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Humidity disproportion incentive of precipitation fluctuation in Thar Desert, Sindh, Pakistan

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Abstract: The humidity of the sub-tropical desert used to record low for the existence of water vapour to form clouds with ratio of precipitation in Thar desert, Pakistan. Due to the strong causal relationship between humidity, watervapour and the amount of water vapour present in the atmosphere leadsto the worth of precipitation. The pattern of air masses in Thar desert is unpredictable due to the existence of the Arabian Sea, which in fact holds the warm air downward and that phenomenon precludes the formation of cloud for precipitation. As a result, unhealthy variation inhumidity triggers the foundation of change of precipitation.

The met-data of two weather stations expounded through time series employing climatic model and anthropogenic ripostes analysed exploiting SPSS software. The SPSS is used to elaborate survey questionnaire positively. In turnit revealed the pattern of precipitation fluctuated through the reduction of humidity 5- 25 percentages, which led to the declining in the precipitation between 5-12 millimetres in the last century.

The findings demonstrated the numerous insolation rain falls during summer. This convention permitted the simulation for the fluctuation of precipitation through the lend confidence of humidity. That could be associated to the quantitative assessment of climate engineering in the region.

Keywords: Sub-tropical, cloud, Air masses, Insolation, Numerous, Lend

1. INTRODUCTION

The engineering of climate and existing hydrological cycle demonstrated the variation in the climate and it's predominant elements. Such as humidity and precipitation caused the co-existence of water in the desert region, which caused by the drastic shift by 20 percent warmer over the globecaused the change of climate on the global scale (Hasnain, *et al.* 2012). It led by variation of hydrological cycle and regional scale of precipitation. This climate variation occurred due to the invariable disturbance and fluctuation in humidity and water present in the air. However, it has been continue happening from the primitive climate 18000-20000 years ago (Fein, *et al.,* 1987 an Alsharhan, et. *al.*, 1995). Therefore, it would lingeron to the present era. This temporal and spatial variability employed to increase 10 to 15 percentages in Thar desert. Which has triggered the fluctuation in the region substantially and it generated extremely harsh climate (Ramesh, and Yadava 2005). it is largely believed that the fluctuation dilemma has been critical and expedited rather exponentially for the world and Thar desert in particular, because it is mentioned as the most populous desert across the world (James, 2007 and SCOPE, 2010). So much so, during the monsoon season, water cycle recorded in fluctuation situation, that could be identified through major factor of Arabian desert to Arabian Sea stretched out till eastern portion of "Runn of kutch" it was usually termed paleo-monsoon period that effect was continually persisted to the 20th century (Chauhan, 1996, Hu, 2000 and Gupta,1997). This imbalanced climate condition upset the water balance hydrology, which should directly cause variation in the climate. That can lead to a great myriad of vulnerable situation in most of the fields in the area. It is believed that twenty century confronted significant fluctuation in precipitation (Ram and Ajay 2015 and Deotare, *et al*, 2004).

2. 1.1 Location and land area

Thar desert is situated at the South-east portion in the province of Sindh, Pakistan with 22000 Square kilometres, it is extended about 800kilometers south and 490 kilometres east-west wide and the geographical location is longitude 69^0, 53', and latitude 24^0, 43' over the globe (Time Atlas 1959 and Herani *et al.*, 2007). Thar desert is known climatically as semi-arid sub-tropical region in the world **(Fig. 1).**

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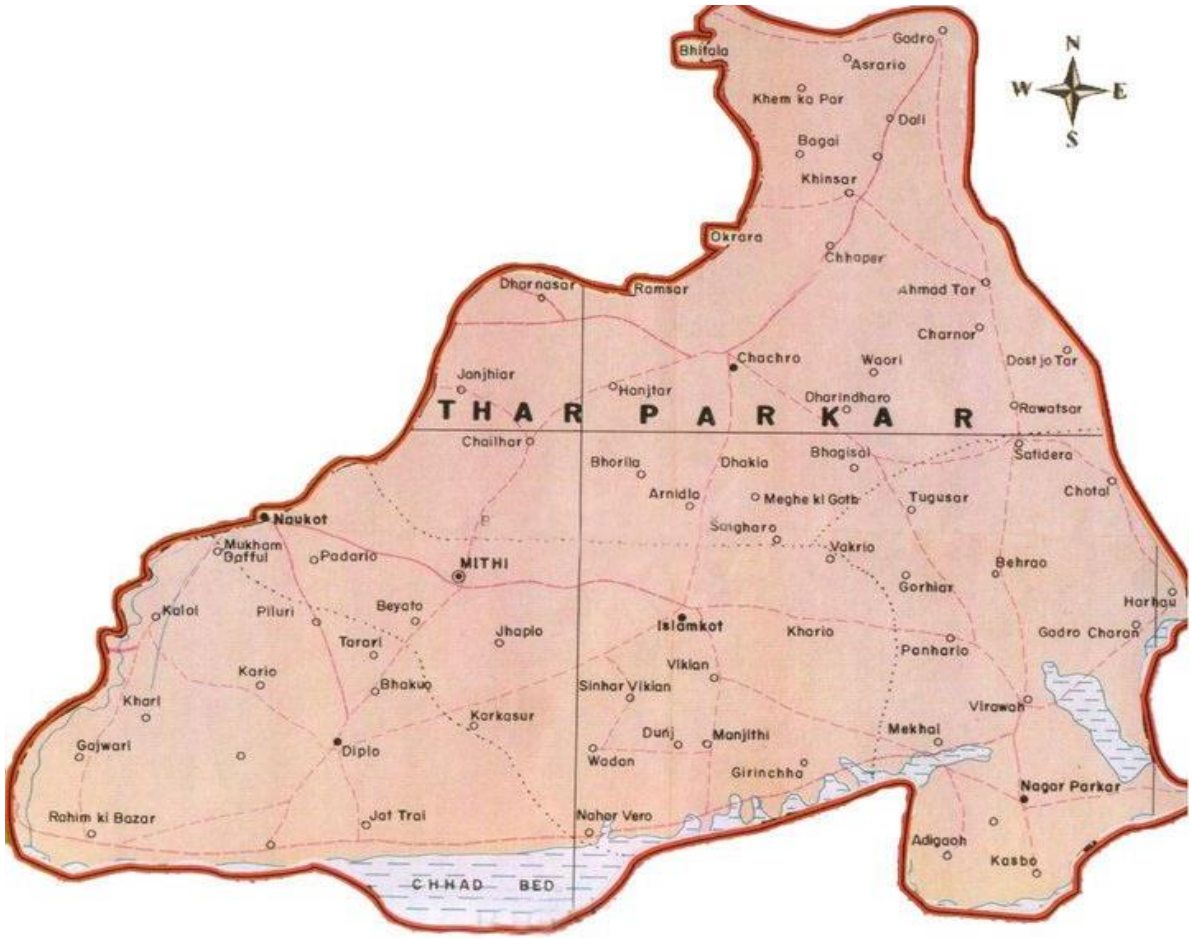


Figure 1 . Location map of Thar Desert.

According to the Census 2017, the total population of Thar desert is 1649661, is shown densely distribution with ratio of 74.98 per square kilometre. Thar Desert is intersected with Indus plain (Indus river surrounding area) and Arabia Sea, which could be source of the existence of the water in the region. (Muslehuddin *et al.*, 2006 and Meghwar, *et al.,* 2019).

2. Humidity induce Precipitation fluctuation

The fluctuation in precipitation has caused changesin the rain pattern across the area. That significant causative element would be the Arabian Sea, for it is sole source of gigantic water body existenceto upset the required atmosphere that is likely for a rise in temperature in desert, which is a pre-condition to the distribution of cloud and arise of water vapour (Swanson and *et al.,* 1999). It is significant believed that temperature and precipitation are directly co-related each other, and both played most significant role in the formation of climate co-existence condition. The temperature of the aforementioned region is considerably high which led to the present unstable condition in the atmosphere. Hence these reasons put into effect on humidity in inconsistent condition, is horrible induced precipitation toward very unhealthy fluctuation pattern (Tank *et al.*, 2006, Zhu, 2011and Shamshad, 1988).This pattern led to decrease in precipitation rate of 5-25 percentages during the last century (Meghwar, *et al.,* 2019 and Ragab, and Prudhomme, 2002). This phenomenon predominantly was persistent due to the Arabian and westerly Sindh atmospheric circulation in mesosphere, which mainly caused the climate change in this region (Chajravarty, *et al.,* 1992 and Muslehuddin, *et al.,* 2006). These atmospheric activities demonstrated rise in the temperature which caused substantial increase water utilization and change hydrological existence in the air, that could be the origin of rainfall fluctuation (Melillo, 1993 and Dearing, *et al,* 2006). The precipitation used to take place throughout monsoon season July- September month every year, but it has

been complicated since ages due to the influence of Arabian Sea (Jameel *et al.*, 2004). As a result, precipitation had been observed in the form of invariable fluctuation, which could be a cause of change of pattern in precipitation, it is known as meteorological disaster in the region since 20th century.

3. RESEARCH METHODOLOGY

The Humidity and precipitation data of 67 years represented through climatic model would show precipitation fluctuation has been occurred due to the existence of gigantic water body source. The Surfer version 16.1 quantified the precipitation fluctuation. This software is a registered as Golden Software Inc trademark. It is employed for large scale of contouring, gridding and mapping program of the surface land area for climatologist, foresters, biologist, oceanographers, bio-geographers, geologist, hydrologist, geophysicists, medical researchers and students who can produce significant map effortlessly. In this context, the data of two weather stations Badin and Chhor were put into practice. Both the weather elements were co-ordinating each other, which could predominantly demonstrate precipitation variation. In surfer, few steps build up for process of XYZ data set.

- marking the base map from project land area map
- Generating an XYX data set, that can produce a worksheet such as: excel
- Creatinga grid file from XYZ data using of Grid command, in turn will generate grid-based maps like contour, image, relief etc.

The base map represented a boundary of Thar map, which shows curves, points, text, images and metafiles. The base map also offers detail of location of precipitation fluctuation.

It is believed that precipitation fluctuation could well be elaborated with the help of local residents' word of mouth. In so doing, anthropogenic responses distributed earlier were collected back through survey questionnaire from 53 different villages of the project land area, which in fact covers the whole region. The questionnaire was formulated in English and it was translated into local language and dialect (Sindhi and Dhatki). The local people were selected above 60 years age of permanent residents of the area, for senior citizens had fairly longer time span spent observations in terms of climate change and were well aware of drastic climatic shifts. The data of survey questionnaire was analysed by exploiting SPSS(Statistical Package for Social Sciences)version 22.0, that was determined through 1.5 significant level.

4. RESULT

The hydrological existence led to the precipitation that was recorded highly durable in the 20th century. It indicated that humidity is the predominant cause of water body source in Thar desert. The local dwellers dealt to humidity through wet condition in atmosphere during summer season (June-September) and winter season (January-February). This wetting of atmosphere represented humidity and it showed sign of precipitation and fluctuation it entails.

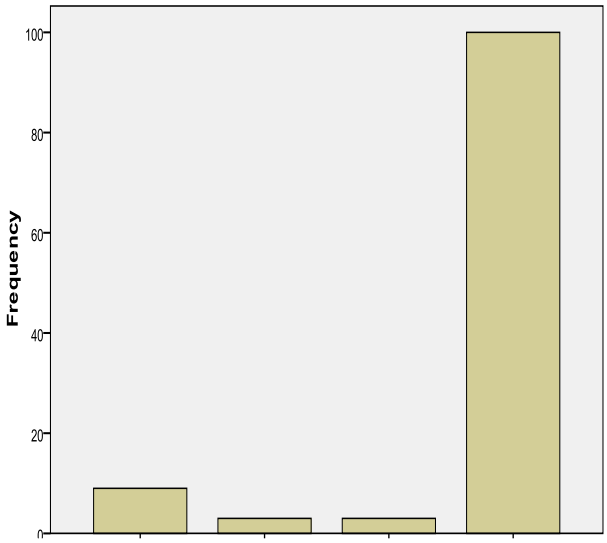


Figure 2. The variation of humidity causes fluctuation precipitation

The 86 percentages of anthropogenic responses indicated that humidity is the key factor of fluctuation in precipitation, because local people should understand water existence source used to be in the form of humidity due the proximity with Arabian Sea **(Fig. 2).** Humidity was experienced almost during high temperature of summer season. The humidity ratio used to be varied due to the existence of Arabian Sea. Badin weather is a physically closer to Arabian Sea where humidity was recorded higher than Chhor weather station. The Badin weather station have more proficiency of recordingseveral fluctuation patterns and slightly higher compared to the other projected weather station. The humidity of Badin represented n every 2-3 years with 52 percentages while 5-6 years 58 percentages and it fluctuated towards diminishing forms 56 percentages after every 8-10 years.

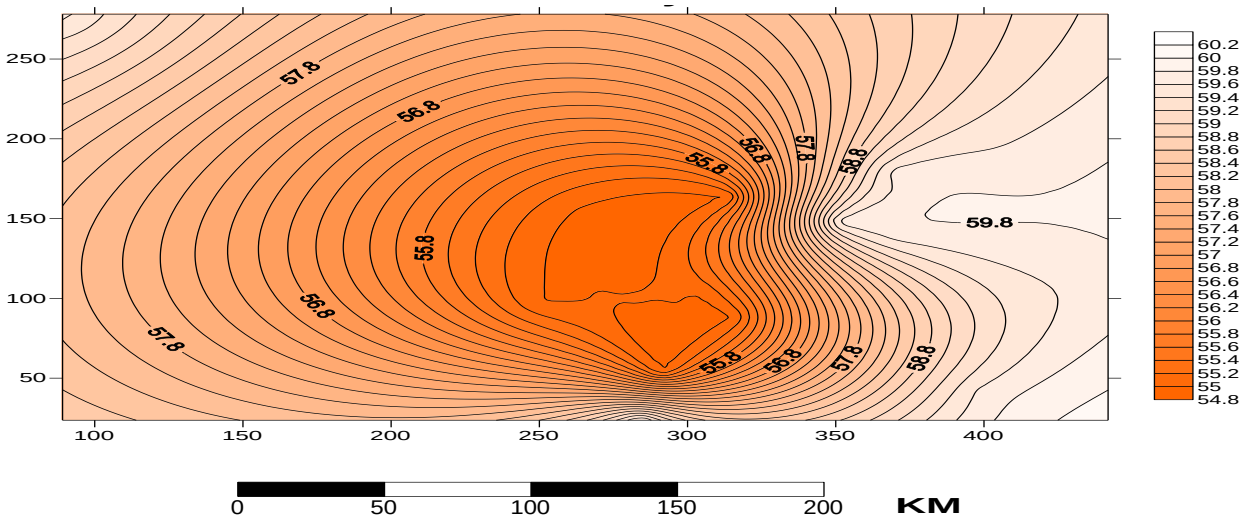


Figure 3. Humidity of Badin and Chhor weather station 1950-1983

Whereas humidity demonstrated with significant variation in the reported period. It also demonstrated significant fluctuation forms during the period of 1970-75. Which was recorded 52 percentages, and this rate was extended 1985-88 to 55 percentages that continued during 2010-17 with 63 percentages in the atmosphere. The humidity of Badin was demonstrated with noteworthy fluctuation forms (Figure 3).The contour representation of humidity used to be clear in the changing formation.

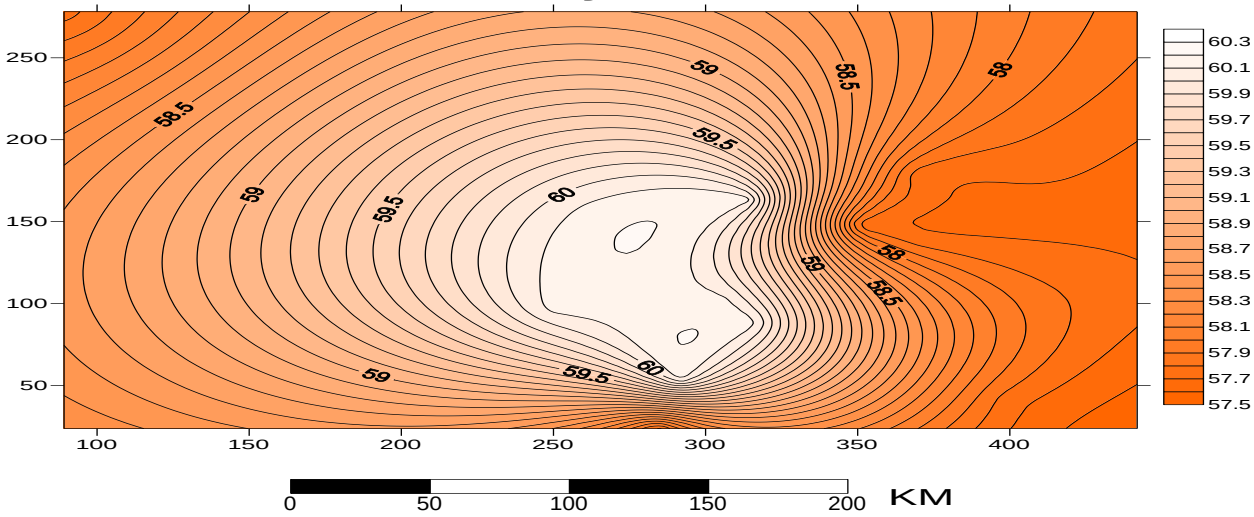


Figure 4. Humidity of Badin and Chhor weather station 1984-2017

The atmospheric condition in the surrounding of Chhor weather station is fairly different due to being distant from Arabian Sea. The humidity rate used to be lower in Chhor area, because it extends to be attached with Runn of Kutch and reasonably distant from the Arabian Sea, however, the climatic condition of variation was recorded surrounding Badin weather station with almost of the same scale. Whereas it used to be 51 percentages after every 2-3 years, which was enhanced with 5-7 years 55 percentages while that reached 60 percentages after 10-13 years in the atmosphere **(Fig. 4).** Consequently, the low humidity was recorded 54percentages in the period of 1954-1964 and it got slightly lower with 48 percentages during 1965-1975, that was increased 1966-1985 to the rate of 60 percentages. The climate change was affected significantly due to physiographic setting, so the humidity once again was decreased 57 percentage in the decade of 1986-1996 and it was marginally surged in era of 2000-2007 and was boosted during 2008-2017 in the atmosphere in the aforementioned region Figure (3 & 4). This variation of humidity led to the fluctuation in precipitation. Which could continue the fluctuation in durable seasons like summer and winter season. Consequentially, 85 percentages are cumulatively agreed upon in the fluctuation of precipitation **(Fig.5).**

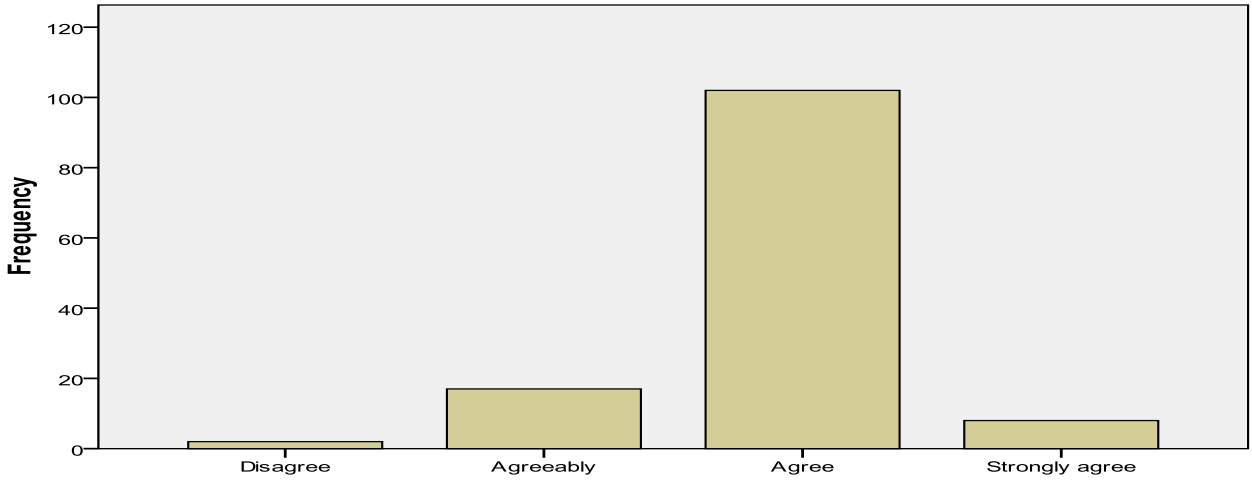


Figure 5 Local people agreed to the fluctuation of Precipitation

A large number of dwellers of the area are well aware of the precipitation, as it is the major source of their economy, besides, there is no any river or body of natural water reservoir either. So, precipitation is the single most critical natural means of water for the mass survival of the region. The summer season is called green period for cultivation for livelihood and it produces food for livestock. Subsequently, precipitation is one of the conducive and the most significant source for flora and fauna as well as for human beings. Hence precipitation is the hobson choice to put the life back on track of the local residents. So, it used to be fluctuated. Whereas closer to Badin weather station reported weighty fluctuation owing to adjacent to Arabian Sea and Chhor weather station was situated primarily distant from Sea water resource and its magnitude to link with Runn of Kutch. In the period of 1950-1960 the precipitation represents the rate of fluctuation of 118 millimetres to 576 millimetres and 124 millimetres to 256 millimetres of Badin and Chhor respectively. This fluctuation rate was encompassed toward period as Badin reported 1 millimetres to 586 millimetres during 1960-1970 while in same period Chhor weather showed 8millimetres to 645 millimetres **(Fig. 6).**

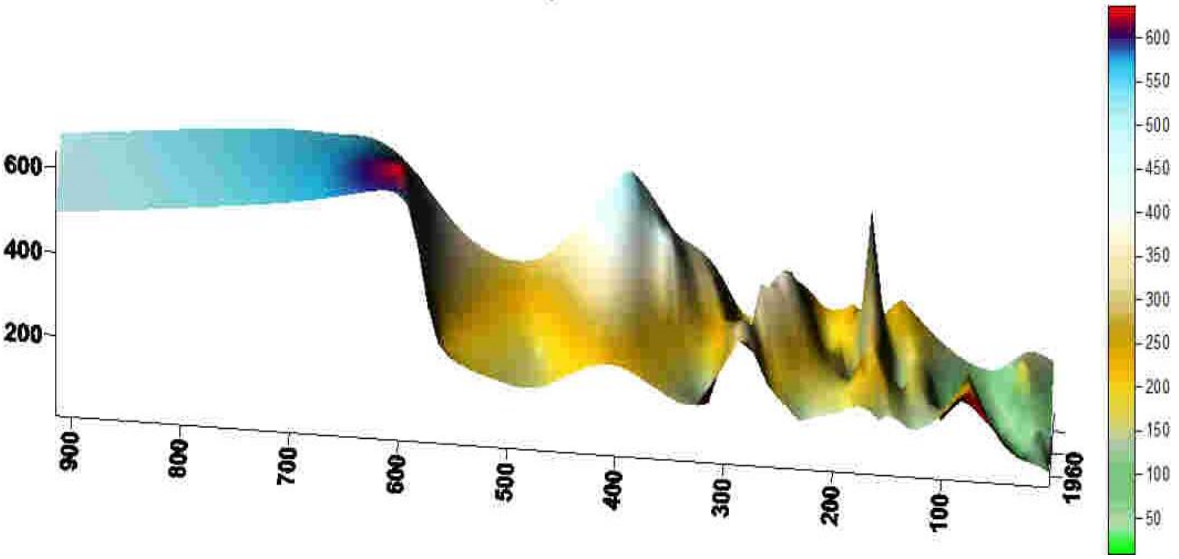


Figure 6. Fluctuation of Precipitation in Badin and Chhor weather station 1950-1983

It continued to be fluctuated in 1971-1980 with rate of 103 millimetres to 472 millimetres at Badin and 174 millimetres to 398 millimetres at Chhor weather station. Which stated as significant fluctuation (figure 6). However, the precipitation was heavily fluctuated after 1980 era, because of the changing of global atmospheric circulation and climate change. Henceforth the last few decades' precipitation **(Fig. 7).**

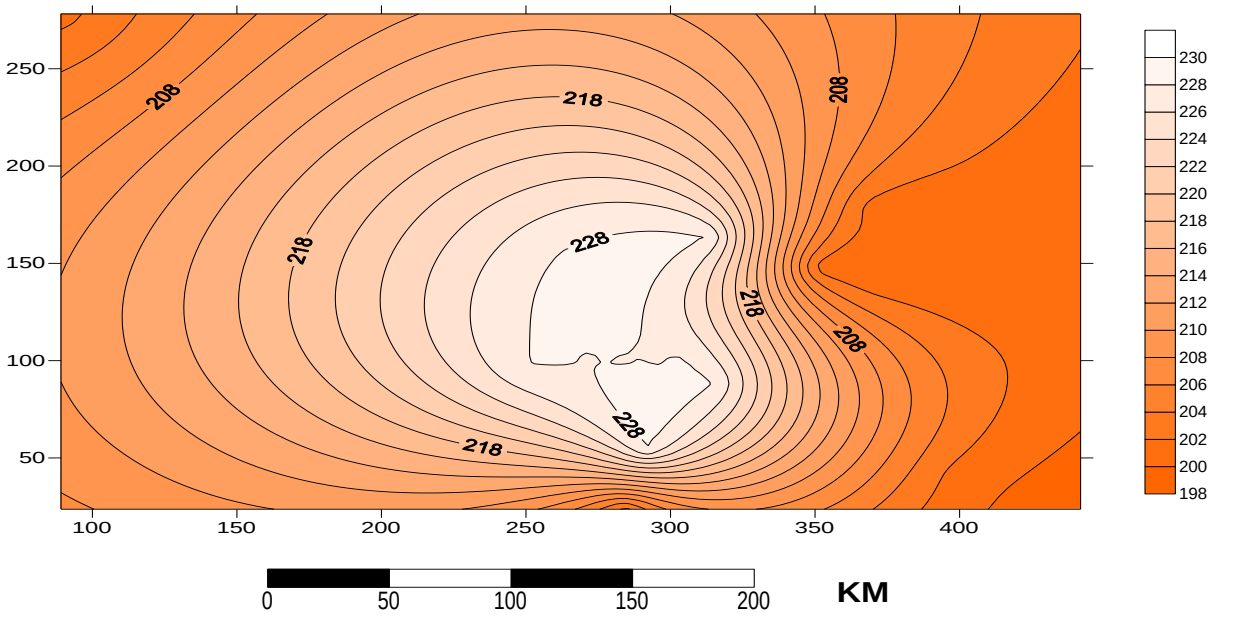


Figure 7. Fluctuation of Precipitation in Badin and Chhor weather station 1984-1917

The fluctuation of the precipitation described heavily with uneven or unsteady record during 1980-2000, rating 41 millimetre to 316 millimetres. While it was heavy precipitation recorded during 1994 with 914 millimetres at Badin. In the same period of Chhor it was 54 millimetres to 322 millimetres **(Fig. 7).** It was almost same pattern with merely difference during 2001 to 2017 rate 57 millimetres to 390 millimetres at Badin with highest rate in 2011 with 663 millimetres. Which could repeat the same situation in Chhor during last reported period with 65 millimetres to 312 millimetres and it extended high ratio in 2011 with 551 millimetres). This whole scenario of fluctuation demonstrated the decrease of precipitation in 20th century across the fore mentioned region.

REFERENCE:

Alsharhan, A. S., K. W. Glennie, and G. L. Whittle, (1995), Quaternary deserts and climatic change: proceedings of the International Conference on Quaternary Deserts and Climatic Change: al Ain, United Arab Emirates, 9-11 December, Taylor & Francis.

Arif, T., (2009) Implementation of the approaches of UN Convention to Combat Desertification (UNCCD) through local area development to combat desertification in district Tharparkar, Pakistan, UNCCD.

Chajravarty, S. C., J. Datt, and C. P. Revankar, (1992), Climatology of long Oscillations in the equatorial middle atmosphere over Thuma, India, Current Science, Vol.36, No.1, 33-42.

Chauhan, S. O., (1996), Aeolian deposition of Arabia and Somalia sediments on the south-western continental margin of India, Current Science, Vol.71, No.3, 10, 233-34.

Dearing, J. A. (2006), Human-environment interactions: learning from the Past, Regional environment change Vol. 6, Numbers 1-2, Copernicus GmbH on behalf of the European Geosciences Union, 1-16.

Deotare, B.C. (2004), Palaeoenvironmental history of Bap-Malar and Kanod playas of western Rajasthan, Thar desert, Earth Planet Science, 403-425.

Fein, J. S. and P. L. Stephens, (1987), Monsoons, Wiley, New York.

Gupta, M. S and A. A. Fernandes, (1997), Quaternary radiolarian faunal changes in the tropical Indian Ocean: inferences to Plaeo-monsoonal Oscillation of the 10^{o} s Hydrographic front, Current Science, Vol.72, No.12, 965-72.

Herani, M. G., R. A. Wasayo and K. M.Ali, (2007), Reforming farming and rangeland in Tharparkar: Suggested implementations for income generation, Indus Journal of management & Social Sciences, Vol.1, 16-36

Hu Jen Chang, (2000), the Indian Summer Monsoon, Geographical Review, Vol. 57, No. 3.

Jameel A., A. Mahmood, S. Jafri, and A. Ali, (2004), Weather in Pakistan (April-June 2003), Pakistan Journal of Meteorology ,Vol. (1) 2, 71.

James F. R. (2007), Global Desertification: Building a Science for Dry land Development, Science 316,847-851.

Meghwar, S., G. M. Mastoi, K. F. Almani and K.H. Lashari, (2019), Incensement of temperature triggered to induce severe drought in Thar Desert, Pakistan, , Sindh University, Res.. Jour. (Sci. Ser.) Vol. 51 (04).

Meghwar, S., A. R. Abbassi, R. Qambrani, and S. Kausar, (2019), Anthropogenic riposte confirmation the impact of climate change on human lives in Thar Desert, Pakistan. The Shield - Research Journal of Physical Education & Sports Science Vol: 14 .

Melillo, J. M. (1993), Global climate change and terrestrial net primary production, Nature 363, 234–240.

Muslehuddin M., H. Mir and N. Faisal (2006), Sindh Summer (June September) Monsoon rainfall prediction, Pakistan Journal of Meteorology ,Vol.2, issue.4, 95-102.

Ragab, R. and C. Prudhomme (2002), Climate change and water resources management in arid and semi-arid regions (Keynote paper): Prospective and challenges for 21st century (Keynote paper), Biosystems engineering, 81(1), 3-34.

Ram B S and A. Kumar, (2015), Climate variability and water resource scarcity in drylands of Rajasthan, India, Geoenvironmental Disasters 2:7

Ramesh, R. and M. G. Yadava (2005), Climate and water resources of India. Current Science Vol: 89 (5), 818–824

SCOPE, (2010) Combating desertification through agro-forestry approaches in semi-arid Tharparkar district – Pakistan.

Shamshad, K.M., 1988), The meterology of Pakistan, Royal Book Company, Karachi, Pakistan.

Stamp, L. D., (1965), A History of landuse in arid regions, UNESCO, Paris, 33-54,144-158.

Swanson, F. (1999), Evaluating the usefulness of natural variability in managing ecological systems, Ecological Applications, November, Vol. 9, No. 4, 1179-1188.

Tank K., (2006), Changes in daily temperature and precipitation extremes in central and South Asia, Geographical research, Vol. 111, 1-8.

Hasnain, S. E., and B. Friedrich, (2012). "Climate change and infectious diseases--impact of global warming and climate change on infectious diseases: myth or reality?" Int J Med Microbiol 302(1): 1-3.

Karvonen, A., P. Rintamaki, (2010), "Increasing water temperature and disease risks in aquatic systems: climate change increases the risk of some, but not all, diseases." Int J Parasitol 40(13): 1483-1488.

Zhu, J. P., (2011), "Exploration of the relationship between geographical environment and human diseases in ancient China." J Tradit Chin Med 31(4): 382-385.