

Pakistan Meteorological Department

Drought Bulletin of Pakistan



January-March 2016

National Drought Monitoring Centre

Pakistan Meteorological Department

Sector H-8/2, Islamabad - 44000, P.O.Box#1214,

Phone # +92-51-9250598, Fax # +92-51-9250368

Website: www.pakmet.com.pk, Email: dirndmc@gmail.com

Drought Bulletin

January – March, 2016

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This bulletin is regularly published on quarterly basis under the guidance of Mr. Hazrat Mir, Chief Meteorologist, National Drought Monitoring Centre (NDMC), Islamabad.

Editor: Mr.Azmat Hayat Khan, Director, NDMC, Islamabad

Sub-Editor: Mr. Shahzada Adnan, Meteorologist, NDMC, Islamabad.

Quarterly Drought Bulletin

January – March, 2016

By

National Drought/Environment Monitoring & Early Warning Centre,
Pakistan Meteorological Department,
Islamabad

1. Introduction

Pakistan has a long latitudinal extent and the rainfall variability during different seasons is considerably high. The climate of the country in its lower southern half is arid and hyper-arid while the northern half of country lies between semi arid to very humid. Some regions of the country in each seasons, remain drastically dry and area always vulnerable to drought. If subsequent seasons fail to generate significant precipitation, the drought conditions then are sure to take the vulnerable regions in the grip. All the provinces of Pakistan have a history of facing major droughts in the past.

Drought differs from other natural disaster (e.g. flood, tropical cyclones, tornadoes and earthquakes etc) in the sense that the effects of drought often accumulate slowly over a considerable period of time and may linger for years even after the termination of the event. Because of this drought is often referred to as a “Creeping Phenomena”. Drought impacts are less obvious and are spread over large geographical areas than are the damages that results from other natural hazards. Consequently drought affects more people than any other environmental hazard.

Unfortunately, no organizations dealing with the drought issues exist in Pakistan and the responses to drought for the distressed economic and social sector, whenever such situation arose, were taken on emergency and on adhoc basis. It is thus inevitable need of the time and Pakistan Meteorological Department (PMD) took an initiative to establish National Drought/Environment monitoring and Early Warning Centre (NDMC) in 2004-05 after the worst drought during 1999-2001 in Pakistan. The main objective is to monitor drought situation in the country and issue advisory before time. Its national centre is in Islamabad while four Regional Drought Monitoring Centers (RDMC’s) are in Lahore, Karachi, Peshawar and Quetta. These four RDMC’s cover those region which comes under their jurisdiction. These centers serve as a hub for the monitoring,

collection, consolidation and analysis of drought related data from all the possible sources in the country. In order to strength the network, 50 Automatic weather stations (AWS) have been installed in different regions particularly the drought prone areas of the country. The data of eleven meteorological parameters (air temperature, humidity, wind speed, wind direction, dew point, sea level pressure, station level pressure, solar radiations, soil moisture at standard depths(5,10,20,50,100)cm and snow level are transmitted through satellite and GPRS technology after 3 hours. So, it has now become easy to access the data of remote areas of the country. NDMC has installed 335 Ordinary Raingages have been installed at districts level in four provinces as shown in figure-1

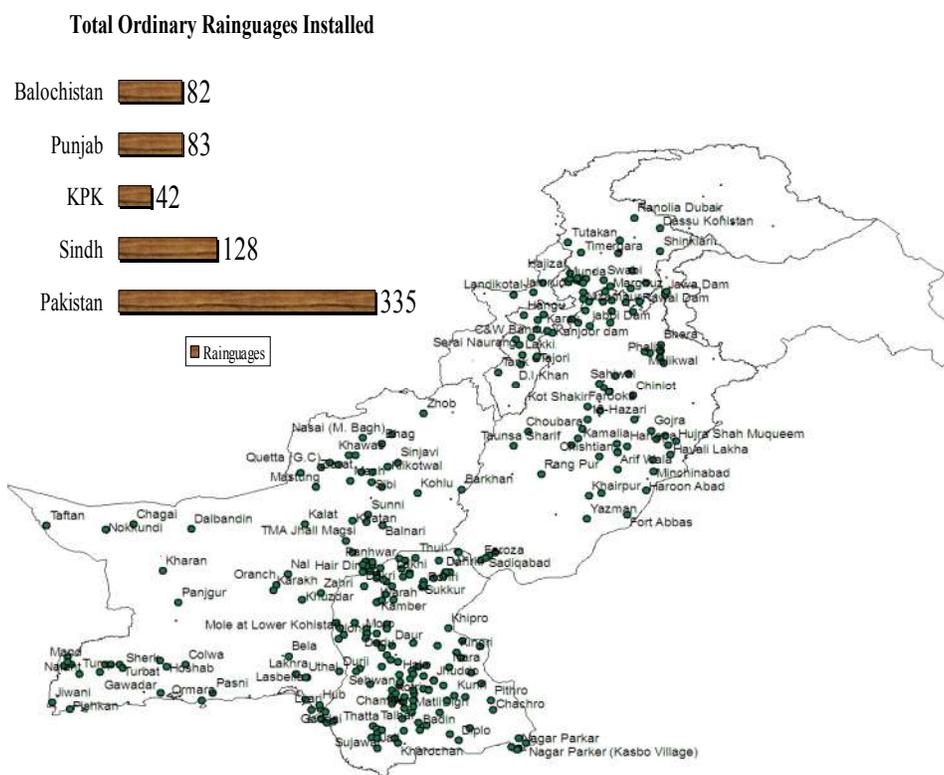


Figure-1 Rain-gauges Network of Pakistan by NDMC

NDMC also monitoring the water level situation of small dams in Barani areas of the country. NDMC using different indices like Standardized Precipitation Index (SPI), Normalized difference Vegetation Index (NDVI), Cumulative Precipitation Anomaly (CPA), Rainfall Anomaly Index (RAI), Percent of normal, Probability of occurrence, Percentage departure and soil moisture analysis etc to monitor drought. NDMC issues fortnightly drought bulletin of the country. Negotiations are underway with NGO's and National Disaster Management Authority (NDMA) for utilization of drought advisories / bulletin to end users.

2. Historical Background.

The Indian sub-continent is predominantly characterized by a tropical monsoon climate and entire regime is distinguished mainly by the differences in rainfall both in quantity and distribution. The most important feature is the regional and temporal alteration of atmospheric flow patterns associated with monsoon. There are two rainfall systems operating in the region (a) Southwest or Summer monsoon and (b) Northeast or the Winter monsoon.

Fortunately Pakistan also falls in this region which receive heavy amount of rainfall in summer due to SW monsoon and in winter due to western disturbances. The summer monsoon accounts for 70 to 80% of the annual rainfall over major parts of South Asia (IMD, 2009). In Pakistan, summer monsoon accounts 60 to 70% of the annual rainfall during July to September (Chaudhry, 1992). There is a large variability in the monsoon rainfall on both space and time scales.

Droughts in Pakistan region are mainly due to failures of rains from southwest monsoon. Also there seems to be some association between El Nino and La Nina events and weak monsoons. Pakistan frequently experiences droughts in southern parts of country. The study conducted at National Drought Monitoring Centre (NDMC) of PMD revealed that the province of Sindh and Balochistan are the more vulnerable to drought. The long term data analysis of past sixty years (1951-2010) different intensity (mild to extreme) of drought were experienced in the country i.e. 31 in Sindh,23 in Balochistan,22 in Punjab and 18 in Khyber Pukhtoorkhaw. The longest episode of drought was experienced during 1999-2002.The Punjab province experienced the worst droughts in 1899, 1920 and 1935,1969,1987-88, 2000-01, Khyber Pakhtunkhwa (KPK) experienced the worst droughts in 1902 and 1951-1952,1970-71,1987-88,1999-2001, Sindh had its worst droughts in 1871, 1881,1899,1931,1947,1951-52,1958,1966,1969,1972-74, 1987-88, 1999-2001 and 2003-04 while Balochistan had 1952,1963-64, 1965, 1968, 1970-71, 1983-84, 1987-88, 1999-2002,2004 and 2006. Over more than hundred year's period between 1871-1988, 11 out of 21 drought years were El Nino years.

Due to climate change, wet and dry cycles some years we receive more rains in wet spell and in dry spell we receive less rain. Due to less rain we have drought and heavy rain we have floods (flash flood, urban flood, costal flood and river flood).

3. Rainfall Distribution (Jan-Mar) 2016

During the first quarter of the year (Jan-Mar) 2016, normal (-8.6 %) precipitation was observed over Pakistan. During this quarter high temporal and spatial variable precipitation has been

observed. Normally January and February are the coldest month in the country and northern areas and southern western parts receive good amount of rainfall. The rainfall amount was near to normal as predicted by the Pakistan Meteorological department in seasonal forecast. During January 2016, below normal rainfall (-49.98%) observed in the country. The highest rainfall departure was observed in Sindh (-88.47%) and lowest in KP (-40.55%). Likewise January, February was also the drier month of the first quarter 2016 in which well below normal rainfall (-77.49%) was observed throughout the country. The Highest departure of rainfall was observed in Balochistan (-100%) and lowest in Gilgit-Baltistan and Kashmir (-56.71%). During March 2016, amount of rainfall was well above normal (77.4%) in the country, in Sindh (-26.5%) it was below normal while it was well above normal (+122.7%) in Punjab. The figure shows the percentage area weighed departure rainfall occurred during (Jan-Mar) 2016. In Pakistan, it was normal (-8.6%) during the first quarter of 2016. Viewing the rainfall distribution on province basis, over Sindh and KP, it was below normal -64.2% and -15.8%, respectively, over Gilgit-Baltistan and Kashmir (-11.7%), Balochistan (-7.1%) while in Punjab it was above normal (15.1%) as shown in figure-2

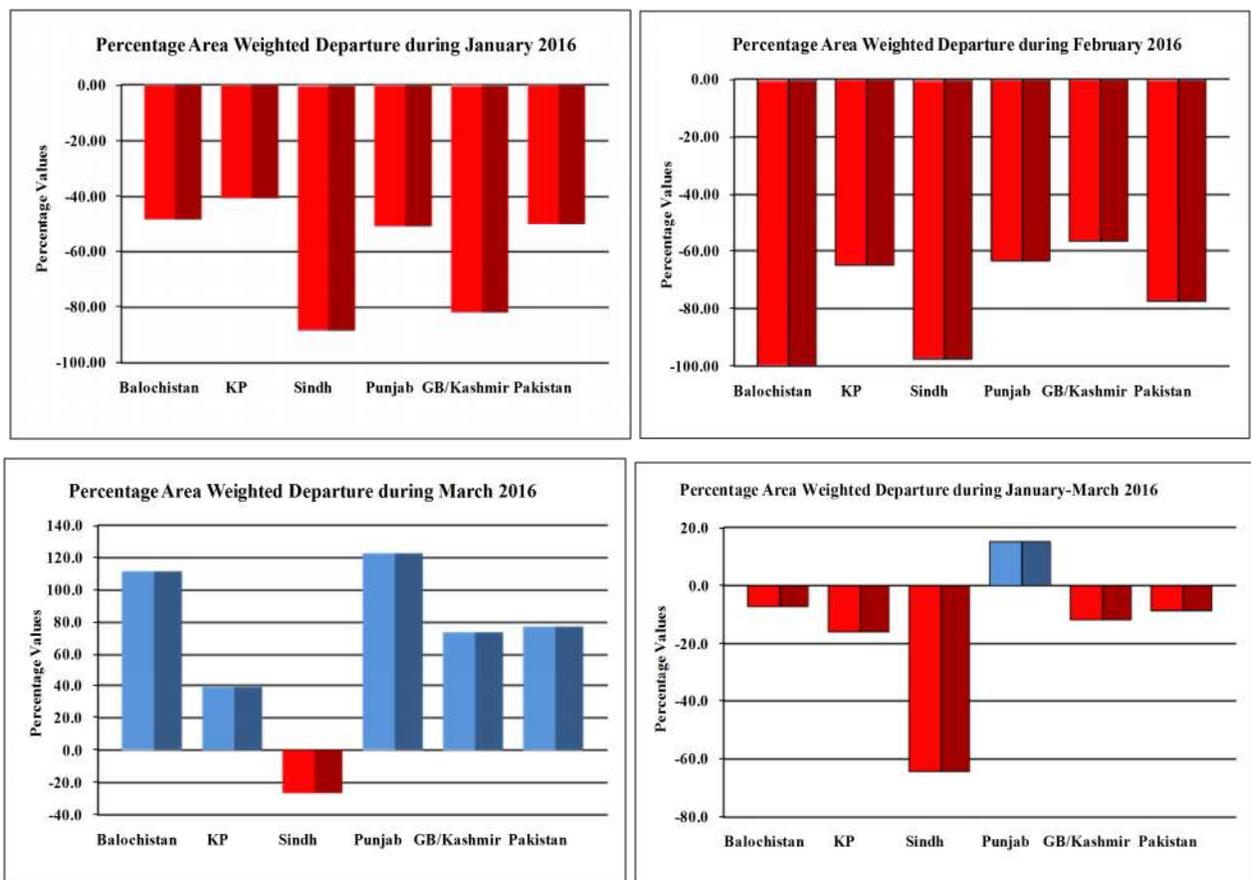


Figure-2 Percentage departure of rainfall during (Jan-Mar) 2016

During the quarter (January-March) rainfall spells were observed in Punjab, Balochistan and KPK. These rains reduced moisture stress condition on wheat crops in rainfed areas. The monthly and seasonal analyses on regional and country basis are as shown below in figure-3.

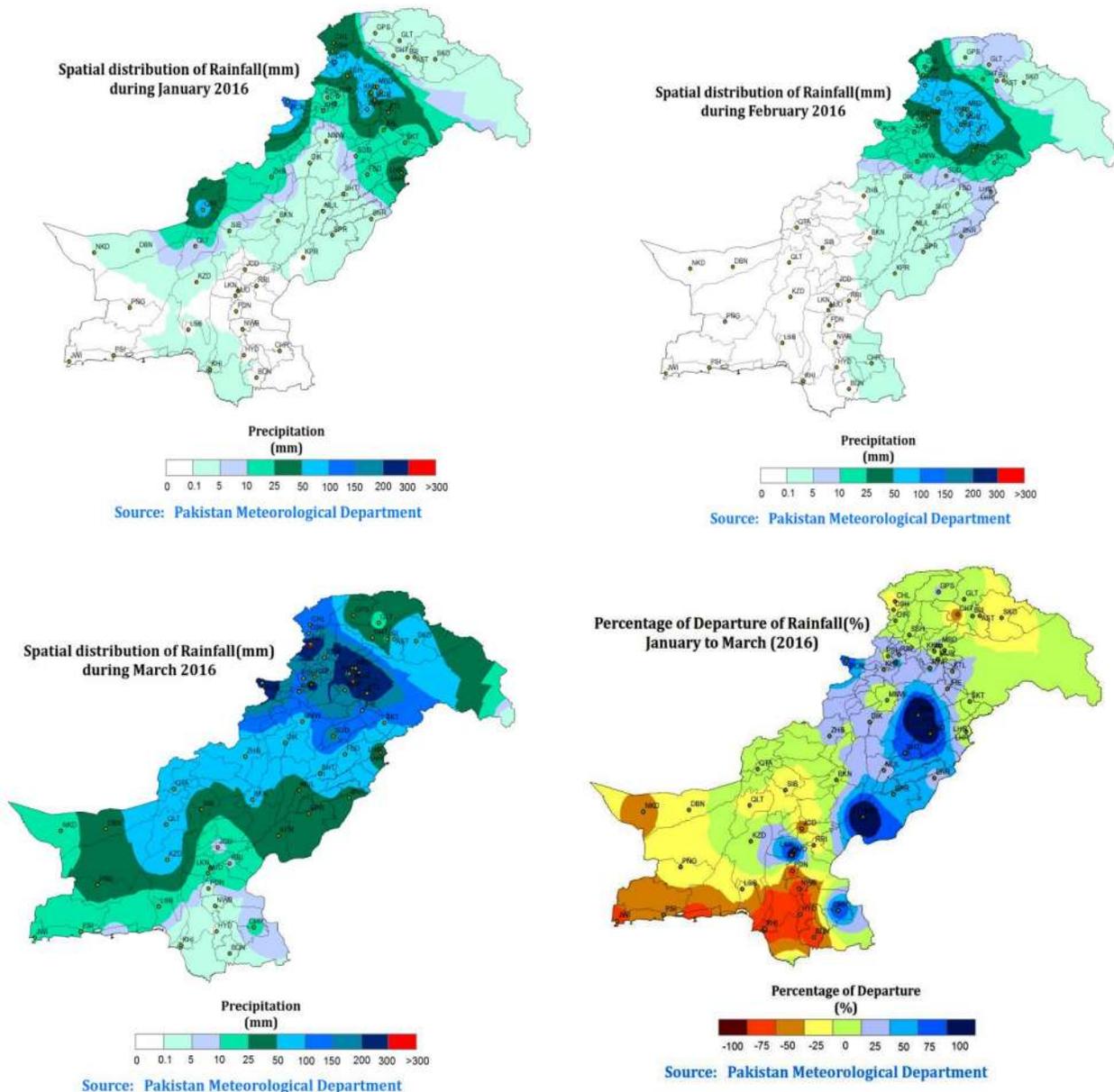


Figure-3 spatial distribution of rainfall during (Jan-Mar) 2016 of Pakistan

- **Mist and Fog Development**

Mist and Fog are atmospheric natural phenomena where small water droplets become suspended in air for a longer period of time. The water vapors condense into fog when ambient temperatures become cooler. In South Asian region, fog formation starts from foothills of Himalayas in India

and moves towards the eastern parts of Pakistan in Punjab. It finally covers large parts of Punjab, major areas of Sindh crossing into adjoining districts of Balochistan across Sibbi, southern parts of Khyber Pakhtunkhwa mainly around Indus river. Dense fog covered upper half of the country about two weeks earlier compared to last year due to lower temperature. This fog continued for almost the second half of December and the whole month of the January.

- **Temperature**

Maximum temperature remained 2-5 degree Celsius less compared to last two years. Minimum temperature during early January remained normal, but decreased during the last half. If the temperature remains lower in next two months, it will lead to increase in wheat yield to the normal level especially in rain-fed areas. In January, severe cold wave (10-15) days observed in most parts due to which temperature falls below zero degree in the agricultural plains of the country including Sindh.

4. Drought products

i. Standardized Precipitation Index (SPI)

The Standardized Precipitation Index (SPI) was developed for the purpose of defining and monitoring drought (McKee *et al.*, 1993). The SPI calculation for any location is based on a series of accumulated precipitation for a fixed time scale of interest (i.e. 1, 3, 6, 9, 12, months). Positive SPI values indicate greater than median precipitation, and negative values indicate less than median precipitation. Because the SPI is normalized, wetter and drier climates can be represented in the same way, and wet periods can also be monitored using the SPI..

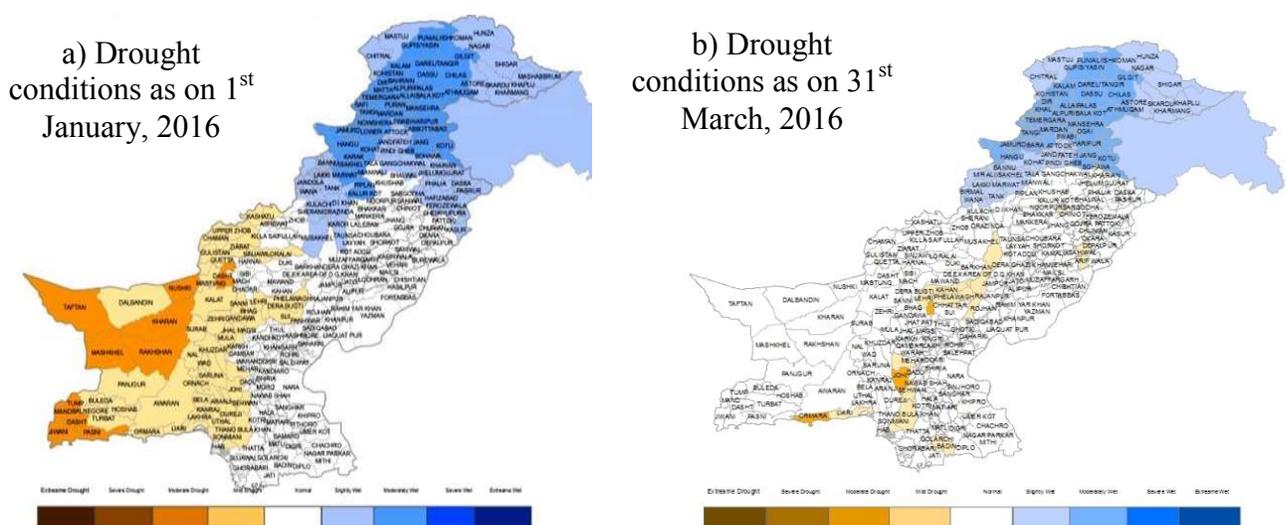


Figure-4 Drought conditions of Pakistan during January to March 2016

Due to deficient rainfall, drought like conditions has emerged in southeastern parts of Sindh. The tharparkar, dadu, umerkot and Kamber shahdad kot reported mild to moderate drought. Similarly, mild drought is reported in Cholistan region of south Punjab. However, an appreciable amount to rainfall has been recorded over agricultural plains of the country that fulfilled the demands of irrigation water for rabi crops which were at grain formation stage.

ii. Cumulative Precipitation Anomaly (CPA)

January is the coldest month of the year for Pakistan. Due to lower solar angle, active western disturbance and sometimes extension of secondaries of frontogenetic systems at higher latitudes of the country are cooler than the lower latitudes independent of elevation of the location. At high elevations, the frequency of occurrence of freezing temperature is highest in January as a normal feature. Westerly waves would continue to move along the middle latitudes and their troughs are expected to extend south ward occasionally affecting country's agricultural plains.

During February, the days were cooler and night's temperatures were very cold. Such daytime and night temperatures resulted into below normal mean daily temperatures throughout the cultivated plains of the country. In this way temperature regime during February remained less favourable for Rabi crop's growth and development process. The soil moisture reserves were available and lower temperatures retard evapotranspirative loss of moisture.

March is normally the wettest month of the winter season. Heating starts over the subcontinent due to increasing solar angle and the sunshine over the equator during last decade of the month. Heating trend triggers energetic weather systems, which resulted in increasing number of dust / wind storms and precipitation. March marks substantial addition to Rabi season precipitation and rising temperatures contribute significantly in photosynthesis process.

During January to March 2016, it was observed that Cumulative Precipitation Anomaly was positive in southern and central parts of Pakistan except some of the barani areas of Punjab, Gilgit-Baltistan/ Kashmir regions and south western parts of Balochistan. The day time temperature is low and Evapotranspiration is relatively stumpy as compared to the previous quarter therefore conditions are satisfactory and no moisture stress has observed especially lower and central regions of the country. The extreme cold wave grip the whole country due to which the minimum temperature was observed below the freezing level in most parts of the country.

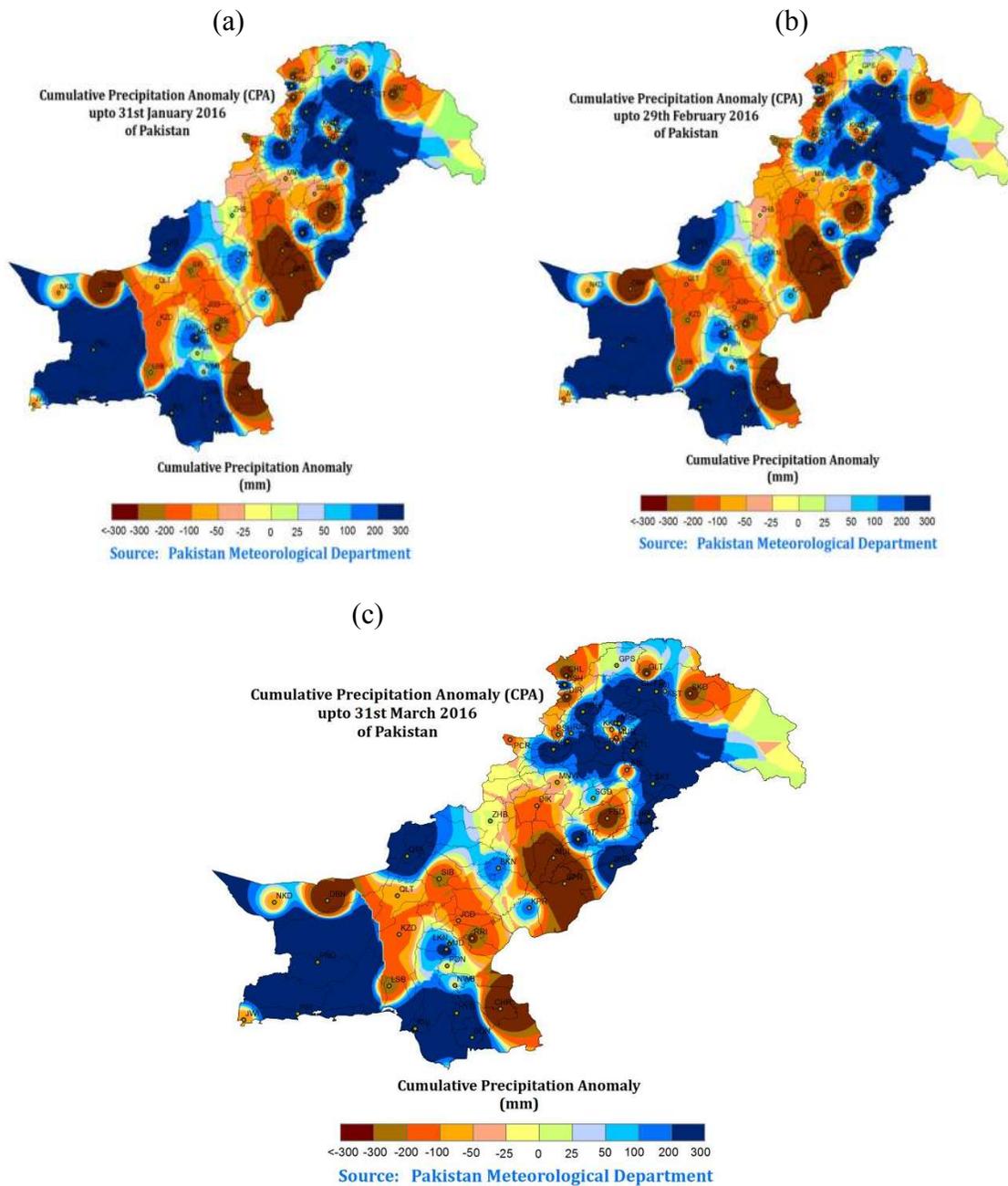


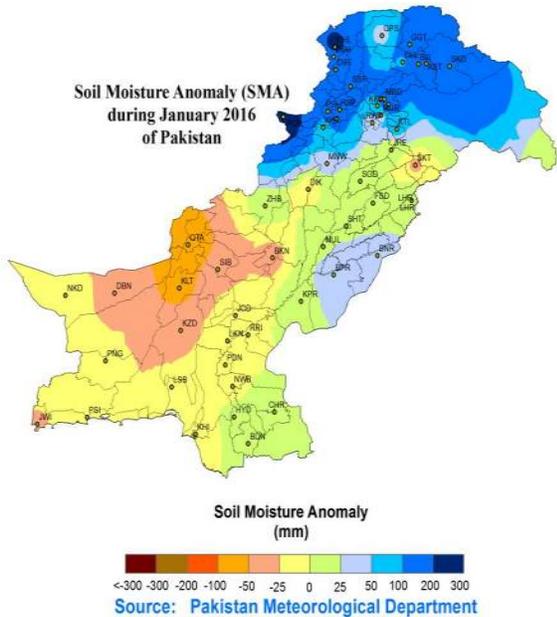
Figure-5 Cumulative precipitation anomaly during (Jan-Mar) 2016 of Pakistan

iii. Soil Moisture Anomaly (SMA)

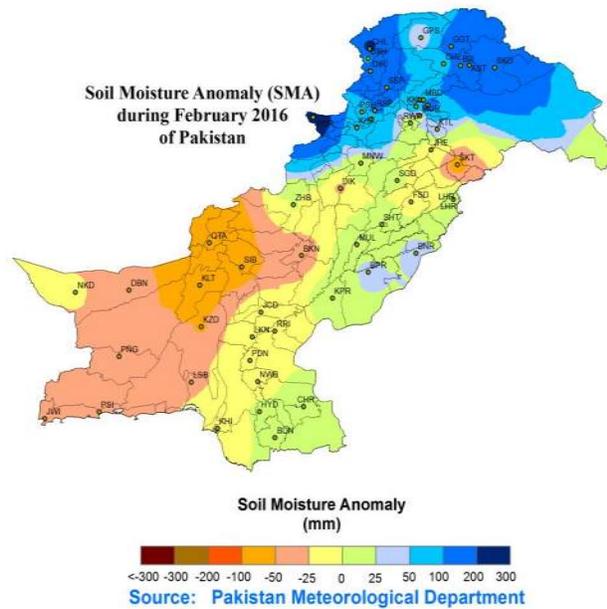
It was observed that the amount of rainfall during January to March was below normal in the country as shown in figure-6. Soil moisture conditions in the country remained near normal while some of the barani areas of Punjab and western parts of Balochistan was under mild stress. It was predicted that rainfall will be well below normal during January-March 2016 due to which soil

moisture stress may be more strengthened, especially Turbat, Nokkundi, Dalbandin and Quetta region and some of the rain-fed areas of the country.

(a)



(b)



(c)

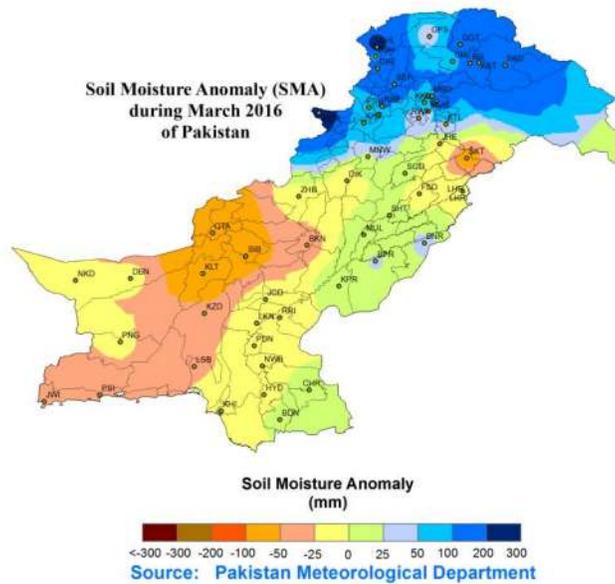


Figure-6 soil moisture anomaly during (Jan-Mar) 2016 of Pakistan
(Courtesy http://www.cpc.ncep.noaa.gov/soilmst/glb_lb/curr.w.anas.gif)

iv. Water Level of Reservoirs

Pakistan has two main reservoirs of water in the form of dam, i.e. Tarbela and Mangla. The dead level of Tarbela is 1378feet while maximum conservation level is 1550feet while Mangla has dead level of 1040 feet and maximum conservation level of 1242feet. Percentage of average water level during January to March 2016 was calculated for both dams are shown below in figure -7;

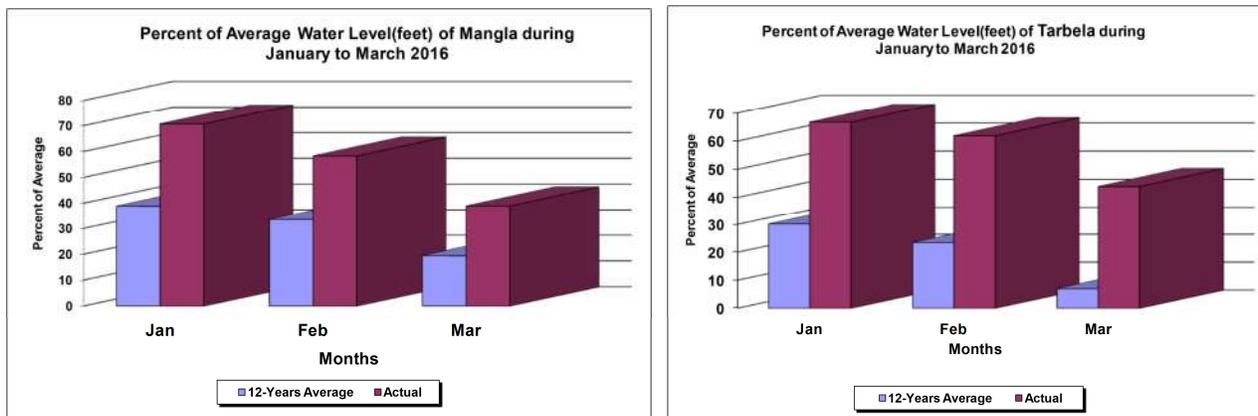


Figure-7 Percent of water level of Mangla and Tarbela during (Jan-Mar) 2016

5. Agriculture

Agriculture is main livelihood of about 70% population of the country. Due to direct relationship between agriculture and water scarcity/drought, drought mapping data is of vital importance. Efforts are being made to inform farmers of drought information in a timely fashion for better utilization of data. The sowing period of wheat crop in various regions and cropping patterns of Pakistan starts from 20th October and concludes around the end of December. As per rule of thumb, the wheat productivity decreases by about 1 percent for each passing day after 20th November. The wheat sowing time frame can be divided into two main categories.viz. (a) Prime sowing time, covering period of late October to end November. This is long duration wheat, sown on fallow fields. The prime time sown wheat has two sub categories of (i) rainfed, un-irrigated wheat or wheat irrigated once during crop growth by non-perennial canals /other sources (ii) wheat sown on Irrigated fallow fields.

5.1 Crop Condition:January-2016

The sowing of Rabi crops in Pakistan stretches from mid September to end December. Rabi season in Pakistan began with the start of November and reached active vegetative growth stage at the end of January, 2016. The potato crop has reached its harvesting stage in major growing areas of Punjab. Oilseeds like Mustard and Gram crops were thriving well by the end of January. Major crops growing areas of Pakistan except in few rainfed areas as crops have reached almost peak vegetative growth stage. However wheat condition is satisfactory in irrigated areas of Punjab, Sindh, Balochistan and Khyber Pakhtunkhwa. Conditions remained favorable for wheat growth.

Crop has reached the flag leaf stage in Katcho areas of Sindh and southern Punjab by end January. This is mainly due to sufficient moisture becoming available from last year's summer floods and early sowing of wheat crop.

Rabi Crops

The sowing situation of Rabi crops is as follows:

- **Wheat Crop**

Wheat sowing started in the month of October in rain-fed areas of Punjab and KPK. In irrigated areas wheat crop was sown on fallow lands during November and in the rice, cotton and sugarcane zones during late November/ December. A light rainfall shower was observed in Punjab, KP and GB during 7-9 November, 2014. Thereafter, both November and December remained dry. In January two rainfall spells were observed, both in Punjab and KPK, rainfall was much higher than January of last two years. These rains brought relief to the moisture stress on wheat crops specially in rainfed areas. The crop stand is good at this stage. If weather remains favourable, the prospects of wheat are bright.

- **Potato Crop**

Autumn potato crop was mostly sown in the districts of Okara, Kasur, Pakpattan, Sahiwal, Chiniot, Faisalabad, Toba Tek Singh, Sialkot, Jhelum and others during October. The harvesting of the crop started in December and is continuing.

5.2 Crop Situation: February, 2016

Wheat is the most important food security crop of Pakistan. The growth of wheat crop is generally slow across the country due to multiple factors mainly low ambient temperatures. The harvest of the crop is likely to be delayed by 10 days or so.

Wheat crop has generally been sown throughout irrigated as well as rainfed areas and reached different growth stages of its development depending on sowing time and location. Wheat crop in Potohar region has suffered from medium level drought due to fewer rains in the season. However wheat condition is satisfactory in irrigated areas of Punjab, Sindh, Balochistan and Khyber Pakhtunkhwa. **Crop has reached the flag grain filling stage in katcho areas of Sindh and southern Punjab by end of February.** Water stress may be due to less rains and less water availability in some parts of Sindh and Punjab during February. The sowing of early and medium season wheat crop was completed by end of November and late season crop in cotton, rice and sugarcane harvested fields was sown during December.

5.3 Crop Situation: March, 2016

Early satellite based indicator during December to February showed around 35-40 % decrease in crop yields of Potohar area than last rabi season. However, significant rainfall during March improved the wheat crop stand but will not recover the drought related losses so much. Wheat condition in irrigated areas of Punjab, Sindh, Balochistan and Khyber Pakhtunkhwa remained somewhat satisfactory.. Wheat harvesting began by mid of March in southern areas of Sindh including districts of Badin, Thatta, Umerkot and MirpurKhas. It progressively moved towards northern areas of Sindh and southern Punjab.

Wheat Crop

Wheat crop was generally sown throughout irrigated as well as rainfed areas and has reached different growth stages of its development depending on sowing time and location. Wheat crop in Potohar region has suffered from medium drought due to fewer rains in early part of the season resulting in stunted crop growth, less plant population, yellowing of plants and early maturity. In some areas of Potohar region, wheat crop has been observed healthy due to more rainfall especially in hilly areas of Rawalpindi and Jhelum while drastically affected by drought in Attock and Chakwal districts.

Early satellite based indicator showed around 35-40 % decrease in crop yields in Potohar area than last rabi season. However, significant rainfall during March improved the wheat crop stand but will not recover drought related losses so much. Wheat condition in irrigated areas of Punjab, Sindh, Balochistan and Khyber Pakhtunkhwa has remained somewhat satisfactory. Crop in katcho areas of Sindh and southern Punjab reached the maturity stage by end of March. Harvesting began by mid of March in southern areas of Sindh including districts of Badin, Thatta, Umerkot, MirpurKhas progressively moved towards northern areas of Sindh and southern Punjab.

Maize Crop

Most of autumn potato harvested area comes under spring maize in Sahiwal division in Punjab, during February-march. Spring maize is mostly at thriving well due to more rains in major growing area during March.

5 District wise impact of drought

Due to below normal rainfall, mild to moderate drought have been reported in Sindh province. Mild to moderate drought is reported at **Dadu, Kambar Shahdadkot, Ormara and Western parts of southern Punjab** regions. Due to current scenario of the coming months it is predicted that drought conditions may strengthen in these regions.

The Kasho area received largely below normal rainfall as recorded at Met observatory Dadu (-62.3%) from June 2013 till March 2016 and the area is under moderate drought conditions. Rainfall towards the end of March has provided relief to the area. Satellite derived soil moisture anomaly analysis indicates near normal (+ 25%) conditions in the area indicating no significant loss of vegetation in the area. Based on satellite and ground based data, it is concluded that moderate drought conditions prevail in the area. However, no appreciable rainfall is likely in the area during April, it may aggravate ground water situation. Therefore necessary interventions may be made accordingly.

6 Seasonal Weather Outlook (April-16 to June-16)

Prevailing oceanic, atmospheric and surface climatic conditions suggest that uncertainties in Pakistan's weather pattern will persist towards the early summer till the El Niño comes to neutral phase in May – June 2016.

Outlook for the next three months has been prepared based upon regional and global weather condition incorporating the climate system dynamics. Following are the highlights of weather in spring and early summer;

- March and April are expected to be wetter than normal. Frequent spells of rainfall and isolated hailstorms associated with windstorm may hamper the harvesting and threshing of wheat and sowing of cotton.
- May and first half of June are likely to remain drier and hotter than normal. That would increase the probability of occurrence of heat waves over plains and coastal belt of the country.
- Heat wave conditions in Gilgit-Baltistan and Chitral may accelerate glacier melting and trigger GLOF events in the coming summer season.
- Due to intense heating, monsoon onset is expected to be early during second half of June 2016.
- El Niño is declining and global climate models predict it to run in the neutral phase during monsoon season.

It is predicted that slightly above normal rainfall is expected in the country while the water storage conditions in two big reservoirs i.e. Tarbela will be normal and slightly above normal in Mangla during kharif season 2016.

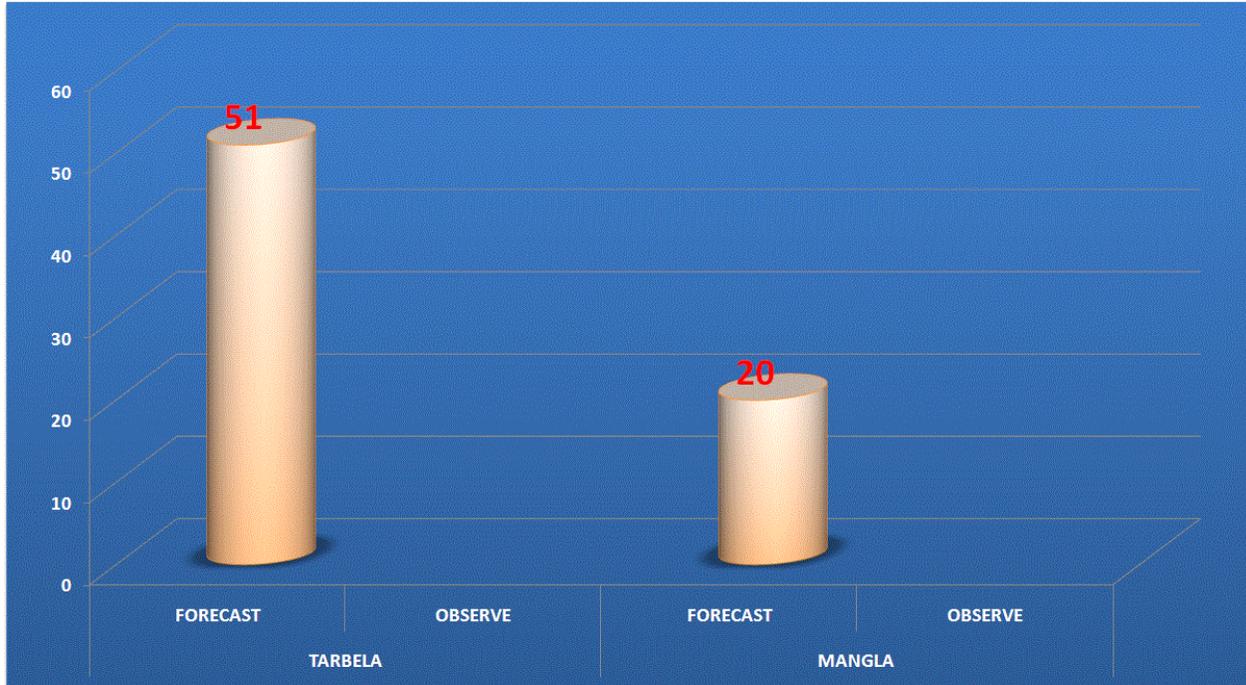


Figure-8 Forecasted water volume (MAF) for Kharif Season 2016 in Tarbela and Mangla

7. Recommendations

Natural disaster could not be stopped. Each disaster gives us a lesson to do better planning, management and taking some precautionary measures to minimize its impacts in future. **Due to deficient rainfall, mild to moderate drought was reported in southwestern parts of Sindh. PDMA Sindh and Punjab are advised to prepare for the coming drought conditions which may strengthen in the coming months.** The water availability in major reservoirs is sufficient and higher than their past averages. These conditions will increase due to above normal snowfall in the catchments areas. Water situation in the dams will improve with the increase of temperature after mid-March. It is therefore advised to all stakeholders for an immediate water management strategy to avoid negative impacts of deficit rainfall on agriculture sector. NDMC continued its monitoring activities and drought monitor was regularly updated on fortnightly basis at PMD website <http://www.pmd.gov.pk/ndmc/index.htm>.

8 Acknowledgement

National Drought Monitoring Centre (NDMC), Pakistan Meteorological Department, Islamabad acknowledges, National Agromet Centre, PMD, Islamabad, SUPARCO, CPC,NOAA, NDMA for sharing the information.

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