

Pakistan Meteorological Department

Drought Bulletin of Pakistan



October-December 2013

National Drought Monitoring Centre

Pakistan Meteorological Department

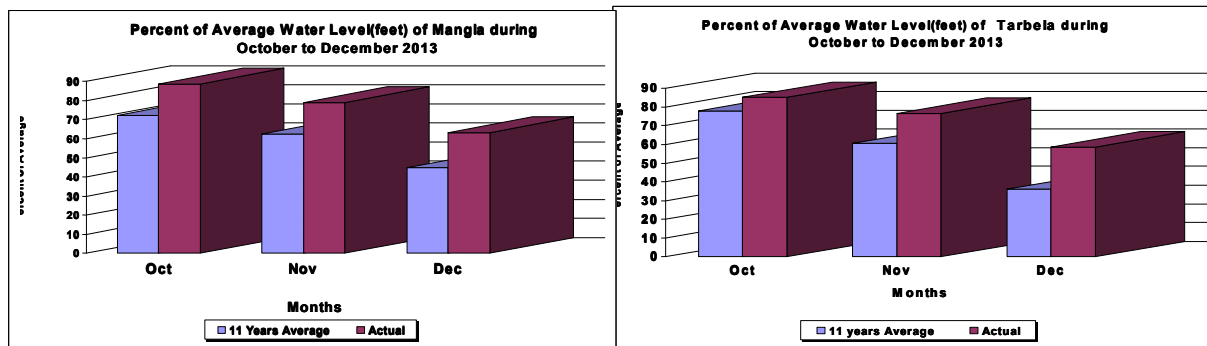
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Highlights

- Oct-Dec 2013 quarter was significantly dry. (-60 %) precipitation was observed over Pakistan.
- Good amount of rainfall was recorded during October in Khyber Pukhtoonkha (+15.64%) while in rest of the provinces it was well below normal.
- Viewing the quarterly rainfall distribution on province basis, over Sindh and Punjab, it was below-normal (-249.9%) and (-116.9%) respectively, over Gilgi-Baltistan and Kashmir (-135.7%), over Khyber-PK below normal (-66.8%) and well above normal and Balochistan (152%).
- Water situation in reservoirs is higher than aaverage



- Mild drought conditions have been observed in Potohar due to dry conditions during December which may affect mainly to wheat growth. However severe cold conditions minimized water requirement of standing crops.
- Frost condition during mid December in Potato growing areas caused early harvesting of potato in addition to high price of potato in the market.

● **Drought Bulletin**

October – December, 2013

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Quarterly Drought Bulletin

October – December ,2013

By

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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,

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 various kinds of 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 several droughts. The Punjab province experienced the worst droughts in 1899, 1920 and 1935. Khyber Pakhtunkhwa (KPK) experienced the worst droughts in 1902 and 1951, while Sindh had its worst droughts in 1871, 1881, 1899, 1931, 1947 and 1999. Over more than hundred year's period between 1871-1988, 11 out of 21 drought years were El Nino years. The El Nino phase of the Southern Oscillations (ENSO) has direct impact on drought in Pakistan as it poses mainly negative impact on summer monsoon.

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 (Oct –Dec) 2013

During last quarter of the year (Oct-Dec) 2013, below-normal (-60 %) precipitation was observed over Pakistan. During the quarter high temporal and spatial variable precipitation has been observed. Normally October and November are the driest month in the country but good amount of rainfall was recorded during October in Khyber Pukhtoonkha (+15.64%) while in rest of the provinces it was well below normal. The maximum departure was observed in Gilgi-Baltistan and

Kashmir (-79.49%). In November, above normal rainfall was observed in Balochistan (324.50%) and Gilgi-Baltistan and Kashmir (35.35%). During November, whole country received above normal rainfall (60.8%). During December, below normal rainfall observed in Sindh (-99.7%), Balochistan (-98.7%), Gilgi-Baltistan and Kashmir (-91.6%), Punjab (-91.3%) and KP (-87.8%). The figure shows the percentage area weighed departure rainfall occurred during (Oct-Dec) 2013 which was well below normal (-59.5%). Viewing the quarterly rainfall distribution on province basis, over Sindh and Punjab, it was below-normal (-249.9%) and (-116.9%) respectively, over Gilgi-Baltistan and Kashmir (-135.7%), over Khyber-PK below normal (-66.8%) and well above normal and Balochistan (152%) as shown in figure-2

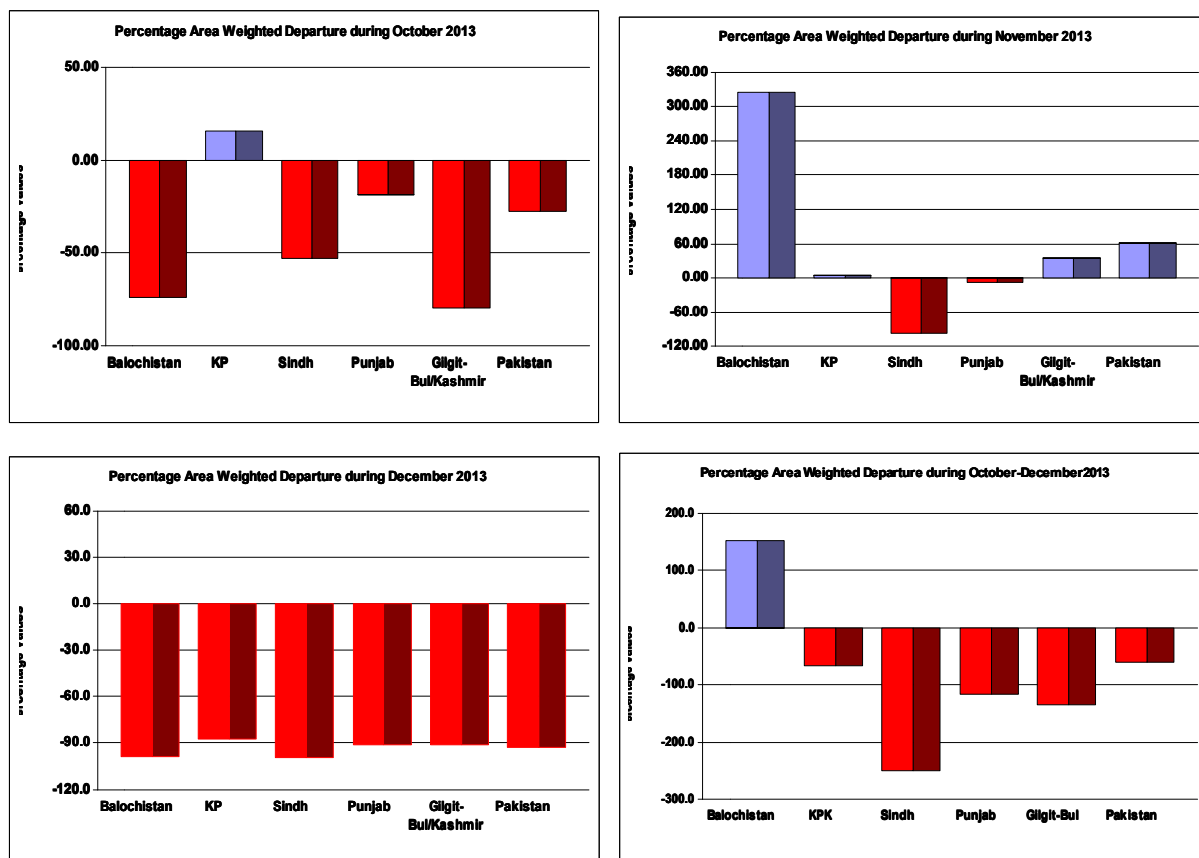


Figure-2: Percentage Area Weighted Departure of rainfall during (Oct-Dec) 2013

The rainfall pattern during October to December, set on by westerly disturbances, showed a systematic gradient from northern to southern areas of the country. This upshot of rainfall, on vast areas of the country, is highly timely and is likely to sustain a good stand (tillering) of wheat crop. North Atlantic Oscillation (NAO) is in positive phase and may effect on normal western disturbances track in the region resulting below normal precipitation (Horrell pc-based monthly

calculation of NAO). ENSO is expected to be in neutral phase up to summer 2014. The monthly and seasonal analyses on country basis is as shown below in figure-3.

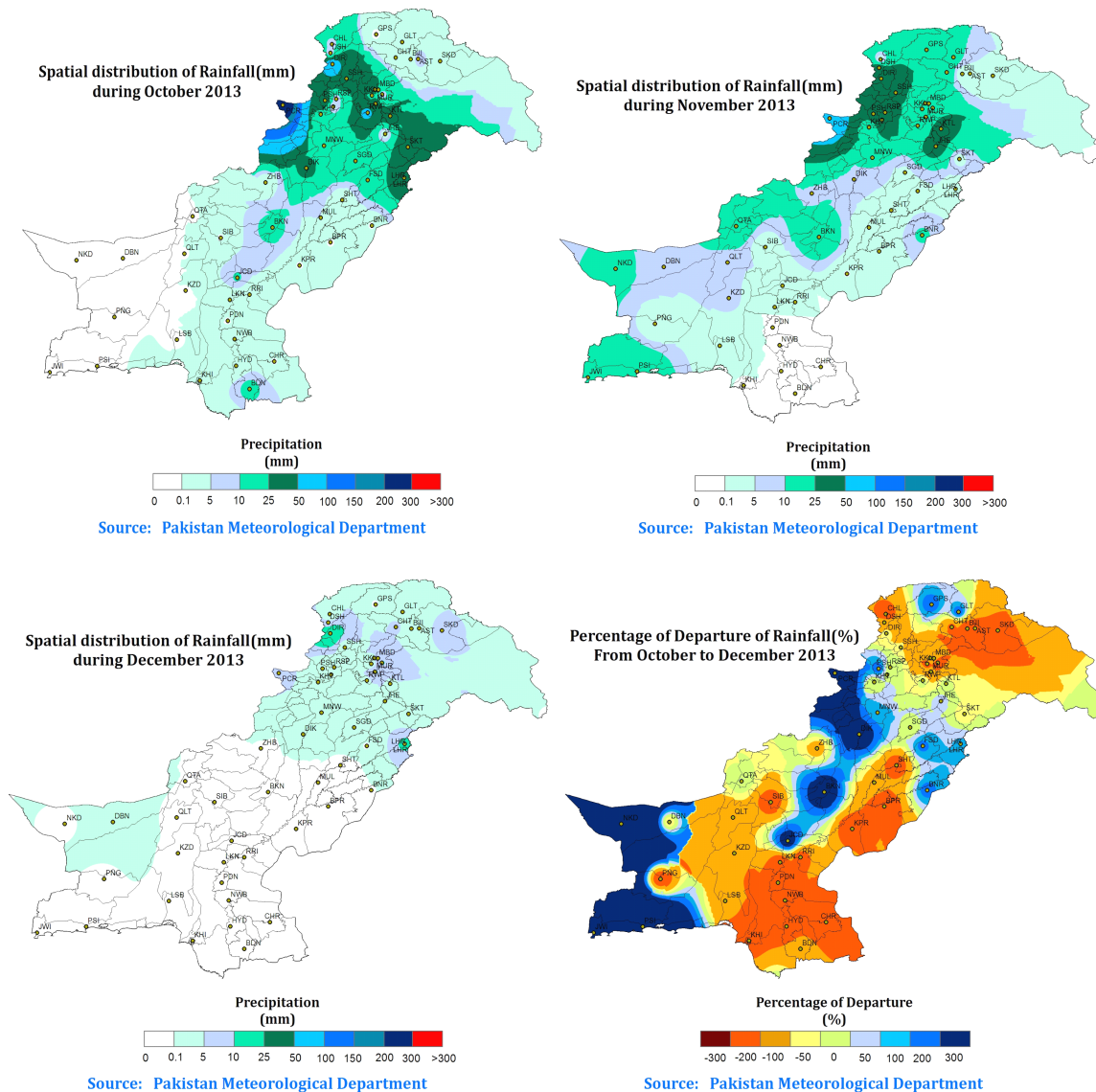


Figure-3: Spatial Distribution of rainfall during (Oct-Dec) 2013 of Pakistan

• ***Rainfall spell***

➤ ***October, 2013***

Three spells of rain 1-3, 11-13 and 30-31 October, 2013 were observed. Khyber Pakhtunkhwa, Gilgit/Baltistan and Azad Kashmir received slightly higher rainfall than Punjab, Sindh and Balochistan.

➤ ***November, 2013***

One spell of rain 6-8 November, 2013 was observed. Khyber Pakhtunkhwa, Gilgit/Baltistan and Azad Kashmir received slightly higher rainfall than Punjab, Sindh and Balochistan. In November 2013, rainfall was higher as compared to same period of last year

➤ ***December, 2013***

December 2013 remain dry while last year in November and December wheat received considerable rain. This dry spell can de-crease wheat yield

• **Temperature**

Minimum temperature remained 2-4 degree higher during October, 2013 as compared to last two years. The maximum temperature remained normal during October 2013as compared to last two years. In second decade of November minimum temperature remained 2 degree lower than same period of last two years. The maximum temperature remained normal during November 2013 as compared to last two years. In the second decade of November minimum temperature remained 2 degree lower than same period of last two years. The maximum temperature remained lower during 15 to 25 December 2013 as compared to last two years.

• **Mist and Fog Development**

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

Mist and Fog are atmospheric natural phenomena where small water droplets become suspended in air for longer period of time. This phenomenon was observed in November which is unusual for this timeline. The burning of rice stubbles supports the formation of this early fog. Heavy and dense fog was reported throughout the country especially the Punjab and Sindh region where it prevailed throughout the day. While in some agricultural plains of upper parts of Punjab, frost was observed during the last ten days of December 2013.

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). Such a series is fitted to a probability distribution, which is then transformed into a normal distribution so that the mean SPI for the location and desired period is zero (Edwards and McKee, 1997). 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. Here we are including one month and seasonal maps to show the drought conditions for the monsoon season in the country.

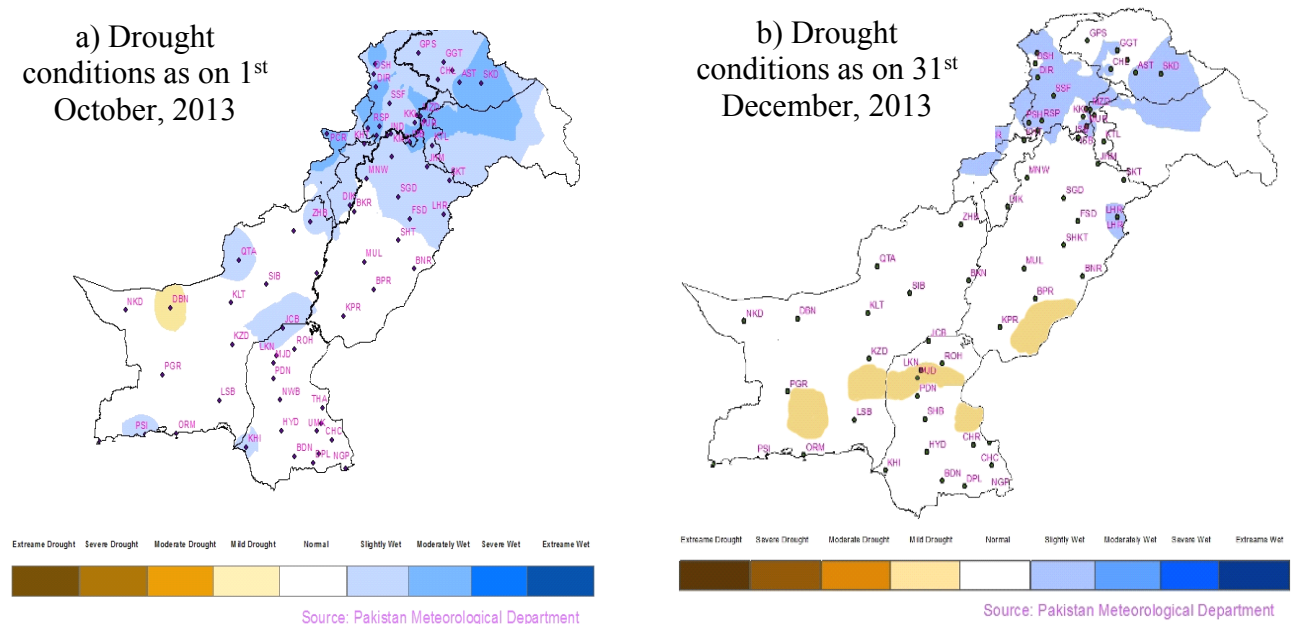


Figure-4 Drought conditions of Pakistan

ii. Cumulative Precipitation Anomaly (CPA)

October and November are the transitional month between summer & winter season, which have the characteristic of dry weather. It is the hottest month in coastal areas whereas dry cold weather starts to prevail in the remaining part of the country. During the month of December, winter weather systems commonly known as “Western Disturbances” become active over the country. Three to four troughs of westerly waves are expected to pass across the upper KP, sub

mountainous areas and snowfall over the hills. Generally the northern half of the country receives the precipitation more frequently than the southern half under the influence of western disturbances.

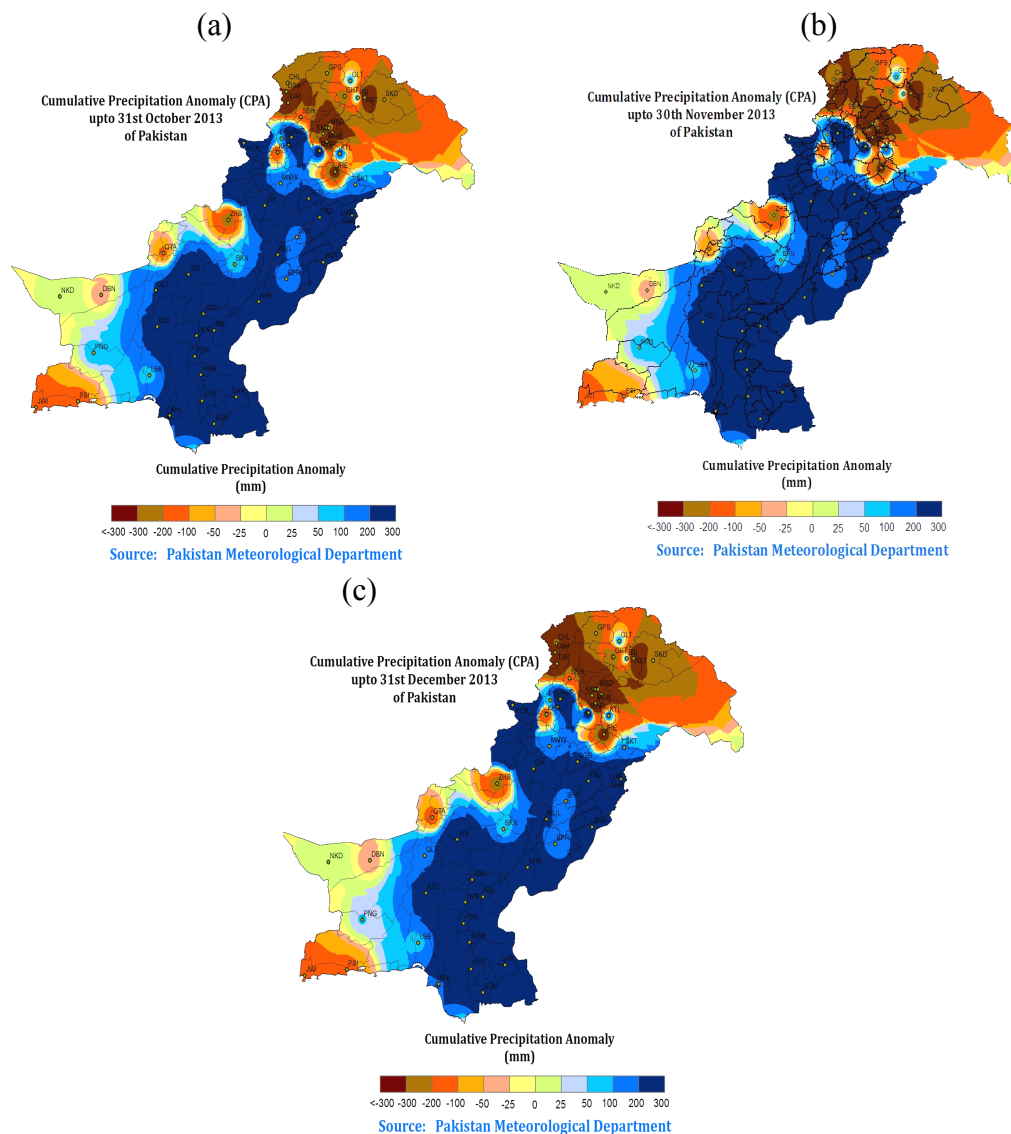


Figure-5 Cumulative precipitation anomaly during (Oct-Dec) 2013 of Pakistan

During October to December 2013, it was observed that Cumulative Precipitation Anomaly was positive in southern and central parts except some of the barani areas, extreme north and south western parts of Balochistan where it was negative. Most parts of Eastern Sindh are under flood water because of monsoon 2013 rainfall. The day time temperature is low and Evapotranspiration is relatively stumpy as compare to the previous quarter therefore conditions are satisfactory and no moisture stress has observed especially lower and central regions of the country.

iii. Soil Moisture Anomaly (SMA)

It was observed that amount of rainfall during October to December was below normal except in Balochistan as shown in figure-6. Soil moisture conditions in north eastern Punjab including barani areas and central and north western parts of the country are slightly under stress. Global and regional meteorological parameters depict that first half of winter season may remain dry whereas above rainfall likely during March 2014. As such there are likely stress conditions during January to Rabi Crops. It is therefore advised farming community to invest in irrigating standing crops where possible till mid February to avoid damaging impacts of dry conditions especially in rainfed areas of the country.

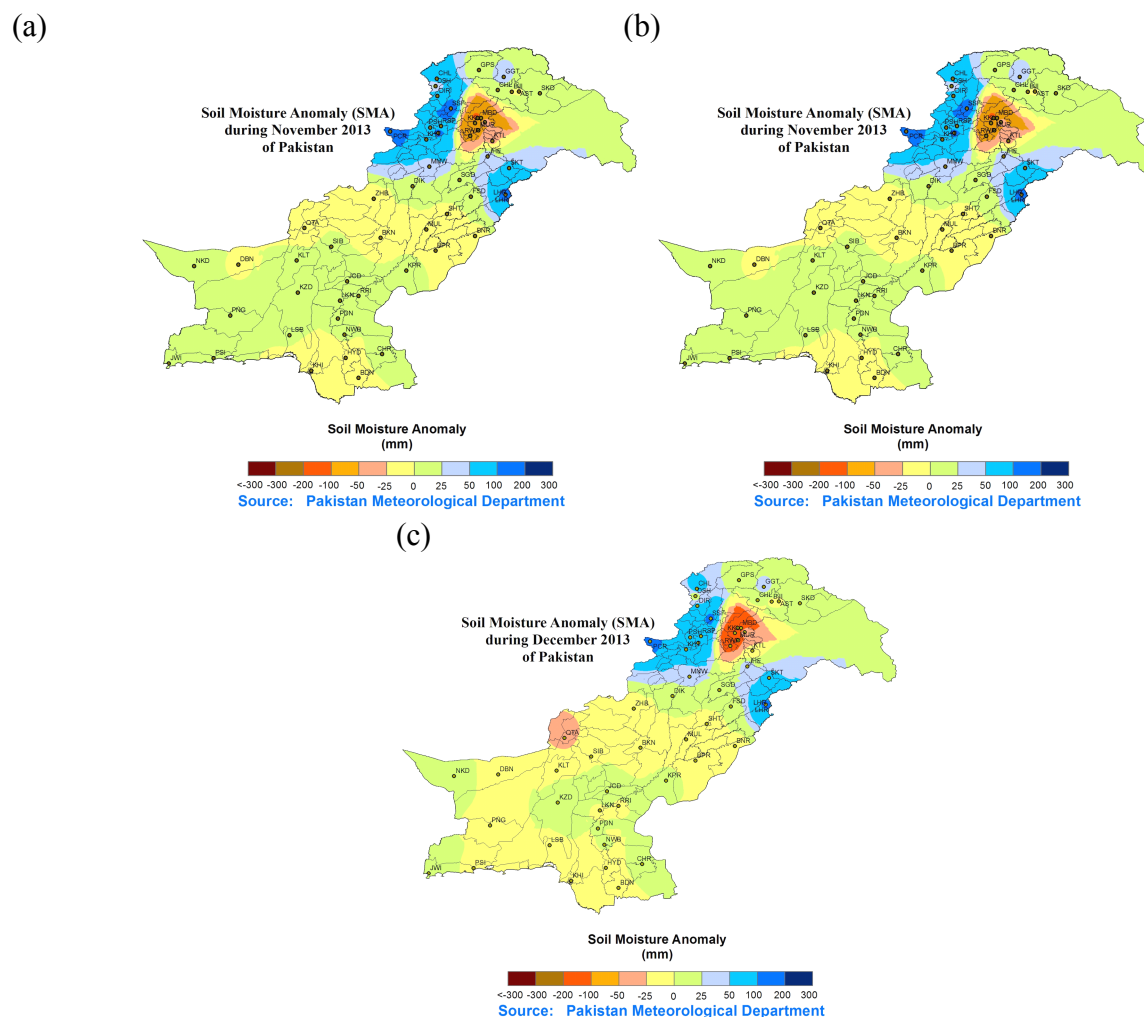


Figure-6 soil moisture anomaly during (Oct-Dec) 2013 of Pakistan

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 1040feet and maximum conservation level of 1242 feet. Due to good monsoon rains, reservoirs were filled to their capacity. In addition, small dams in various parts of the country were also filled to their capacity that would help boost agriculture and improve socio-economic activities in the country. Percentage of average water level during October to December 2013 was calculated for both dams are shown below in figure -7;

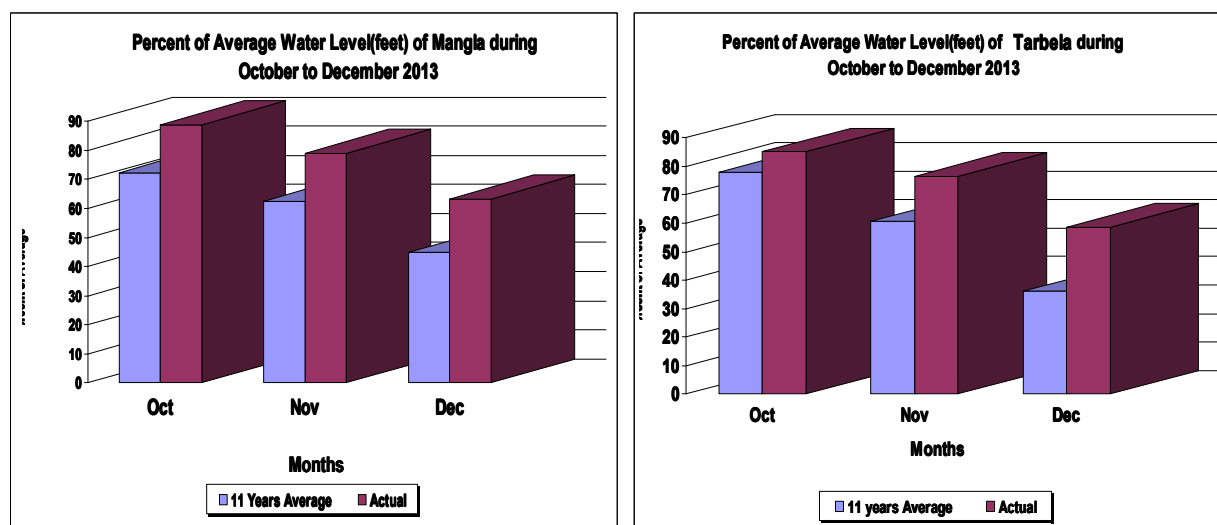


Figure-7 percent of water level of Tarbela and Mangla during (Oct-Dec) 2013

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.

• Crop Condition during the period.

October-2013

The month of October is characterized by transition of cropping season from kharif to rabi. During this month, the kharif crops are at maturity and senescence stage and ready for harvesting. This state of the crops is well expressed by a decrease in satellite vegetation indices as chlorophyll levels and the photosynthetic activity of crops decreases leaving behind carotene contents that have coloring matters other than green. Major kharif crops sown are rice, cotton, sugarcane, autumn maize and pulses.

The Kharif and Rabi seasons integrate into each other during the month of October. The Kharif crops progressively lose chlorophyll contents, culminating the process of photosynthetic activity and reaching maturity. The harvest operation of Kharif crops kicks off in October and stretch over

to November and beyond. This includes harvest of rice, chilies, autumn maize & onions and other seasonal crops. The picking of cotton starts much earlier but ends in synchronization with the above crops. The harvest of sugarcane starts by mid November and continues up to February or March. The growth patterns of all above crops slow down during October and onwards, ending up in senescence of crop plants.

The month of October also makes a debut in sowing of Rabi crops. The sowing of chickpeas, oilseeds, vegetables and fodders was completed during this month. The sowing of potato crop was also completed in the maize -potato-maize cropping patterns. The sowing of wheat was initiated in October and continues through next two months. The sowing of wheat starts from rain-fed areas after maize harvest, availing moisture conserved from monsoon rains. In irrigated areas, the sowing of wheat crop in October, is generally confined to fallow lands. The sowing of wheat in cotton-wheat and rice-wheat cropping pattern will be completed in subsequent months, after the harvest of cotton and rice crops.

- **Cotton Crop**

The picking of February sown cotton started in June and the picking of May sown cotton started in September. The cotton picking touched peak in October. The cotton picked in October is of the best quality with respect to Micronaire, fiber strength and other characters. Attack of mealy bug and pink boll worm infestation in some areas of Sindh and Whitefly & Jassids in Punjab along with high temperature in September have affected the final crop yield negatively

- **Rice Crop**

The bulk of coarse rice is grown in Sindh, Balochistan and Southern Punjab and harvesting has been mostly completed in all provinces. The harvesting of basmati rice which is cultivated in North Eastern Punjab has started in the early November and is expected to finish by early December. Except the early damages by floods/rains in basmati tract, the crop condition was generally good.

- **Sugarcane Crop**

Sugarcane based agro-industry is the country's second largest after textile. The crushing of sugarcane by design of provincial legislation has to begin from 1st October but it is usually delayed. About 3 percent of early harvested sugarcane crop area is used for sowing of wheat crop. Sugarcane produces valuable byproducts like alcohol used by pharmaceutical industry, ethanol used as a fuel, biogases used for paper and fuel and chipboard manufacturing.

Pre-harvest farmer's opinion survey showed a decrease of around 4.4% in yield than last year. Farmer reported sugarcane yield of 74 tons/ha as compared to 77 tons/ha last year. Main reasons are reduction in cropped area than last year's area in main sugarcane growing region of Punjab and pest attacks of pyrilla and borers. Area is reduced due to farmer preference for rice and autumn maize and periodic termination of zatoon crop during current year. Generally, sugarcane crop is stressed in southern Punjab due to less rainfall coupled with high temperature regime that affected crop growth and development further more farmers are expecting lower crop yield than last year.

- **Maize Crop**

Maize is a highly important crop for promotion of livestock sector, since it is an essential component of feed ingredients. There are two growing seasons of maize i.e. spring and autumn maize. Punjab has both seasons of maize, KP has only autumn maize season and maize is not a popular crop in Sindh and Balochistan. The spring maize was harvested in June. Harvesting of autumn maize started in October and that of the late sown maize will be completed by mid-November in maize grown areas of Punjab and Khyber Pakhtunkhwa. Autumn maize production has remained same this year.

- **Rabi Crops**

Sowing of oilseed and potato crops started in September and that of wheat started at the end of October in Potohar and other rain fed areas of Punjab, Sindh, Balochistan and Khyber Pakhtunkhwa which will likely be completed by mid-November. The sowing of wheat crop in fallow fields of irrigated areas would start in November and that in the cotton-wheat and rice-wheat cropping pattern during December. In Punjab, Khyber Pakhtunkhwa and Balochistan, conditions seem to be favorable for wheat sowing in normal tempo. The potato crop was sown after harvesting of autumn maize in Sahiwal division of Punjab, during October. The sowing of gram crop was started in October and will be completed by mid-November. In Rabi season, the sowing of crops is mainly carried out during Oct-Dec period. The monsoon rains flood in river embankments would have positive impact on the crops of Rabi 2013-14.

November, 2013

Kharif Crops Situation

Rice Crops

The coarse rice is grown in Sindh, Balochistan and Southern Punjab and harvesting has been completed in all provinces. The harvesting of basmati rice which is cultivated in North Eastern

Punjab is on peak at end of November. Except the early damages by floods/rains in basmati tract, the crop condition was generally good.

Rains/floods impacted on rice crop (area and yield) in Punjab and short term farmer preference for sugarcane over rice crop in Khyber Pakhtunkhwa. Similarly, production has reduced in Punjab and Khyber Pakhtunkhwa by 11.9 and 6.9 percent, respectively. Whereas, increase in production is observed in Sindh and Balochistan by 2.2 and 44 percent respectively. There is overall decrease in rice production by 1.7 percent at national level. Main reasons are attributed to damages due to floods 2013 in Punjab and reduction in cropped area in Khyber Pakhtunkhwa.

Cotton Crops

Cotton crop is main cash crop in Pakistan which almost contributes 1.5 percent to national GDP and main source for textile industry. Cotton picking touched peak in October and is almost completed by end of November. The cotton picked in October is of the best quality with re-spect to micronaire, fiber strength and other characteristics. Attack of mealy bug and pink boll worm infestation in some areas of Sindh and Whitefly & Jassids in Punjab along with high temperature in September have affected the final crop yield negatively.

Sugarcane Crops

Sugarcane based agro-industry is the country's second largest after textile. Sugarcane produces valuable by products like alcohol used by pharmaceutical industry, ethanol used as a fuel, biogases used for paper and fuel, chipboard manufacturing. With the onset of harvesting season in November, sugar mills have started crushing and will be actively operational till the end of March.

Maize crops

Maize is a highly important crop for promotion of livestock sector, as it is an essential component of feed ingredient. There are two growing seasons of maize i.e spring and autumn maize. Punjab has both seasons of maize, KP has only autumn maize season while it is not a popular crop in Sindh and Balochistan. The spring maize was harvested in June. Harvesting of autumn maize started in October and that of the late sown maize will be completed by mid-November in maize grown areas of Punjab and Khyber Pakhtunkhwa. Autumn maize production this year has remained the same as compared to last year.

Rabi Crops

Rabi season in Pakistan begins with the advent of November and characterized by the end of Kharif or summer season crops as well as accelerated sowing of Rabi crops. The potato crop was sown during October after harvesting of autumn maize in Sahiwal division of Punjab. The sowing of oilseeds like Mustard and Gram crop was started in October and completed by end of November. Being a major food security crop of the country, wheat production estimate is highly debated at all forums. Wheat crop productivity is the function of area under crop and yield per unit area. Wheat sowing started during end of October in Potohar and other rainfed areas and has been completed by mid-November across the country. The sowing in irrigated areas is still under progress and expected to be completed by end of December. In Punjab, Khyber Pakhtunkhwa and Balochistan, conditions seem to be favourable for wheat germination and its root establishment process. Last year the agro-meteorological condition for wheat crop remained promising for the crop growth as no damaging heat wave and frequent rains were observed at critical crop development stages. This year the government has set 25 million tons production as target for Rabi 2013-14. One of the significant factor which may affect the out-come of wheat productivity is the support price. Second important factor is the sowing time of the crop both in rainfed as well as in irrigated area. Optimal management of factors of wheat production system can assure an increase of about 15-20% production without additional inputs. This includes timely sowing, balanced nutrient management, weeds management, insect pest management and efficient on-farm water management.

Wheat crop

Being a major food security crop of the country, wheat production estimate is debated at all forums. Wheat crop productivity is the function of area under crop and yield per unit area. Area factor is mainly derived by the government policies especially the support price for the farmers and availability of crop inputs like irrigation water, fertilizers, etc. whereas, wheat crop yield is the function of crop inputs (irrigation water, fertilizer, seed and farming practices) and Agro meteorological growing conditions (Temperature and Rainfall).

Wheat sowing started during end of October in Potohar and other rainfed areas of Punjab, Sindh, Balochistan and Khyber Pakhtunkhwa and has been completed by mid-November. The sowing of wheat crop in fallow fields of irrigated areas has almost been completed by end of November depending upon availability of irrigation water. Wheat sowing in cotton-wheat and rice-wheat

cropping pattern is still under progress and will be completed by end of December. In Punjab, Khyber Pakhtunkhwa and Balochistan, conditions seem to be favourable for wheat germination and its root establishment process. Last year the agro-meteorological condition for wheat crop remained promising for the crop growth as no damaging heat wave event occurred and frequent rains were observed at critical crop development stages.

In Pakistan, wheat is generally sown over a period of 6-8 weeks extending from October to end December. Time of sowing is important factor contributing to achieve optimal yield. Generally, wheat acreage sowing of 1/3 cultivated area comes under normal sown on optimum time whereas 2/3 acreage is late sown crop. Sowing of wheat depend on market situation of cash crops of cotton and rice especially. Wheat sown after cotton is affected by the price of cotton in local market which leads to more picking of cotton and delay in sowing of wheat crop. Rice crop is transplanted normally in June-July and lowering of temperature during grain filling period prolongs the crop harvest time.

December, 2013

Rabi season in Pakistan begins with the start of November and sowing of rabi crops is almost completed by end December. The potato crop has reached its harvesting stage in major growing areas of Punjab. The sowing of oilseeds like Mustard and Gram crop was started in October and completed by end of November and is in full boom.

Wheat crop has generally been sown throughout irrigated as well as rainfed areas and has reached different growth stages of its development depending upon sowing time and location. Wheat crop in potohar region suffered from likely drought conditions which has resulted stunted crop growth due to less rains in the month of November and December. However wheat condition is satisfactory in irrigated areas of Punjab, Sindh, Balochistan and Khyber Pakhtunkhwa. Conditions remained favorable for wheat crop establishment as well as tillering process. Fog / Frost conditions pre-vailed in agriculture plain areas during mid December. Nitrogenous and phosphates fertilizers availability are comparatively better than last year which could add to the final wheat crop productivity.

Rabi Crops

Rabi season in Pakistan begins with the advent of month of November and sowing of rabi crops is completed by end December. In Rabi season, the sowing of crops is mainly carried out during Oct-Dec period. The potato crop was sown during October after harvesting of autumn maize in

Sahiwal division of Punjab. The sowing of oilseeds like Rapeseed Mustard and Gram crop were completed by end of November and are in full bloom.

Wheat crop

Wheat crop has generally been sown through out irrigated as well as rainfed areas and reached different growth stages of its development depending on sowing time and location. Being a major food security crop of the country, wheat production estimate is debated at all forums. Wheat crop productivity is the function of area under crop and yield per unit area. Area factor is mainly derived by the government policies especially the support price for the farmers and availability of crop inputs like irrigation water, fertilizers, etc. whereas, wheat crop yield is the function of crop inputs (irrigation water, fertilizer, seed and farming practices) and agro meteorological growing conditions (Temperature and Rainfall).

Potato Crop

Three crops of potato are sown in Pakistan viz. autumn (80%) spring (12%) and hill crop (8%). Autumn crop is grown mainly in Punjab and to some extent in Khyber Pakhtunkhwa. In Punjab, the crop is mainly sown in Okara, Sahiwal, Pakpattan, Kasur, Chiniot, Jhelum, Lahore and Sialkot districts. The cropping patterns of potato usually involve maize-maize-potato or rice-potato-maize rotation. The high temperature at sowing are damaging for seed tubers. The potatoes are therefore sown when soil temperatures cool down in late October. However high temperature in October have affected crop germination in many potato growing areas. The harvesting of the crop starts in late December.

Kharif Crops Situation 2013-14

The perceptible features of Kharif season 2013 were (a) strong heat wave extending into early Kharif season (b) Reduction in cotton area (c) Kharif crops damages due to floods (d) Water shortage may have marginally reduced sown area in major cotton growing districts of Sindh.

Cotton crop

Cotton crop is the main cash crop in Pakistan which contributes almost 1.5 percent to national GDP and is the main source for textile industry. Cotton picking touched peak in October and was almost completed by end of November. The cotton picked in the October is of the best quality with respect to micronaire, fiber strength and other characteristics. Attack of mealy bug and pink

boll worm infestation in some areas of Sindh and whitefly & jassids in Punjab along with high temperature in September, have affected the final crop yield negatively.

Rice crop

The rice is grown in Sindh, Balochistan and Southern Punjab and harvesting had been completed in all provinces.

Sugarcane crop

Sugarcane based agro-industry is the country's second largest after textile. Sugarcane produces valuable by products like alcohol used by pharmaceutical industry, ethanol used as a fuel, bagasse used for fuel, paper and chipboard manufacturing. With the onset of harvesting season in November, sugar mills have started crushing and will be actively operational till the end of March.

6. Impact of drought

No serious negative impacts of drought have been reported from any part of the country. However there is mild drought reported in southwestern Balochistan, southeastern parts and barani areas of Punjab including Potohar plateau because of the below normal rainfall during October to December 2013.

Impacts on crops: Mild drought conditions have been observed in Potohar due to dry conditions during December which may affect mainly to wheat growth. However severe cold conditions minimized water requirement of standing crops. Secondly frost condition during mid December in Potato growing areas caused early harvesting of potato in addition to high price of potato in the market.

7. Seasonal Weather Outlook (Jan-14 to Feb-14)

“Normal precipitation is expected during the season all over the country with more snowfall over the northern region.”

- I. Average (+ 15 %) precipitation is expected during predicted season 2014.
- II. In January below normal precipitation with less than normal night temperature is expected all over the country.

- III. In February normal precipitation is likely to prevail over the country. However, night temperature will improve over northern parts and become at normal where as southern parts will continue and behave as cooler month than normal.
- IV. Density of fog will be less during upcoming winter months.
- V. Area of fog will be less with shallow density.
- VI. Last decade of December and early January will be wet with higher intensity of precipitation over upper parts as well as hilly areas of the country.
- VII. Above normal precipitation is expected over GB region and southern parts of Khayber Pakthoonkhawa during predicted period.
- VIII. Below normal precipitation are expected over AJK province during predicted period.
- IX. Well intense snowfall spells over northern glaciers are expected during December and January.

8. Monthly Quantitative Weather Forecast:

	Jan-14		Feb-14		(Jan-Feb)2014	
Regions	Average	Expected	Average	Expected	Average	Expected
Gilgit-Baltistan	27.2	Above Average	29.7	Above Average	56.9	Above Average
Khyber Pukhtoonkawa	49.0	Average	71.9	Above Average	120.9	Above Average
Azad Jammu Kashmir	91.1	Below Average	110.5	Below Average	201.6	Below Average
FATA	30.2	Above Average	54.0	Above Average	84.2	Above Average
Punjab	17.2	Below Average	27.2	Average	44.4	Average
Balochistan	19.5	Average	20.9	Above Average	40.4	Above Average
Sindh	3.0	Below Average	5.4	Average	8.4	Below Average
	Precipitation is in mm/month					
Pakistan	20.8	Average	27.2	Average	48.0	Average

Below Average > -10 %, Average precipitation range = -10 to +10 %, Above Average > +10 %

Note: Average precipitation is computed by using Global Precipitation Climatology Centre (GPCC) girded data by resolution (0.5x0.5°) latitude by longitude. Ensembles of different climate models are used for computation of expected precipitation over the region.

9. Government reactions to drought

Since there was no significant impact of drought during the quarter, no intervention was made at official level. However, 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>

10. 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. Following are some recommendations to cope with the floods and droughts in Pakistan

- Pakistan dam's water storage capacity is much less than the neighbouring countries like India. Therefore it is the need of the hour to built large and small dames in catchments areas especially the rainfall water during monsoon period.
- Manage the floods and storage the water
- The stored water will protect food security especially fulfill the water requirements of crops during drought period in the country.
- The water will also be helpful in generating hydropower electricity which is essential requirement of country and reduce the unemployment in the country.

11. Acknowledgement

National drought monitoring centre, Pakistan Meteorological Department, Islamabad acknowledges SUPARCO and district office agricultural department Sargodha for sharing the information.

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