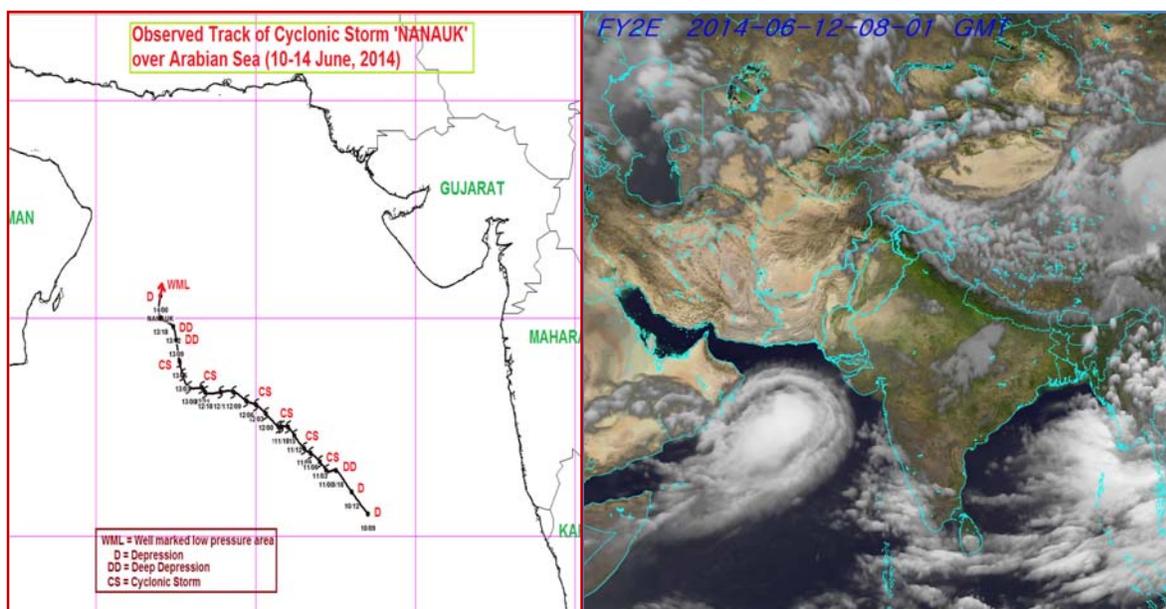
Four cyclonic disturbances formed (depression and above) during April to September 2014 Out of them, one formed during pre-monsoon season which reached upto depression stage. In monsoon season, Cyclonic Storm "Nanauk" formed over Arabian Sea. Also two depressions formed over land, out of them one reached upto Deep Depression stage.

- Depression over Bay of Bengal (21st – 23rd May, 2014)
- Cyclonic Storm (CS) "Nanauk" over the Arabian Sea (10th – 14th June, 2014)
- Depression over land (21st - 23rd July, 2014)
- Deep Depression over land (3rd - 6th August, 2014)

CYCLONIC STORM "NANAUK" OVER THE ARABIAN SEA (10TH – 14TH JUNE, 2014)

A Cyclonic Storm (CS) 'Nanauk' originated from a low pressure area over east central Arabian Sea which developed on 9th June, 2014. It concentrated into a depression over the same region in the afternoon of 10th June, 2014. Moving north-north-westwards, it intensified into a Cyclonic Storm 'Nanauk' in the early morning of 11th June 2014. It weakened into a deep depression in the afternoon of 13th June, 2014 over west-central Arabian Sea and into a depression in the evening of 13th June, 2014 and further into a well-marked low pressure area over the same

region in the morning of 14th June, 2014. The track of the system and satellite imagery is shown side by side below:



The numbered warning bulletins were issued since the cyclonic storm stage (i.e. from early morning of 11th June, 2014) by the Regional Specialized Meteorological Centre and Cyclone Warning Division, New Delhi are given in Table below:

S.No.	Bulletins	No. of Bulletins
1	Press Release	1
2	Personal Briefing to Higher Officials	daily
3	National Bulletin	27
4	RSMC Bulletin	26
5	TCAC Bulletin (Text & Graphics)	12
6	ADRR Bulletin to Hong Kong	12
7	TC Vitals	11
8	Observed and forecast track and Quadrant Wind radii graphics	17

HIGHLIGHTS OF MONSOON SEASON 2014

- For the country as a whole, the rainfall for the season (June-September) was 88% of its Long Period Average (LPA).
- Seasonal rainfall was 79% of its LPA over Northwest India, 90% of its LPA over Central India, 93% of its LPA over south Peninsula and 88% of its LPA over Northeast (NE) India.
- Out of the total 36 meteorological subdivisions, 23 subdivisions constituting 67% of the total area of the country received normal season rainfall and 12 subdivisions (30% of the total area of the country) received deficient season rainfall. One subdivision (South Interior Karnataka) constituting 3% of the total area of the country received excess rainfall.
- Monthly rainfall over the country as a whole was 57% of LPA in June, 90% of LPA each in July and August, and 108% of LPA in September.
- Monsoon current advanced over the Andaman Sea two days earlier than its normal date of 20th May. However, it set in over Kerala on 6th June, five days later than its normal date of 1st June and covered the entire country by 17th July, two days later than its normal date of 15th

July. Withdrawal of monsoon from west Rajasthan commenced on 17th September against its normal date of 1st September.

- During the season, one Cyclonic Storm (Nanauk), two monsoon depressions and ten monsoon low pressure areas were formed as against the normal of six monsoon depressions and six monsoon low pressure areas per season.
- All the operational long range forecasts for 2014 southwest monsoon season rainfall over the country as a whole and that over four broad geographical regions were within the limits of second forecast update issued in August. The forecasts for the monthly rainfall (for the months July and August) and that for the second half of the monsoon season over the country as a whole were also within the forecast limits.

FIELD EXPERIMENTS

- **SAARC STORM Program**

The 'SAARC STORM Program' is a multidisciplinary nationally co-ordinated research and development programme to build appropriate operational early warning system for highly damaging severe thunderstorms over various parts of India. This year, the programme was started as 'STORM Project-2014' w.e.f. 15th March and completed on 15th June, which covered entire Indian region phase wise. During this period Weather Advisory Committee (WAC) meetings were conducted on every Monday, Wednesday and Friday to keep a watch and discuss development of daily weather situation over various regions of India and issue 'Storm Bulletins'. Total 39 Storm Bulletins were issued during 'STORM Project-2014'.

- **Soil Moisture Project**

Agrimet Division in collaboration with International Centre for Radio Science (ICRS), Jodhpur is preparing maps for soil moisture estimation for Gujarat, Madhya Pradesh and Uttar Pradesh states. These maps are being generated on experimental mode in near real time using satellite data viz. soil moisture, NDVI and brightness temperature data from SMOS, MODIS and LST values from SSMIS sensors.

ACHIEVEMENTS

- **ISO Certification**

The surface instruments division of the IMD acquired ISO 9001:2008 certification for the year 2015-2016 for the process of manufacturing, testing, calibration and supply of meteorological Instruments

- **Installation of Weather Observatory at Bharati, Antarctica**

The summer team of the 33rd ISEA installed the meteorological observatory at Bharati station, Antarctica consisting of the instruments such as; Global radiation radiometer, UV-A radiometer, snow gauge, Thermometers Stevenson screen, mast for ultrasonic anemometer

- **National Collaboration for Aviation Safety**

A milestone has been achieved in the field of aviation safety when National Aerospace Laboratories, Bangalore and India Meteorological Department signed a partnership agreement on 20th May 2014 for joint production of Drishti system; a sophisticated instrument for assessment of Runway Visual Range, which is a critical parameter for safe landing and takeoff of aircraft in poor visibility. The agreement which



was signed by Dr. Shyam Chetty, Director-NAL and Dr. LS Rathore, Director General of Meteorology, IMD; encompasses a wide range of research & development activities for further development of various meteorological sensors. The agreement paves the way for operational deployment of Drishti system at different airports where IMD provides aeronautical meteorological services. A mega project for installing nearly 70 such systems at various Airports of the country is being jointly undertaken by the two organizations. Drishti Transmissometer, a visibility measuring system is an innovative, indigenous product first of its kind, designed and developed by CSIR-NAL to cover the wide span of lowest to highest visibility (< 25).

- **Appreciation for accuracy and timely prediction**

Dr. David Rogers and Dr. Vladimir V. Tsikunov members of World Bank team (already visited, Meteorological Centre, Dehra Dun) mentioned in their report that the weather forecasts for heavy rainfall during Kedarnath disaster in June, 2013 were “Accurate and Timely” and helped in limiting the exposure of tourists beginning their pilgrimage. It is a great recognition from World Bank for Meteorological Centre, Dehra Dun and India Meteorological Department.

INFRASTRUCTURE DEVELOPMENT

- **Global Navigation Satellite System**

Eight sets of Global Navigation Satellite System (GNSS) purchased and handed over to all RMCs (one set each) and two are presently used in the AWS Lab, Pune. GNSS measures the Altitude, Latitude & Longitude of the station with real time five centimeter accuracy for which no base station/or radio communication is required. As per instructions by the WMO for selection of AWS/Met; Observatory site, the obstacle should be away from the site by two times of its height. GNSS finds the distance between the obstacle and the site for finalisation of AWS/Met. Observatory as per WMO criteria. GNSS Satellite orbit and clock corrections are calculated from a global tracking network of dual frequency receivers.

- **Hand Held Data Loggers (HHDL)**

29 observatories under RMC Mumbai have been equipped with HHDL sets. HHDL is an electronic device which can be used by Conventional Meteorological Observatories to transmit manually collected weather data in near real-time in digital form over GSM Mobile channel to various RMCs and NDC for archival.

- **High Wind Speed Recorder (HWSR)**

GPRS based HWSR made operational at Kakinada, Kalingapatnam, Puri, Balasore and Digha. Data is available on the website www.imdaws.com.

- **Dissemination of agromet advisories**

A pilot project was undertaken for dissemination of agromet advisories for the farmers in collaboration with Mahindra Samriddhi in Pune and Parbhani from 1st April 2014. Total 10816 farmers are being benefitted by this service.

IMPORTANT EVENTS

- A website <http://www.rsmcnewdelhi.imd.gov.in> for Regional Specialised Meteorological Centre-Tropical Cyclone, New Delhi was inaugurated by Dr. Shailesh Nayak, Secretary, Ministry of Earth Sciences and Chairman, Earth System Science Organization (ESSO) on 4th April, 2014. This website has all the facilities for dynamical uploading of cyclone warning bulletins, advisories and graphical products useful for national and international users especially WMO/ESCAP Panel member countries (Bangladesh, Myanmar, Thailand, Sri Lanka, Maldives, Pakistan & Oman).



- The Pre-cyclone exercise was conducted during 15th & 16th April and 23rd & 24th September, 2014 with meeting of cyclone forecasters, numerical weather prediction modelers from IMD & NCMRWF, Indian Air Force, Indian Navy and Ministry of Home affairs & (ii) lecture series for the forecasters.
- Automatic Weather Observing System (AWOS) was successfully installed at Sanjhi Chhat, Katra, Vaishnodevi. The system was inaugurated by the Hon. Minister for Science & Technology & Earth Sciences, Dr. Jitendra Singh on 14th September, 2014. Shri. A.D. Tathe, Scientist-D made the presentation on the AWOS with live demonstration, during the inauguration.



WORKSHOP/TRAINING

- **Understanding weather and forecasting**

Two weeks training course on “Seasonal Weather Prediction” which was organized by SAARC Meteorological Research Centre (SMRC) at Dhaka, Bangladesh during 1st to 12th June, 2014. Dr. D.S. Pai, Scientist-E participated in this course as a resource person for first week while Sh. S.D. Raskar, S.A. attended the training course for whole period as a trainee.

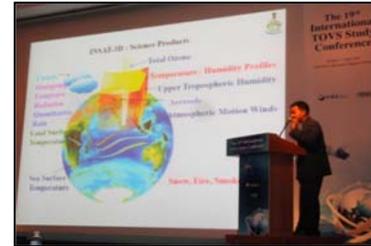
- **Capacity Building Training Workshop**

A Capacity Building Training Workshop on “Operational Climate Prediction for South Asia” was conducted at the India Meteorological Department (IMD), Pune for participants from the South Asian countries. The training workshop was attended by representatives from eight South Asian countries viz. Bangladesh, Bhutan, India, Maldives, Myanmar, Nepal, Sri Lanka, Dhaka and UKMO London. Experts from the IMD and IITM, Pune and international experts from United Kingdom Meteorological Office, U.K, APCC, Korea, NOAA, U.S. and World Meteorological Organization, Geneva participated in the training workshop as the resource persons. Two days SASCOF-5 meeting co-hosted by IMD was held at IITM, Pune during 22nd – 23rd April.

- A two day workshop on ‘Enhanced and Unique Cyclonic Activity during 2013’ was organised by Cyclone Warning Division, India Meteorological Department, New Delhi on 24th & 25th July 2014 at New Delhi. About eighty delegates including renowned scientists from various institutes participated in the workshop. 54 papers were presented in the workshop on various themes. A book of abstract and a book on Climatology of Jammu & Kashmir were released by Prof. S.K. Dube, Vice Chancellor (Amity University, Rajasthan) who was the Chief Guest during the inaugural session. A number of recommendations were adopted for future action so as to improve further the cyclone forecast and warning services of IMD.



- Dr. L. S. Rathore, Director General of Meteorology attended the 16th Session of WMO Commission for Agriculture Meteorology at Antalya, Turkey from 10th – 15th April, 2014.
- Sh. A.K Mitra, Director / Scientist-D participated in the ITSC-19th Conference and RARS meeting in South Korea from 23rd March to 3rd April 2014.
- Shri B. Mukhopadhyay, DDGM(C) visited the Korea Meteorological Administration, Seoul, South Korea to attend the “26th Session of WMO Executive Council Panel on Education and Training” from 24th to 28th March, 2014.
- Dr. N. Chattopadhyay, DDGM (Agrimet) participated in the International Conference on “Promoting Weather and Climate Information for Agriculture and Food Security” held at Antalya, Turkey during 7th to 9th April, 2014.



- Smt. Suman Goyal, Scientist-C participated in the “Eighth Session of Expert Team on Satellite Utilization and Products (ET-SUP-8)” at Geneva, Switzerland during 14th – 17th April, 2014.
- Sh. Virendra Singh, Scientist-C participated in the “42nd Plenary Session of the Coordination Group for Meteorological Satellites (CGMS-42)” at Guangzhou, China during 19th – 23rd May, 2014.
- Shri G. K. Das, Scientist-C was on tour to Nanjing, China during 9th – 11th June, 2014 for attending the training workshop on “Synergized Standard Operating Procedures (SSOP) for Coastal Multi-Hazards Early Warning System.”



- Shri R.R. Mali, DDGM (SI) was on ex-India deputation to Paraguay from 6th – 16th September, 2014 for participation in the extraordinary session of WMO Commission for Basic Systems at Asuncion, Paraguay during 8th – 12th September, 2014.

IMPORTANT MEETINGS

- Dr. Shailesh Nayak, Secretary, Ministry of Earth Sciences (MoES), Dr. L S Rathore, Director General of Meteorology & PR of India with WMO, Sh. A. S. Khati, JS (MoES) and Dr. S D Attri, DDGM (O) IMD, New Delhi participated in 66th Session of WMO Executive Council during 18th – 27th June, 2014 at WMO Geneva. DGM also attended meeting of Management Group of RA II and GFCS of WMO.



Dr. L. S. Rathore, Director General of Meteorology, PR of India with WMO and Member, Executive Council of WMO at EC-66,



H.E. Ambassador & PR of India with UN, Secretary, MoES, DGM, DPR, PMI Geneva & JS MoES at WMO EC-66.

PUBLICATIONS

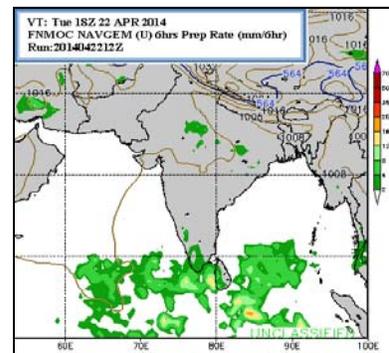
- The implementation report on Forecast Demonstration Project (FDP) on land falling cyclones in Bay of Bengal for the year 2013 has been published and available in the RSMC website (<http://www.rsmcnewdelhi.imd.gov.in>)
- The Tropical Cyclone Operational Plan for North Indian Ocean (TCP-21), 2014 edition has been prepared by RSMC, New Delhi and published by WMO. (<https://www.wmo.int>)
- The publication entitled, “Disastrous Weather Events - 2012” has been published by ADGM (R), Pune.

Maldives

SEVERE WEATHER EVENTS (APRIL – SEPTEMBER 2014)



Convective clouds formed over southern atolls on 22nd April, 2014 brought scattered rain with a few heavy showers and thunderstorms to southern atolls. Heaviest rainfall of 92mm was recorded at the Meteorological office, Kaadehdhoo. Over the northern atolls on 23rd April, heavy thunderstorms caused lighting strikes on a 65 feet



antenna at Shaviyani Kanditheemu and gave severer damages to electronic items in six houses and the island's cable TV station. Furthermore, gust wind speed of 44mph recorded at the Meteorological Office, Gan on 27th April and National Meteorological Centre on 29th April 2014.

May, 2014 started with pre-monsoon activities throughout the Maldives. On 2nd May, a fishing vessel ran aground on the reef near Nolhivaram of northern-most atoll and caused serious damages. It was due to low tides. On 3rd May, a low pressure trough formed in the south-west Bay of Bengal and affected northern and central atolls. Strong winds caused a branch of tree to fall over a parking zone in Male' damaging four vehicles. This condition deteriorated further on 5th May when another circulation formed in the south-east of Maldives developing a windy zone over southern atolls. The systems brought



Road of Ra. Meedhoo on 7 May 2014

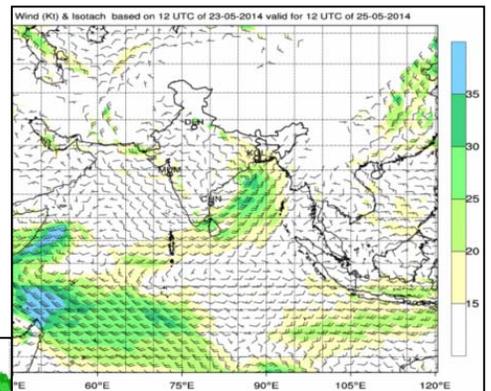


Near Ghiyaasuhdhdhin School

combined effect of these two 98mm of rain to Hulhule Island and maximum gust wind speed of 47mph was registered at the Meteorological Office, Gan. A Yellow alert was issued when torrential rain and heavy thundershowers with gusty winds of 50 mph expected to central and southern atolls. Several incidents occurred; man swept into sea when a strong wave crashed into a ferry-boat travelling to Male'. A 60 feet barge carrying large two containers went missing after its rope

broke while being towed by a tugboat. Another boat in Huvadhu Atoll got its hull ripped off, cabin torn off and got drifted away due to strong winds/ currents and rough seas. It finally sunk with two crew-men on-board but reports said coast guard rescued them later. The following day, an 85 feet boat with 14 fishermen ran aground on the reef northern side of Noonu atoll. On 7th May, heavy rain fell over Raa Atoll from morning and brought the water level up to 2 feet leaving the area muddy and unsafe for move around or driving. The trough retreated on 8th May.

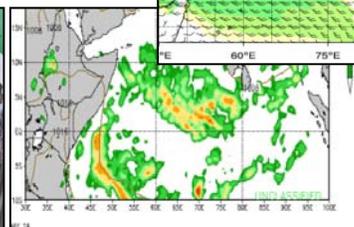
Another low pressure area formed in the Bay of Bengal and its trough extended over the Maldives on 20th May. This brought few heavy showers to central and southern atolls with rainfall of 67mm in Kaadehdhoo and 51mm in both Kadhdhoo and Hulhule'. Monsoon became more active when a converging area formed in the Arabian Sea on 23rd May. This caused average wind speed of 15 – 25 miles per hour in both central and southern atolls. Again on the 28th, rain and thundershowers occurred over the country with a heavy fall of 57 mm in Hulhule' and this system brought flash flood in Male' on the following day.



Ameencemagu of Male' on 29th



Near National stadium on 24th May



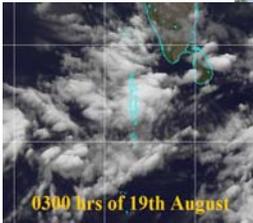
The month of June, 2014 started with less rain but with strong winds averaged between 15 – 23 mph in central part of the country. Due to the formation of a low pressure trough over the country on 7th June, maximum gusty winds of 44 mph was registered at the Meteorological Office, Hanimaadhoo. The ongoing strongly active South-west monsoon caused tidal waves in some islands especially in central atolls. Alif Dhaal Fenfushi experienced tidal waves for three consecutive days with most severe on 14th June when sea water went 100 feet in to the island. On 15th June, Noonu Velidhoo experienced severe waves that knocked down few trees. A person was reported injured on this particular island and day to day activities got hampered in other islands those were affected by the waves. More islands namely Rathafandhoo, Maathoda in Gaafu Dhaalu Atoll and Gaadhiffushi in Thaa Atoll also reported tidal waves on 25th June. On 26th June, Thaa Thimarafushi experienced high tidal waves. Domestic flights to ‘Thimarafushi Airport’ were cancelled due to flooding and the subsequent accumulation of debris on the runway and neighborhood. After, a comparatively fine weather condition for most of the month, scattered thundershowers occurred over the country on 27th June with a report of lightning strike in Fuvahmulah Island damaging electronic items in several households.



During July 2014, cloud cluster spread over central and southern atolls on 1st July caused rain over the area with a violent shower that measured 43 mm out of daily total 67mm at Gan Met Office. The trough of low pressure formed over the Maldives on 2nd July brought strong gusty winds of 48 mph to Kaadedhdhoo Meteorological Office. Prevailing strong winds averaged between 15 to 25 mph in central and northern parts as well. The trough intensified back on 5th July and caused much stronger winds in the order of 18 to 28 mph in the central. High gusts of 53 mph were also recorded at the National Meteorological Centre. On 9th July fairly widespread rain was experienced over the country with heavy falls mostly confined to Kaadedhdhoo area. In addition, average strong winds of 15 to 25 mph sustained in central atolls with gusty winds of 47 mph. The marine transport communication between Male City and adjoining islands were on halt for several hours due to high seas.

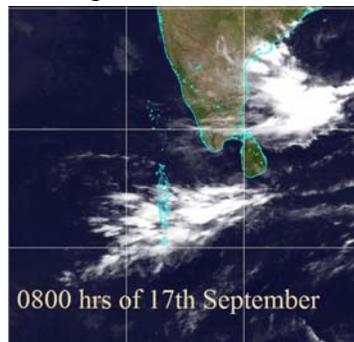


On 1st of August, a cyclonic circulation formed in the north-west Bay of Bengal and its associated convective clouds reached up to Maldives. The impact of this system persisted over the area for couple of days as strong average winds with high gust prevailed over northern and central atolls. An intense convective cloud area formed near northern atolls on 10th August



bringing rain to northern and central area again. However, gust wind occurred over central and southern parts. The impact of stronger southwest monsoon was more pronounced on 18th of August for the next 3 days. Heavy rain accompanied with strong wind interrupted daily activities and even some schools in northern atolls were closed on the 19th due to flooding. Maldives Meteorological Service issued Yellow Alert Advisory for taking precautions against strong winds and rough seas. High gust wind speed of 49 mph was registered at Meteorological Centre. The low level circulation formed over Lakshadweep – Comorin / Maldives area on the 22nd August caused winds of 15 to 25 mph in central and northern atolls with gusts of 44 mph recorded again at National Meteorological Centre. Then the circulation rapidly moved northwards away from the Maldives.

The convective cloud area formed in the west of Maldives caused heavy showers in southern atolls. Heavy falls of 77 mm were registered at the Meteorological Office, Kaadehdhoo on 5th and 75mm on 7th September, 2014. Occasional heavy showers were experienced in central and southern atolls. Schools in Thinadhoo were closed due flooding on the 16th September and many households in the area were affected as well. Flood water had to be pumped out from the island by the authorities. The low level circulation brought fairly widespread rain and isolated heavy showers to the country on 28th September. Heavy downpours of 111mm were registered at the Meteorological Office, Kaadehdhoo followed by 80mm in Gan Met Office next day. Strong winds ranging from 23 to 30 mph sustained in Addu city for nearly 10 hours and associated gusty winds reached 51 mph over Gan, Addu city.



MEETING OF SSOP PROJECT (AN EXPERT MISSION TO MALDIVES)

The SSOP team of experts had a two days meeting during August 2014 with personnel involved in Early Warning System, mainly related to coastal multi-hazards disasters. The Synergized Standard Operating Procedures for Coastal Multi-Hazards Early Warning System (SSOP) project was funded by the ESCAP Trust Fund for Tsunami, Disaster and Climate Preparedness in Indian Ocean and Southeast Asian Countries. The long term goal of the Project is to promote the coastal community resilience to coastal multi-hazards through having Standard Operating Procedures for effective Multi-hazards EWS to improve the policy and institutional arrangements at national and community levels. The Meetings were attended by senior officials from stakeholder agencies.



Myanmar

WEATHER SUMMARY (APRIL - SEPTEMBER, 2014)

During early monsoon period, there was a low pressure area formed over East Central Bay of Bengal and intensified further into a depression. Southwest monsoon set into Southern Myanmar on 17th May and retreated from the whole Country on 13th October 2014. Total monsoon period was observed 149 days. During the monsoon period, the monsoon intensity was moderate to strong with regional heavy falls in lower Myanmar areas and isolated heavy fall in Upper Myanmar areas. During peak monsoon period, two depressions and seven low pressure areas formed in the Andaman Sea and Bay of Bengal. During late monsoon period, two low pressure areas formed in the Andaman Sea and Bay of Bengal. During April to September of the year 2014, out of ten low pressure areas, three intensified further into Depressions.

NEW RECORDS OF METEOROLOGICAL PARAMETERS

During (April to September) 2014, average rainfall for whole country were about normal but most parts of the country were above normal in late monsoon period. Heaviest total rainfall was observed 261.91 inches at Launglon station in coastal area of Southern Myanmar and lowest total rainfall was 16.10 inches at Sinphyugyun station in central Myanmar. The country's 24 hour heaviest rainfall of 12.83 inches was observed at the Gwa station (48085), Coastal areas of Rakhine State on 3rd August 2014. Seven stations set the new rainfalls records during (April-September) 2014. The highest maximum temperature during the summer was 44.3°C at Mawleik station (48088) on 25th April, 2014.

DRILL FOR CYCLONE AND CAPACITY BUILDING WORKSHOP

- On 17th September, 2014, Information Transmission Exercise and Evacuation Drill for Cyclone was performed by Department of Meteorology and Hydrology, Department of Relief

and Resettlement and General Administrative Department with local people in collaboration of Japan International Cooperation Agency at Deltaic (cyclonic storm effected) areas.

- Two Staff Officers from Department of Meteorology and Hydrology attended the Workshop on Dvorak technique and Tropical Cyclone forecasting which was held in Oman from 28th September, 2014 to 2nd October, 2014.

HYDROLOGICAL ACTIVITIES

- Training Workshop for Satellite Based Drought Management was held at Tungapuri Hotel in Nay Pyi Taw, Myanmar on 15th May, 2014 jointly by the Department of Meteorology & Hydrology (DMH) and Asian Development Bank (ADB). This one-day training program was to understand satellite-based drought monitoring system to be developed under TA6521, make satellite-based drought indices used in the system, drought risk map and to conduct the cost benefit analysis using freely available data. This meeting was attended by participants from the Department of Agricultural Research (DAR), Ministry of Agriculture and Irrigation (MoAI), Water Resources Utilization Department (WRUD).



- Workshop on use of Remote Sensing Data for Flood Warning and Management was held at Horizon Lake View Hotel in Nay Pyi Taw, Myanmar on 25th – 26th June, 2014 by Japan Aerospace Exploration Agency (JAXA) and DMH. Participants from the relevant departments i.e. Department of Irrigation, Water Resources Utilization Department Directorate of Water Resources and Improvement of River System, Relief and Resettlement Department, Central Statistical Organization, DMH attended the workshop.
- Transformation of Urban Management meeting (Part II-Flood Management) in Myanmar for Yangon, Mandalay and Mawlamyine using Rainfall Run-off (RRI) Model Storm Surge Model & GIS was jointly organized by International Center for water Hazard and Risk Management (ICHARM), ADB and DMH and was held in Multi Hazard Early Warning Center (DMH), Nay Pyi Taw on 16th September 2014. The meeting was attended by the relevant departments like Department of Agricultural Planning, Irrigation Department, Land Survey Department, Myanmar Port Authority, General Administration Department, City Development Committee of Yangon, Mandalay and Mawlamyine, Relief and Resettlement Department, Human Settlement and Housing Development, Myanmar Engineering Society, Water Resource Utilization Department, Directorate of Water Resource and Improvement of River.
- Department of Meteorology and Hydrology (DMH) hold SOPs working level meeting for Coastal Multi-Hazards Early Warning System on 4th – 5th August 2014, cooperative with UN-ESCAP, WMO and Typhoon Committee, under the Synergized Standard Operating Procedures for Coastal Multi-Hazards Early Warning System Project.



- Participants belonging to DMH and Disaster Risk Reduction sector attended the Standard Operating Procedures for Coastal Multi-hazards Early Warning System training on 9th – 11th June, 2014, at Nanjing, China which was organized jointly by UN-ESCAP, WMO and Typhoon Committee.
- DMH installed Telemetry Water Level Monitoring System at Hinthada of Ayeyarwady River, Toungoo of Sittoung river, Hpaan of Thanlwin river, Bago of Bago river and Shwegyin of Shwegyin river.
- A special River Survey was conducted at Bago of Bago River with river surveyor (M-9).
- 12th Monsoon forum was held on 7th May, 2014 at Nay Pyi Taw which was organized by DMH in collaboration with the Regional Integrate Multi-hazards Early warning System- (RIMES).

CAPACITY BUILDING AT NATIONAL EARTHQUAKE DATA CENTRE (NEDC)

- National Earthquake Data Center (NEDC) contacted the IOC communication test on 11th June 2014.
- NEDC organized a the training workshop on “Seismic Hazard Assessment” with University of Bergen and Asian Disaster Preparedness Center (ADPC) at Department of Meteorology and Hydrology, Nay Pyi Taw, Myanmar from 20th June to 4th July 2014.
- NEDC organized the “2nd Training Workshop on Tsunami Exercise” with collaboration of UNESCO/IOC at Department of Meteorology and Hydrology, Nay Pyi Taw, Myanmar from 1st to 4th September 2014).
- NEDC successfully hold the training of “Seismological Data Processing and Network Operation” with University of Bergen and ADPC at Department of Meteorology and Hydrology, Nay Pyi Taw, Myanmar on 23rd to 26th September 2014.
- NEDC successfully conducted IOWave14 Exercise on 9th and 10th September 2014.



Oman

INTERNATIONAL WORKSHOP ON DVORAK TECHNIQUE AND TROPICAL CYCLONE FORECASTING (MUSCAT, OMAN FROM 28TH SEPTEMBER – 2ND OCTOBER, 2014)

The Sultanate of Oman and WMO sponsored a workshop to improve operational capabilities of National Meteorological Services of Panel on Tropical Cyclone member countries in tropical cyclone forecasting and warning, through providing training for forecasters in the most up-to-date techniques. The Directorate of Meteorology in the Public Authority of Civil Aviation hosted an International Workshop on Dvorak Technique and Tropical Cyclone Forecasting, at the Sultan Qaboos University in Muscat, Oman from 28th September to 2nd October 2014.

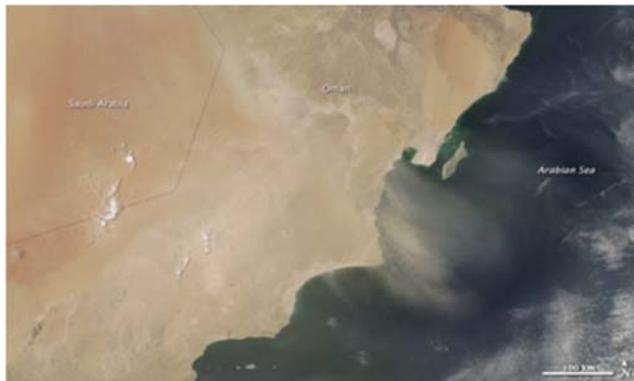
The workshop covered essential topics on state-of-the-art technologies in operational tropical cyclone forecasting, with particular focus on Dvorak technique. This is a technique used for tropical cyclone intensity estimation. It is a statistical correlation between cloud banding and intensity of a tropical cyclone. It is considered as the best technique currently available, but is complex and, to some extent, subjective.



The workshop was attended by thirteen participants from seven out of eight member countries of the WMO/ESCAP Panel on Tropical Cyclones (PTC), including twenty-five local participants. In addition, two participants each from the United Arab Emirates (UAE) and Qatar were also invited to attend the workshop. It was targeted particularly at meteorologists who have practical experience in operational tropical cyclone forecasting. Three internationally distinguished experts, a WMO representative and two Omani experts were invited to deliver lectures for the workshop. Oman, which hosted the event, is quite often impacted by tropical cyclones. One significant case was of the Tropical Cyclone “Gonu” which caused severe flooding and damage to the country in 2007.

DUST OVER OMAN

It was expected that Tropical Cyclone “Nanauk” will make landfall on 15th June, 2014, but the advancing of Southwest Monsoon intervened with winds that carried very dry Middle Eastern air into the core of Tropical Cyclone “Nanauk”. The storm fell apart and strong northwesterly winds prevailed causing dust. The Moderate Resolution Imaging Spectroradiometer (MODIS) on NASA’s Aqua satellite acquired this image of dust storm. The dust blurs land features and extends out over the Arabian Sea. The winds and resulting dust reduced visibility, leading to warnings throughout the region. The winds also caused high waves in the Persian Gulf and Gulf of Oman.



Pakistan

WEATHER SUMMARY (APRIL TO SEPTEMBER, 2014)

APRIL – JUNE, 2014

Variability of the monthly rainfall was observed during the pre-monsoon season 2014 over country, when first month of the season i.e. April recorded nearly normal rainfall, May received excessively more than normal rainfall, whereas June recorded largely below normal rainfall (Fig-1). However, as a whole country, near to normal rainfall, i.e. 9%, was recorded in the season while more than normal rainfall was recorded over Balochistan and Punjab provinces and normal in KP province, whereas largely deficient of rainfall was recorded elsewhere in the country (Fig-2).

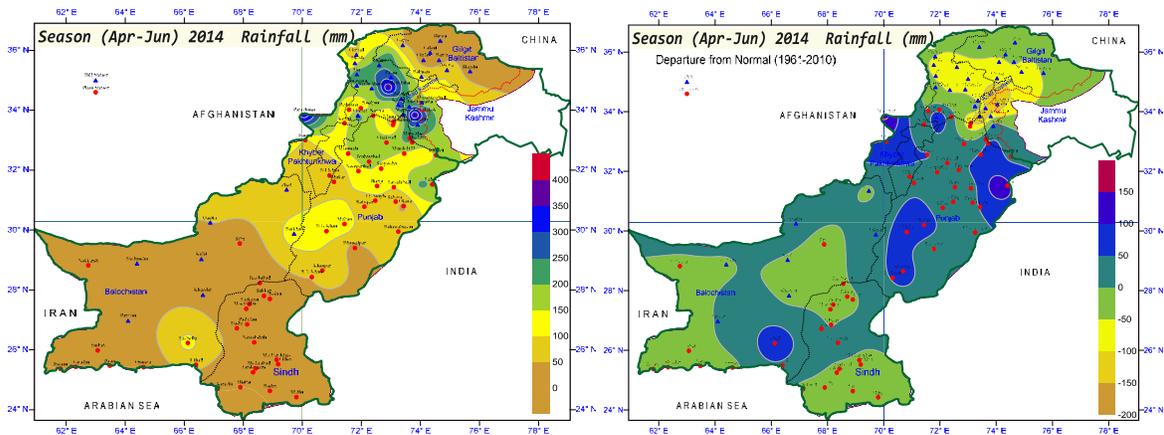


Fig-1: Spatial Distribution of Seasonal (actual & departure) Rainfall 2014

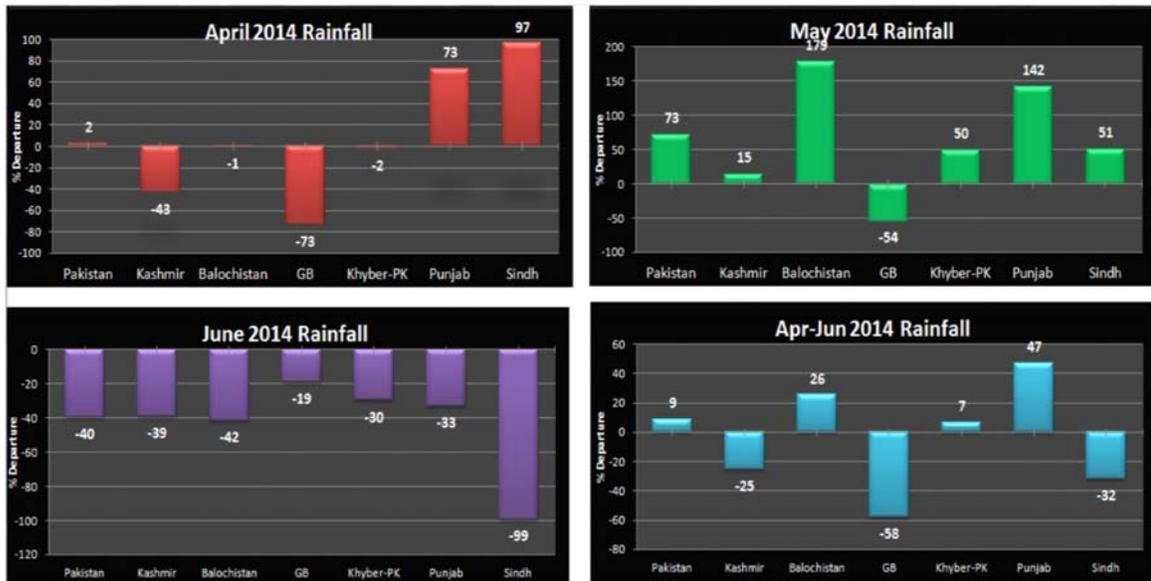


Fig. 2. Monthly & seasonal rainfall departure (%) from normal on national and provinces basis

April 2014

Near to normal rainfall was recorded in the month over the country. Similar position was observed over Balochistan & KP but exceptionally very high rainfall were recorded over parts of Punjab & Sindh, whereas sever dryness was observed over the regions of Kashmir & Gilgit-Baltistan (Fig-3).

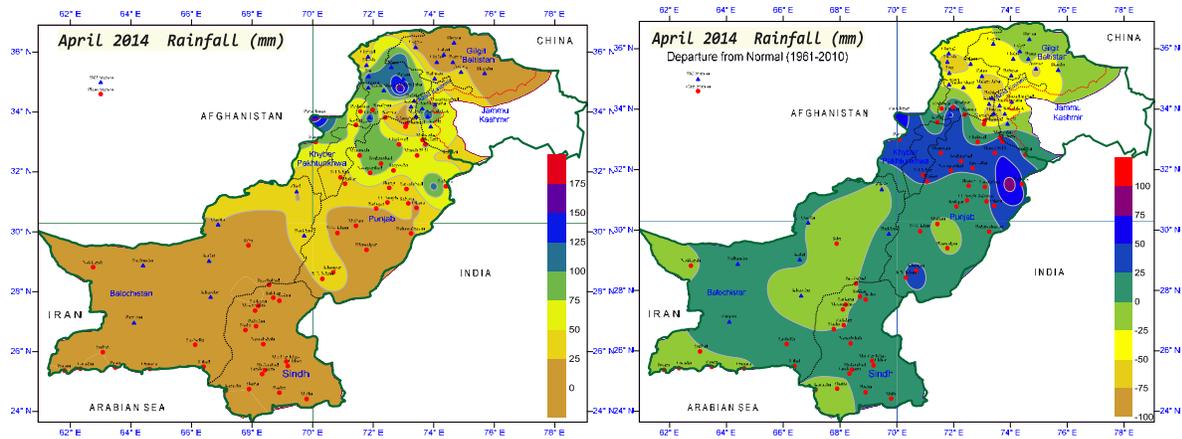


Fig-3: Spatial Distribution of April (actual & departure) Rainfall 2014

May 2014

The rainfall received was one of the heaviest recorded rainfall in May. The monthly accumulated rainfall of the country was 73% more than normal and it can be ranked as fifth heaviest May rainfall during past 54 years. All provinces received exceptionally more than normal rainfall except Kashmir & Gilgit-Baltistan, where it was normal to below normal (Fig-4).

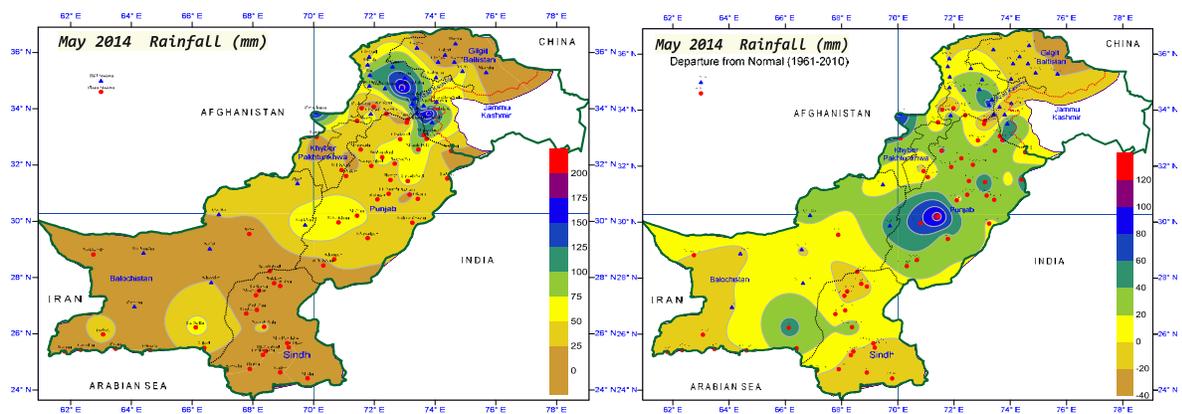


Fig-4: Spatial Distribution of May (actual & departure) Rainfall 2014

June 2014

June was the driest month of the season and received 40% below than normal rainfall. Sindh province remained the severest dry area throughout the month (Fig-5).

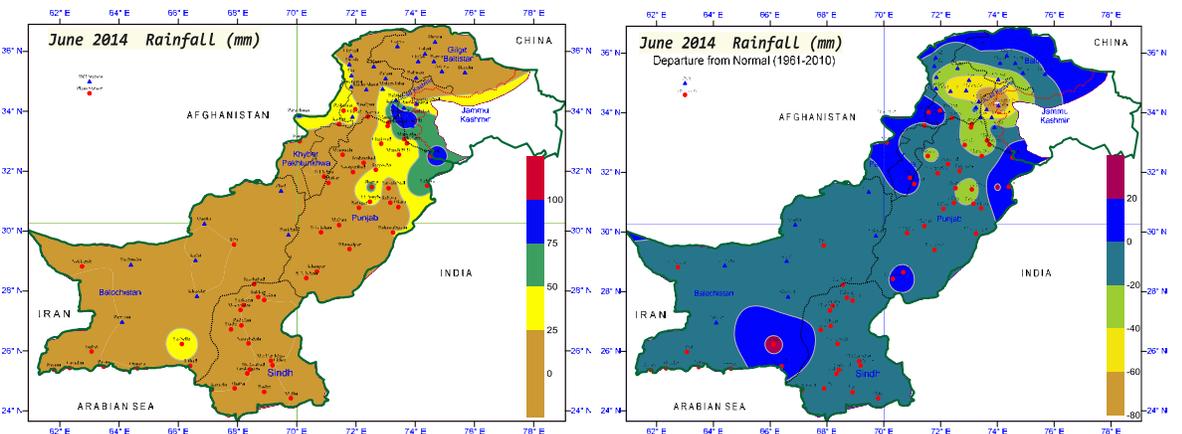


Fig-5: Spatial Distribution of June (actual & departure) Rainfall 2014

JULY-SEPTEMBER 2014 (MONSOON SEASON)

The severe rainfall deficit exists in the first two months of the season over the country was broken with heavy rainfall spell of 2nd-6th September. Spatial distribution of seasonal rainfall depicts (Fig-1) concentration of rainfall over upper Punjab & adjoining areas. During the season larger parts of Sindh, Balochistan and Southern Punjab regions remained either dry or received very little rainfall. The seasonal monsoon 2014 rainfall of the country as a whole is 18% below Normal/Long Period Average (1961-2010). The seasonal rainfall, over Gilgit-Baltistan was exceptional very higher than normal and close to normal over Azad Kashmir & Punjab, whereas slightly, moderately & largely below normal over KP, Balochistan & Sindh respectively (Fig-2).

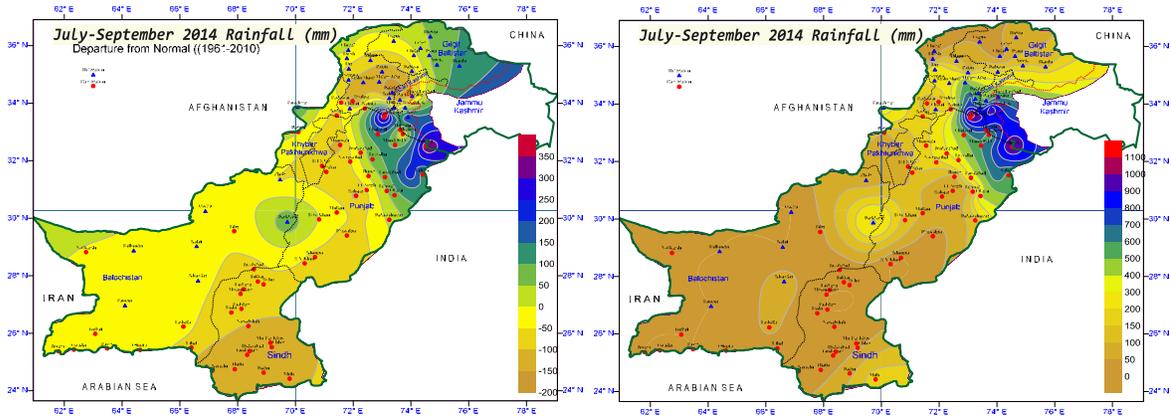


Fig-1: Spatial Distribution of Seasonal (actual & departure) Rainfall 2014

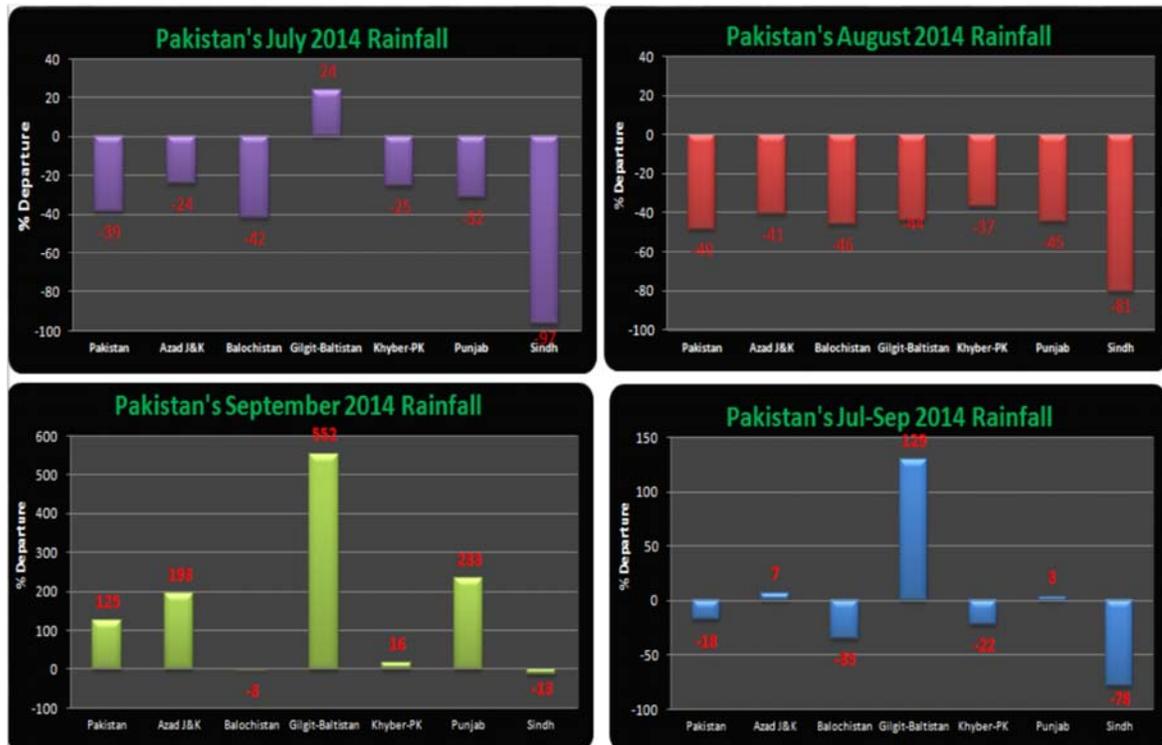


Fig-2: Spatial Distribution of monthly & seasonal Rainfall over country & provinces

In September 2014, the parts of Azad Kashmir, Gilgit-Baltistan and Punjab region were hit by heavy floods caused by torrential rainfall. According to NDMA, several thousand villages across these regions had been hit and nearly 280 people died due to the floods.

July 2014

In the month, as a whole country, deficient rainfall, i.e. below 39 % of normal was observed over Pakistan. In the month, slightly above normal rainfall were recorded over Gilgit-Baltistan, whereas below than normal rainfall were recorded over AJK, Punjab, KP, Sindh and Balochistan.

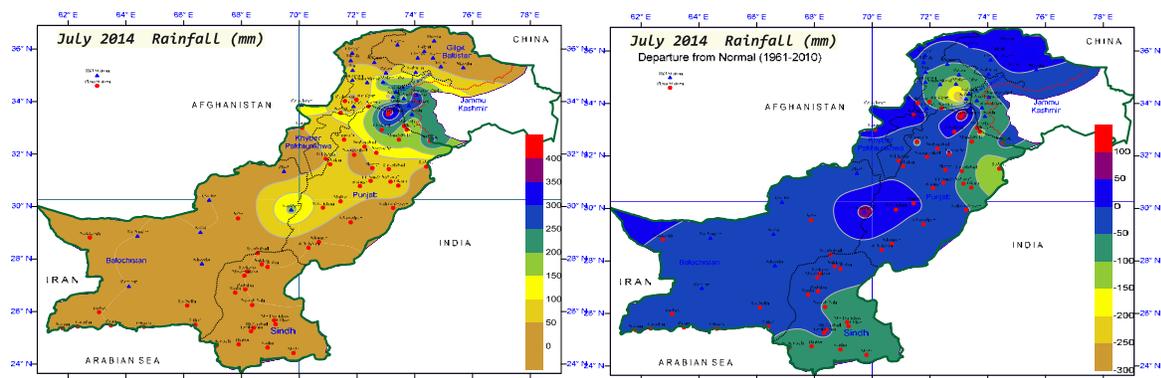


Fig-3: Spatial Distribution of July (actual & departure) Rainfall 2014

AUGUST 2014

The sever rainfall deficit continues to persist in the month of August, when as a whole country, 49% below normal rainfall was recorded over Pakistan. In the month, all the provinces received moderately below normal except Sindh, which received largely below than normal rainfall.

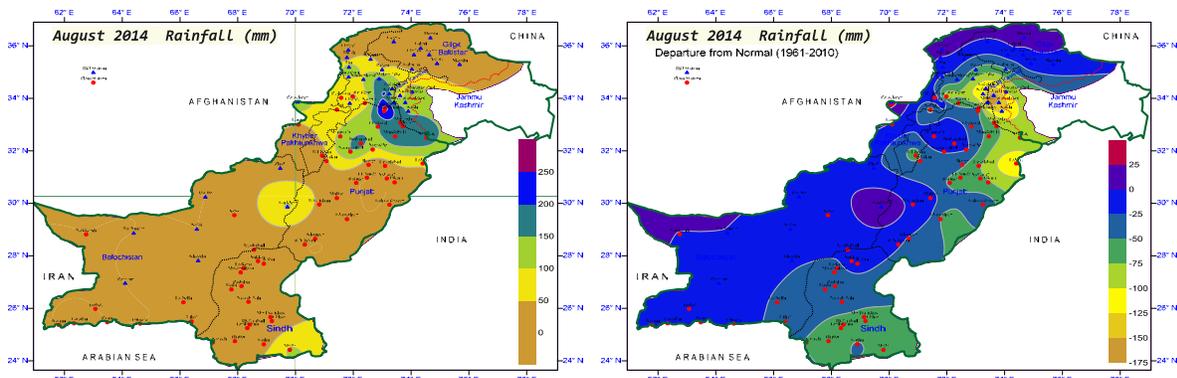


Fig-4: Spatial Distribution of August (actual & departure) Rainfall 2014

SEPTEMBER 2014

In September, on as a whole country, 125% above normal rainfall was recorded over Pakistan. The year the September rainfall of Azad Kashmir & Gilgit-Baltistan was the second highest rainfall after 1992 while September, 2014 rainfall of Punjab was fourth highest rainfall after 2012, 2011 & 1992.

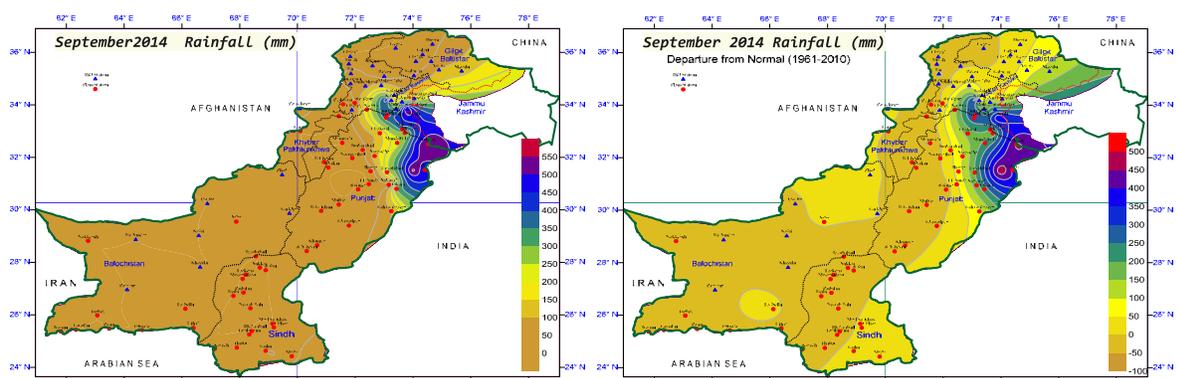
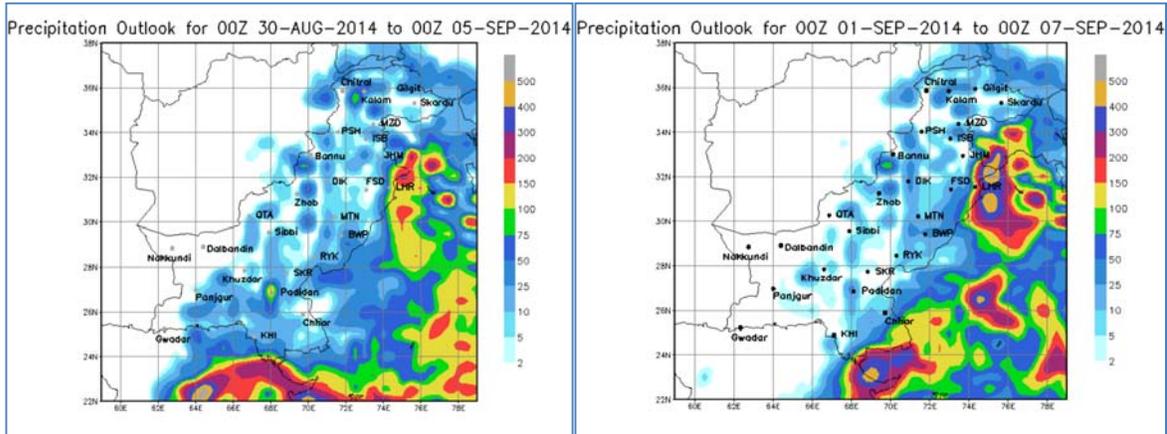
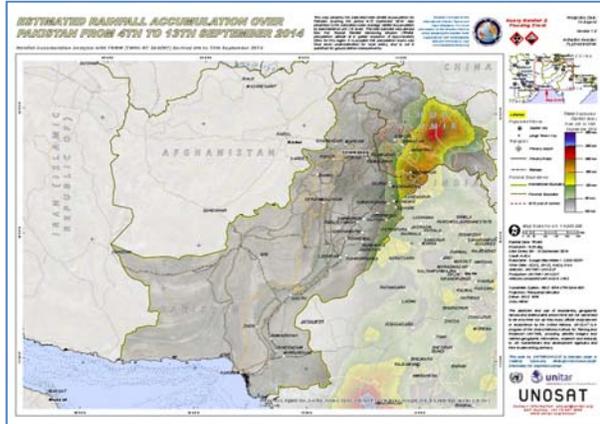


Fig-5: Spatial Distribution of September (actual & departure) Rainfall 2014

MONSOON FLOOD 2014

The Himalayan mountain range is steep and unstable: landslides and flash floods are all too common. The summer monsoon reliably delivers an intense abundance of water, swelling rivers, lakes and flooding water-courses incredibly fast. Pakistan Meteorological Department issued monsoon outlook during first week of August keeping in view the global parameters and stated that monsoon is expected to remain by and large normal embedded with few extreme rainfall events during the period from mid-August to mid-September. In July and August, the overall rainfall for whole of country remained mostly deficient but during first week of September, the monsoon became active and northern parts of the country received exceptionally high rainfall resulted in widespread flooding in Azad Kashmir, Gilgit-Baltistan, Khyber Pakhtunkhwa, Punjab and later in Sindh province. This was the fourth consecutive year of high-impact monsoon rains in Pakistan. The initial rainfall caused flash flooding and landslides in parts of Azad Kashmir, Punjab, Gilgit-Baltistan, Khyber Pakhtunkhwa. Levels of the rivers Indus, Jhelum, Chenab and Ravi began to rise soon after, which flooded areas along river banks and later affected parts of Sindh province.



The images below show the situation “before and after flood” as captured by the Moderate Resolution Imaging Spectroradiometer (MODIS) on NASA’s Terra satellite.



Pakistan before floods dated 31st August 2014



Pakistan floods, 11th September 2014

The floods were caused by heavy rain from a slow moving area of monsoonal low pressure across northern India and Pakistan, which in turn increased river levels. The heavy rain began to fall in the first few days of September. The significant rainfall during 24 hours between 3rd and 4th September, 2014 were at Lahore (168.9 mm), Sialkot (182.9 mm), Faisalabad (82.9 mm), and Jhelum (78.1 mm). The rain continued for several days. The table below shows how much rain fell for the whole of the month in several locations in Punjab and Azad Jammu & Kashmir (AJK).

Province	Location	Total Rainfall (mm) September 2014	Normal Monthly Rainfall (mm)
Punjab	Islamabad A/P	416.3	110.7
	Islamabad ZP	438.3	123.3
	Jhelum	239.1	65.4
	Lahore A/P	564	74.6
	Lahore PBO	451.1	60.4
	Murree	302	130.9
	Sialkot Cantt	551.2	not known
	Sialkot A/P	472.1	89
AJK	Toba Tagh Singh	113	not known
	Astore	102.1	20.9
	Kotli	487.1	84.3
	Muzaffarabad	172.1	109.6
	Rawalakot	547.2	not known

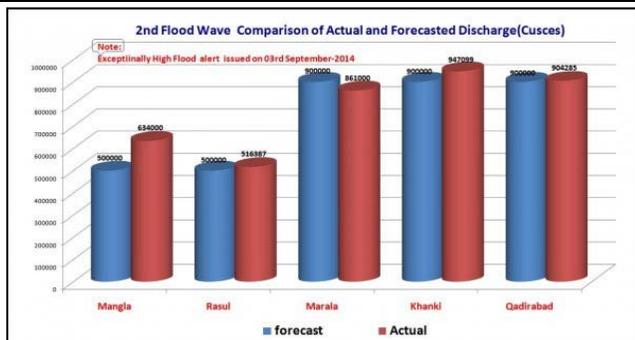


River levels were extremely high, the flow rate in cubic feet per second (cusecs) were lower than previous extreme flood events, as shown in the table below:

River	Site	Flow (cusecs) during 3 rd – 4 th Sept. 2014	Ever Highest Record Flow (cusecs)	Date
Jhelum	Mangla	634000	1090000	10-09-1992
	Rasul	516387	952170	10-09-1992
Chenab	Marala	861000	1100000	26-08-1957
	Khanki	947099	1086410	27-08-1959
	Qadirabad	904285	948530	11-09-1992

The chart shows the “Exceptional High Flood Alert” issued by the Flood Forecasting Division of PMD for flow of rivers next to actual figures.

According to National Disaster Management Authority (NDMA) about 367 people died in the disaster. Over 2.5 million people were affected by the flooding from over 4,000 villages. Nearly



700,000 people were evacuated and the floods left over 100,000 homes damaged. Livelihoods were also damaged. In Punjab, Azad Kashmir and Gilgit-Baltistan, more than 2.4 million acres of crops have been lost and 9,000 cattle perished.

Province	Deaths	Injured	Houses Damaged	Villages Affected	Population Affected	Persons Evacuated
Khyber Pakhtunkhwa	12	15	42	0	0	0
Punjab	286	512	100000 approx.	3484	2470000	618347
Azad Kashmir	56	111	5768	187	46979	0
Gilgit-Baltistan	13	35	1292	127	13266	0
Sindh	0	0	0	267	0	65583
Totals	367	673	107102	4065	2530245	683930



EARLY WARNING SYSTEM FOR MONSOON LOA SIGNED BETWEEN PMD & UNDP

A Letter of Agreement (LoA) has been signed between the United Nations Development Programme (UNDP) and Pakistan Meteorological Department (PMD) on 14th April, 2014 at Met. Headquarter, Islamabad to strengthen PMD's early warning system for monsoon season.

The main purpose of LoA was to enhance capabilities in "Early Warnings Dissemination" during upcoming monsoon under the Supporting Community Resilience (SCORE) Project". On behalf of PMD the LoA was signed by Mr. Arif Mahmood, Director General while UNDP was led by Mr. Herman Besgsme (CTA, DRR). At the signing ceremony, senior government officials and representatives of



UNDP, NDMA and PMD were also present. This LoA was meant to provide a framework for timely dissemination of Flash Flood Alerts using FM radio transmission and SMS for targeted areas of vulnerable areas with special focus on Khyber Pukhtunkhaw's districts Peshawar, Charsada and Nowsherea.

**AWCI TRAINING WORKSHOP ON
ASSESSMENT OF CLIMATE CHANGE IMPACT ON A WATERSHED HYDROLOGY
INCLUDING HYDROLOGICAL MODELING IN COLD REGION BASINS
(ISLAMABAD, PAKISTAN ON 15TH – 17TH SEPTEMBER, 2014)**

The training workshop was organized by PMD in collaboration with the University of Tokyo supported by the Asia Pacific Network for Global Change Research (APN). The Asian Water Cycle Initiative (AWCI) has developed an advanced river management system, which is based on integration of data from earth observation satellites and in-situ networks with other types of data, including numerical weather prediction model outputs, climate model outputs, geographical information, and socio-economic data. The system has been successfully applied to a set of AWCI demonstration basins showing a high potential for practical applications including assessment of climate change impacts on watershed hydrological regimes and hence water resources availability in future.



The objectives of the training workshop included:

- Thematic lectures on Climate-Water-Food-Health Nexus and APN and AWCI related activities in Pakistan.
- Introduction, description and demonstration of capabilities of the Water and Energy Budget Distributed Hydrological Model for Snow and glacier basins (WEB-DHM-S), which is a novel and robust tool for cold region hydrological applications.
- In-depth explanation of the techniques for climate change impact assessment studies on water resources that are built in the Data Integration and Analysis System (DIAS) and available on-line (demonstration version).

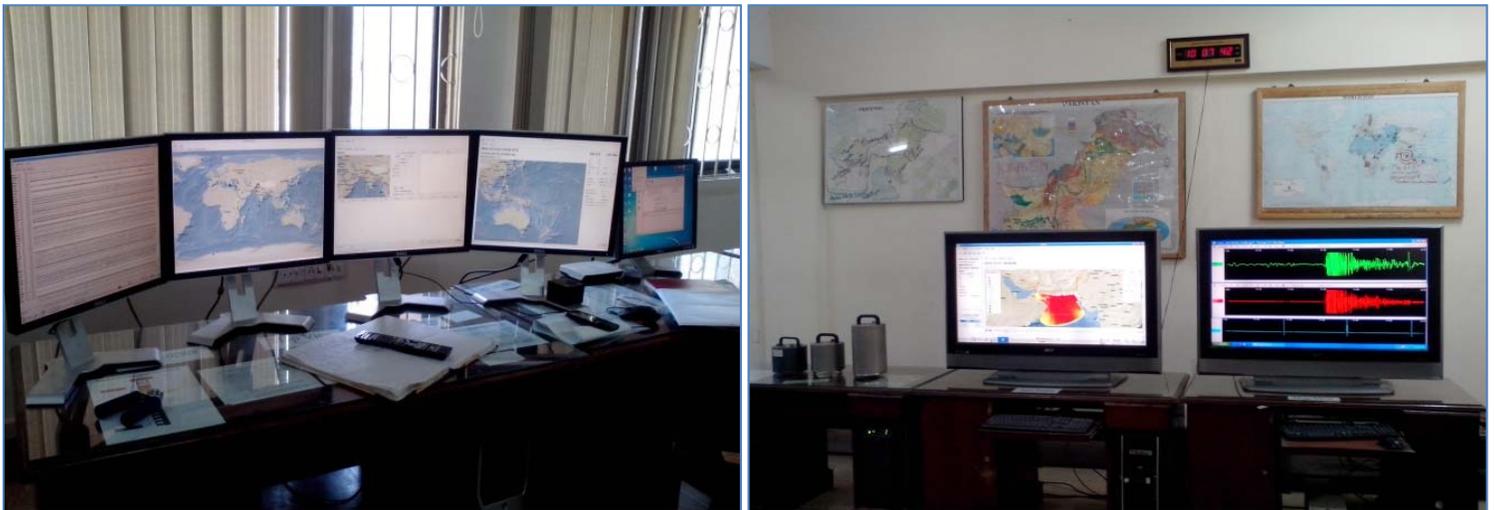


More than 45 participants/trainees from various national organizations & academia and participating Asian nations representing Bangladesh, Bhutan, Indonesia, Korea, Malaysia, Myanmar, Nepal, Philippines, Sri Lanka, Thailand and Vietnam attended the training workshop.

IOC / UNESCO ORGANIZED “IOWAVE14” EXERCISE (10TH SEPTEMBER, 2014)

An Indian ocean-wide exercise was organized by IOC/UNESCO held on 10th September, 2014. 24 countries including Pakistan which are all part of Indian Ocean Tsunami Warning System (IOTWS) were invited to take part in the exercise. The exercise started at 0600 UTC on 10th September 2014. The Makran trench scenario was selected for this exercise.

The purpose of the IOWave14 exercise was to evaluate and improve the effectiveness of IOTWS, through its operational Regional Tsunami Service Providers (RTSPs) Indonesia, Australia and India, National Tsunami Warning Centre (NTWCs) and National Disaster Management Organizations in each country, in responding to a potentially destructive tsunami. Another important purpose of the exercise was to test the operational lines of communications, review tsunami warning and emergency response Standard Operating Procedures (SOP), and to promote emergency preparedness. Regular exercises are important for maintaining staff readiness for real events like tsunamis, which are infrequent but require rapid response.



The following were the specific objectives for IOWave14:

- To validate the dissemination by RTSPs of Tsunami Bulletin Notification Messages to NTWCs.
- To validate the reception by NTWCs of Tsunami Bulletin Notification Messages and access by NTWCs to the tsunami bulletins and other products on the RTSP websites.
- To validate the reporting by NTWCs to the RTSPs of their National Tsunami Warning status.
- To validate the SOPs within countries for disseminating tsunami warnings and other threat information to their relevant disaster response agencies.
 - To validate the organizational decision-making processes within countries for the issuing of tsunami warning bulletins and ordering evacuations.
 - To identify the methods used for issuing tsunami warning bulletins to relevant response agencies.
 - To assess the elapsed time for tsunami warning bulletins to reach the response agencies.

Participants belonging to key organizations including National Disaster Management Authority (NDMA), Pakistan Navy, Karachi Port Trust (KPT), PAEC, Maritime Security Agency (MSA) & local administrations of Karachi, Gwadar, Lasbela, Badin and Thatta attended the exercise. A mock coastal evacuation drill was also included in these actions. Pakistan Navy responded excellently during the exercise. They further tested their own SOPs and arranged evacuation within Navy.

Sri Lanka

WEATHER SUMMARY (APRIL, 2014 – SEPTEMBER, 2014)

Northeast monsoon winds became weak, establishing inter-monsoon conditions by 3rd April, which is characterized by thunder showers during the afternoon or evening. Convective activities became prominent towards the latter part of April and in the first week of May due to moving of the Inter Tropical Convergence Zone, favoring, formation of low level disturbances near the latitudes of Sri Lanka and neighbouring southern seas. More than 100 houses were reported to be damaged predominantly due to the down draft associated with thunderstorms in the month of April and localized floods were also reported from Kandy in 3rd May. During 31st May to 1st June, a spell of very heavy rain with isolated extremely heavy falls occurred in the southwestern parts of the island. The heavy rain triggered land sliding and floods especially in Kaluthara district and resulted in 22 casualties and displaced more than 150,000 people. The most of lives were lost due to lightning activity during April and May. The southwest monsoon established over the island by 5th June. Disturbance formed in the lower levels of the atmosphere increased the rainfall along the western slopes of the hills on 12th June as well. Norton, Laxapana and Canyon reported very heavy falls of 348mm, 263.3mm and 230mm respectively. During the remaining parts of June and July, the rainfall remained less than the average.



Strong winds washed away 3 houses along the coast of Negombo on 20th July and damaged 850 houses in the hilly areas in the central parts of the country. The monsoon was fairly active in terms of rainfall associated with mid-tropospheric disturbances over Northern, Eastern and Uva provinces as well during 16th-17th and 21st-22nd August. Property damages were also reported due to strong winds. The prolonged deficit of the rainfall prevailed throughout the year and developed drought like conditions in Uva, North Central, Eastern and Northwestern provinces and parts of Southern province affecting about two million people. The monsoon became weaken significantly after 23rd September, and inter-monsoon conditions were gradually establishing afterwards over the country bringing some relief to the drought affected areas. Normal to slightly above normal rainfalls were reported from the most parts of the island except in the eastern and southeastern parts. A woman was died and other five people were injured due to lightning strikes. Property damages (around 51 houses) were also reported from Monaragala district (Uva province) on 7th September due to active monsoon winds and several houses in Boralanda area in Nuwara Eliya district were damaged due to localized strong winds associated with convective activity on 27th September.

WORKSHOP ON INSPIRE-ESCAPE SOFTWARE TO IDENTIFY TSUNAMI RISK AREAS AND SAFE ZONES FOR HAMBANTOTA (HAMBANTOTA, SRI LANKA FROM 4TH – 9TH AUGUST, 2014)

This workshop was conducted under the project entitled “Enhancing Coastal Hazard Early Warning and Response: Tools and Institutional Strengthening”, supported by the United Nations Economic and Social Commission for Asia and the Pacific through the Trust Fund for Tsunami, Disaster and Climate Preparedness. The project aims to build tsunami risk assessment capacities in Myanmar, Philippines, Sri Lanka and Thailand, building on UNESCO/IOC efforts in the Indian Ocean region and taking advantage of low-cost methodologies developed at RIMES. The workshop on INSPIRE and ESCAPE software application for tsunami hazard and risk assessment and evacuation planning was held from 4th – 9th August, 2014 in Hambantota, Sri

Lanka, successfully concluded with a community meeting to affirm optimally feasible evacuation paths and shelters. Nineteen participants from Sri Lanka's Disaster Management Centre, Coast Conservation Department, National Aquatic Resources Research and Development Agency, Survey Department, and Department of Meteorology (Hambantota Office) participated in the 6-day workshop on the functionalities and applications of the Internet-based Simulation Platform for Tsunami Inundation and Risk Evaluation (INSPIRE) and the Evaluation System for Computing Accessibility and Planning Evacuation (ESCAPE). Both applications are web-based tools: INSPIRE, for processing data, simulating tsunami propagation and inundation, and estimating tsunami loss; and ESCAPE, for computing the fastest evacuation path toward shelters, informed by INSPIRE outputs on tsunami safe areas. The workshop used data, generated from near-shore bathymetric, topographic, and exposure surveys in Hambantota in April 2013, which were processed and prepared for use in INSPIRE and ESCAPE through a training at RIMES on DEM generation from July – August 2013. Most of the workshop participants were involved in these activities.



Workshop outputs, which include tsunami arrival time from the worst-case earthquake scenario, maximum depth and extent of potential inundation, potential loss of life and building damage, shelter locations and capacities, and evacuation routes were presented to the District Disaster Management Committee. A meeting was also held with representatives from areas in Hambantota that were affected by the 2004 Indian Ocean tsunami. The meeting appreciated the outputs from the workshop. The subsequent field visit verified the evacuation routes to and locations and capacities of the selected shelters, as well as provided alternate shelter options. After evaluation, maps of tsunami inundation and risk zones, and final evacuation routes and shelter locations shall be handed-over to the District Disaster Management Committee, to guide evacuation planning. (Source: www.rimes.int)

CAPACITY BUILDING WORKSHOPS UNDER THE PROJECT OF ENHANCING THE CAPACITY OF MULTI-HAZARD EARLY WARNING SYSTEMS (EWS) FOR COASTAL HAZARDS IN SRI LANKA

Coastal Hazard impacts are local but the hazards are in most of the cases sourced in regional waters and now are heavily influenced by the rapid change of climate. India Ocean climate change induced hazards are increasing frequency in the coastal areas of the Bay of Bengal. Recent Climate Change report by IPCC (2014) has indicated that more and more disasters can be expected to affect the Asian Region and in particular the Island countries like Sri Lanka. There are many records indicating increased levels of coastal hazards, which also could be observed within Sri Lanka in past few years. The specific attention to enhance further capacity of multi-hazard early warning systems for coastal hazards has been given by the Ministry of Disaster Management of Sri Lanka. Several trainings sessions have been conducted under this project earlier at Regional level and at national levels as well. In addition, two more training

workshops on several focused tools have been conducted at local level from 19th - 22nd May 2014, where officers from DMC (Disaster Management Center) and DOM (Department of Meteorology) had received hands-on training in improving their skills on the ground. The two training workshops were included with:

- Capacity Building Training Workshop on "Tools for Coastal Hazard Modeling, Forecast Visualization and Verification" was organized by DOM and conducted in the DOM premises just adjacent to DMC premises.
- National Level Hands-on Training Workshop on "End-to-End Early Warning System Tools and Response for Coastal Hazards". This workshop was organized by the DMC.

These two trainings sessions were fully targeted towards two different set of professionals and different set of skills to grow their own profession. The first training session was conducted with the participation of Assistant Directors who are working in the coastal districts of Sri Lanka and the second training session was conducted for DOM professionals who are working in modeling and forecasting of the coastal hazards. These two trainings would help to grow their in-service skills to tackle the coastal hazards in a more systematic way and would help them to function with more knowledge and skills in their respective duty areas. (Source: <http://www.dmc.gov.lk/>)



OTHER ACTIVITIES:

- Residential training programme on "Importance and the use of meteorological products and data for different sectors" for the officers of Sri Lanka Technological Services (SLTS) department was organized in Kandy during 25th-27th June. Experts from the Department of Meteorology briefed the participants about the significance of the meteorological data and its products.
- Prior to southwest monsoon season, national monsoon forum (ninth of the series) was held with the participation of most relevant national stake holders. The program was facilitated by RIMES and was held at the auditorium of the Department of Meteorology on 29th May.
- Follow up training workshop on "DIANA/WRF/PRECIS/JMA-SSM Forecast verification" was organized by Asian Disaster Preparedness Centre (ADPC), at the Department of Meteorology during 19th – 23rd May, 2014.
- As a part of the project "Synergized Standard Operating Procedures (SSOP) for Coastal Multi-Hazards Early Warning System" funded by the ESCAP Trust Fund for Tsunami, Disaster and Climate Preparedness in Indian Ocean and Southeast Asian Countries with technical assistance from WMO, the Department of Meteorology organized a stakeholders' meeting at the Department of Meteorology from 7th - 8th August, 2014.



Thailand

TMD CELEBRATED THE 72ND ANNIVERSARY

During the year 2014, Thai Meteorological Department (TMD) organized a number of events to celebrate its 72nd Anniversary with the theme “72-Years Thai Meteorological Department and Climate Change”. Among those, two Seminars on the same topic entitled “Climate Changes and utilization of Meteorological Data for Planning” were organized by the Southern Meteorological Center (East Coast) in Song Khla Province on 30th April, 2014 and by the Northeastern Meteorological Center (Upper Part) in Khon Kaen Province on 24th May, 2014 respectively. The objectives of the seminars were to encourage people to learn more about climate change, natural disasters and adaptation to climate change, and to contribute meteorological network in provincial, district and sub-district (local area) levels. More than 200 participants from the private and public sectors attended these seminars.



Seminar on “Climate Changes and utilization of Meteorological Data for Planning” in Song Khla Province hosted by Southern Meteorological Center (East Coast) on 30th April, 2014.



Seminar on “Climate Changes and utilization of Meteorological Data for Planning” in Khon Kaen Province hosted by Northeastern Meteorological Center (Upper Part) on 24th May 2014.

**TMD ATTENDED INTERNATIONAL WORKSHOP ON
DVORAK TECHNIQUE AND TROPICAL CYCLONE FORECASTING
(MUSCAT, OMAN FROM 28TH SEPTEMBER – 2ND OCTOBER, 2014)**

The Sultanate of Oman and WMO sponsored a Workshop on Dvorak Technique and Tropical Cyclone Forecasting, at the Sultan Qaboos University in Muscat, Oman from 28th September to 2nd October, 2014 in order to improve operational tropical cyclone forecasting and warning, through providing training for forecasters in the most up-to-date techniques. Two participants namely; Mrs. Pensiri Trisataya, Meteorologist, Northern Meteorological Center, and Mr. Methawee Nuanla-ong, Meteorologist, Southern Meteorological Center (East Coast) from TMD attended this workshop.



**DISSEMINATION OF METEOROLOGICAL INFORMATION
THROUGH TV CHANNEL**

Provision of useful meteorological information to the local community relating to natural disasters, its prevention and preparedness by the Northeastern Meteorological Centre (Upper part), TMD is playing a significant role in disaster mitigation efforts. Television broadcasting is a very useful method to swiftly report weather predictions and warnings of natural disasters to the general public at broader level.



Northeastern Meteorological Center (Upper part), in cooperation with the National



Broadcasting Services of Thailand (Khonkean branch), has broadcasted meteorological reports through “Isan Today”, in a morning (Monday-to-Friday) television program on NBT channel, in order to inform the people about the meteorological news and data.

LIST OF MEETINGS

Listed below are the meetings in which the PTC Secretariat has been involved as part of its responsibilities undertaken on behalf of the PTC:

- 70th Session of the ESCAP (Phase-II), Bangkok, Thailand from 4th – 8th August, 2014.
- 9th Integrated Workshop on the ESCAP/WMO Typhoon Committee, Bangkok, Thailand from 20th – 24th October, 2014.
- 3rd Joint Session of Panel on Tropical Cyclones and Typhoon Committee, Bangkok, Thailand from 9th – 13th February, 2015.

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