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Short communication

Analysis of regional droughts intensity and frequency over north Gujarat

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Drought is one of the most frequently happening national disasters in India. Droughts are the costliest natural disaster of the world and affect more people than any other natural disaster (Wilhite, 2000). First Scarcity Manual was Droughts are generally considered as periods with insufficient precipitation, soil moisture and water resources for sustaining and supporting the socio-economic activities of a region. Indian agriculture continues to be a gamble of the vagaries of monsoon, rainfall being most critical because nearly 70 % of the net sown area is still rain dependent (Narain *et al,*. 2006). Greogory and Parthasrathy (1986) studied large-scale droughts over India. In north Gujarat monsoon-rainfall is the only possible mean for ground water recharge. The monsoon activity commences from middle of June and retreats by mid September in the region. A continuous spell of poor rainfall during successive years in combination with high temperature affects ground water recharge and imparts stress on ground water resources leading to severe drought in many parts of this region. The rainfall distribution is extremely uneven and irregular as the state is located at the peripheral boundary of the main current of South-West monsoon. The average annual rainfall over different parts of north Gujarat varies widely from 250 mm in the Western half of Kutchh to 1000 mm in the eastern parts. Generally, the number of rainy days increases towards the eastern and the southern parts of the state.

Six stations viz Bhuj (23.15°N and 69.49°E, Altitude 110.0m), Kandla (22.98° E and 70.21 °E, Altitude 3.0m), Deesa (24.26°N and 72.18° E, Altitude 150.0m), Sardarkrushinagar (24.32° N and 72.32° E, Altitude 152.0 m), Idar (23.50°N and 73.02° E, Altitude 195.0 m) and Ahmedabad (23.03° N and 72.40 °E, Altitude 53.0 m) were selected for study where long period (>30 yeras) rainfall data were available. The drought intensity as per the India Meteorological Department classification (annual rainfall deficit from normal) as given below was calculated.

Criterion for drought intensity

Departure of rainfall from normal (%)	Drought intensity
0-25%	Mild
26-50%	Moderate
>50%	Severe

Bhuj experienced 7 mild, 6 moderate and 11 severe droughts during the past 42 years. Drought of different intensities at Bhuj is demonstrated in Table 1. Annual rainfall of Bhuj varied from 13.6 mm in 1987 to 917.0 mm in 1989 with a normal of 384.2 mm with standard deviation (SD) of 247.9 mm and coefficient variance (CV) 64.5%. During the last 42 years, 22 years (15%) rainfall were below normal. The severe droughts were occurred once in 4 years, while moderate droughts occurred once in 7 years and mild droughts occurred in every 4 years (Table 1).

Drought of different intensities at Kandla showed that the severe drought occurred once in 5 years moderate droughts occurred once in 6 years and mild droughts occurred in every 5 years (Table 1).

The frequency of drought conditions were more common at Sardarkrushinagar followed by Deesa, Ider, and Ahmedabad.

Sixty two percent (19 years) of the years received rainfall less than normal at Sardarkrushinagar. Drought of different intensities at Sardarkrushinagar (Table 1) showed severe drought years. The severe drought was occurred once in 7 years while moderate droughts occurred once in 9 years and mild droughts occurred once in 6 years (Table 1). Nine years received more than 20% rainfall than normal rainfall during the period of 31 years (1981 - 2010).

Drought of different intensities at Ahmedabad is showed that the severe droughts occurred once in 11 years. While moderate droughts occurred once in 6 years and mild droughts occurred in every 4 years. Fifty five percent (23 years) of the years received rainfall less than normal at Ahmedabad. Fourteen

Table 1: Frequency of drought of different intensity

Agroclimatic Zones	Station	Drought Intensity	Years	Frequency
North West	Bhuj	Mild	1971, 1977, 1984 and 1990	once in 4 years
Agroclimatic		Moderate	1973, 1983, 2000, 2001, 2004 and 2008	once in 7 years
Zone(NWAZ)		Severe	1969, 1972, 1974, 1982, 1985, 1986, 1987, 1991, 1993, 1995, 1996 and 2002	once in 4 years
	Kandla	Mild	1971, 1983, 1984, 1986, 1992, 1996, 1998, 2000 and 2008	once in 5 years
		Moderate	1973, 1982, 1985, 1989, 1990, 1995 and 2009	once in 6 years
		Severe	1969, 1972, 1974, 1987, 1991, 1993, 1999, 2001 and 2002	once in 5 years
North Gujarat	Deesa	Mild	1970, 1979, 1983, 1988 and 2008	once in 4 years
Agroclimatic Zone(NGAZ)		Moderate	1969, 1971, 1972, 1980, 1995, 1996, 1999, 2000, 2004 and 2009	once in 5 years
		Severe	1974, 1985, 1986, 1987, 1991 and 2002	once in 7 years
	Sardarkrushinagar	Mild	1980, 1981, 1983, 1984, 1995, 2001, 2005 and 2008	once in 6 years
		Moderate	1988, 1996, 2000, 2004 and 2009	once in 9 years
		Severe	1985, 1986, 1987, 1991, 1999 and 2002	once in 7 years
	Ider	Mild	1978, 1981, 1982, 1985, 1989, 1995, 1996, 2001, 2004, 2008 and 2009	once in 4 years
		Moderate	1972, 1980, 1994 and 1997	once in 11 years
		Severe	1969, 1974, 1980, 1986, 1987, 1999, 2000 and 2002	once in 11 years
	Ahmedabad	Mild	1978,1979,1980,1982, 1984,1985,1988,1993,1996, 2000,2001 and 2008	once in 4 years
		Moderate	1971,1974,1986,1991, 1992, 1999 and 2009	once in 6 years
		Severe	1972, 1987, 1995 and 2002	once in 11 years

years received more than 20% rainfall than mean rainfall during the period of 42 years (1969 - 2010).

The maximum rainfall deficiency occurred during at region Ider, which was characterized as severe drought years. The severe drought was occurred once in 11 years, while moderate droughts occurred once in 11 years and mild droughts occurred in every 4 years (Table 1). Ten years received more than 20% rainfall than normal during the period of 40years (1969-74 and 1977-2010. Fifty seven percent (23 years) of the years received rainfall less than normal at Ider.

The severe droughts occurred once in 7 years, while moderate droughts occurred once in 5 years and mild droughts occurred in every 4 years (Table 1). Thirteen years received more than 20% rainfall than normal during the period of 42 years (1969 - 2010).

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