Flood and Drought Analysis Of Godavari Sub Basin Based on Precipitation Index

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Abstract: Godavari river is one of the largest river in the India . Various government agencies are monitoring the hydrological flood and drought studies in the region, the most of the river flowing in the Maharashtra and Terengganu and Andhra prudish , states of India he flood forecasting is based on the precipitation classified . The flood forecasting and drought scenarios like rain fall intensity, depth of run of water and, water levels and spread area over the study area has analyzed. Drought effects in aspect of irrigation has also analyzed over a period of historical data in the Telangana state(India) and Godavari of sub basin. The aim of this paper is analyzing the flood and drought of study areas based on the intensity of the precipitation from historical data and The result obtained from this analysis is presented in form graphs . The Godavari flood and drought scenarios are very important to analyze the study area to protect the natural disasters and also to take preventive measures for the future floods and droughts. Some data has collected from the Government agencies to obtain the better result. The study area has total 141 number weather stations. Important weather stations where is collected maximum precipitation and least, average precipitation data has used for the analysis. The results available are presented in the form of graphs and numerical evaluation. Study is carried out in the G5, G6, G10 (Godavari sub Basin5, Godavari sub Basin6, Godavari sub Basin10) Godavari sub Basin

Key words : G5,G6,G10, flood, Drought , Index, Rain fall, Analysis, kaleswaram, SRSP(sriram sagar project)

1. Introduction

1.1 Kaleswaram irrigation project in Godavari Basin

Godavari enters in the Telanagana state in the Nizamabad at khandakurthy and where it forms Trivani sangam by join with Manjra and Haridra. This river flows the border line of the Manchuria and Nirmal districts of Telnagana (India) which are situated in the north side where as south side Nizambad, jagityal, peddapalli. Godavari after flowing in the Telangana near to 12km it reaches to Sriram sagar project. Manchuria Latitude DMS: 18°52'32.14"N Longitude DMS 79°27'32.9"E .The project is classified into 7 links and 28 packages to carry the work simultaneously and complete the project in scheduled time. The first 4 links are the projects main artery which takes Godavari water from Medigadda (100 MFSL) to Konda pochamma (620 M FSL) via Yallampalli, Mid Manair, Mallanna sagar. Links 5 to7 execute the lateral or parallel subsidiary projects which form part of the KLIP.[1] The KLIP is a very big project. Its has resilient working operations ; it can be operated according to the need in the command area. It is basically a massive Lift irrigation project, it will not be needed always to lift the water at one time from all the links to serve the entire configuration of the project. There is scope for supplying the irrigation water by three ways in(KLIP) **kaleshwaram lift irrigation,** when there is flood to SRSP (SRIRAM SAGAR PROJECT), water will be fed through flood flow canal of main Godavari in to Mid-Manair reservoir and through Kakatiya canal in to Lower

Manair reservoir [1]. The excess flood of SRSP in Godavari will go in to Yallampalli reservoir. After that via Sundilla, Annaram, Medigadda, Tupakulagudem barrages it will end up in Polavaram and go down the river in to Bay of Bengal. According to previous studies that Sree ram sagar project (SRSP) will get heavy flood once in 3 years on an average calculation. When SRSP is in flood there is no need for Kaleshwaram Link I pumps (Medigadda to Yallampalli) and Link II pumps (Yallampalli to Mid-Manair) to operate. Two, even if there is no flood in SRSP, there is a possibility of flood to Yallampalli from Kadem river from the catchment

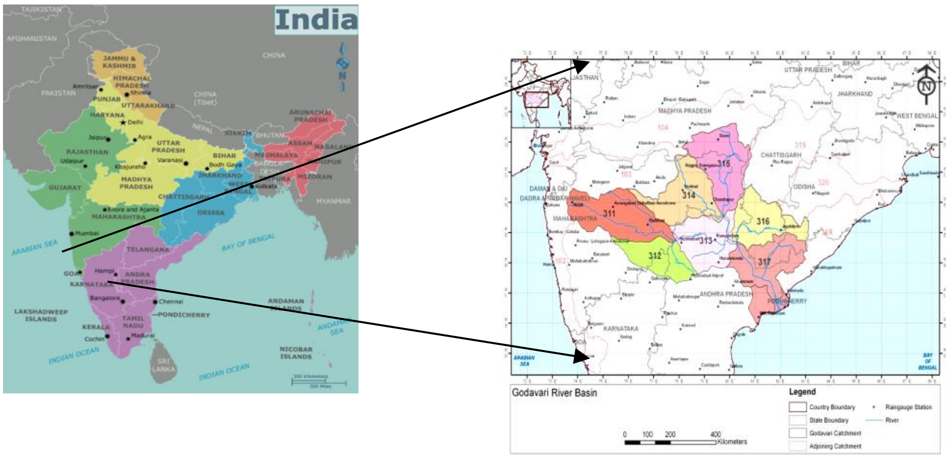

Fig 1. Showing The Godavari Basin In India Map

Area between SRSP and Yallampalli. In that event there is no need to operate Kaleshwaram Link I pumps. By operating link II pumps from Yallampalli, water can be taken up to Kondapochamma reservoir, filling up intervening reservoirs. The third choice is, when there are no floods only in the above catchments, The pumps in Link I and Link II will need to be operated in full to the water all the way from Medigadda to Kondapochamma, which is the full complement of the project. It is to say that depending on the rainfall and floods in the different catchments of the vast ayacut and the exigent local needs, the infrastructure of the project of pumping and delivery can be used selectively. It will facilitate to use the huge power needed, economically and efficiently to derive maximum benefit from the multifarious project, unlike in other conventional Dams or exclusive Lift irrigation projects. The study of some of the Godhavari basin has situated in the Telangana state ,India. The region of Godavari lies in the geographical latitudes and longitudinal areas of Latitude of 16° 16' ' N, 22° 43" E 18° 26" N, to 73° 16' ' E, 83° 07' E 18° 26" N Winter radiation can be divided as more but some time it is cold due to northerly or northwesterly winds blowing cold air from north. [14]modeling of 3 months SPI for each 3season has carried out using the interpolation distance weight method(IDW) [15] After evaluating the SPI in the General, working drought thresholds which are depends on an objective method are finding out at each station. This all thresholds values useful in drought-response decisions taking [16]

2. About Godavari River Basin

The karimnagar is part of the Godavari basin having 79° 7' 43.8168" E. it IS one of the large developing city in Telanagana state has nearly 2 lakh 60 thousand populations.

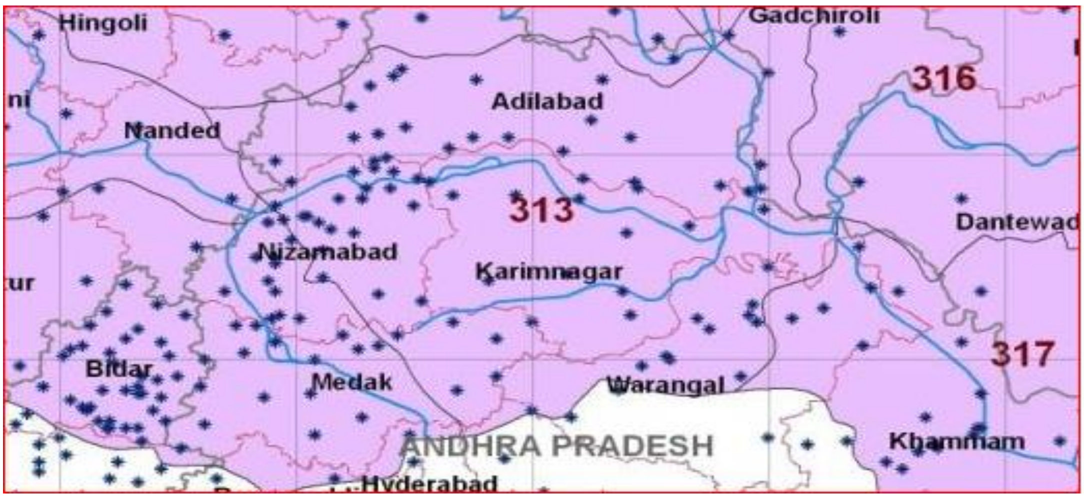

Fig 2. Map Showing The Different Rian Gauge Stations In The Study Area

Name of Sub Basin Normal Rain fall values are in Manjira is having 846 mm. Middle Godavari- 996mm Purna 706.4mm , Maneru 875.7mm ,Penganga mm 910.8mm , Wardha 953.0mm ,Average rain fall for the Entire

Basin 946 mm. The important tributaries of the Godavari and its topographical features are follows Map [2]. Nearly 60% of land is prone to earthquakes of various intensities; over 40 M Hectors is dangerous to floods; about 8% area is prone to cyclones finally 68% of the area is susceptible to drought. [9]

Fig. 3.Map showing the various Karimnagar districts location of the study area in the Telangana. (INDIA)

Original circular of HPC(High power disaster management committee) was stipulated to preparation of disaster management plans it has consider natural disaster [6]

3. Objectives

1, Study area has selected for the G4,G5 an G10 Godavari sub basin
2. Analyzed the flood affected areas in the Godavari sub basin
3 . Flood and drought is estimated using the deviation method for the analysis

3, Methodology and work flow process

The main process has started by collecting all the data from required historical period from the various departments. More than 60 % of in the India has earth quack prone of different intensity of the vector scale. [12]The classification of the rain fall is based on the low rain fall, no rain fall and heavy rain fall standard deviation is calculated. Based on that rain fall standard deviation value it is decided the flood or drought. National disaster management takes steps towards prevention of floods and earth quakes. National water policy emphasis the irrigation, flood control, ground water related policies [10]. Fig 4, shown the flow chart.

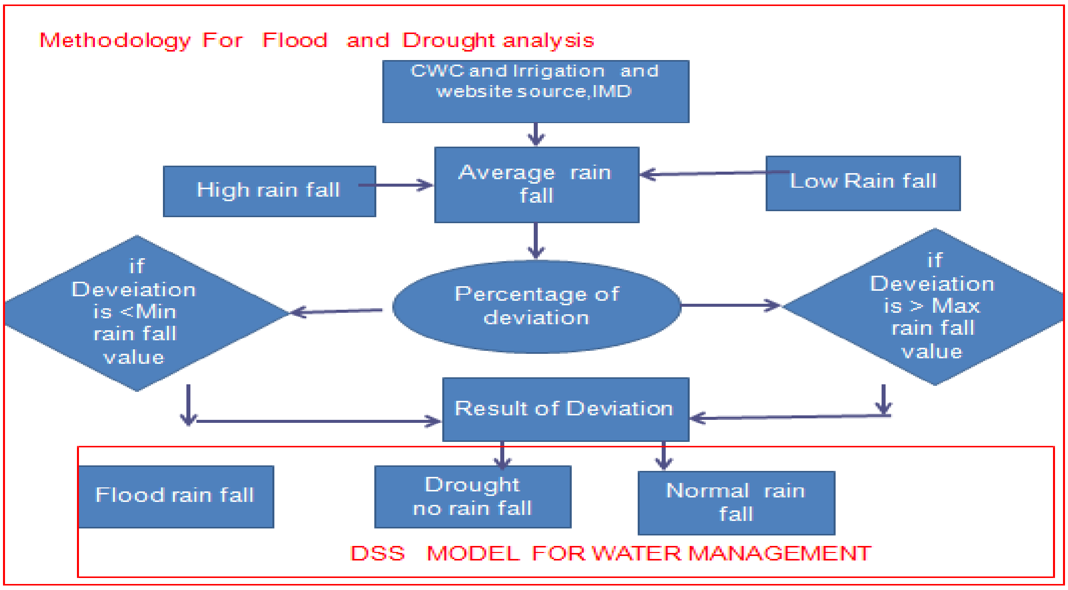

Fig 4 Flow chart Showing the Methodology of the flood and Drought Analysis

The Maximum rain fall events are selected from the different years from the previous 44 years are selected . Nearly 44 years of Historically data from Godavari sub basin G4,G5 and G10 of historical data has consider for the analysis. The analysis forecasted for the population loss, area affected, , Houses effected , cattle loss, there is decision modal for the heavy rain fall, no rain fall and normal fall is created for the Decision making . Godavari has different elevations and various tributaries. The catchment areas of basin and Average annual rain fall have shown in the Table 1.

. In Telangana region of the Godavari basin has categorized in to middle Godavari and upper Godavari basin . various rivers length , catchment and elevation , and the main tributaries of Godavari has mentioned in the Table 1 [2].

Table1. **Showing the Different Tributaries of the Godavari**

Differentiating the z-index SPI has well evaluation stability and it is used to water resources evaluation and drought monitoring in the various time series to study dry climate and wet climate events [18]. 35 sub divisions in India have studied the drought of occurring probability and in the divisions as highlighted [17]

4. Rainfall and forecast in the basin

study area receives rain fall mostly due to South West monsoon. occurs due to western ghats and sahyadri ranges in the konkan and near surrounding area of the Madhya Pradesh (India) . most of the rain fall is due to the orgrophical effect which leads most of the precipitation due to heavy wind sometimes heavy rain fall s exists due to low pressure in the bay of Bengal ocean. jeongeun won , sangdan kim ," Future drought analysis using SPI and EDDI to consider climate change in south korea" , water supply,20(8), 2020 [11]. Table 2 representing the flood forecasting of number year's data available the godavri sub basin

Most of the Precipitation occurs due to the N-E part of the Godavari basin . Months of rain fall jan-Feb dry weather and there is no flow in the Godavari river. The depth of rain fall in this 2 months is Nearly and less then 15mm . March, April, May rain fall between 20 to 50mm June to September maximum ran fall occurs in this basin and receive more rain. The period of the Available data from the C.W. C Flood forecasting station. Table no [3].

Table 2 Flood Forecasting Stations From The Data Available For No. Of Years

S.NO	Period of available flood fore casting station	Data from the year available	No. of years of available data
1	Kaleshwaram	1982	34
2	Eturunagaram	1995	22
3	Dumm gudem	1979	37
4	Badrachalam	1978	38

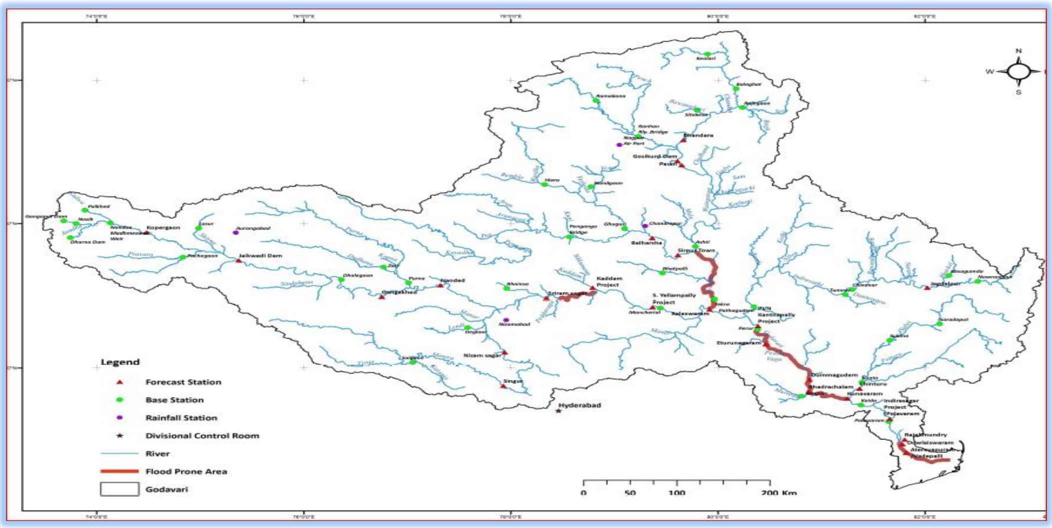

Fig.5 Flood Forecast In The Godavari Entire Basin (Source CWC)

The present year 2018 is the 44(forty fourth) year of operation of flood forecasting activities in Godavari basin. Flood forecasting activity in the basin started in 1974 with the opening of a Division office of Central Water Commission at Pochampad (Sriramsagar Dam). [4].In 1975 the office was shifted to Hyderabad for better Management and communications. Initially, stage forecasts were issued for Dowlaiswaram Anicut (Sir Arthur Cotton Barrage) for the monsoon 1975. Presently, stage forecasts are issued

6 Data Collection Network

on regular basis for 14 (fourteen) stations located on the main Godavari and its tributaries. Inflow forecasts are also issued for the 4 (four) reservoirs viz., Jaikwadi and Sriramsagar on the main Godavari & Singur and Nizamsagar on river Manjira. In addition, 3 level forecast and 3 inflow forecast stations are taken up in the XII plan scheme. Further, 15 inflow forecast stations are proposed to be taken up by 2020[21].. River stage forecasts and advance warnings enable the concerned authorities to take up appropriate precautionary measures to minimize the loss of life and property. [5].Reservoir inflow forecasts help in better reservoir regulation.

Rainfall is observed normally twice in a day during the flood season at all the rain gauges maintained by CWC (Central Water Commission). In addition, Flood Meteorological Office of the India Meteorological Department, Hyderabad supplies rainfall data, the daily weather situation, the Quantitative Precipitation Forecast(QPF) and the outlook for subsequent two days.

Table 3 Showing Methodology Of Standard Deviation Method

S.No.	Name of Sub Basin	Normal RF in mm	Actual RF in mm	% STANDARD Deviation
1	Upper Godavari	777.4	499.9	-35.7
2	Pravara	487.4	326.1	-33.1
3	Purna	706.4	583.5	-17.4
4	Manjira	846.1	573.7	-32.2
5	Middle Godavari	996.6	951.8	-4.5
6	Maneru	875.7	765.4	-12.6
7	Penganga	910.8	938.1	3
8	Wardha	953.0	882.5	-7.4
9	Wainganga	1182.0	1135.9	-3.9
10	Lower Godavari	1041.0	1006.6	-3.3
11	Indrāvati	1361.0	1439.9	5.8
12	Sabari	1217.0	1448.2	19
Average for the Entire Basin		**946.3**	**879.3**	**-10.2**

The standard deviation method has adopted for the sub basin of Godavari. Table 3 shows the normal and actual rain fall data for the Godhavari basin[7]. The distribution of the water thus available is not uniform and is highly uneven in both space and time. [6] (Table3 source cwc India,IMD Hyderabad,India) .

Table 3 showing the methodology of standard deviation Method

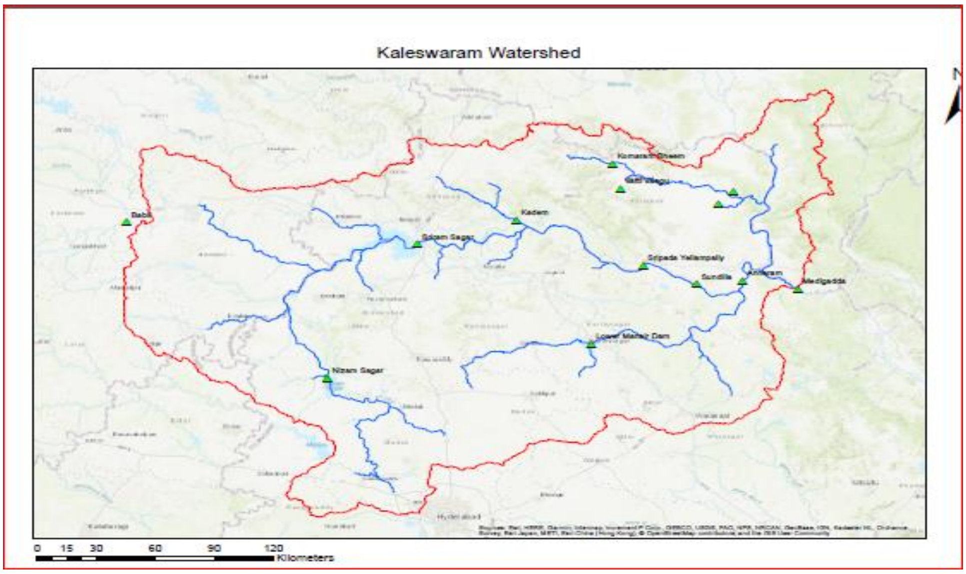

Fig 5 Kaleswarm water shed area

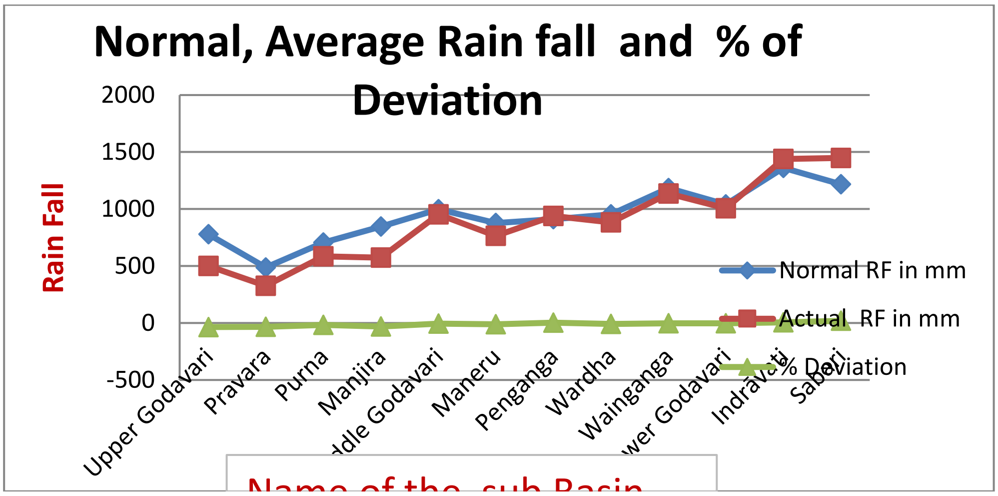

Fig 6 . Graph Showing Average And Mean Rain Fall Deviation

Table 4. The Highest rain fall for the basin for the I day , 2nd day ,3rd day Rain fall

CatchmentName	Catchment No.	Area(sq.km.)	1-Day		2-Day		3-Day	
			Storm Date	Highest Rain depth, mm	Storm Date	Highest Rain depth, mm	Storm Date	Highest Rain depth, mm
Upper Godavari	311	54,790	27-Jun-1914	128	26-27 Jun 1914	223	26-28 Jun 1914	234
Manjra	312	31,916	27-Jun-1914	145	26-27 Jun 1914	254	26-28 Jun 1914	267
Middle Godavari	**313**	**41,616**	**12-Jul-1994**	**190**	**11-12 Jul 1994**	**300**	**10-12 Jul 1994**	**346**
Wardha	314	47,075	18-Jul-2000	191	18-19 Jul 2000	313	17-19 Jul 2000	356
Wainganga	315	50,957	21-Sep-1926	172	20-21 Sep 1926	314	19-21 Sep 1926	418
Indravati	316	40,392	18-Jul-2000	206	18-19 Jul 2000	333	17-19 Jul 2000	384
Lower Godavari	317	48,089	23-Jul-1989	161	23-24 Jul 1989	210	22-24 Jul 1989	219

7. Middle Godavari (Between confluence of Manjra and confluence of Pranhita catchment no. 313
Considering the topography and location of the catchment, rainstorms that can affect this catchment have been analyzed using the DAD (depth area and duration method. [7]Out of storms listed in Table 3, storms for 1-day, 2-day and 3-day durations that are transposable (linear transposition withinthe limit of ± 2 degree in flat region) to the catchment have been listed in Table 3 respectively. List of rainstorms, which affected the Catchment-313. [8]. Annual peak rain fall and flow in the Godavari Basin of karimnagar and mancherail and Warangal and peddapalli areas of Godavari 313 region listed in Table 3 Rainstorms affecting Catchment-313 region of the Godavari basin[20]. Fig 6 show.ing the graph for the Normal rain fall , Actual rain fall and Percentage of the standard deviation , Table 4 showing the different rain fall s for the different days . selected peak rain fall in the table5.

Table 5: storm duration and location

Sr. No.	Date	Storm Duration	Peak (mm)	Storm Centre	Lat (Deg)	Long (Deg)
1	02 Aug 1908	1-Day	320	Gadchiroli	20.18	80.00
2	03 Aug 1912	1-Day	304	Armori	20.47	79.98
3	18 Jul 1913	1-Day	313	Hinganghat	20.55	78.83
4	26 Jun 1914	1-Day	254	Digras	20.12	77.72
5	02 Jul 1930	1-Day	360	Wani	20.05	78.95
6	21 Jul 1937	1-Day	338	Yeotmal	20.38	78.13
7	31 Jul 1951	1-Day	286	Dhanora	20.27	80.32
8	28 Sep 1954	1-Day	295	Achampet	18.17	77.83
9	05 Jul 1958	1-Day	355	Nizamsagar	18.08	77.92
10	31 Aug 1958	1-Day	324	Satpur	18.75	77.92
11	13 Sep 1959	1-Day	247	Wani	20.05	78.95
12	15 Jul 1965	1-Day	510	Nizamsagar	18.08	77.92
13	17 Aug 1970	1-Day	279	Ramadugu	18.62	78.25
14	18 Aug 1970	1-Day	259	Perkit	18.83	78.30
15	19 Aug 1970	1-Day	296	Pochampet proj.	18.97	78.33
16	28 Jun 1975	1-Day	315	Kunghari	19.58	79.83
17	21 Jun 1978	1-Day	266	Pocharam	18.12	78.20
18	11 Aug 1983	1-Day	276	Billoli	18.78	77.73
19	06 Oct 1983	1-Day	350	Jakora/jakor	18.50	77.92
20	18 Jul 1986	1-Day	280	Alisagar	18.68	77.95
21	22 Jul 1986	1-Day	384	Gadchiroli	20.18	80.00
22	14 Aug 1986	1-Day	448	Warora	20.22	79.02
23	18 Jul 1988	1-Day	335	Nuguru/venkitapu	18.33	80.55
24	30 Jul 1988	1-Day	450	Khanapur	19.03	78.65
25	28 Jun 1989	1-Day	390	Kinwat	19.63	78.20
26	17 Jun 1990	1-Day	281	Kaddam	19.08	78.75
27	16 Aug 1990	1-Day	260	Venkatapuram	18.33	80.90
28	22 Aug 1990	1-Day	302	Armori	20.47	79.98
29	30 Aug 1990	1-Day	380	Alisagar	18.68	77.95
30	12 Jul 1991	1-Day	301	Bhomendrapalli	18.47	77.92
31	16 Aug 1991	1-Day	285	Gadchiroli	20.18	80.00
32	20 Jun 1992	1-Day	236	Swarna project	19.23	78.23
33	04 Jul 1994	1-Day	320	Rajura	19.70	79.35
34	30 Aug 1994	1-Day	365	Nagbhir	20.60	79.65
35	20 Oct 1995	1-Day	403	Chinnur/chinnoor	18.85	79.80
36	18 Jun 1996	1-Day	248	Nalesar	20.05	79.47
37	12 Jul 2000	1-Day	356	Perur	18.55	80.38
38	11 Aug 2000	1-Day	211	Kamareddy	18.32	78.35
39	24 Aug 2000	1-Day	245	Halbarga	17.98	77.23
40	28 Aug 2000	1-Day	290	Asifabad	19.37	79.30

41	03-04 Aug 1912	2-Day	519	Armori	20.47	79.98
42	02-03 Jul 1930	2-Day	713	Wani	20.05	78.95
43	13-14 Aug 1953	2-Day	471	Aheri	19.40	80.00
44	04-05 Jul 1958	2-Day	432	Bodhan	18.67	77.88
45	13-14 Sep 1959	2-Day	426	Pandherikawara	20.02	78.55
46	14-15 Jul 1965	2-Day	540	Nizamsagar	18.08	77.92
47	17-18 Aug 1970	2-Day	463	Ramadugu	18.62	78.25
48	18-19 Aug 1970	2-Day	469	Perkit	18.83	78.30
49	27-28 Jun 1975	2-Day	484	Sindewahi	20.28	79.68
50	11-12 Aug 1983	2-Day	510	Navipet	18.70	78.03

Flood effected area in the particular G5 ,G6, G10 subbasin of number of year and population affected mensioned in Millons. The Damage to the houses and cattle lost , damage to public utilitie and Total Damages to crops and house all are mensioned in the Table 6 [21]

Table 6 Flood History of Telantan region of Godavari basin from 1953 to 2016

Previously ANDHRA PRADESH(combine states of A.p and Telangana) SHOWING FLOOD DAMAGE DURING 1953 TO 2016											
Sl. Nos.	Year	Area Affected in m.ha	Population Affected in million	Damage to Crops		Damage to Houses		Cattle lost nos.	Human lives lost nos.	Damage to Public utilitie in Rs. Crore	Total Damages crops, House &public utilities in Rs.Crore
				Area in m.ha	Value in Rs. Cror e	Nos.	Value in Rs. Crore				
1	2	3	4	5	6	7	8	9	10	11	12
1.	1953	0.070	2.660	Nil	Nil	Nil	Nil	40509	Nil	Nil	Nil
2.	1954	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
3.	1955	Neg	Nil	0.190	1.260	3561	0.070	1358	18	0.110	1.440
4.	1956	1.390	0.200	0.050	0.270	3460	0.020	4	126	0.040	0.330
5.	1957	0.010	Nil	0.010	0	17560	0.121	4630	66	0.400	0.521
6.	1958	0.120	Nil	0.080	1.121	3467	0.306	3286	20	Nil	1.427
7.	1959	0.070	Nil	0.070	0	500	0	Nil	Nil	8.000	8.000
8.	1960	Nil	Nil	Nil	Neg	Nil	Neg	Nil	Nil	Neg	Neg
9.	1961	0.050	0.200	0.010	0.121	4388	0.028	Nil	1	0	0.149

10.	1962	0.100	Nil	0.100	0	10992	0.010	Nil	5	0.140	0.150
11.	1963	0.130	0.920	0.180	0.094	5222	0.025	66	11	0.657	0.776
12.	1964	0.110	Nil	0.110	1.000	30490	1.170	302	389	0.330	2.500
13.	1965	Nil	Nil	Nil	Neg	Nil	Neg	Nil	Nil	Neg	Neg
14.	1966	0.040	Nil	0.040	1.050	7195	0	Nil	8	0.080	1.130
15.	1967	Nil	Nil	Nil	Neg	Nil	Neg	Nil	Nil	Neg	Neg
16.	1968	0.070	0.260	0.070	24.089	30	1.484	2034	11	1.434	27.007
17.	1969	0	13.420	0	109.000	701731	45.230	253881	993	41.170	195.400
18.	1970	0.160	Nil	0.130	1.360	27630	4.270	412	93	6.743	12.373
19.	1971	Neg	Nil	Neg	0	Nil	Neg	Nil	Nil	Neg	Neg
20.	1972	0.200	Nil	0.200	15.750	53680	0.662	710	7	2.683	19.095
21.	1973	Neg	Nil	0.000	Neg	Nil	Neg	14	9	0.028	0.028
22.	1974	0.004	Nil	Neg	0	259	0	138	3	0.070	0.070
23.	1975	0.004	Nil	Neg	0.156	219	0.027	Nil	Nil	0.308	0.491
24.	1976	1.000	7.420	0.890	186.727	205507	10.212	18772	166	14.583	211.522
25.	1977	0	11.110	0	352.264	1063879	84.238	500978	9974	172.036	608.538
26.	1978	0.490	2.180	0.490	54.028	20015	1.577	2341	57	16.030	71.635
27.	1979	0.070	4.000	0.070	21.644	737500	120.000	301180	706	26.800	168.444
28	1980	0.060	0.180	0.030	9.221	34157	4.989	26069	88	16.851	31.061
29	1981	Neg	Nil	Neg	0	374	0.010	41	1	0.065	0.075
30	1982	0.040	0.040	0.040	2.280	13466	0.518	650	22	12.158	14.956
31	1983	0.714	12.800	0.714	312.900	459756	45.676	13437	290	264.530	623.106
32	1984	0.400	3.730	0.400	136.690	328266	65.493	93616	618	73.930	276.113
33	1985	0.006	0.190	Nil	0.094	3190	0.106	8	9	10.025	10.225
34	1986	1.340	6.876	1.340	451.610	426000	335.820	17388	323	937.310	1724.740
53	1987	Nil	Nil	Nil	Neg	Nil	Neg	Nil	119	0	Nil
36	1988	0.406	2.343	0.406	149.400	48694	Neg	4233	88	14.856	164.256
37	1989	3.480	8.940	0.780	368.740	234725	20.950	43213	264	525.660	915.350
38	1990	0	0.018	0	0	76420	0	0	52	82.530	82.530

39	1991	0.022	0.307	0.007	0.143	750	0.215	Nil	Nil	3.492	3.850
40	1992	0.344	1.437	0.344	112.630	16113	0.669	61	48	69.391	182.690
41	1993	0	0	0	Neg	0	Neg	0	0	4.552	4.552
42	1994	0.013	0.048	0.013	Neg	1190	Neg	0	8	Neg	Neg
43	1995	0	0	0	Neg	0	Neg	0	0	Neg	Neg
44	1996	1.128	0.137	1.128	0	30891	0	45059	338	0	0.000
45	1997	0.184	5.098	0.184	128.850	14990	Neg	137	58	249.730	378.580
46	1998	0.026	1.634	1.405	821.410	150196	100.000	5126	260	1583.79	2505.200
47	1999	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
48	2000	0.020	2.935	0.178	18.810	35667	110.000	6368	210	902.320	1031.130
49	2001	0.018	2.024	0.090	103.180	81783	408.910	3303	167	434.850	946.940
50	2002	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
51	2003	0.287	4.268	0.266	575.100	17147	1.890	1970	52	188.940	765.930
52	2004	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	0.000	0.000
53	2005	9.040	3.500	0.552	939.540	118618	58.730	14416	107	1699.700	2697.970
54	2006		2.792	0.824	1569.660	401622	632.240	11847	258	8615.020	10816.920
55	2007		3.901	0.153	34.870	849850	904.750	10138	172	1512.700	2452.320
56	2008		4.642	0.996	1742.220	57490	65.680	3308	179	1095.450	2903.350
57	2009		2.072	0.497	893.550	259095	883.530	49686	90	10678.670	12455.750
58	2010		5.189	1.995	3758.870	49043	294.010	13477	171	8563.250	12616.130
59	2011		0.000	0.000	0.000	0	0.000	0	0	0.000	0.000
60	2012	0.000	2.040	0.465	1033.044	30973	69.836	1858	61	3268.090	4370.970
61	2013	1.630	3.020	1.630	44.905	75304	2.244	2743	88	66.957	114.106
62	2014	0.000	0.000	0.000	0.000	3279	317.040	0	0	0.000	317.040
63	2015			0.000		103		420	28		0.000
64	2016	0.003	0.386	0.003				4	3		0.000
	Total	23.249	122.917	17.129	13977.651	6716437	4592.756	1499191	16835	41166.459	59736.866
	Average	0.517	2.998	0.343	285.258	129162	99.843	30596	324	807.185	1127.111

	Maximum	9.040	13.420	1.995	3758.870	1063879	904.750	500978	9974	10678.670	12616.130
	(Year)	(2005)	(1969)	(2010)	(2010)	(1977)	(2007)	(1977)	(1977)	(2009)	(2010)

The Graph between year, area affected and population selected

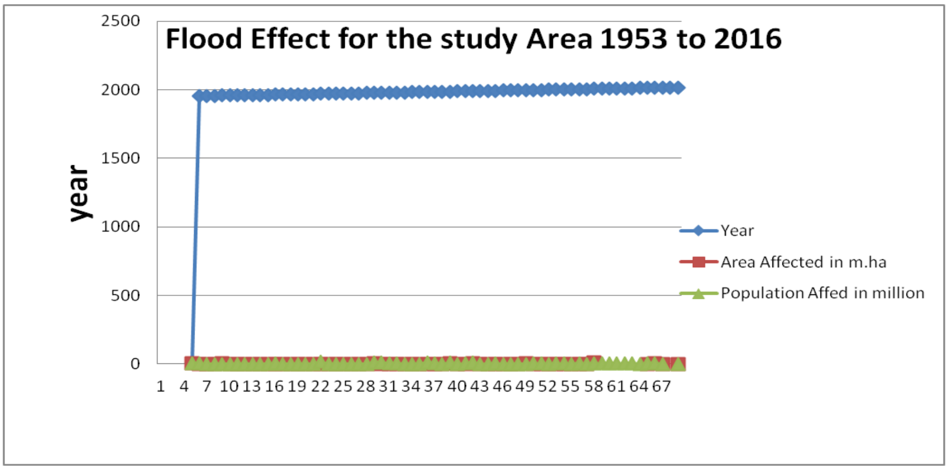

Fig 7 Showing Flood And Drought Analysis For Area And Population Effected

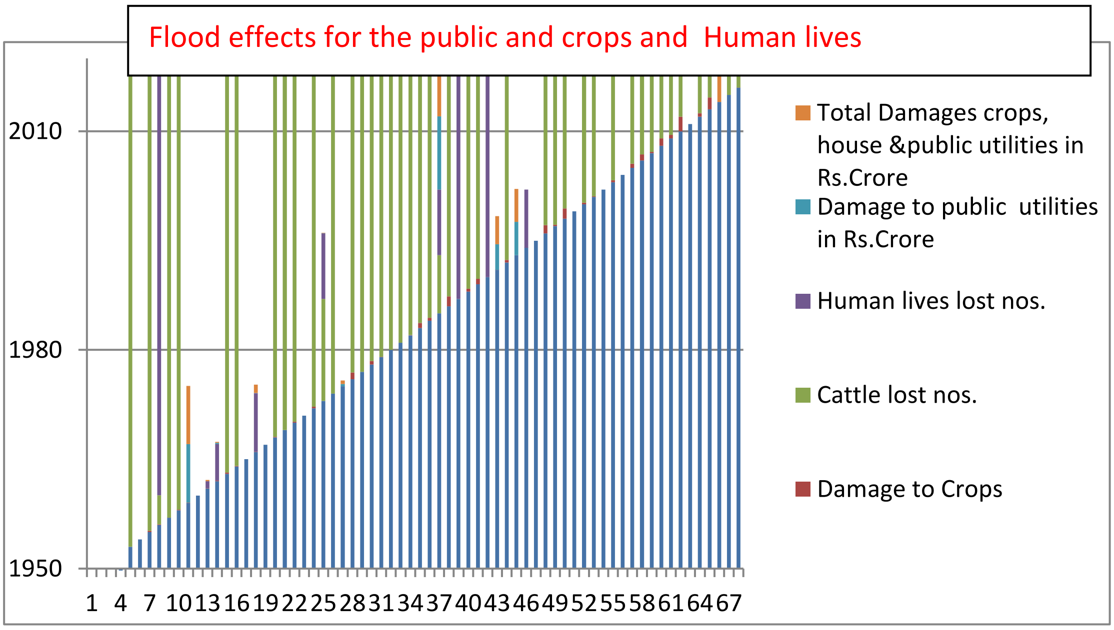

Fig 8 Showing Flood And Drought Analysis For Area And Population Effected

Table 7 Peak rain fall in the Basin

Sr. No.	Date	Storm Duration	Peak (mm)	Storm Centre	Lat (Deg)	Long (Deg)
51	13-14 Aug 1986	2-Day	612	Wardha	20.31	79.11
52	17-18 Jul 1988	2-Day	471	Nuguru/venkitapu	18.33	80.55
53	29-30 Jul 1988	2-Day	645	Nuguru/venkitapu	18.33	80.55

54	28-29 Jun 1989	2-Day	568	Kinwat	19.63	78.20
55	17-18 Jun 1990	2-Day	406	Kaddam	19.08	78.75
56	03-04 Jul 1994	2-Day	520	Rajura	19.70	79.35
57	11-12 Jul 2000	2-Day	437	Perur	18.55	80.38
58	27-28 Aug 2000	2-Day	481	Sironcha	18.83	79.97
59	01-03 Jul 1930	3-Day	774	Wani	20.05	78.95
60	13-15 Jul 1965	3-Day	600	Nizamsagar	18.08	77.92
61	17-19 Aug 1970	3-Day	533	Ramadugu	18.62	78.25
62	27-29 Jun 1975	3-Day	517	Kunghari	19.58	79.83
63	10-12 Aug 1983	3-Day	600	Navipet	18.70	78.03
64	12-14 Aug 1986	3-Day	630	Warora	20.22	79.02
65	17-19 Jul 1988	3-Day	503	Nuguru/venkitapu	18.33	80.55
66	29-31 Jul 1988	3-Day	753	Nuguru/venkitapu	18.33	80.55
68	**12 Jul 1994**	**1-Day**	**468**	**Chandur Railway**	**20.82**	**77.97**
69	**11-12 Jul 1994**	**2-Day**	**630**	**Paoni**	**20.78**	**79.65**
70	**10-12 Jul 1994**	**3-Day**	**673**	**Paoni**	**20.78**	**79.65**

Table 7, [21]source form the cwc Using the listed storms, envelope curves for the basin were derived for 1-day, 2-day and 3- day durations. The storms contributing to the envelope curves of the catchment have been listed in Table 3-11 to Table 3-13 for 1-day, 2-day and 3-day durations respectively. Envelope DAD curves for the catchment for 1-day, 2-day and 3-day durations are shown in Figure 3-25 to Figure 3-27. The insitu Standard Project Storm (SPS) were read from corresponding DAD envelope curves of the basin for 1-day, 2-day and 3-day durations separately. These SPS (insitu) values were multiplied with the MMF to obtain insitu PMP values. SPS (insitu), contributing storm, MMF and PMP (insitu) for 1-day, 2-day, and 3-day durations for different areas for the catchment. The Fig7

Are the due to flood , ffected area, population . Fig 8.flood and drought analysis graph

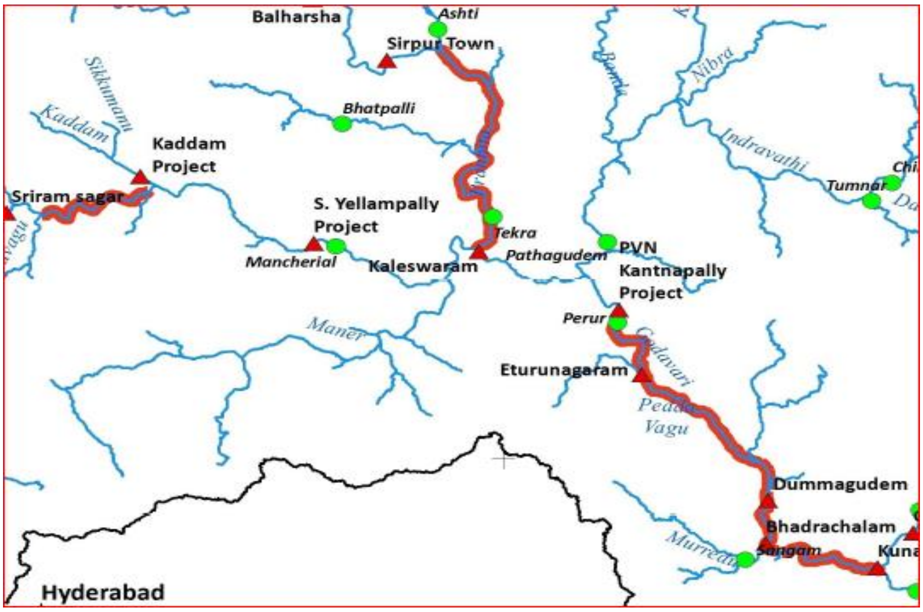

Fig.9 Flood prone area of the Godavari in Telangana and A.p (India)

The flood prone area in the Godavari basin has shown in Fig 9 [21]. Which indicates the effect the nearby area in the Middle and lower Godavari region . The rain

8. **Results and conclusions**

- The maximum floods are occurred from 1956 to 2016 is analyzed and form graph . It is observed Flood s are occur due to more intensity of rain fall and Percentage of deviation .

- The maximum droughts are occurred previous 1956 to 2016 is analyzed and imprested in the form graph from.
- It is observed that drought area occur due intensity of rain fall and Percentage of deviation is very less
- The flood prone areas that can be prevented by embankment with appropriate height and drought prone area can be built with ground water harvesting structures.
- flood and drought for the period 1956 to 2016 shown in the table column

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