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# Temporal Analysis Of Changing Groundwater Level In Dausa District From 1991 To 2021

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## ABSTRACT

Groundwater is playing a significant role in the agricultural growth of India. Hydrology in India has a historical foot print of several millennium. as many archaeological evidences proves this.This research has been done to understand the changing dynamics of availability of ground water in Dausa district. To analyse the change in availability of groundwater the key wells data are used and with the help of the Kriging Interpolation technique these data have been converted into surface data.

**Keywords:**Ground Water Level, Kriging Interpolation, Key wells data.

## 1. Introduction

Groundwater is local and open access common property natural resource therefore any one can bore a well and pump out without limit. India is the world's largest user of groundwater (Shah, T.,2007; Dynamic groundwater resources of India, 2022). More than 60% of irrigated agriculture and 85% of drinking water needs depend on the groundwater resources (Chinnasamy et al., 2013; Bhujal news 2021, CGWB) out of total water used in irrigation 61.6% water for irrigation is from groundwater which includes wells, dug wells, shallow tube wells and deep tube wells (Suhag, 2016; Namara, 2019).

Groundwater is playing a significant role in the growth of India. Hydrology in India has a historical foot print of several millennium. as many archaeological evidences proves this. The hydrological knowledge of Indians is about 5000 years old. Presently India has 16% of the world's population but has only 4% of the total available fresh water(Gleick, P. H., 2000). This research has been done to understand changing dynamics of availability of ground water in Dausa district.

### *1.1.Study Area*

The Dausa district is located in the eastern region of Rajasthan between 26˚ 22′ to 27˚ 50′ northern latitude and 76˚ 53′ to 78˚ 16′ eastern longitude. The geographical areaof the district is 3432 square kilometres, accounting for almost 1% of the statestotal area.The district is drained by three important rivers and the district falls within the three corresponding river basins namely 'Banganga River Basin' in northern part, 'Banas River Basin' in southern part, and 'Gambhir River Basin' is in lower eastern part. The climate of Dausa is generally dry and is subject to extremeness of cold and heat at various places. The minimum (3.33 $^0$ C) and maximum (44 $^0$ C) temperatures in the district. Average annual rainfall is 570.3mm over the district.

### 1.2.Methodology

Methodology is the strategy used to accomplish the defined goals. This methodology aims to highlight the methods followed in the study to accomplish the objectives ofanalysis of GWL. First, we used the key wells data of GWL for the years of 1991, 1996, 2001, 2009, 2016 and 2021 and then through the technique of Kriging Interpolation we converted these data into surface data for the proper representation

*1.2.1.Data Sources*

A variety of Data set has been explored, compiled, and used in order to obtain a sequential set of data which ultimately aided in examining the region's spatial phenomenon. The details about the data used have been mentioned below in sequence.

*1.2.1.1.Groundwater Level*

Ground water refers to the water stored below the surface of the earth. GWL data will enable us to examine the inter-relationship between availability of ground water level change of Dausa district of Rajasthan. GWL wasprovided by the Central Ground Water Board, Western Regional Centre, Jaipur.  The data was acquiredfor the Pre-monsoon and Post-monsoon period for the years 1991 to 2021. However, only the post monsoon season data has been used in the current study due to fact that the effect of rainfall will get normalized.

### *1.2.2.Method*

*1.2.2.1. Groundwater level analysis*

For this study, groundwater data of post-monsoon period ofDausa district for the years 1991 to 2021wascollected from theCentral Ground Water Board, Western Regional Centre, Jaipur. The analysis was done for observing thetemporal change in rabi session phase. The point data were surfaced using kriging interpolation method. The surfaced data were averaged for the five times period i.e.,1991 to 1996, 1996to 2001, 2001 to 2009, 2009 to 2016 and 2016 to 2021. After this mean and standard deviation values have been calculated of pre and post monsoon of data which tells about the availability and variation of groundwater level in that particular year.

## 1. Result and Discussion

*Ground Water Level Status in Dausa District*

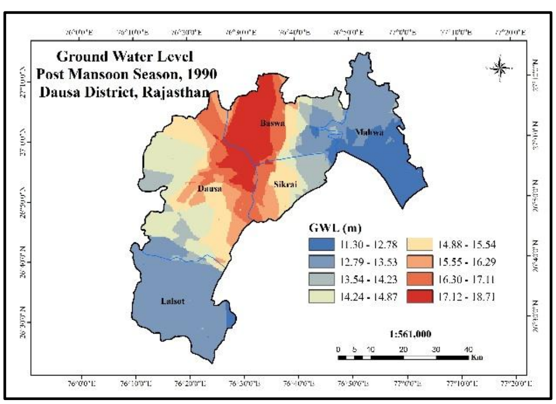
This information will help us identify the impact of monsoon rainfall on groundwater recharge and the fluctuations that have been caused after irrigation period.Table 1Thepost-monsoon period, the groundwater levels varied from 11.30 meters to 18.71 meters, with a mean of 14.56 meters and a standard deviation of 1.65 meters from the mean value. Season later, after the rabi irrigation period, during the pre-monsoon groundwater levels ranged from 12.39 meters to 19.56 meters, with an average of 15.66 meters and a standard deviation of 1.57 meters. During the post monsoon period the range of ground water level is from 6.66m to 21.46m eventually having a higher standard deviation of 3.56 from the mean value. While during the pre-monsoon season the range dips down further from surface and is from 8.61m to 22.56m and therefore a standard deviation of 3.40 is recorded from the mean value of 13.89.

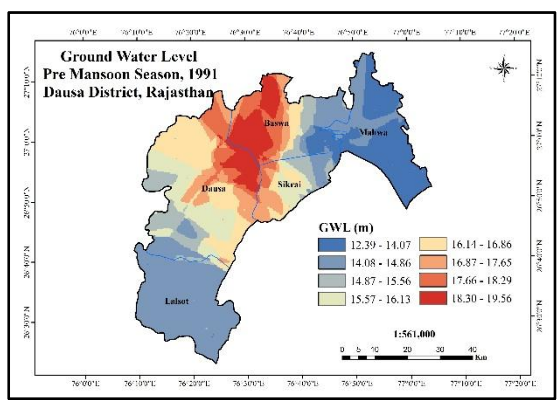
Table 1 Statistical analysis of GWL (m) for post and pre-monsoon season

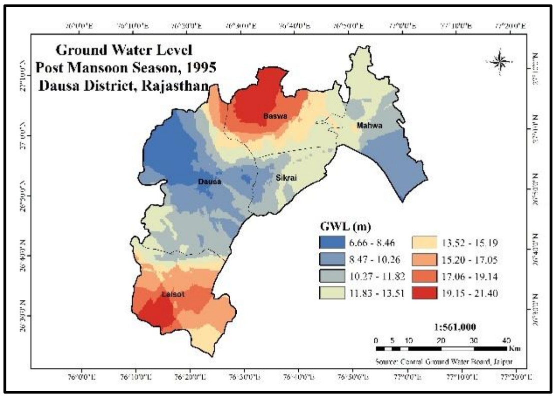
| Year | Season | MIN | MAX | MEAN | STD |
|---|---|---|---|---|---|
| **1990** | Pre-monsoon | 12.39 | 19.56 | 15.66 | 1.57 |
| **1991** | Post-monsoon | 11.3 | 18.71 | 14.56 | 1.65 |
| **1995** | Pre-monsoon | 8.61 | 22.56 | 13.89 | 3.4 |
| **1996** | Post-monsoon | 6.66 | 21.46 | 12.84 | 3.56 |
| **2000** | Pre-monsoon | 9.85 | 31.31 | 17.24 | 4.51 |
| **2001** | Post-monsoon | 6.92 | 30.14 | 15.57 | 4.79 |
| **2008** | Pre-monsoon | 13.99 | 37.71 | 25.86 | 6.09 |
| **2009** | Post-monsoon | 9.24 | 41.81 | 25.47 | 6.77 |
| **2015** | Pre-monsoon | 17.63 | 39.69 | 28.01 | 5.49 |
| **2016** | Post-monsoon | 20.24 | 41.73 | 30.89 | 5.36 |
| **2020** | Pre-monsoon | 22.48 | 49.63 | 36.6 | 6.34 |
| **2021** | Post-monsoon | 20.2 | 47.78 | 34.45 | 6.34 |

The ground water level after a period of five years is next discussed. During the post-monsoon period of 2000, the minimum ground water level observed is 6.92m, while the maximum level is 30.14m. The mean ground water level is 15.57m, and the standard deviation from the mean is 4.79. In the pre-monsoon period of 2001, the minimum ground water level observed is 9.85m, while the maximum level is 31.31m. The mean ground water level is 17.24m, and the standard deviation from the mean is 4.51. It is worth mentioning that the range has increased from that of 1996. The maximum depth of water availability was 22.56m to 21.46m below the surface during the 1995-1995, now ground water level has sunk deeper to 30.14m to 31.31m during 2000-2001. Ground water level during the year 2008-2009 has been discussed further. During the post monsoon period the range of ground water level is from 9.24 m to 41.81m eventually having a higher standard deviation of 6.77 from the mean value. While during the pre-monsoon season the range of ground water level has changes and is recorded from13.99m to 37.71m and therefore a standard deviation of 6.09 is recorded from the mean value of 25.86.

The ground water level after a period of six years is next discussed. During the post-monsoon period of 2016, the minimum ground water level observed is 20.24m, while the maximum level is 41.73m from the surface. The mean ground water level is 30.89m, and the standard deviation from the mean is 5.36. Later in the pre-monsoon period of 2001, the minimum ground water level observed is 17.63m, while the maximum level is 39.69m. The mean ground water level is 28.01m, and the standard deviation from the mean is 5.49.




Ground Water Level
Post Mansoon Season, 1995
Dausa District, Rajasthan
Baswa
Mahwa
Dausa
Sikrai
Lalsot
GWL (m)
6.66 - 8.46
8.47 - 10.26
10.27 - 11.82
11.83 - 13.51
13.52 - 15.19
15.20 - 17.05
17.06 - 19.14
19.15 - 21.40
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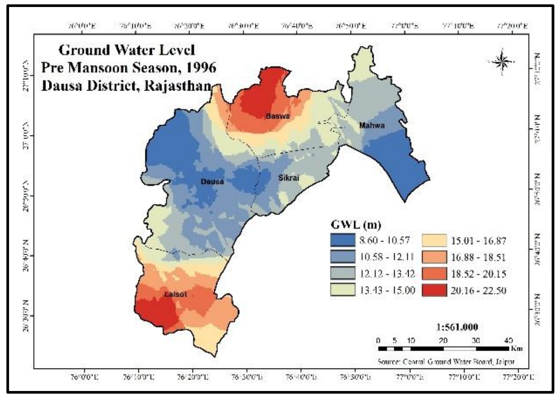
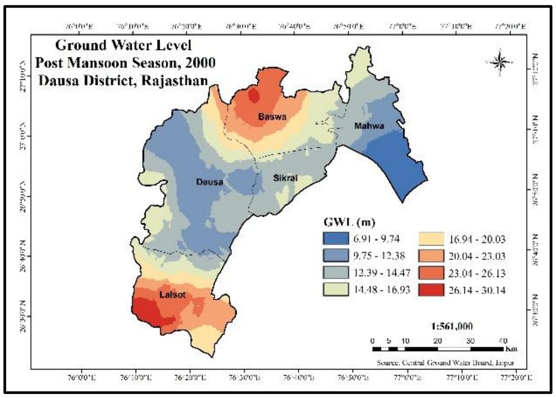
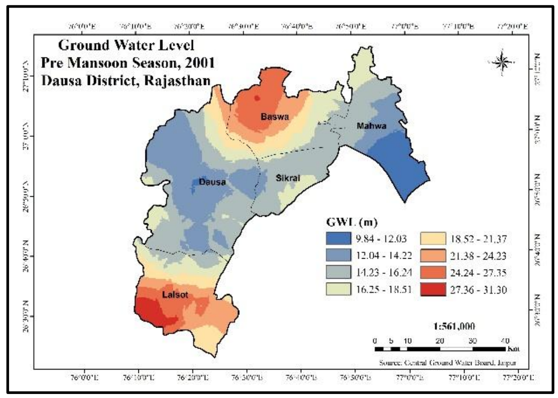
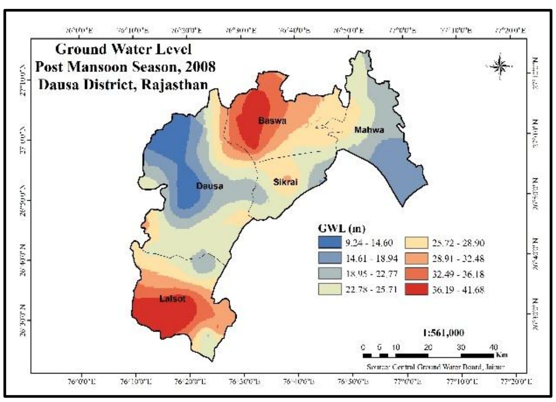
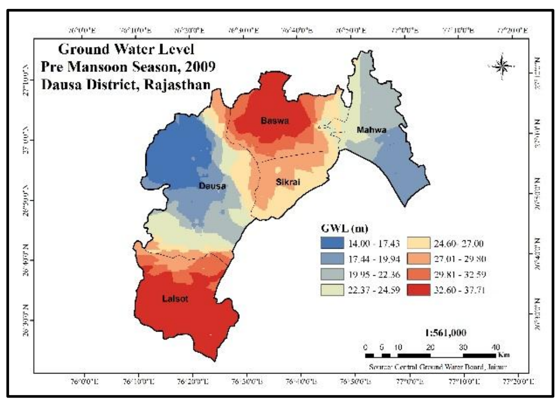
Source: Central Ground Water Board, Jaipur

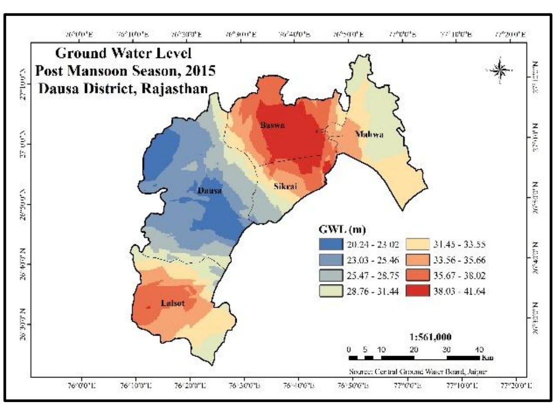

Ground Water Level
Pre Mansoon Season, 1996
Dausa District, Rajasthan
Baswa
Mahwa
Dausa
Sikrai
Lalsot
GWL (m)
8.60 - 10.57
10.58 - 12.11
12.12 - 13.42
13.43 - 15.00
15.01 - 16.87
16.88 - 18.51
18.52 - 20.15
20.16 - 22.50
1:561,000
Source: Central Ground Water Board, Jaipur

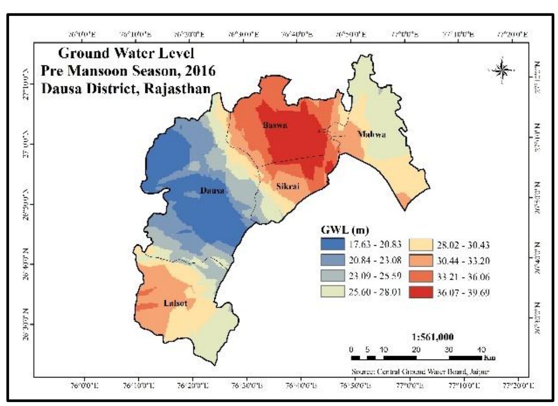

Ground Water Level
Post Mansoon Season, 2000
Dausa District, Rajasthan
Baswa
Mahwa
Dausa
Sikrai
Lalsot
GWL (m)
6.91 - 9.74
9.75 - 12.38
12.39 - 14.47
14.48 - 16.93
16.94 - 20.03
20.04 - 23.03
23.04 - 26.13
26.14 - 30.14
1:561,000
Source: Central Ground Water Board, Jaipur


Ground Water Level
Pre Mansoon Season, 2001
Dausa District, Rajasthan
Baswa
Mahwa
Dausa
Sikrai
Lalsot
GWL (m)
9.84 - 12.03
12.04 - 14.22
14.23 - 16.24
16.25 - 18.51
18.52 - 21.37
21.38 - 24.23
24.24 - 27.35
27.36 - 31.30
1:561,000
Source: Central Ground Water Board, Jaipur


Ground Water Level
Post Mansoon Season, 2008
Dausa District, Rajasthan
Baswa
Mahwa
Dausa
Sikrai
Lalsot
GWL (m)
9.24 - 14.60
14.61 - 18.94
18.95 - 22.77
22.78 - 25.71
25.72 - 28.90
28.91 - 32.48
32.49 - 36.18
36.19 - 41.68
1:561,000
Source: Central Ground Water Board, Jaipur


Ground Water Level
Pre Mansoon Season, 2009
Dausa District, Rajasthan
Baswa
Mahwa
Dausa
Sikrai
Lalsot
GWL (m)
14.00 - 17.43
17.44 - 19.94
19.95 - 22.36
22.37 - 24.59
24.60- 27.00
27.01 - 29.80
29.81 - 32.59
32.60 - 37.71
1:561,000
Source: Central Ground Water Board, Jaipur


Ground Water Level
Post Mansoon Season, 2015
Dausa District, Rajasthan
Baswa
Mahwa
Dausa
Sikrai
Lalsot
GWL (m)
20.24 - 23.02
23.03 - 25.46
25.47 - 28.75
28.76 - 31.44
31.45 - 33.55
33.56 - 35.66
35.67 - 38.02
38.03 - 41.64
1:561,000
Source: Central Ground Water Board, Jaipur


Ground Water Level
Pre Mansoon Season, 2016
Dausa District, Rajasthan
Baswa
Mahwa
Dausa
Sikrai
Lalsot
GWL (m)
17.63 - 20.83
20.84 - 23.08
23.09 - 25.59
25.60 - 28.01
28.02 - 30.43
30.44 - 33.20
33.21 - 36.06
36.07 - 39.69
1:561,000
Source: Central Ground Water Board, Jaipur

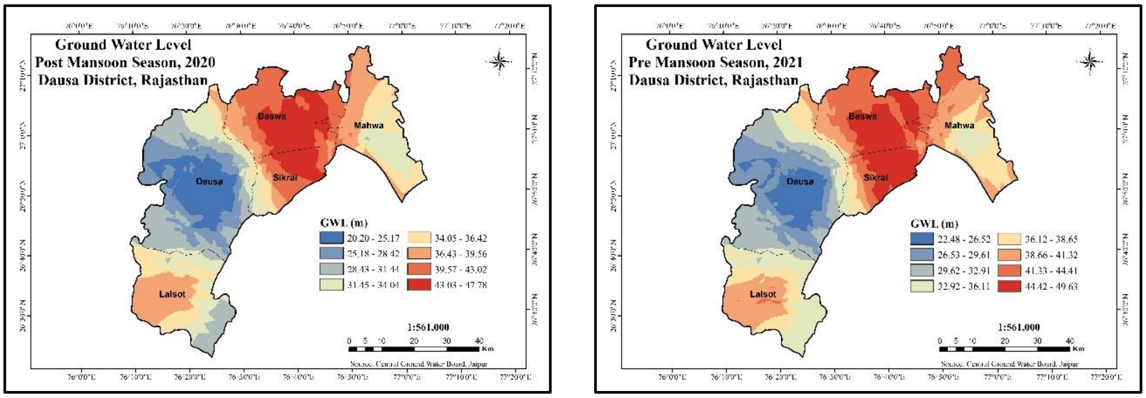



Figure: 1 Temporal Status of GWL Pre and Post-monsoon season of Dausa district

2021 is the latest year in our study. It covers the very latest data regarding the ground water level in Duasa district. From the table above we can study the data in details. In the post monsoon season of the year 2020, the minimum depth of ground water availability was 20.20m while the maximum depth was 47.78m from the surface. In the pre-monsoon the minimum depth of ground water availability declined and reached 22.48m and even the maximum depth fell to all time low of 49.63m from the surface. Both post and pre-monsoon have a high standard deviation from the mean values.

**Conclusion**

This discerned pattern serves as a keystone in enhancing our comprehensive understanding of the intricate hydrological dynamics at play within the district. Specifically, it offers a deeper insight into the intricate interrelationship between groundwater levels before and after the Rabi season, contributing to our holistic understanding of how these variables are intertwined. This study also provided that how much variation occurred in these years and which tehsil has the highest level of variation.In culmination we can say that the groundwater availability of Dausa district has beenadverselyaffected. It may be due to number of reasons such as increase in population, advancement of groundwater-based irrigation cropped area, urbanization, and fluctuation in rainfall in last three decades.

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