FLOOD FREQUENCY ANALYSIS

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Concept:

Flood frequency means a period of years, based on a statistical analysis, during which a flood of a stated magnitude may be expected to be equalled or exceeded. Flood frequency means a statistical expression of the average time period between floods equalling or exceeding a given magnitude.

Table 6.13: Flood Frequency and Range Moving Average

Range of Year	Number of flood	2 range moving average	3 range moving average	4 range moving average	5 range moving average
1950-55	02				
1955-60	04	03			
1960-65	03	3.5	03		
1965-70	04	3.5	3.66	3.25	
1970-75	03	3.5	3.33	3.5	3.2
1975-80	05	04	4.0	3.75	3.8
1980-85	06	5.5	4.66	4.5	4.2
1985-90	09	7.5	6.66	5.75	5.4
1990-95	07	8.0	7.33	6.75	6.0
1995-2000	07	07	7.66	7.25	6.8
2000-05	11	09	8.0	8.25	8.0
2005 onward	08	9.5	8.66	8.25	8.4

Source: Irrigation and Waterways Department, West Bengal, 2008.

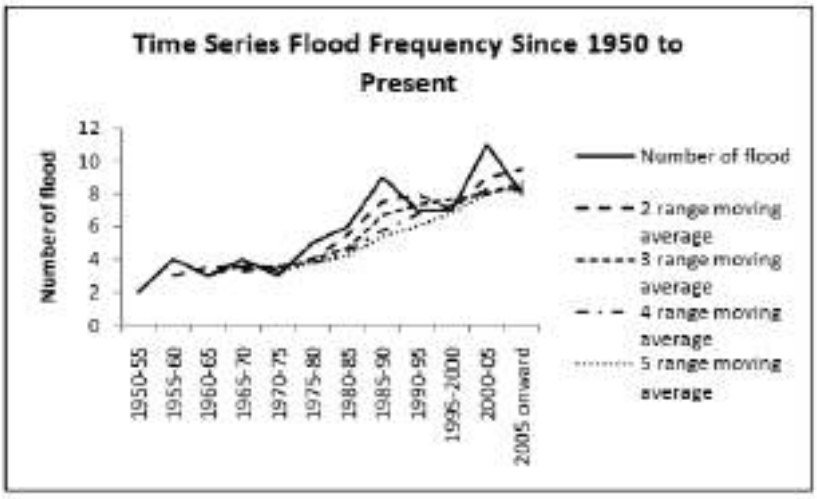

Fig. 6.8

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1. Recurrence interval: If the annual flood discharges of n (say 100) years are arranged in a descending order, then there will be some discharge figure (say 1000 m3/s) at serial order at m

(say 25). Then it can be said that this discharge of 1000 m3/s at m or more than this will occur in m (25 years) out of n (100 years), i.e. its recurrence interval is 25/100 = 1/4, i.e. once in 4 years.

It is also known as return period and generally represented by Tr.

Here,Tr = 4. This does not mean that in every 4 years it will occur once, but on an average in 40 years it will occur 10 times or in 80 years it will occur 20 times.

2. Probability: In the example, the probability of flood discharge of 1000 m3/s or more, occurring in 100 years is 1/4. It is generally denoted as p. Probability is reciprocal of recurrence interval, i.e. p 1/Tr. In this case, it is 0.25.

Thus, probability is always a fraction, i.e. less than 1.

3. Frequency: Probability expressed in terms of percentage is frequency. In the above example, the frequency is p *100 1/Tr * 100 25%.

Probability plotting

Arrange the available discharge figures (say n in total) in descending order. Let the serial order of this specific discharge Q be m. This serial order m is called rank or order of the observation. The recurrence interval and the probability of the specific discharge Q in the series can be calculated by the following methods.

1. California formula, $T_r = \frac{n}{m}$
2. Hazen's formula, $T_r = \frac{n}{m - 0.50}$
3. Weibul's formula, $T_r = \frac{n + 1}{m}$

m= rank

N= no of observation

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1960-65	03	3.5	03
1965-70	04	3.5	3.66
1970-75	03	3.5	3.33
1975-80	05	04	4.0
1980-85	06	5.5	4.66
1985-90	09	7.5	6.66
1990-95	07	8.0	7.33
1995-2000	07	07	7.66
2000-05	11	09	8.0
2005 onward	08	9.5	8.66

Source: Irrigation and Waterways Department, West Bengal, 2008.

Year	Annual Peak discharge in cumec (Q)
1978	6988.6
1979	312.5
1980	549
1981	622.6
1982	232.6
1983	1174.5
1984	56.6
1985	584.4
1986	2012.5
1987	3254.3
1988	268.5
1989	325.45
1990	621.6
1991	185.6
1992	1047.1
1993	273.5
1994	872.5
1995	422.18
1996	948.2
1997	912.9
1998	606.3
1999	7568.4
2000	8978.6
2001	254.7
2002	226.4
2003	90.56
2004	5686.4
2005	141.5
2006	2212.3
2007	962.2

California Method					Allen Hazen Method		
Year	**Annual highest flood level (m.) (descending order)**	**Rank (m)**	**Recurrence Interval (T = n / m)**	**Percent Probability (T = n/ m)*100**	$T = \frac{n}{m - \frac{1}{2}}$	**Percent Probability 1/ T * 100**	**Remarks**
1978	31.10	1	34.0	2.94	68	1.47	
2000	29.79	2	17.0	5.88	22.66	4.41	Mean stream flow level = 26.66 m.
1999	29.35	3	11.33	8.82	13.6	7.35	
2004	28.57	4	8.50	11.76	9.71	10.29	

Year	Weibull's Method				Remarks
	Annual highest flood level (m.) (descending order)	**Rank (m)**	**Recurrence Interval (T = n + 1/ m)**	**Percent Probability** 1/t*100	
1978	31.10	1	35	2.86	
2000	29.79	2	17.50	5.71	Mean stream flow level = 26.66 m.
1999	29.35	3	11.66	8.57	
2004	28.57	4	8.75	11.43	
1987	28.50	5	7	14.29	
1986	27.82	6	5.83	17.14	