Agroclimatic DroughtAnalysis In Mahasamund District of Chhattisgarh

Abstract

Drought can have a serious impact on health, agriculture, economy, energy and the environment. Drought is a prolonged dry period in the natural climate that can occur anywhere in the world. It is a slow-onset disaster characterized by the lack of precipitation, resulting in a water shortage. The study was conducted to analyze agroclimatic drought in Mahasamunddistrict of Chhattisgarh . Mahasamund district is chosen for the study on agroclimatic drought analysis and also to examine the farmer's adaptability under AICRPAM-National Innovations on Climate Resilient Agriculture (NICRA) project. Two time periods have been taken into account viz., annual and SWM season. Long term data has been analyzed to give a clear picture through Trend software.Rainfall data for Mahasamund, Bagbahara, Basna, Saraipali , Pithora blocks of Mahasamund district were collected from the Department of Agrometeorology, Indira Gandhi Krishi Viswavidyala, Raipur. Study is as a part of CRIDA, (Hyderabad) sponsored NICRA project which has been implemented in Department of Agrometeorology, Indira Gandhi Krishi Vishwavidyalaya, Raipur, (C.G.) w.e.f. 2011.The result showed significant increasing trendfor high rainfall events in summer and winter season particularly for Mahasamund block. Long term data analysis indicates that only Saraipali block suffered from agricultural drought while other blocks do not indicate any rabi drought.

Key Words : Drought, Rainfall, Trend Analysis, Kharif Drought, Rabi Drought.

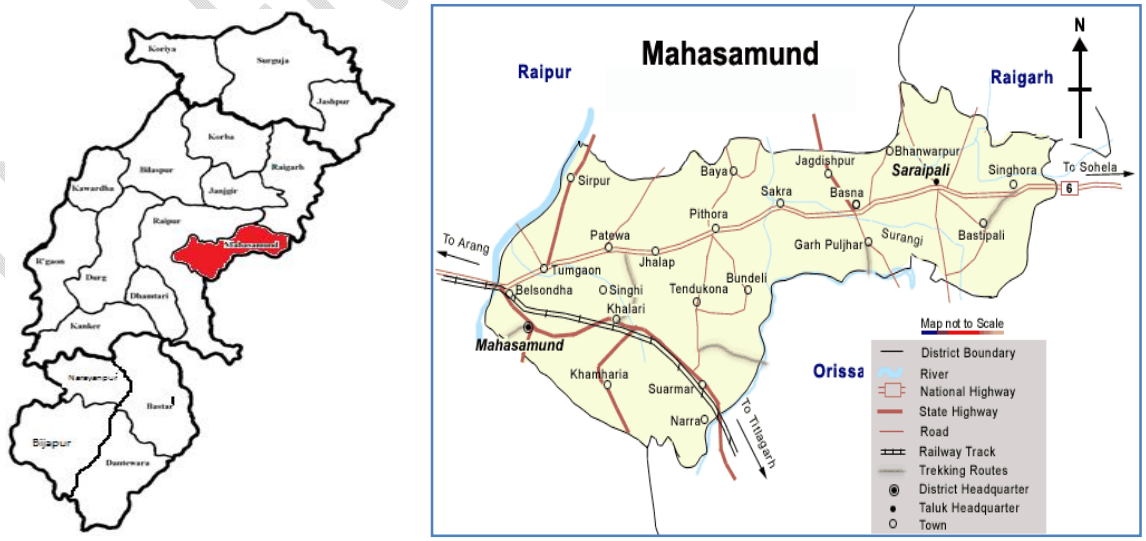
Introduction:

Chhattisgarh state, situated in Eastern India, is located between 17º 46’ N and 24º 05’ N latitudes and 84º 15’ E and 84º 24’ E longitudes (**Fig.1**).Mahasamund district (NICRA-AICRPAM domain district) is spread out in an area of 4790 Sq. Kms in the Central-East of Chhattisgarh State. The district lies between 20°47' to 21°31'30" latitude and 82°00' to 83°15'45" longitude, surrounded by districts of Raigarh and Raipur of Chhattisgarh State and Nawapara and Bargarh districts of Odisha. The climate of NICRA-AICRPAM district Mahasamund which was moist sub-humid in the beginning of 20th century has changed to semi-arid type by the end of the 20th century. Added to the agony Mahasamund district comes under trans-Mahanadi area where the soils are very light (sandy loam) and hence the impact of climate change is easily discernible. In view of this decreasing rainfall pattern, Mahasamund district is chosen for the study on climate resilience on agriculture and also to examine the

farmer's adaptability under AICRPAM-National Innovations on Climate Resilient Agriculture (NICRA).

In the coming years, climate resilent agricultural technologies already developed will be refined. Mahasamund district located in eastern part of the state about 55 km from University H.Q. is selected as the study area for demonstration of technologies under climate resilience. The KVK situated at Mahasamund has been part of these NICRA-AICRPAM activities. Being mainly a mono-cropped region, rice is the main cereal crop of the district during kharif season. Nearly 88.61 percent are allocated under paddy crop in Kharif season. The total area under different crops in *kharif* and *Rabi* season is observed as 83.91 percent and 7.57 percent respectively. Remaining 8.51 percent of the total cropped area is allocated during summer season in the district. The area under rice crop is observed to be as 74.35+7.47= 81.82 percent of the total cropped area of the district. The remaining area is allocated under other crops like urd, groundnut, wheat and gram etc in different season. Urd is second most important crop of the region during *kharif* season which occupies 3.64 percent area of the gross cropped area. However, several other cereal crops are being grown in *kharif* as well as during rabi season in this district, although the area under cultivation is very less.

The total geographical area of the state is 1,37,90000 hectares. Out of the total geographical area, Mahasamund district has 496300 hectare area constituting 3.60 percent. The cropping intensity of the district is 119.2 percent as compared to 131.27 percent in the state. The land utilization pattern of the NICRA domain district as compared to CG state is presented in Table-1.



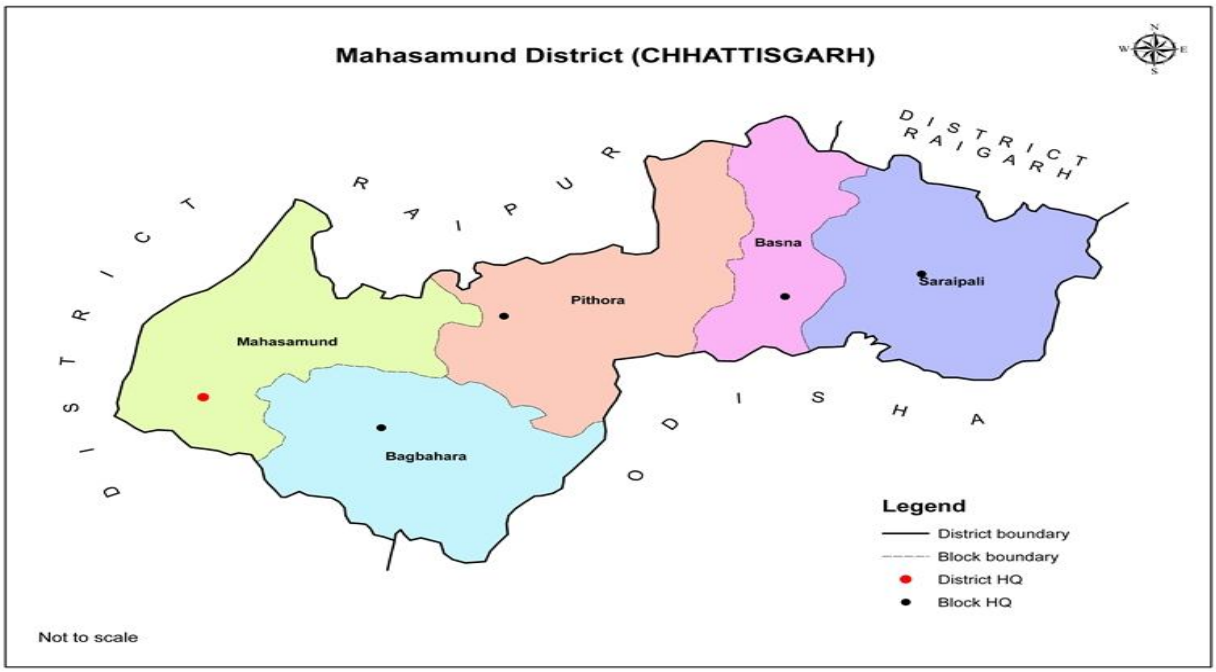


Fig. 1: Location map of Mahasamund district and blockwise boundaries

Table-1: Land utilization pattern of Chhattisgarh and NICRA domain district in Chhattisgarh (area in hectares)

S.No	Particulars	CG state	Mahasamund district
01	Total Geographical Area	13790000	496300 (3.60 %)
02	Area Under Forest	5977000	11020(1.74)
03	Land Under Non-Agriculture use	1004000	47510(4.73)
04	Permanent Pasture and Grazing	855000	30250(3.54)
05	Cultivable Waste Land	344000	8210 (2.37%)
06	Fallow land (old fallow+current fallow)	523000	13060 (2.50%)
07	Net Cropped Area	4710000	263700 (5.60%)
08	Gross Cropped Area	6183000	314370 (5.08%)
09	Cropping intensity (%)	131.27	119.2

Source: Department of Agriculture and Statistics, Mahasamund, 2011

Note: Figure in parenthesis indicates percentages of total geographical pattern of the state

Methodology :

Here two time periods have been taken into account viz., annual and SWM season. Long term data has been considered and analyzed to give a clear picture through Trend software.Rainfall data for Mahasamund, Bagbahara,Basna,Saraipali, Pithora were collected from the Department of Agrometeorology, Indira Gandhi Krishi Viswavidyala, Raipur. The length of rainfall data period available for Bagbahara (1984-2022), Basna (1990-2022), Mahasamund (1973-2022), Saraipali (1981-2021), Pithora (2001-2022) were used for study. Rainfall data was converted into seasonal viz. winter (Jan–Feb), summer (March–May), southwest monsoon (June –Sep) and annual format using weathercock software.

Result and Discussion :

a. Trend analysis of rainfall and rainy days in different blocks of Mahasamund district:

Rainfall is not found to be decreasing significantly. Generally perception of farmers is like that rainfall has decreased but for both the annual and SWM basis, rainfall has not decreased. However, pattern of rainydays which determine length of crop growing season is found to be increasing for Pithora block (**Table-2**).

Table 2: Trend analysis for rainfall and rainy days of blocks in Mahasamund district

Blocks and Time - Period	Rainfall		Rainy day	
	Annual	SWM	Annual	SWM
Bagbahara (1984-2022)	3.651 (NS)	2.973 (NS)	-0.042 (NS)	-0.057 (NS)
Basna (1990-2022)	9.60 (NS)	6.399 (NS)	0.008 (NS)	-0.125 (NS)
Mahasamund (1973-2022)	0.401 (NS)	-0.335 (NS)	0.127 (NS)	0.122 (NS)
Saraipali (1981-2021)	0.383 (NS)	-1.614 (NS)	-0.029 (NS)	0.007(NS)
Pithora (2001-2022)	9.37 (NS)	-11.77 (NS)	-0.389 (NS)	**0.458 (0.05)**

b. Studies on Agricultural Drought in Mahasamund district of Chhattisgarh State for Strategic Crop Planning in Rice Based Cropping System.

Blocklevel analysis of agricultural drought has been done. Basically there are two seasons viz. kharif and rabi. Kharif season agricultural drought has been shown in **Table 3.** Drought during kharif season indicates that all blocks can experience intermittent dry spells of 4 weeks. Maximum agricultural droughts during Kharif season are being experienced in Mahasamund block followed by Bagbahara block. However, the least kharif agricultural droughts are being experienced in Saraipali.

Table -3: Long-term analysis of Agricultural drought (kharif season) in different blocks of Mahasamund district

Station	Mahasa Mund	Saraipali		Bagbahara		Basna		Pithora	
Year	Drought Week	Year	Drought Week	Year	Drought Week	Year	Drought Week	Year	Drought Week
1991	25 – 28	1991	25 - 28	1994	38 - 41	1992	37 - 40	1992	37 - 40
1992	37 – 42	1998	38 - 41	1995	36 - 42	1994	38 - 42	1994	38 - 42
1994	38 - 42	2000	39 - 42	2000	39 - 42	1999	26 - 30	1995	36 - 41
1995	36 - 41	2008	39 - 42	2001	35 - 38	2000	39 - 42	2000	29 - 32
1996	37 - 42	2015	39 - 42	2002	26 - 30	2004	35 - 38		39 - 42
1998	38 - 41	2018	39 - 42	2004	35 - 38	2006	24 - 27	2004	35 - 38
2000	34 - 37			2006	37 - 42	2008	39 - 42	2008	39 - 42
	39 - 42			2008	39 - 42	2011	38 - 42	2011	39 - 42
2002	26 - 30			2010	22 - 25	2015	39 - 42	2015	39 - 42
	38 - 41			2011	39 - 42	2018	39 - 42	2018	39 - 42
2004	35 - 38			2015	39 - 42				
2006	39 - 42			2018	39 - 42				
2008	39 - 42								
2009	35 - 38								
2011	39 - 42								
2015	39 - 42								
2018	39 - 42								
2021	25 - 28								

Rabi season drought analysis has been shown in **Table-4**. Long term data analysis indicates that only Saraipali block suffers from agricultural drought while other blocks donot indicate any rabi drought.

Table -4: Agricultural drought (Rabi season) in different blocks of Mahasamund district

Station	Mahasamund	Saraipali		Bagbahara		Basna		Pithora	
Year	Drought Week	Year	Drought Week	Year	Drought Week	Year	Drought Week	Year	Drought Week
No drought		1996	40 - 45	No drought		No drought		No drought	
		2000	40 - 45						
		2008	40 - 45						
		2011	40 - 45						
		2015	40 - 45						
		2018	40 - 45						

5.7. Studies on high rainfall events trend in different blocks of Mahasamund district:

High rainfall events have been studied for different seasons in different blocks. Results have been shown in **Table-5**. There have been mostly non-significant trends but there has been significant increasing trend in summer and winter season particularly for Mahasamund block.

Table -5: Trends of high rainfall events in different blocks of NICRA-AICRPAM district.

SI.	Districts	Winter	Summer	SWM	NEM	Annual
1	**Bagbahara**	NS – Inc	**S – Inc ***	NS – Inc	NS - Inc	NS – Inc
2	**Basna**	NS – Inc	NS – Inc	NS – Inc	NS – Inc	NS – Inc
3	**Mahasamund**	**S - Inc ***	**S - Inc ***	NS – Inc	NS – Inc	NS – Inc
4	**Pithora**	NS – Inc	NS – Inc	NS – Inc	NS – Inc	NS – Inc
5	**Saraipali**	NS - Inc	NS – Inc	NS - Inc	NS –Dec	NS – Inc

Conclusion:

This work has been carried out so that scenario of regional agroclimatic drought at block level can be understood. The study area records a fluctuating trend of South West Monsoon rainfall, which is the main source of water supply for rainfed agriculture. This rainfall is the main source of water for agricultural activities in the region. There has been significant increasing trend in summer and winter season rainfall particularly for Mahasamund block.Long term data analysis indicates thatonly Saraipali block suffers from agricultural drought while other blocks do not indicate any rabi drought.

However, the least kharif agricultural droughts are being experienced in Saraipali and maximum agricultural droughts during Kharif season are being experienced in Mahasamund block followed by Bagbahara block.For managing the situation in these drought prone blocks, farmers need to be advised to gofor less water requirement crops or varieties. There are also possible options in kharif season i.e. suitable alternative crops like groundnut, arhar, millets etc.

References:

Bharath AL and Venkatesh B., Long term drought, trend analysis, and homogeneity analysis for the Belagavi district, Karnataka, J. Earth Syst. Sci.2022;131:238.

Arpana, Gill, KK, Samanpreet K, Bhatt K, Sandhu SS ,Decadal Analysis of Rainy Days and Extreme Rainfall Events in Different Agroclimatic Zones of Punjab, Agriculture Archives 2022.

Kaur B. , KaurN., Kataria SK and Singh S, Assessing the variability in temperature and rainfall extremes using RClimdex in Jalandhar district of Punjab, Journal of Agrometeorology. 2022; 437-439.

Mundel PS, Upadhye SK, Wale VD, Jadhav JD, Sthool, VA and Bhagat AA,Weekly Rainfall and Rainy Days Trend Analysis for Crop Planning in Baramati Tehsil of Pune District,International Journal of Current Microbiology and Applied Sciences .2021;10(02): 589-598.

Singh R , ChandravanshiA , Gurjar S , Saxena B and Sahu KK, Trend Analysis of Rainfall Patterns in Rajnandgaon District, Chhattisgarh, India, International Journal of Environment and Climate Change. 2023; 3553-3561

Bhuarya SK, ManikandanN., Chaudhary JL, Khalkho D and Pradhan S, Temperature trend analysis of four stations of Chhattisgarh state, Journal of Agrometeorology2017; 19(4) : 378-379..

Wale VD, Sthool VA and Upadhye SK, Trend analysis of rainfall and rainy days using Mann Kendall method and sen's slope estimator in Tasgaon Tahsil of Sangli District of Maharashtra (India), Journal of Pharmacognosy and Phytochemistry .2020; 9(4): 99-102.

Pandey V, SrivastavaPK, SinghSK, PetropoulosGPand Mall RK, Drought Identification and Trend Analysis Using Long-Term CHIRPS Satellite Precipitation Product in Bundelkhand, India,Sustainability. 2021;(13)1042.