

# METEOROLOGICAL CUM AGRICULTURAL DROUGHT REOCCURRENCE WITH CLIMATE CHANGE OF KARSTIC REGION IN CHHATTISGARH STATE

<sup>1</sup>Dr. P K Gupta, <sup>2</sup>Mr. Rishi Kumar Gupta, <sup>3</sup>Ritika Jayaswal

<sup>1</sup>Professor, <sup>2</sup>Founder

<sup>1</sup>Department of Civil Engineering, <sup>2</sup>Chartered Engineers,

<sup>1</sup>Dr. C V Raman Institute of Science & Technology Raman University, Kota, Bilaspur, Chhattisgarh, India, premkg14@gmail.com, <sup>2</sup> & <sup>3</sup> Chartered Engineers, Bilaspur, Chhattisgarh, India

## Abstract

Karstic region of Chhattisgarh has cluster of more than one dozen operating Cement Plants for cement production as testimony to Industrial growth since the inception of the state. It has been generating cum release on contrast, the same magnitude of Carbon Dioxide to the local atmosphere. It has adverse impact on climate with local climate change in terms of irregular to decreasing pattern of rainfall and allied aspects. This has direct linkage to ‘Paniya Aakal’ in the rice bowl of CG.

Paniya Aakal has been explained scientifically through meteorological cum agricultural drought reoccurrence in the studied area. It has been discussed through different rainfall characteristics under varied time scale at regional, district and yearly basis along-with other inputs of local hydrological cycle. The monitoring methodology and mode of reoccurrence of Paniya Aakal has been overviewed.

## Introduction

Drought refers to the absence/scarcity of water in an area for prolong period in general manner. It has been classified into four categories namely: Meteorological, Agricultural, Hydrological and Socio-economic. It acts as creeping disaster in Karstic region and locally well known as “Paniya Aakal” due to reoccurrence of meteorological cum agricultural drought [2].

Meteorological drought is characterized through rainfall deficiency on long term. If the rainfall deficiency is more has 26-50% than normal rainfall, it is called moderate meteorological drought. The severe meteorological drought occurs, if the rainfall deficiency is more than 50 % of normal rainfall. It may be related with local climate change on account of enormous Carbon Dioxide release into atmosphere through operating Cement plants, equivalent to annual quantity of cement production.

Agricultural drought is followed, after four consecutive weeks of meteorological drought with rainfall occurs less than 50 mm from 15 May to 15 October [5]. It is influenced by deteriorating trend of moisture content in soil and low content of evapo-transpiration in vegetation plant for proper plant growth. It normally affects the 80% growth of paddy crop in Kharif season.

## Area of Study

Karstic region of CG belongs to central portion of state, within Mahanadi river catchment. It covers districts namely: Dhamtari, Rajnandgaon, Durg, Raipur, Balodabazaar, Bilaspur, Jajgiri-champa and Raigarh comprises with Rice Bowl of CG. It is illustrated through Fig.1.



Fig. 1 Location map for area of Study

### Origin of Meteorological & Agricultural Drought

The origin of Meteorological drought depends upon the abnormality to anomalous nature of irregular rainfall pattern in an area. It is due to Human influence on local hydrological cycle and atmospheric disturbances on account of climate change.

The origin of Agricultural drought depends upon inadequate soil moisture in local soil condition and irregular evapo-transpiration during entire growth period of vegetation plant. It exhibits the adverse behavior of rain water as per water requirement to the entire growth of vegetation plant. It leads to crop failures, which ultimately drop the paddy production [3].

### Governing factors for Reoccurrence of Meteorological cum Agricultural drought in Karstic region of CG

Basically, “Payal Aakal” depends upon the degree of human influence on land-water, uses & abuses and inadequate conservative measures. There are six governing factors and as follows:-

- Decrease in vegetation index: It is due to fast rate, unplanned cutting of trees with name sack forestation [8].
- Deficiency in Rainfall pattern: It has been inferred through analysis of rainfall data. It is due to varied socio-economic factors and population pressure.
- Increase in dry spell during Rainy season: It is due to enhancing evapo-transpiration and reducing soil moisture condition.
- Increase of surface Temperature on land: It is due to reducing open cum agricultural land, increasing concrete jungle growth.
- Increase in cement production: The carbon dioxide emission rate and cement production rate quantitative vise have same ratio and is responsible for local climate change.
- Adverse human influence on local Hydrological cycle: It is due to fast rate overuse of water [need for rain water harvesting], exploitation of groundwater [depletion of groundwater table], pollution/contamination of water body etc.

### Analysis and Interpretation of Rainfall data

“Paniya Aakal” in karstic region of CG is characterized through excess rainfall in the start of rainy season [month of June-July], dry spell in the middle of rainy season [month of August-September] followed with low magnitude of rainfall in diminishing nature during the end phase of rainy season [6].

The first crop failure in Ratanpur area of Bilaspur had been recorded during 1828-29 due to agricultural drought. The low magnitude of rainfall during rainy season of 1868-69 and 1899-1900, respectively in Ratanpur area again had been observed due to failure of rainfall, resulting severe distress condition among paddy growth and loss of crop.

The systematic rainfall data had been collected since 1901 at I M D data center, Raipur and is continued presently. Khutaghat reservoir in the Ratanpur area was constructed in 1931 for famine relief work by British Government by converting old lake into irrigation purpose. The available rainfall data for karstic nature of CG has been analyzed statistically in terms of determining mean, standard deviation, maximum, minimum, coefficient of variation and standard error for rainy season [8].

The record of rainfall data during the start of rainy season [July month] in CG state for twenty year with gap of five year has been summarized in Table 1.

S N	Year	Rainfall in start of rainy season [mm]
1	2000	380
2	2005	550
3	2010	410
4	2015	180
5	2020	370

Table 1 Rainfall data during the start of rainy season in CG state

The interpretation of Table 1 reveals the magnitude of rainfall in early phase of rainy season has increasing trend with cyclic low-high order. It is due to higher surface temperature of land, and responsible for removing nutrients of soil along-with rain wash water. It results in unsettlement and poor survival in fertility of agricultural soil with loss of 26-33 % kharif crop.

The record of rainfall data during the end phase of rainy season [October month] in CG state for twenty year with gap of five year has been summarized in Table 2.

S N	Year	Rainfall in end of rainy season [mm]
1	2000	10
2	2005	55
3	2010	07
4	2015	05
5	2020	70

Table 2 Rainfall data during the end of rainy season in CG state

The interpretation of Table 2 reveals the minimum-maximum range of 05-70 mm with comparison of average annual rainfall of 1100-1200 mm. It has been the testimony for low magnitude of rainfall at ending phase of rainy season [3].

The middle phase of rainy season has dry spell of long duration. It causes low soil moisture content and evapo-transpiration and leads to water scarcity for kharif crop.

The monthly rainfall data for Bilaspur during 2020 has been summarized for overall rainfall pattern evaluation, with months of rainy season in bold letter as Table 3 [4] & [9].

S N	Months	Rainfall in mm
1	January	20
2	February	30
3	March	20
4	April	20
5	May	20
6	<b>June</b>	<b>200</b>
7	<b>July</b>	<b>370</b>
8	<b>August</b>	<b>360</b>
9	<b>September</b>	<b>200</b>
10	<b>October</b>	<b>070</b>
11	November	010
12	December	000

Table 3 Monthly rainfall data during 2020 for Bilaspur

The interpretation of Table 3 reveals the average annual rainfall =1200 mm with rainy season rainfall =1130 mm i e 95 % of average annual rainfall.

### Monitoring of Meteorological cum Agricultural Drought

The monitoring of drought is necessary to assess the reoccurrence of meteorological cum agricultural drought for estimation of crop damage and ascertain the nature of relief measure. It is carried through INDICES based upon the nature of data collected namely: Secondary sources, Satellite observation and Computer simulation modeling [7].

The secondary source of rainfall data is carried through IMD published report, research paper and provides Standardized Precipitation Index [SPI]. The satellite data observation Vegetation Index [VI], Normal

Vegetation Index [NDVI] and is carried out for karstic region of CG [6]. The computer simulation modeling deals with multi-variate standardized Drought Index with numerical approach. It infers the socio-economic aspects for reoccurrence of drought [1].

## Conclusion

‘Paniya Aakal’ has been emerged as enemy number one for “Bowel of Rice” in CG. The reoccurrence of such event has negative impact on the overall economy of CG. It is estimated that 25-33% annual loss in rice production is due to this phenomena on account of the following factors:-

- Loss of Vegetation Index---deforestation / haphazard cutting of trees.
- Changing Land-use/land cover pattern---loss of agricultural open land.
- Higher release of Carbon Dioxide to atmosphere --- enhanced Cement Production.
- Improper watershed management practices.
- Lack of systematic cum scientific study to monitor the mechanism for reducing adverse impact of water scarcity.

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