



ISSN (E): 2277-7695

ISSN (P): 2349-8242

NAAS Rating: 5.23

TPI 2023; SP-12(8): 458-463

© 2023 TPI

www.thepharmajournal.com

Received: 20-06-2023

Accepted: 21-07-2023

SH Suryawanshi

Department of Soil and Water Conservation Engineering, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, India

RS Talole

Department of Soil and Water Conservation Engineering, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, India

UH Khobragade

Department of Soil and Water Conservation Engineering, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, India

Y Bisen

Department of Soil and Water Conservation Engineering, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, India

KD Gharde

Department of Soil and Water Conservation Engineering, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, India

Corresponding Author:

SH Suryawanshi

Department of Soil and Water Conservation Engineering, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, India

Spatial variation of onset and withdrawal of monsoon in Amravati district of Vidharbha region

SH Suryawanshi, RS Talole, UH Khobragade, Y Bisen and KD Gharde

Abstract

The average monsoon seasonal rainfall ranges from 648.9 mm to 1231.3 mm in different taluka stations, with a coefficient of variation of 36.2 to 35.5 percent. The average dates of the onset and withdrawal of the effective monsoon ranged from the 3rd to the 30th of June and from the 25th of September to the 2nd of October in different talukas in the Amravati district. During early and delayed onset years, the mean date of onset of the effective monsoon ranged from 6th to 15th June and 27th June to 21st July, respectively. During early and delayed withdrawal years, the mean date of monsoon withdrawal ranged from September 8th to September 19th and October 5th to October 17th, respectively. In the Amravati district, spatial variation maps for the average dates of onset and withdrawal of the effective monsoon were developed. The average start date of distinct category critical dry spells (CDS) occurred in different monsoon months from the 14th to the 22nd of June, the 15th to the 24th of July, the 15th to the 20th of August, and the 11th to the 17th of September across different talukas in Amravati district.

Keywords: Onset, withdrawal and its spatial variation, Critical dry spells

Introduction

The drought is a frequent phenomenon in several regions of Maharashtra's Vidharbha region. With the increased usage of water resources in recent years, there is a demand for wise use of available rainfall for appropriate management of agriculture and to reduce drought risk. Dry agricultural areas in India encounter the greatest drought risk and are identified by low and unreliable crop yields. Agriculture plays a dominant role in life of the majority of the rural population. In Indian situation, spatial and temporal variation of monsoon rainfall adversely affects the crop production. The greatest risk in agriculture production is attributed to the variability of seasonal rainfall, uncertainty in the amount of rainfall and its distribution in a given season (Abuj *et al.*, 2011) ^[1].

The important characteristics of rainfall influencing agricultural production from rainfed areas are the date of onset of effective monsoon, the duration of dry spells, the time of occurrence of dry spells, the duration of wet spells and number of rainy days (Chavhan *et al.*, 2018) ^[3]. Knowledge of dry spells is important for crop planning in the given area and for planning of drought mitigation measures (Kolhe, 1988) ^[4]. Due to erratic and irregular rainfall pattern, crops suffer seriously and there is also a risk of crop failure under aberrant weather situation. There is a need for identifying onset of effective monsoon as the commencement of crop sowing rains in the district which is different from the premonsoon showers. Premonsoon rains cannot be considered as effective monsoon for agricultural operations, particularly for sowing of grains because these rains it followed by a long dry spell, may affect the germination of seeds resulting in crop failure when sowings are undertaken immediately after premonsoon showers. This study was conducted to generate information on spatial variation of onset and withdrawal of monsoon at taluka level and study of occurrence of dry spells in the district.

Material and Methods

The study of determination of OEM and its withdrawal at taluka level was undertaken in Amravati district which is situated between 20°32' to 21°46' North latitude and 76°37' to 78°27' East longitude. The district has a geographical area of 12,212 sq. km in western Vidharbha region of Maharashtra and is shown in Fig. 1.

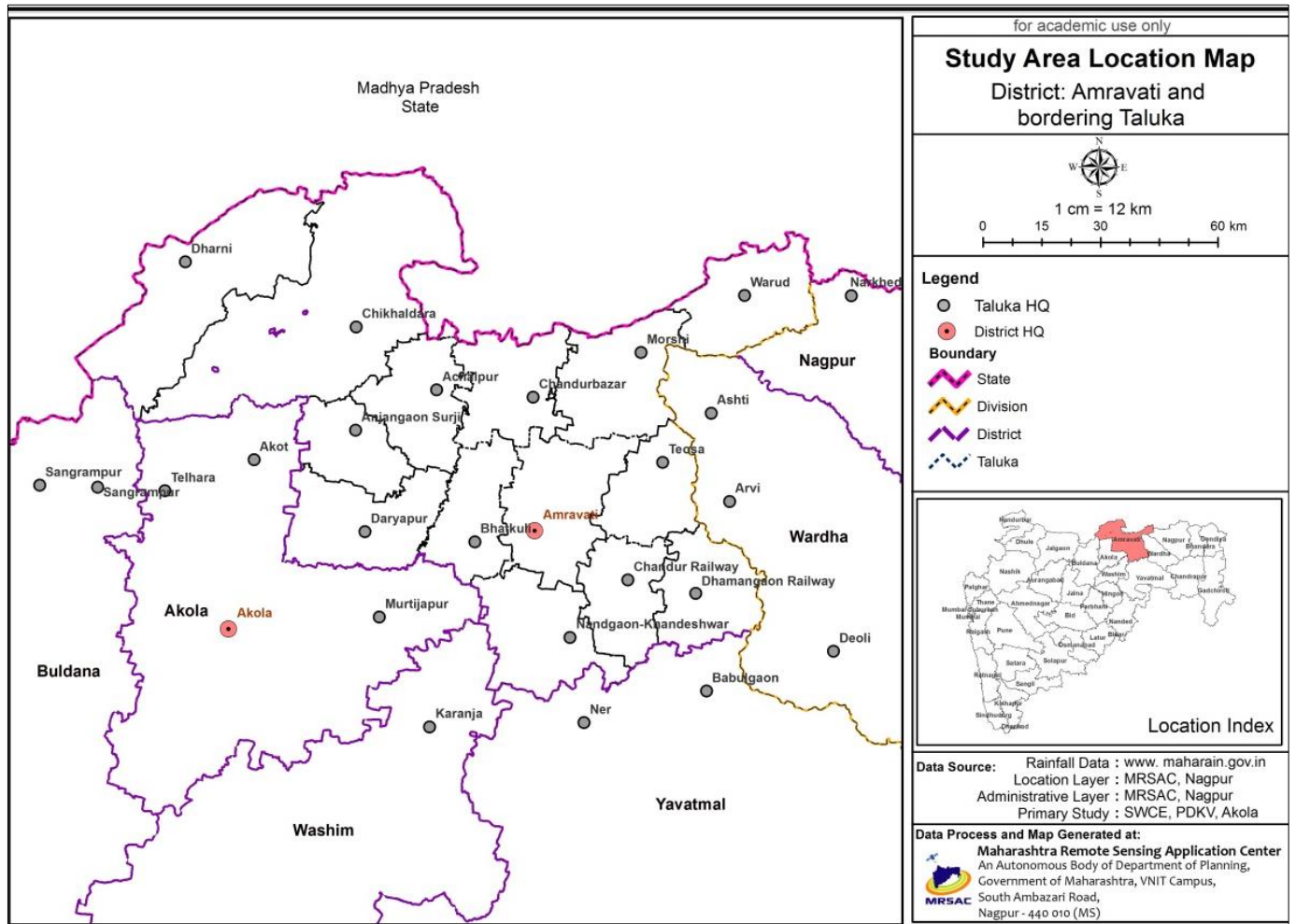


Fig 1: Location map of study area

From 1998 to 2018, daily rainfall data was obtained at 14 tehsils in the Amravati district and for different taluka stations surrounding to Amravati district from Akola, Yavatmal, Buldhana, Washim, Nagpur and Wardha districts were obtained from the website of Maharashtra State Government (<http://www.mahaagri.gov.in/raifall>). Daily pan evaporation data for Amravati station for study period was obtained from Agro-Meteorological, Observatory, Department of Agronomy, Dr. P.D.K.V, Akola.

Onset of effective monsoon

The date of onset and end of effective monsoon was estimated by using daily rainfall data of different taluka places and Ashok Raj's (1979) [2] approach for the onset of effective monsoon and dry spells was recognized. Based to this approach, the date of the start of a seven-day spell that met the three requirements listed below was considered the start of the effective monsoon.

- The very first day's rain in the seven-day spell must be greater than the region's daily mean evaporation (e).
- The total amount of precipitation throughout the seven-day period ought to total at least $5e + 10$ mm.
- Not less than four of the seven days in question must be rainy, with precipitation at or above 2.5 mm.

Withdrawal of monsoon

The withdrawal of monsoon was decided as the end of last wet spell in the last week of September, which may sometimes extended upto middle of October, depending upon

the delayed pattern of withdrawal of Northeast winds in respective years.

Identifying the dry spells

The dry spells were identified using Ashok Raj's (1979) [2] criteria. The first dry spell is defined as the period between the end of the effective monsoon and another rainy day with 5e mm or greater of rain or the beginning of another 7-day rainy spell corresponding the third criteria provided earlier, with an overall rainfall of 5e mm or more throughout this spell. If the length of such a dry spell exceeds a particular value determined by the crop-soil combination of the region, it is referred to as the first crucial dry spell; otherwise, it is categorized as the first wet spell. Likewise subsequent critical dry spells were determined by considering the duration limit of 11 days for this region according to Pawade (1982) [5].

Result and Discussions

Seasonal rainfall analysis

The monsoon seasonal rainfall during kharif season was estimated by taking the total of daily rainfall received from June to September or October considering the withdrawal of monsoon. The seasonal rainfall for different taluka places in Amravati district for 21 years from 1998 to 2018 is presented in Table 1.

According to Table 1, the mean monsoon seasonal rainfall in the Amravati district varies between 648.9 to 1231.3 mm, with a coefficient of variance that varies from 36.2 to 35.5 percent. Chikhaldara gets its highest precipitation during the

year 2007 (2154.9 mm). The maximum average seasonal monsoon rainfall was recorded at Chikhaldara (1231.3 mm) followed by Dharni (927.8 mm), Dhamangaon Railway (825 mm), Amravati (803.4 mm), Nandangaon Khandeshwar (802.1 mm) and Morshi (728 mm), Warud (728), Bhatkuli (717 mm), Chandur Railway (694.3 mm), Achalpur (692.6 mm), Anjangaon Surji (691.6 mm), Daryapur (688.8 mm), Tiwasa (660.3 mm) and Chandur Bajar (648.9 mm). Amongst all the talukas of Amravati district, Chandur Bajar shows highest coefficient of variation of 36 per cent.

The dates of onset and withdrawal of monsoon for the study period at Amravati taluka is presented in Table 2. In Amravati taluka, the onset of effective monsoon varies from 3rd June to 23rd July, with the mean date of onset of effective monsoon being 22nd June (SD = 16 days). The earliest and latest likely ($p=0.68$) OEM dates are June 6th and July 8th, respectively. The withdrawal date of the effective monsoon in Amravati taluka was noticed between August 31st and October 21st. The average date of monsoon withdrawal is September 25th.

Table 2: Effective monsoon onset and withdrawal dates for Amravati taluka

| Year | Onset | Withdrawal |
|------|--------|------------|
| 1998 | 15-Jun | 28-Sep |
| 1999 | 16-Jun | 23-Sep |
| 2000 | 03-Jun | 31-Aug |
| 2001 | 04-Jun | 08-Oct |
| 2002 | 14-Jun | 07-Sep |
| 2003 | 11-Jul | 29-Sep |
| 2004 | 23-Jul | 09-Sep |
| 2005 | 16-Jul | 21-Oct |
| 2006 | 21-Jun | 02-Oct |
| 2007 | 14-Jun | 23-Sep |
| 2008 | 07-Jun | 22-Sep |
| 2009 | 29-Jun | 07-Sep |
| 2010 | 16-Jun | 18-Oct |
| 2011 | 14-Jul | 16-Sep |
| 2012 | 11-Jun | 06-Oct |
| 2013 | 07-Jun | 13-Oct |
| 2014 | 15-Jul | 11-Sep |
| 2015 | 13-Jun | 19-Sep |
| 2016 | 24-Jun | 04-Oct |
| 2017 | 13-Jul | 15-Oct |
| 2018 | 06-Jun | 24-Sep |
| Mean | 22-Jun | 25-Sep |

The average date of earliest, mean and delayed onset of effective monsoon and withdrawal of monsoon at different taluka places of Amravati district as presented in Table 3

indicated 10 to 18 days and 11 to 17 days variation in average date of onset and withdrawal of monsoon at different taluka stations.

Table 3: Average date of earliest, mean and delayed onset and withdrawal of effective monsoon at different taluka places in Amravati district

| Taluka place | Average date of onset of effective monsoon | | | Average date of withdrawal of effective monsoon | | |
|------------------------|--|--------|---------|---|--------|---------|
| | Earliest | Mean | Delayed | Earliest | Mean | Delayed |
| Achalpur | 14-Jun | 30-Jun | 16-Jul | 09-Sep | 26-Sep | 13-Oct |
| Amravati | 06-Jun | 22-Jun | 08-Jul | 11-Sep | 25-Sep | 10-Oct |
| Anjangaon Surji | 10-Jun | 26-Jun | 13-Jul | 13-Sep | 27-Sep | 11-Oct |
| Bhatkuli | 11-Jun | 27-Jun | 13-Jul | 16-Sep | 30-Sep | 13-Oct |
| Chandurbajar | 11-Jun | 25-Jun | 09-Jul | 18-Sep | 01-Oct | 15-Oct |
| Chandur Railway | 14-Jun | 28-Jun | 11-Jul | 13-Sep | 30-Sep | 17-Oct |
| Chikhaldhara | 08-Jun | 18-Jun | 27-Jun | 11-Sep | 28-Sep | 14-Oct |
| Daryapur | 15-Jun | 03-Jun | 21-Jul | 17-Sep | 28-Sep | 09-Oct |
| Dhamangaon Railway | 07-Jun | 18-Jun | 29-Jun | 16-Sep | 28-Sep | 10-Oct |
| Dharni | 08-Jun | 21-Jun | 04-Jul | 13-Sep | 24-Sep | 05-Oct |
| Morshi | 11-Jun | 26-Jun | 11-Jul | 09-Sep | 27-Sep | 14-Oct |
| Nandangaon Khandeshwar | 07-Jun | 21-Jun | 05-Jul | 19-Sep | 02-Oct | 15-Oct |
| Tiwasa | 12-Jun | 25-Jun | 08-Jul | 08-Sep | 24-Sep | 10-Oct |
| Warud | 13-Jun | 25-Jun | 07-Jul | 12-Sep | 26-Sep | 11-Oct |

Critical dry spell analysis

The duration of dry spells at Amravati taluka place as presented in Table 4, revealed that it varied from 11 to 40 days in different monsoon months. The total number of dry spells at Amravati taluka varied from one to three during different years of the study period. The average number of critical dry spells (CDS) at Amravati taluka is 1. The average

CDS in different monsoon months starts from June, 22 with duration of 23 days, July, 21 with duration of 21 days, August, 17 with duration of 23 days and September, 15 with duration of 21 days. Similarly the critical dry spells in different taluka places in Amravati district also varies from 1 to 3 in number with an average of 1 CDS, which are in confirmation with the results of Chavhan (2018)^[3]. The mean

critical dry spells dates during different monsoon months at different talukas of Amravati district are presented in Table 5. The average start date for various category CDS differs from 14th to 22nd June, 15th to 24th July, 15th to 20th August, and 11th to 17th September in different taluka sites. The results illustrate that the mean onset dates of dry spells across the various taluka stations of Amravati district throughout

different monsoon months do not vary greatly. The average duration of CDS in Amravati district talukas varies from 16 to 28 days, 17 to 25 days, 20 to 27 days, and 14 to 26 days throughout June, July, August, and September. In addition, the overall number of dry spell events ranges from 3 to 8 in June, 4 to 12 in July, and 11 to 16 in August and 2 to 10 during September month.

Table 4: Distribution of critical dry spells in Amravati taluka

| Year | Critical Dry Spells (CDS) | | | | | | | | No. of CDS |
|------|---------------------------|----------|--------|------|--------|------|-----------|------|------------|
| | June | | July | | August | | September | | |
| | Date | Days | Date | Days | Date | Days | Date | Days | |
| 1998 | | | | | | | | | 0 |
| 1999 | 25-Jun | 22 | | | 14-Aug | 14 | | | 2 |
| 2000 | | | 23-Jul | 17 | | | | | 1 |
| 2001 | 16-Jun | 23 | 11-Jul | 24 | 22-Aug | 40 | | | 3 |
| 2002 | 28-Jun | 46 | | | | | | | 1 |
| 2003 | | | 29-Jul | 24 | 30-Aug | 25 | | | 2 |
| 2004 | | | | | 15-Aug | 17 | | | 1 |
| 2005 | | | | | 07-Aug | 29 | 25-Sep | 21 | 2 |
| 2006 | | | 06-Jul | 12 | 18-Aug | 13 | | | 2 |
| 2007 | | | | | 10-Aug | 14 | | | 1 |
| 2008 | 13-Jun 29-Jun | 15 21 | | | | | | | 2 |
| 2009 | | | 28-Jul | 23 | | | | | 1 |
| 2010 | | | | | | | 11-Sep | 37 | 1 |
| 2011 | | | | | | | | | 0 |
| 2012 | 20-Jun | 11 | | | | | | | 1 |
| 2013 | | | | | 27-Aug | 26 | | | 1 |
| 2014 | | | 29-Jul | 22 | | | | | 1 |
| 2015 | 24-Jun | 25 | | | 15-Aug | 24 | | | 2 |
| 2016 | | | | | 07-Aug | 21 | 03-Sep | 11 | 2 |
| 2017 | | | 29-Jul | 21 | | | 24-Sep | 15 | 2 |
| 2018 | | | 19-Jul | 24 | 23-Aug | 30 | | | 2 |
| Mean | 22-Jun | 23 | 21-Jul | 21 | 17-Aug | 23 | 15-Sep | 21 | 1 |

Table 5: Average starting date and length (days) of critical dry spells over monsoon months in distinct tehsils of Amravati district

| Taluka place | Mean critical dry spell (CDS) during monsoon months | | | | | | | | Avg. No. of CDS per year |
|----------------------|---|--------|--------|--------|--------|--------|-----------|--------|--------------------------|
| | June | | July | | August | | September | | |
| | Date | Days | Date | Days | Date | Days | Date | Days | |
| Achalpur | 21-Jun | 23(3)* | 18-Jul | 20(11) | 17-Aug | 24(12) | 16-Sep | 21(7) | 2 |
| Amravati | 22-Jun | 23(7)* | 21-Jul | 21(8) | 17-Aug | 23(11) | 15-Sep | 21(4) | 1 |
| Anjangaon | 20-Jun | 18(4)* | 18-Jul | 20(12) | 17-Aug | 25(14) | 13-Sep | 16(6) | 2 |
| Bhatkuli | 21-Jun | 16(6)* | 16-Jul | 21(10) | 17-Aug | 26(12) | 12-Sep | 26(6) | 2 |
| Chandurbajar | 22-Jun | 28(7)* | 18-Jul | 17(10) | 16-Aug | 20(15) | 12-Sep | 21(10) | 2 |
| Chandur Railway | 20-Jun | 18(3)* | 17-Jul | 18(7) | 16-Aug | 24(16) | 15-Sep | 24(7) | 2 |
| Chikhaldhara | 19-Jun | 18(7)* | 17-Jul | 17(6) | 20-Aug | 20(12) | 17-Sep | 17(6) | 2 |
| Daryapur | 14-Jun | 21(3)* | 24-Jul | 21(7) | 16-Aug | 23(16) | 12-Sep | 20(6) | 1 |
| Dhamangaon Railway | 22-Jun | 23(8)* | 23-Jul | 20(7) | 18-Aug | 27(16) | 12-Sep | 24(6) | 2 |
| Dharni | 18-Jun | 21(4)* | 15-Jul | 25(4) | 18-Aug | 25(13) | 13-Sep | 14(2) | 1 |
| Morshi | 22-Jun | 22(5)* | 21-Jul | 21(7) | 18-Aug | 20(13) | 12-Sep | 19(9) | 2 |
| Nandgaon Khandeshwar | 21-Jun | 19(4)* | 18-Jul | 19(10) | 15-Aug | 22(15) | 11-Sep | 24(13) | 2 |
| Tiwasa | 20-Jun | 25(7)* | 18-Jul | 24(9) | 18-Aug | 26(13) | 17-Sep | 25(4) | 2 |
| Warud | 22-Jun | 27(5)* | 24-Jul | 18(9) | 17-Aug | 21(14) | 15-Sep | 19(6) | 2 |

* Values in brackets represent the total number of dry spell events recorded throughout the investigation period.

The number of CDS occurrences over various monsoon months revealed a distinct trend, with August having the highest number of events subsequent to the rest of the

monsoon months.

Spatial variation in date of onset of effective monsoon

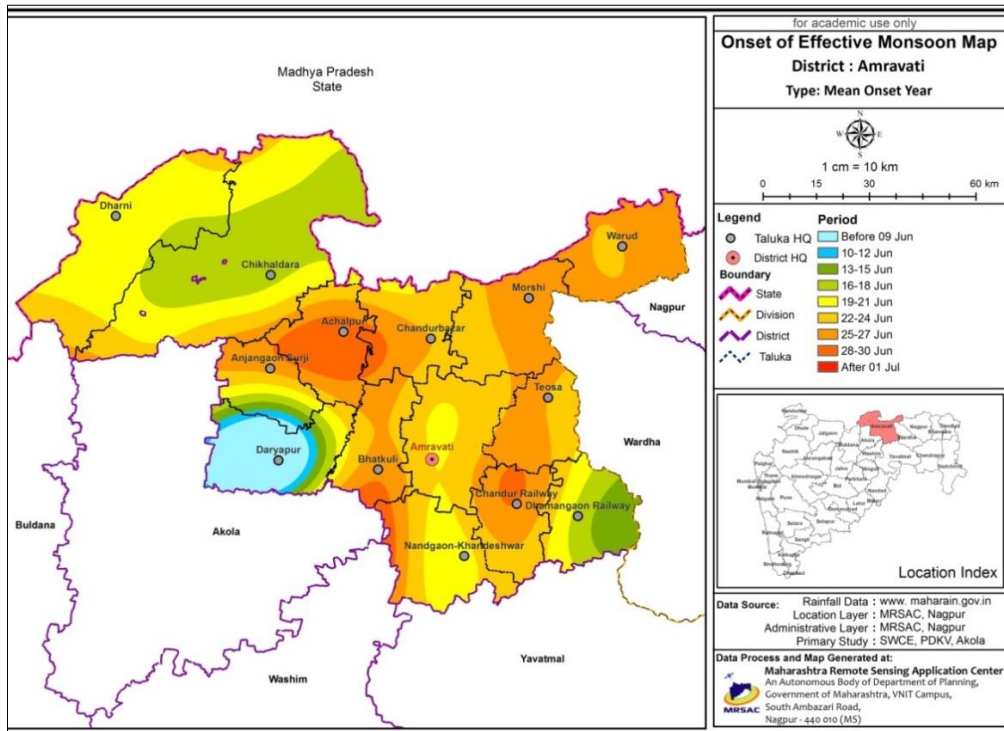


Fig 2: Spatial variation in mean date of onset of effective monsoon in different talukas of Amravati district

The spatial variation in onset of effective monsoon during mean onset years as shown in Fig. 2 clearly indicates the early beginning during 9th to 12th June on southern side of the Daryapur taluka and later progresses steadily in all other directions in nearby talukas. Late onset of monsoon after 1st July was observed in some part of Achalpur, Bhatkuli, Chandur Railway and Chandurbajar talukas. Such spatial information on variation in starting of rainy season can be useful for planning of land preparation work, seed material availability and rainfed crop sowing operations and crop planning in general in different talukas of Amravati district.

Spatial variation in withdrawal dates of monsoon

The spatial variation of withdrawal of monsoon during mean withdrawal year as shown in Fig. 3, indicates early withdrawal from Dharni, Chikhaldara, Warud, Morshi, Tiwasa, Amravati, and Dhamangaon Railway talukas before 26th September on all four sides of the district and central part of Achalpur taluka. The withdrawal of monsoon was observed from 27th September to 2nd October in most of the talukas in Amravati district except for western parts of Nandgaon Khandeshwar and little part of Bhatkuli talukas where the withdrawal occurs slightly late after 3rd October.

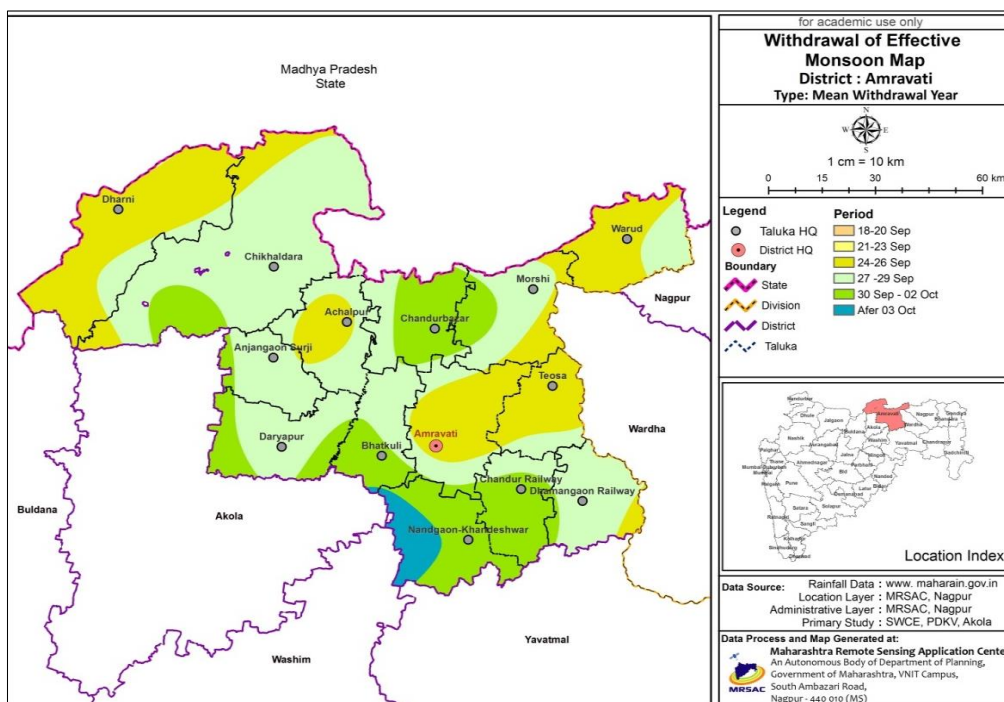


Fig 3: Spatial variation in mean date of withdrawal of monsoon in different talukas of Amravati district Spatial variation in average monsoon duration

The spatial variation of average monsoon duration in Amravati district as depicted in Fig. 4 revealed that the monsoon duration (in days) at different talukas of Amravati district ranges from 80 days to more than 100 days and the monsoon duration of 80 to 90 days was observed in some parts of Daryapur, Achalpur, Anjangaon Surji and Tiwsa talukas and small portion of Morshi taluka on eastern side of

the district. The monsoon duration of 95 to 105 days was observed in maximum areas of Dharni, Chandurbajar, Bhatkuli, Amravati, Morshi, Chandur Railway and Warud talukas and parts of Achalpur, Daryapur, Anjangaon Surji talukas and Dhamangaon Railway taluka on eastern side of the Amravati district while all other remaining areas of the district are covered under monsoon of more than 100 days.

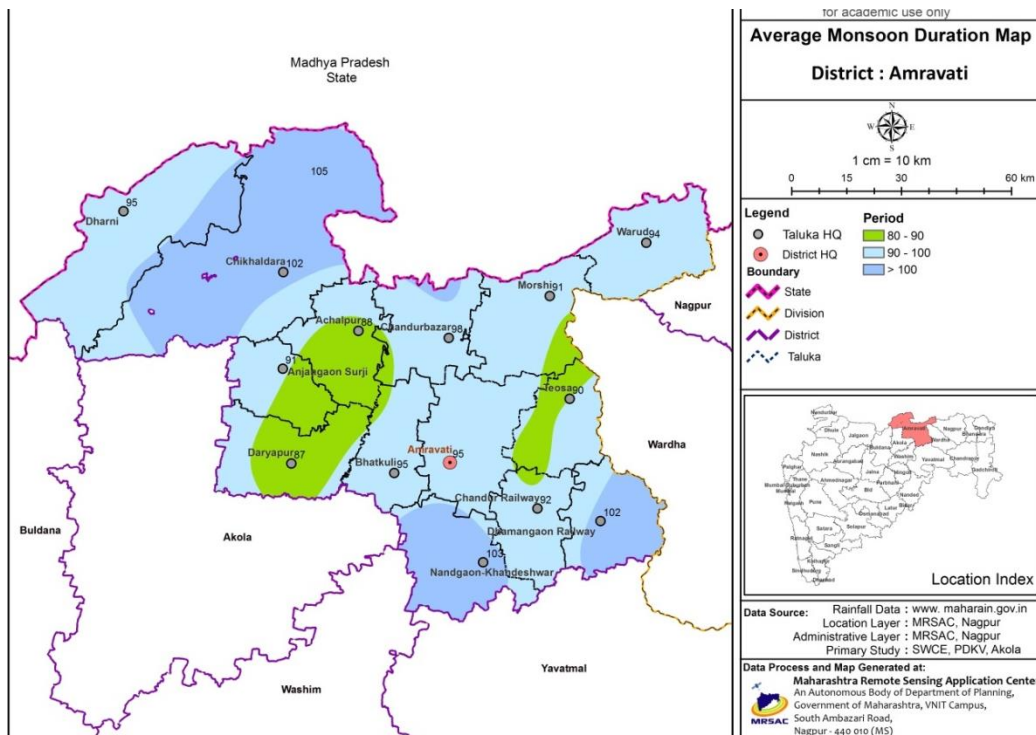


Fig 4: Spatial variation in average monsoon duration at different talukas in Amravati district

Conclusions

The average dates of the onset and withdrawal of the effective monsoon ranged between the 3rd up to the 30th of June in addition to the 25th of September until the 2nd of October across various talukas in the Amravati district. The mean date of onset of effective monsoon during early and delayed onset years varied from 6th to 15th June and 27th June to 21th July respectively. Average date of withdrawal of monsoon during early and delayed withdrawal years varied from 8th to 19th September and 5th to 17th October respectively. Distribution map for the average dates of onset and withdrawal of the effective monsoon in Amravati district have been produced and may be utilized for planning agricultural activities in the region. The average start date of distinct category critical dry periods (CDS) ranged across several monsoon months, particularly 14 to 22 June, 15 to 24 July, 15 to 20 August, along with 11 to 17 September, across different taluka locations in Amravati district. This knowledge on monsoon duration might be very helpful for crop variety selection across various villages and talukas throughout that region.

References

1. Abuj MD, Magar AP, Bombale VT, Popale PG, Birajdar SA. Rainfall and dry spell analysis for Beed district, Engineering & Technology in India. 2011;2(1&2):37-42.
2. Ashok Raj PC. Onset of effective monsoon and critical dry spells. A computer based forecasting technique; IARI Bulletin No.II, WTC, IARI, New Delhi, 1979.
3. Chavhan A, Satpute GU, Apturkar SM. Spatial variation of onset and withdrawal of monsoon in Washim district

- of western vidarbh region. Contemporary Research in India. 2018;I(Special Issue-I):334-340.
4. Kolhe NR. Dry spell probability analysis and its application to crop development stages. M. Tech. Thesis. Unpub. submitted to PGI, Dr. PDKV, Yavatmal, 1988, 45-55.
5. Pawade MN. Optimum utilization of water resources in Agriculture Watersheds. An unpublished Ph. D. thesis submitted to the faculty of the Post Graduate School, IARI, New-Delhi, 1982.