Volume : 2 | Issue : 4 | April 2013 ISSN - 2250-1991

Research Paper Engineering

A Drought Analysis by Herbst Method (A Case Study of Patan District)

* Dixitsinh Jitaji Thakor
** Purvang Hemantkumar Pandya

* Student of Master Engineering in Water Resource Management in L.D.College of Engineering, Navarangpura, Ahmedabad-380015

** Student of Master Engineering in Water Resource Management in L.D.College of Engineering, Navarangpura, Ahmedabad-380015

ABSTRACT

In the Patan District the drought analysis by the Herbst method such that various effects of different months and its characteristics. Patan Districts has Patan taluka is drought effected prone area three times in June, July, September months and Chansma taluka is affected in August month. Patan taluka is most drought prone area in 50 years.

Keywords : Drought, Herbst, Drought Intensity

INTODUCTION

Drought is a shortage of water in the simple terms, we understood. It has a drastic effect on the society and its harms and our human feeling. Any administrator has to handle the situations, which are like drought, flood, cyclone etc. Because people believe that state is a welfare agency. State has to help the society crisis in conditions of natural crisis. So to predict, monitor, asses and control the drought it is necessary for each responsible administration.

STATEMENT OF PROBLEM IDENTIFICATION

Patan District is drought prone area in Gujarat State. Patan District is located in Northern Gujarat. Patan District has a 5600 Sq.Km area in Gujarat State. Patan District has five rivers but there are non- perennial rivers. Patan District has an only supporting factor of rainfall and its better management. In this time the rainfall is uneven distribution and uneven season. There are the causes to analysis the drought, drought characteristics, drought intensity, and drought proper management in future to be needed the Patan District.

DROUGHT ANALYSIS BY HERBST METHOD

Herbst's et. al. (1966) evolved a new method of drought analysis using monthly rainfall data, whereby it was possible. Hebst method is one of the methods widely used in the determination of duration and intensity and possible to determine the duration and intensity of droughts and their month's onsets and termination. The model using the following steps to calculate indices to evaluate onset and termination of droughts.

1. Calculation of Mean Monthly Rainfall (MMR): From the long record of monthly rainfall. The mean rainfall is calculated below:

MMR= $\sum RAINFALL(x,y) / NUMBEROFYEAR$

Where x and y are the year and month respectively. Summation could be carried out depending on the number of years/monthly data availability.

2. Mean Annual Precipitation (MAP):

MAP= $\sum MMR(y)$

3. Effective Rainfall (ER): Effective Rainfall (ER) is required to estimate the carry over effects from month to month.

ER (1, 1) =RF(x, y) =RF(x, y) +CO(x, y)*W(y)

Where CO (x, y) =ER (x, y-1) – MMR (y-1) and
W (j) =0.1*(1+ (MMR (y) / (MAP/4))

Where W (y) is the weighting factor month of y which is used to carry over effects and CO is derived from empirical formula suggested by Herbst et. al. (1966).

4. Mean annual deficit (MMD) is difference of effective rainfall for a month and mean monthly rainfall.

Diff (x, y) =ER (x) – MMR (y)

It is carried out for each month of every year using the above method. If the difference is greater than zero, then: is no deficit of rainfall for the month. Mean monthly deficit of every month and the annual deficit are used in determining the onset and termination of drought. Termination of drought is calculated for the months having positive monthly difference, the sum of the difference are negatives from the month when the drought started.

5. Drought Intensity is evaluated by:

$$\sum_{y}^{end}[\text{üüüüü(üüüü)} - (,) - (,)] / \sum_{y}^{end} (,)$$

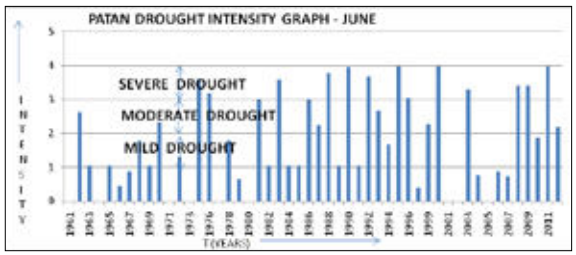
Where MMR is Mean Monthly Rainfall, ER is Effective Rainfall, MMD is Mean Monthly Deficit

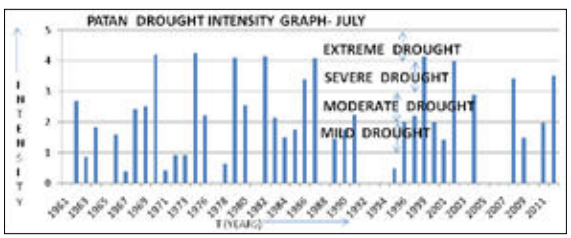
PALMER DROUGHT INTENSITY INDEX

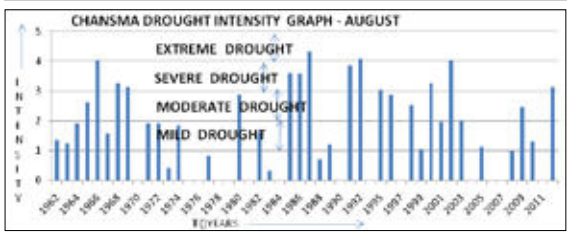
Palmer Drought Severity Index (PDSI) indicates standardized moisture conditions and allows comparisons to be made between locations and months.

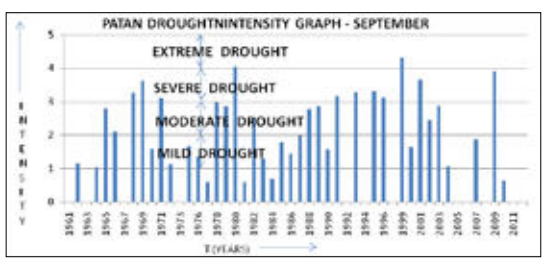
DROUGHT INTENSITY	CONDITIONS
-6 TO 6	ROUGHLY DROUGHT
-4 TO ABOVE	EXTREME DROUGHT
-4 TO -3	SEVERE DROUGHT
-3 TO -2	MODERATE DROUGHT
-2 TO -1	MILD DROUGHT

GRAPHICAL RESULT









CONCLUSION:

1. The most prone taluka is Patan taluka which has a 66% total percentage of drought and minimum prone area Satalpur taluka which has a 40 % total percentage of droughts. So it concludes that the Patan taluka is the most drought prone area in June Patan district.
2. The most prone taluka is Patan taluka which has a 60% total percentage of drought and minimum prone area Satalpur taluka which has a 42% total percentage of droughts. So it concludes that the Patan taluka is the most drought prone area in July Patan district.
3. The most prone taluka is Chansma taluka which has a 62% total percentage of drought and minimum prone area Satalpur taluka which has a 46 % total percentage of droughts. So it concludes that the Chansma taluka is the most drought prone area in august Patan district.
4. The most prone taluka in September is Patan taluka which has a 66% total percentage of drought and minimum prone area Satalpur taluka which has a 50 % total percentage of droughts. So it concludes that the Patan taluka is the most drought prone area in September Patan district.

ACKNOWLEDGEMENT

I am very grateful to Sate Water Data Centre, Gandhingar for providing the monthly data of rainfall.

REFERENCES

1. M.A.Beran And J.A.Rodier Rapporteurs(Hydrological Aspects Of Drought, Unesco-WMO) | 2. Manual For Drought Management November 2009(Department Of Agriculture And Cooperation Ministry Of Agriculture, Government Of India New Delhi) | 3. U.S.PANU &T.C.SHARMA(Department Of Civil Engineering, Lakehead University, Thunder Bay-Canada) | 4. Zoran Radic And Vladislava Mihailovic(Development Of Drought Monitoring System For Serbia-Hydrological Drought Analyses, Faculty Of Civil Engineering, University Of Belgrade, Serbia, SCG) | 5. I.Nalbantis(Evaluation Of A Hydrological Drought Index) | 6. Andrezej By Czkowski Weodzimirz Meyer(Drought And Its Hydrological Aspect-Case Study For Poland , Department Of Hydraulic Structures, Warsaw Agricultural University, Poland) | 7. A.Yahiaoui, B.Touaibia And C.Bouvier(Frequency Analysis Of The Hydrological Drought Regime- Case Study Of Oued Mina Catchment In Western Of Algeria) | 8. N.Eriyagama, V.Smakhtin And N.Gamage (A Global Picture Of Drought Occurrence, Magnitude And Preparedness,Internation Water Management Institute (IWMI)-Colombo) | 9. Ashok K. Mishra And Vijay P. Singh(A Review Of Drought Concepts-Journal Of Hydrology, Department Of Biological And Agricultural Engineering. , Department Of Civil And Environmental Engineering. , Texas A& M University-USA) | 10. G.Rossi And A.Cancelliere(At-Site And Regional Drought Identification By Redim Model, Department Of Civil And Environmental Engineering, University Of Catania, Italy) | 11. Neil S. Grigg(Hydrology And Management Of Drought In United States, Department Of Civil Engineering, Colorado State, University) | 12. Siegfried Demuth &Barbara Heinrich(Temporal And Spatial Behaviour Of Drought In South Germany, Department Of Hydrology, University Of Freiburg, Werderring 4,Germany) | 13. American Meteorological Society, 2003 | 14. Ahmad Jamalluddin Shaaban, Hong Kee An And Jabir Kardi (Characteristics Of The 1998 Drought Affecting Langat Valley) | 15. M.N.Thakkar(A Hydrological Aspect And Management Of Drought) | 16. Zarna J. Chovatiya (A Case Study Of Drought Assessment And Monitoring Of Kutch Region)