TELANGANA STATE

Weather Analysis

Jan 2021 - March 2022

INDEX

INTRODUCTION:

Telangana state is geographically located in semi-arid region and has predominantly hot and dry climate. Summer starts in March and high temperature is observed in May with average temperature of 42° C. Southwest Monsoon starts in the month of June and lasts until September. As per agricultural department (Govt of Telangana), state can be divided into following sub zones.

- North Telangana Zone
- Central Telangana Zone (CTZ)
- Southern Telangana Zone

North Telangana Zone (NTZ)

This zone includes Adilabad, Komaram Bheem Asifabad, Nirmal, Mancherial, Nizamabad, Jagtial, Peddapalli, Kamareddy, Rajanna Sircilla and Karimnagar districts. Annual rainfall ranges from 867 mm to 1189 mm, received mostly from the south-west monsoon rainfall. During this season maximum temperatures ranges between 31 and 390C and minimum ranges between 14 and 250C. There are 16 types of soils in NTZ. It has shallow black soils (18.4%), deep calcareous soils (16.6%) and red clayey soils (15.2% of area). However, as a whole, red soils of different textures are predominant in this zone to an extent of 45 per cent and is followed by black soils (24%) and calcareous soils (20%). Predominant crops in this zone include rice, maize, soybean, sesame, cotton, redgram, sugarcane and turmeric.

Central Telangana Zone (CTZ)

This zone includes Sangareddy, Medak, Siddipet, Jangaon, Warangal Urban, Warangal Rural, Mahabubabad, Jayashankar Bhupalapally, Bhadradri Kothagudem and Khammam districts. Annual rainfall ranges from 779 to 1213 mm, received mostly from south-west monsoon rainfall.
During this season maximum temperature ranges between 29 and 390C and minimum ranges between 16 and 250C. There are 19 types of soils in CTZ. It has red shallow gravelly soils (12.4%), red clayey soils (12.2%), deep calcareous soils (9%), red gravelly loam (8.5%) and colluvial soils (8% of the area). Red type of soils, as a whole in this zone occupies 54 per cent and is followed by calcareous soils (13%), colluvial soils (8%) and black soils (6%). Predominant crops in this zone include cotton, rice, maize, greengram, mango, sugarcane and chillies

Southern Telangana Zone(STZ)

This zone includes Vikarabad, Medchal Malkajgiri, Hyderabad, Yadadri Bhuvanagiri, Rangareddy, Mahabubnagar, Nalgonda, Suryapet, Wanaparthy, Nagarkurnool and JogulambaGadwal districts. Annual rainfall ranges from 606 to 853 mm, received mostly from south west monsoon rainfall. During this season maximum temperature ranges between 28 and 380C and minimum ranges between 16 and 250C. There are 19 types of soils in this zone. It has red clayey soils (22.3%), red gravelly loam (16.5%) and alluvio-colluvial soils (14.4% of the area). As a whole, the zone is dominated by different textured red soils with varied depths to an extent of 54.8 per cent and is followed by alluvio-colluvial soils and calcareous soils (11.2%). Predominant crops in this zone include sorghum, cotton, rice, redgram, sesame maize, castor, safflower and groundnut.

CODE:

Telangana-Weather-Analysis-Jan-2021—March-2022.R

```
# Data Extraction
library(dplyr)

##
## Attaching package: 'dplyr'

## The following objects are masked from 'package:stats':
##
##     filter, lag

## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union

#Set the working directory
setwd('C:/Users/Reena/Desktop/Project in R')

d=read.csv('Weather 2021-March 2022.csv')

#Dimension of the dataset
dim(d)

## [1] 278987     10

#Structure of the dataset
str(d)

## 'data.frame':    278987 obs. of  10 variables:
##  $ District             : chr  "Adilabad" "Adilabad" "Adilabad" "Adilabad"
...
##  $ Mandal               : chr  "Bheempoor" "Bheempoor" "Bheempoor" "Bheemp
oor" ...
##  $ Date                 : chr  "01-Jan-21" "02-Jan-21" "03-Jan-21" "04-Jan
-21" ...
##  $ Rain..mm.            : num  0 0 0 0 0 0 0 0 0 0 ...
##  $ Min.Temp...C.        : num  10.1 11.7 10.4 13.1 13.4 15.6 19.3 21.3 17.
3 12.4 ...
##  $ Max.Temp...C.        : num  30 29.9 30.4 30.5 29.8 30.9 31.2 29.6 31.2
33.7 ...
##  $ Min.Humidity....     : num  37.8 40.6 45.8 38.4 50.7 43.3 48.2 59.8 51.
8 24.8 ...
##  $ Max.Humidity....     : num  95.7 96.6 97 96.4 97 93.6 92.6 91.8 96.1 88
.1 ...
##  $ Min.Wind.Speed..Kmph.: num  0 0 0 0 0 0 0 0 0 0 ...
##  $ Max.Wind.Speed..Kmph.: num  3.1 2.2 2.2 2 2 1.6 1.4 2 1.6 2.8 ...
```

```
#Displays the first six records
head(d)
```

```
##   District    Mandal      Date Rain..mm. Min.Temp...C. Max.Temp...C.
## 1 Adilabad Bheempoor 01-Jan-21         0          10.1          30.0
## 2 Adilabad Bheempoor 02-Jan-21         0          11.7          29.9
## 3 Adilabad Bheempoor 03-Jan-21         0          10.4          30.4
## 4 Adilabad Bheempoor 04-Jan-21         0          13.1          30.5
## 5 Adilabad Bheempoor 05-Jan-21         0          13.4          29.8
## 6 Adilabad Bheempoor 06-Jan-21         0          15.6          30.9
##   Min.Humidity.... Max.Humidity.... Min.Wind.Speed..Kmph. Max.Wind.Speed..
Kmph.
## 1             37.8             95.7                    0
3.1
## 2             40.6             96.6                    0
2.2
## 3             45.8             97.0                    0
2.2
## 4             38.4             96.4                    0
2.0
## 5             50.7             97.0                    0
2.0
## 6             43.3             93.6                    0
1.6
```

```
#Displays the last 6 records
tail(d)
```

```
##                   District        Mandal      Date Rain..mm. Min.Temp...C.
## 278982 Yadadri Bhuvanagiri Yadagirigutta 26-Mar-22         0          22.6
## 278983 Yadadri Bhuvanagiri Yadagirigutta 27-Mar-22         0          23.5
## 278984 Yadadri Bhuvanagiri Yadagirigutta 28-Mar-22         0          23.7
## 278985 Yadadri Bhuvanagiri Yadagirigutta 29-Mar-22         0          23.5
## 278986 Yadadri Bhuvanagiri Yadagirigutta 30-Mar-22         0          23.3
## 278987 Yadadri Bhuvanagiri Yadagirigutta 31-Mar-22         0          23.3
##        Max.Temp...C. Min.Humidity.... Max.Humidity.... Min.Wind.Speed..Kmp
h.
## 278982          36.6             29.6             93.4
0
## 278983          37.2             35.0             87.6
0
## 278984          38.8             29.8             83.9
0
## 278985          38.7             27.2             81.4
0
## 278986          42.3             13.5             90.3
0
## 278987          42.7             11.4             92.2
0
##        Max.Wind.Speed..Kmph.
```

```
## 278982                    8.7
## 278983                    8.9
## 278984                    8.7
## 278985                    5.7
## 278986                    3.6
## 278987                    4.3
```

```
#Columns of the Dataset
colnames(d)
```

```
##  [1] "District"              "Mandal"                "Date"
##  [4] "Rain..mm."             "Min.Temp...C."         "Max.Temp...C."
##  [7] "Min.Humidity...."      "Max.Humidity...."      "Min.Wind.Speed..Kmph
."
## [10] "Max.Wind.Speed..Kmph."
```

```
# Five sample values
sample_n(d,5)
```

```
##      District          Mandal      Date Rain..mm. Min.Temp...C. Max.Temp..
.C.
## 1   Nizamabad Nizamabad_South 08-Feb-21         0          11.5          3
0.5
## 2      Mulugu          Wazeed 05-Feb-21         0          12.3          3
3.5
## 3  Sangareddy        Kondapur 12-Apr-21         0          21.7          3
6.1
## 4 Mahabubabad      Nellikudur 02-May-21         0          24.7          3
5.8
## 5    Adilabad          Mavala 23-Jun-21        46          24.0          3
4.7
##   Min.Humidity.... Max.Humidity.... Min.Wind.Speed..Kmph. Max.Wind.Speed..
Kmph.
## 1             36.8             86.4                    NA
NA
## 2             15.8             99.9                    NA
NA
## 3             34.9             77.0                     0
3.3
## 4             42.7             92.0                     0
13.2
## 5             35.3             92.3                     0
8.1
```

```
# Length of the dataset
length(d)
```

```
## [1] 10
```

```
#Data Cleansing
```

```r
#Check null values
table(is.na(d))
```

```
##
##   FALSE    TRUE
## 2689062  100808
```

```r
#Null values in each column
summary(d)
```

```
##    District           Mandal              Date             Rain..mm.
##  Length:278987      Length:278987      Length:278987      Min.   :  0.00
##  Class :character   Class :character   Class :character   1st Qu.:  0.00
##  Mode  :character   Mode  :character   Mode  :character   Median :  0.00
##                                                           Mean   :  2.55
##                                                           3rd Qu.:  0.00
##                                                           Max.   :388.00
##
##  Min.Temp...C.   Max.Temp...C.   Min.Humidity.... Max.Humidity....
##  Min.   : 3.50   Min.   :17.30   Min.   : -1.00   Min.   : -1.00
##  1st Qu.:17.90   1st Qu.:31.10   1st Qu.: 27.00   1st Qu.: 83.80
##  Median :22.00   Median :33.10   Median : 43.10   Median : 95.50
##  Mean   :20.84   Mean   :33.58   Mean   : 43.73   Mean   : 87.85
##  3rd Qu.:24.20   3rd Qu.:36.30   3rd Qu.: 59.90   3rd Qu.:100.00
##  Max.   :32.10   Max.   :44.60   Max.   :100.00   Max.   :100.00
##
##  Min.Wind.Speed..Kmph. Max.Wind.Speed..Kmph.
##  Min.   : 0.00         Min.   : 0.00
##  1st Qu.: 0.00         1st Qu.: 2.50
##  Median : 0.00         Median : 7.10
##  Mean   : 0.08         Mean   :11.46
##  3rd Qu.: 0.00         3rd Qu.:11.90
##  Max.   :16.40         Max.   :69.80
##  NA's   :50404         NA's   :50404
```

```r
#Check duplicated values
table(duplicated(d))
```

```
##
##  FALSE
## 278987
```

```r
#Convert to upper case
d$District=toupper(d$District)#Convert to upper case
d$District=toupper(d$District)

#Convert to lower case
d$Mandal=tolower(d$Mandal)
head(d)
```

```
##   District    Mandal      Date Rain..mm. Min.Temp...C. Max.Temp...C.
## 1 ADILABAD bheempoor 01-Jan-21         0          10.1          30.0
## 2 ADILABAD bheempoor 02-Jan-21         0          11.7          29.9
## 3 ADILABAD bheempoor 03-Jan-21         0          10.4          30.4
## 4 ADILABAD bheempoor 04-Jan-21         0          13.1          30.5
## 5 ADILABAD bheempoor 05-Jan-21         0          13.4          29.8
## 6 ADILABAD bheempoor 06-Jan-21         0          15.6          30.9
##   Min.Humidity.... Max.Humidity.... Min.Wind.Speed..Kmph. Max.Wind.Speed..
Kmph.
## 1             37.8             95.7                    0
3.1
## 2             40.6             96.6                    0
2.2
## 3             45.8             97.0                    0
2.2
## 4             38.4             96.4                    0
2.0
## 5             50.7             97.0                    0
2.0
## 6             43.3             93.6                    0
1.6
```

```
# Data Transformation

# Rename the columns
d=rename(d,"Rain_mm"="Rain..mm.",
         "Min_Temp_C"="Min.Temp...C.",
         "Max_Temp_C"="Max.Temp...C.",
         "Min_Humidity_percent"="Min.Humidity....",
         "Max_Humidity_percent"="Max.Humidity....",
         "Min_Wind_Speed_Kmph"="Min.Wind.Speed..Kmph.",
         "Max_Wind_Speed_Kmph"="Max.Wind.Speed..Kmph.")
head(d)
```

```
##   District    Mandal      Date Rain_mm Min_Temp_C Max_Temp_C
## 1 ADILABAD bheempoor 01-Jan-21       0       10.1       30.0
## 2 ADILABAD bheempoor 02-Jan-21       0       11.7       29.9
## 3 ADILABAD bheempoor 03-Jan-21       0       10.4       30.4
## 4 ADILABAD bheempoor 04-Jan-21       0       13.1       30.5
## 5 ADILABAD bheempoor 05-Jan-21       0       13.4       29.8
## 6 ADILABAD bheempoor 06-Jan-21       0       15.6       30.9
##   Min_Humidity_percent Max_Humidity_percent Min_Wind_Speed_Kmph
## 1                 37.8                 95.7                   0
## 2                 40.6                 96.6                   0
## 3                 45.8                 97.0                   0
## 4                 38.4                 96.4                   0
## 5                 50.7                 97.0                   0
## 6                 43.3                 93.6                   0
##   Max_Wind_Speed_Kmph
## 1                 3.1
```

```
## 2                  2.2
## 3                  2.2
## 4                  2.0
## 5                  2.0
## 6                  1.6

#Change the data type
#d=type.convert(d) #Automatic conversion
str(d)

## 'data.frame':    278987 obs. of  10 variables:
##  $ District            : chr  "ADILABAD" "ADILABAD" "ADILABAD" "ADILABAD"
...
##  $ Mandal              : chr  "bheempoor" "bheempoor" "bheempoor" "bheempo
or" ...
##  $ Date                : chr  "01-Jan-21" "02-Jan-21" "03-Jan-21" "04-Jan-
21" ...
##  $ Rain_mm             : num  0 0 0 0 0 0 0 0 0 0 ...
##  $ Min_Temp_C          : num  10.1 11.7 10.4 13.1 13.4 15.6 19.3 21.3 17.3
12.4 ...
##  $ Max_Temp_C          : num  30 29.9 30.4 30.5 29.8 30.9 31.2 29.6 31.2 3
3.7 ...
##  $ Min_Humidity_percent: num  37.8 40.6 45.8 38.4 50.7 43.3 48.2 59.8 51.8
24.8 ...
##  $ Max_Humidity_percent: num  95.7 96.6 97 96.4 97 93.6 92.6 91.8 96.1 88.
1 ...
##  $ Min_Wind_Speed_Kmph : num  0 0 0 0 0 0 0 0 0 0 ...
##  $ Max_Wind_Speed_Kmph : num  3.1 2.2 2.2 2 2 1.6 1.4 2 1.6 2.8 ...

#Change the data type
d$District=as.character(d$District)
d$Mandal=as.character(d$Mandal)
d$Date=as.Date(d$Date,'%d-%b-%y')
d$Year=as.numeric(format(d$Date,'%Y'))
d$Month=as.numeric(format(d$Date,'%m'))

str(d)

## 'data.frame':    278987 obs. of  12 variables:
##  $ District            : chr  "ADILABAD" "ADILABAD" "ADILABAD" "ADILABAD"
...
##  $ Mandal              : chr  "bheempoor" "bheempoor" "bheempoor" "bheempo
or" ...
##  $ Date                : Date, format: "2021-01-01" "2021-01-02" ...
##  $ Rain_mm             : num  0 0 0 0 0 0 0 0 0 0 ...
##  $ Min_Temp_C          : num  10.1 11.7 10.4 13.1 13.4 15.6 19.3 21.3 17.3
12.4 ...
##  $ Max_Temp_C          : num  30 29.9 30.4 30.5 29.8 30.9 31.2 29.6 31.2 3
3.7 ...
##  $ Min_Humidity_percent: num  37.8 40.6 45.8 38.4 50.7 43.3 48.2 59.8 51.8
24.8 ...
```

```
##  $ Max_Humidity_percent: num  95.7 96.6 97 96.4 97 93.6 92.6 91.8 96.1 88.
1 ...
##  $ Min_Wind_Speed_Kmph : num  0 0 0 0 0 0 0 0 0 0 ...
##  $ Max_Wind_Speed_Kmph : num  3.1 2.2 2.2 2 2 1.6 1.4 2 1.6 2.8 ...
##  $ Year                : num  2021 2021 2021 2021 2021 ...
##  $ Month               : num  1 1 1 1 1 1 1 1 1 1 ...
```

```
#Sort the Data
d=arrange(d,District)
```

```
# Data Wrangling
```

```
#District Wise Max Temperature in C, Max Rain in mm, Max Humidity in %, Max W
ind in kmph (Jan 2021 - March 2022)
districtwise=d %>% group_by(District) %>% summarise(Maxtemp=max(Max_Temp_C),M
axrain=max(Rain_mm),Maxhumid=max(Max_Humidity_percent),MaxWind_Kmph=max(Max_W
ind_Speed_Kmph,na.rm=TRUE)) %>% arrange(desc(Maxtemp))
districtwise
```

```
## # A tibble: 35 x 5
##    District             Maxtemp Maxrain Maxhumid MaxWind_Kmph
##    <chr>                  <dbl>   <dbl>    <dbl>        <dbl>
##  1 PEDDAPALLI              44.6    222       100         67.4
##  2 JAYASHANKAR             44.5    256.      100         67.4
##  3 BHADRADRI KOTHAGUDEM    44.1    221.      100         67.4
##  4 MANCHERIAL              44.1    164.      100         67.4
##  5 MULUGU                  44.1    164.      100         67.4
##  6 JAGTIAL                 43.9    228.      100         69.8
##  7 KUMURAM BHEEM           43.9    374.      100         67.4
##  8 WARANGAL RURAL          43.9    388       100         65.1
##  9 ADILABAD                43.8    173.      100         67.4
## 10 KARIMNAGAR              43.8    303.      100         67.4
## # ... with 25 more rows
```

```
# District Wise Min Temperature in C, Min Rain in mm, Min Humidity in %, Min
Wind in kmph (Jan 2021 - March 2022)
districtwise1=d %>% group_by(District) %>% summarise(Mintemp=min(Min_Temp_C),
Minrain=min(Rain_mm),Minhumid=min(Min_Humidity_percent),MinWind_Kmph=min(Min_
Wind_Speed_Kmph,na.rm=TRUE)) %>% arrange(Mintemp)
districtwise1
```

```
## # A tibble: 35 x 5
##    District             Mintemp Minrain Minhumid MinWind_Kmph
##    <chr>                  <dbl>   <dbl>    <dbl>        <dbl>
##  1 KUMURAM BHEEM            3.5       0        0            0
##  2 ADILABAD                 3.8       0        0            0
##  3 MANCHERIAL               5.5       0        0            0
##  4 NIRMAL                   5.8       0        0            0
##  5 BHADRADRI KOTHAGUDEM     6         0        0            0
##  6 HANUMAKKONDA             6         0        5.2          0
##  7 HYDERABAD                6         0        0            0
```

```
##  8 JAGTIAL                  6         0      0              0
##  9 JANGAON                  6         0      0              0
## 10 JAYASHANKAR              6         0      0              0
## # ... with 25 more rows

library('sqldf')

## Loading required package: gsubfn

## Loading required package: proto

## Loading required package: RSQLite

#Monthly Wise Max Temperature in C
print(sqldf('SELECT Month, District, Date, Max_Temp_C FROM d GROUP BY month H
AVING max(Max_Temp_C)'))

##    Month             District       Date Max_Temp_C
## 1      1 BHADRADRI KOTHAGUDEM 2021-01-25       36.6
## 2      2 BHADRADRI KOTHAGUDEM 2021-02-28       39.4
## 3      3        KUMURAM BHEEM 2022-03-31       43.9
## 4      4 BHADRADRI KOTHAGUDEM 2021-04-02       44.1
## 5      5           PEDDAPALLI 2021-05-30       44.6
## 6      6           MANCHERIAL 2021-06-01       43.3
## 7      7             SURYAPET 2021-07-08       39.3
## 8      8              KHAMMAM 2021-08-09       39.6
## 9      9              KHAMMAM 2021-09-20       37.4
## 10    10              KHAMMAM 2021-10-04       38.1
## 11    11              KHAMMAM 2021-11-24       37.5
## 12    12              KHAMMAM 2021-12-08       37.1

#Monthly Wise Max Rain in mm
print(sqldf('SELECT Month, District, Date, Rain_mm FROM d GROUP BY month HAVI
NG max(Rain_mm)'))

##    Month             District       Date Rain_mm
## 1      1             NALGONDA 2022-01-16   117.0
## 2      2       WARANGAL RURAL 2021-02-19    52.7
## 3      3 BHADRADRI KOTHAGUDEM 2022-03-24    58.5
## 4      4           WANAPARTHY 2021-04-14    68.0
## 5      5       WARANGAL URBAN 2021-05-03   114.5
## 6      6       WARANGAL URBAN 2021-06-09   146.7
## 7      7        KUMURAM BHEEM 2021-07-23   374.4
## 8      8               NIRMAL 2021-08-31   195.2
## 9      9       WARANGAL RURAL 2021-09-07   388.0
## 10    10           RANGAREDDY 2021-10-09   133.8
## 11    11             NALGONDA 2021-11-01   101.8
## 12    12          MAHABUBABAD 2021-12-10    50.9

#Monthly Wise Max Wind in kmph
print(sqldf('SELECT Month, District, Date, Max_Wind_Speed_Kmph FROM d GROUP B
Y month HAVING max(Max_Wind_Speed_Kmph)'))
```

```
##    Month             District       Date Max_Wind_Speed_Kmph
## 1      1             ADILABAD 2022-01-31                65.1
## 2      2             ADILABAD 2022-02-09                67.4
## 3      3             ADILABAD 2022-03-03                65.1
## 4      4              JAGTIAL 2021-04-10                69.8
## 5      5            HYDERABAD 2021-05-05                65.1
## 6      6           WANAPARTHY 2021-06-17                67.6
## 7      7            HYDERABAD 2021-07-27                65.1
## 8      8               NIRMAL 2021-08-13                67.0
## 9      9 BHADRADRI KOTHAGUDEM 2021-09-24                65.1
## 10    10               NIRMAL 2021-10-08                67.4
## 11    12             ADILABAD 2021-12-28                65.1
```

```
#District wise Average Max Temperatures in C from Jan 2021-March 2022
print(sqldf('SELECT District, Max_Temp_C Average_Max_Temp FROM d GROUP BY Dis
trict HAVING avg(Max_Temp_C)'))
```

```
##                District Average_Max_Temp
## 1              ADILABAD             30.0
## 2  BHADRADRI KOTHAGUDEM             29.5
## 3          HANUMAKKONDA             33.0
## 4             HYDERABAD             28.0
## 5               JAGTIAL             28.3
## 6               JANGAON             28.2
## 7           JAYASHANKAR             30.4
## 8       JOGULAMBA GADWAL             28.7
## 9              KAMAREDDY             30.2
## 10            KARIMNAGAR             28.6
## 11               KHAMMAM             30.2
## 12         KUMURAM BHEEM             26.8
## 13           MAHABUBABAD             29.0
## 14          MAHABUBNAGAR             29.8
## 15            MANCHERIAL             30.6
## 16                 MEDAK             30.3
## 17   MEDCHAL-MALKAJGIRI             28.1
## 18                MULUGU             29.4
## 19         NAGARKURNOOL             29.7
## 20             NALGONDA             30.4
## 21            NARAYANPET             30.1
## 22                NIRMAL             28.8
## 23             NIZAMABAD             28.4
## 24            PEDDAPALLI             32.1
## 25     RAJANNA SIRCILLA             30.0
## 26           RANGAREDDY             30.7
## 27           SANGAREDDY             27.8
## 28              SIDDIPET             30.3
## 29              SURYAPET             30.0
## 30             VIKARABAD             30.0
## 31           WANAPARTHY             29.5
## 32              WARANGAL             33.3
```

```
## 33       WARANGAL RURAL             29.6
## 34       WARANGAL URBAN             29.7
## 35  YADADRI BHUVANAGIRI             27.7

#Max Temp from Jan 2021-March 2022
Maxtemp=subset(d,Max_Temp_C==max(Max_Temp_C))
select(Maxtemp,District,Mandal,Date,Max_Temp_C,Year,Month)

##          District   Mandal       Date Max_Temp_C Year Month
## 187410 PEDDAPALLI manthani 2021-05-30       44.6 2021     5

#Min Temp from Jan 2021-March 2022
Mintemp=subset(d,Min_Temp_C==min(Min_Temp_C))
select(Mintemp,District,Mandal,Date,Min_Temp_C,Year,Month)

##            District  Mandal       Date Min_Temp_C Year Month
## 87821 KUMURAM BHEEM tiryani 2021-12-21        3.5 2021    12

#Max Rainfall from Jan 2021-March 2022
MaxRain=subset(d,Rain_mm ==max(Rain_mm ))
select(MaxRain,District,Mandal,Date,Rain_mm,Year,Month)

##              District   Mandal       Date Rain_mm Year Month
## 267508 WARANGAL RURAL nadikuda 2021-09-07     388 2021     9

#Min Rainfall except 0 from Jan 2021-March 2022
Rainfall=subset(d,Rain_mm>0)
MinRain1=subset(Rainfall,Rain_mm==min(Rain_mm))
head(select(MinRain1,District,Mandal,Date,Rain_mm,Year,Month),20)

##                   District         Mandal       Date Rain_mm Year Month
## 500               ADILABAD    inderavelly 2021-02-19     0.1 2021     2
## 532               ADILABAD    inderavelly 2021-03-23     0.1 2021     3
## 770               ADILABAD adilabad urban 2021-02-19     0.1 2021     2
## 2111              ADILABAD          tamsi 2021-04-11     0.1 2021     4
## 2227              ADILABAD adilabad urban 2021-05-10     0.1 2021     5
## 2898              ADILABAD     talamadugu 2021-05-17     0.1 2021     5
## 3300              ADILABAD    inderavelly 2021-06-24     0.1 2021     6
## 3418              ADILABAD    neradigonda 2021-06-22     0.1 2021     6
## 3512              ADILABAD          tamsi 2021-06-26     0.1 2021     6
## 3595              ADILABAD adilabad urban 2021-07-18     0.1 2021     7
## 3969              ADILABAD    neradigonda 2021-07-20     0.1 2021     7
## 4697              ADILABAD adilabad urban 2021-09-05     0.1 2021     9
## 4712              ADILABAD adilabad urban 2021-09-20     0.1 2021     9
## 5813              ADILABAD adilabad urban 2021-11-23     0.1 2021    11
## 6045              ADILABAD    inderavelly 2021-11-15     0.1 2021    11
## 10832 BHADRADRI KOTHAGUDEM      dammapeta 2021-04-14     0.1 2021     4
## 10834 BHADRADRI KOTHAGUDEM      dammapeta 2021-04-16     0.1 2021     4
## 12597 BHADRADRI KOTHAGUDEM      dammapeta 2021-06-08     0.1 2021     6
## 12604 BHADRADRI KOTHAGUDEM      dammapeta 2021-06-15     0.1 2021     6
## 12606 BHADRADRI KOTHAGUDEM      dammapeta 2021-06-17     0.1 2021     6
```

```r
#Descriptive Statistics
summary(d)
```

```
##    District            Mandal               Date               Rain_mm
##  Length:278987      Length:278987      Min.   :2021-01-01   Min.   :  0.00
##  Class :character   Class :character   1st Qu.:2021-04-29   1st Qu.:  0.00
##  Mode  :character   Mode  :character   Median :2021-08-09   Median :  0.00
##                                        Mean   :2021-08-13   Mean   :  2.55
##                                        3rd Qu.:2021-12-04   3rd Qu.:  0.00
##                                        Max.   :2022-03-31   Max.   :388.00
##
##    Min_Temp_C      Max_Temp_C    Min_Humidity_percent Max_Humidity_percent
##  Min.   : 3.50   Min.   :17.30   Min.   : -1.00       Min.   : -1.00
##  1st Qu.:17.90   1st Qu.:31.10   1st Qu.: 27.00       1st Qu.: 83.80
##  Median :22.00   Median :33.10   Median : 43.10       Median : 95.50
##  Mean   :20.84   Mean   :33.58   Mean   : 43.73       Mean   : 87.85
##  3rd Qu.:24.20   3rd Qu.:36.30   3rd Qu.: 59.90       3rd Qu.:100.00
##  Max.   :32.10   Max.   :44.60   Max.   :100.00       Max.   :100.00
##
##  Min_Wind_Speed_Kmph Max_Wind_Speed_Kmph      Year          Month
##  Min.   : 0.00       Min.   : 0.00       Min.   :2021   Min.   : 1.000
##  1st Qu.: 0.00       1st Qu.: 2.50       1st Qu.:2021   1st Qu.: 2.000
##  Median : 0.00       Median : 7.10       Median :2021   Median : 5.000
##  Mean   : 0.08       Mean   :11.46       Mean   :2021   Mean   : 5.616
##  3rd Qu.: 0.00       3rd Qu.:11.90       3rd Qu.:2021   3rd Qu.: 9.000
##  Max.   :16.40       Max.   :69.80       Max.   :2022   Max.   :12.000
##  NA's   :50404       NA's   :50404
```

```r
#Mean
mean(d$Rain_mm)
```

```
## [1] 2.549664
```

```r
#Median
median(d$Max_Temp_C)
```

```
## [1] 33.1
```

```r
#Quantile
print(quantile(d$Max_Temp_C))
```

```
##   0%  25%  50%  75% 100%
## 17.3 31.1 33.1 36.3 44.6
```

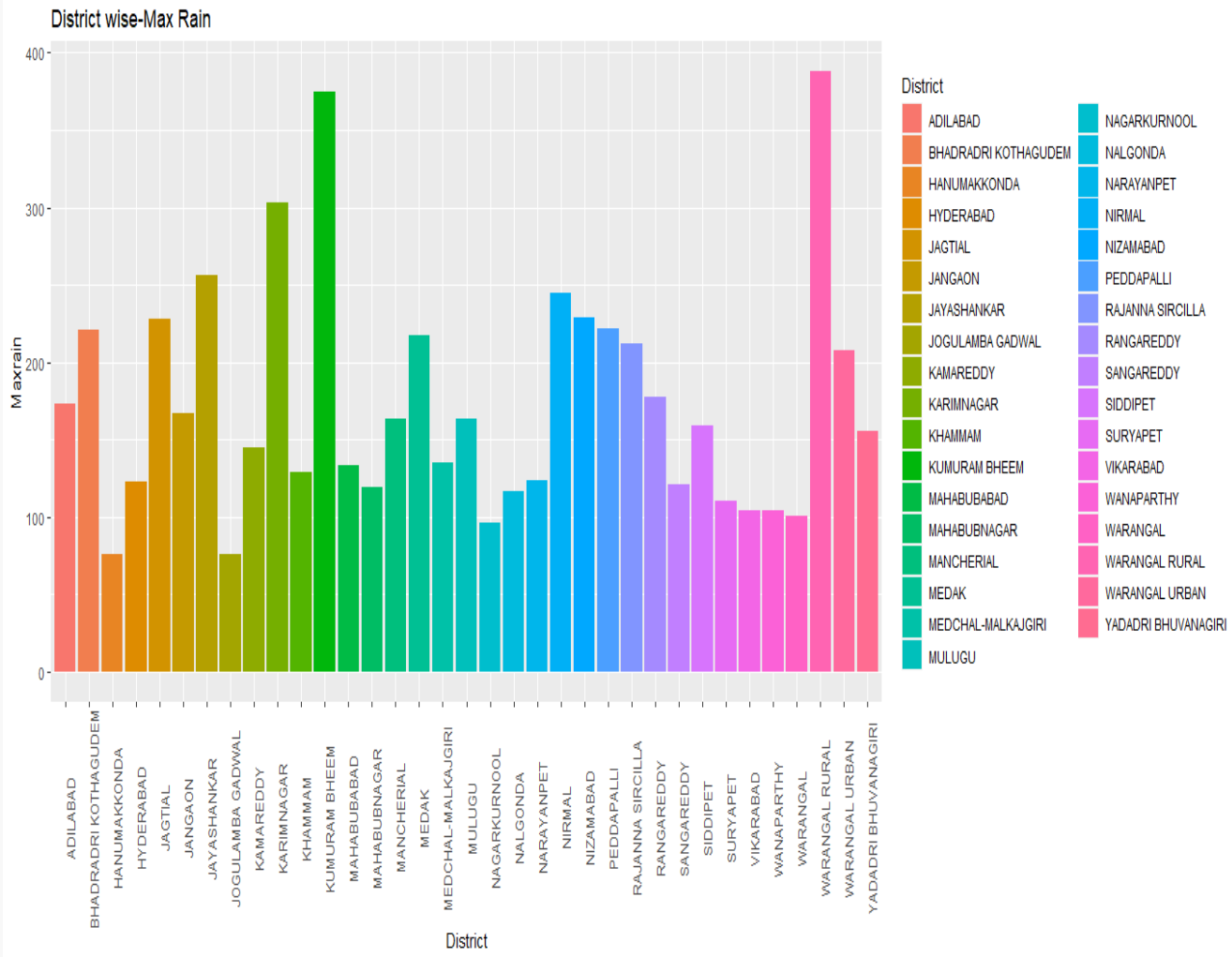
```r
print(quantile(d$Min_Temp_C))
```

```
##   0%  25%  50%  75% 100%
##  3.5 17.9 22.0 24.2 32.1
```

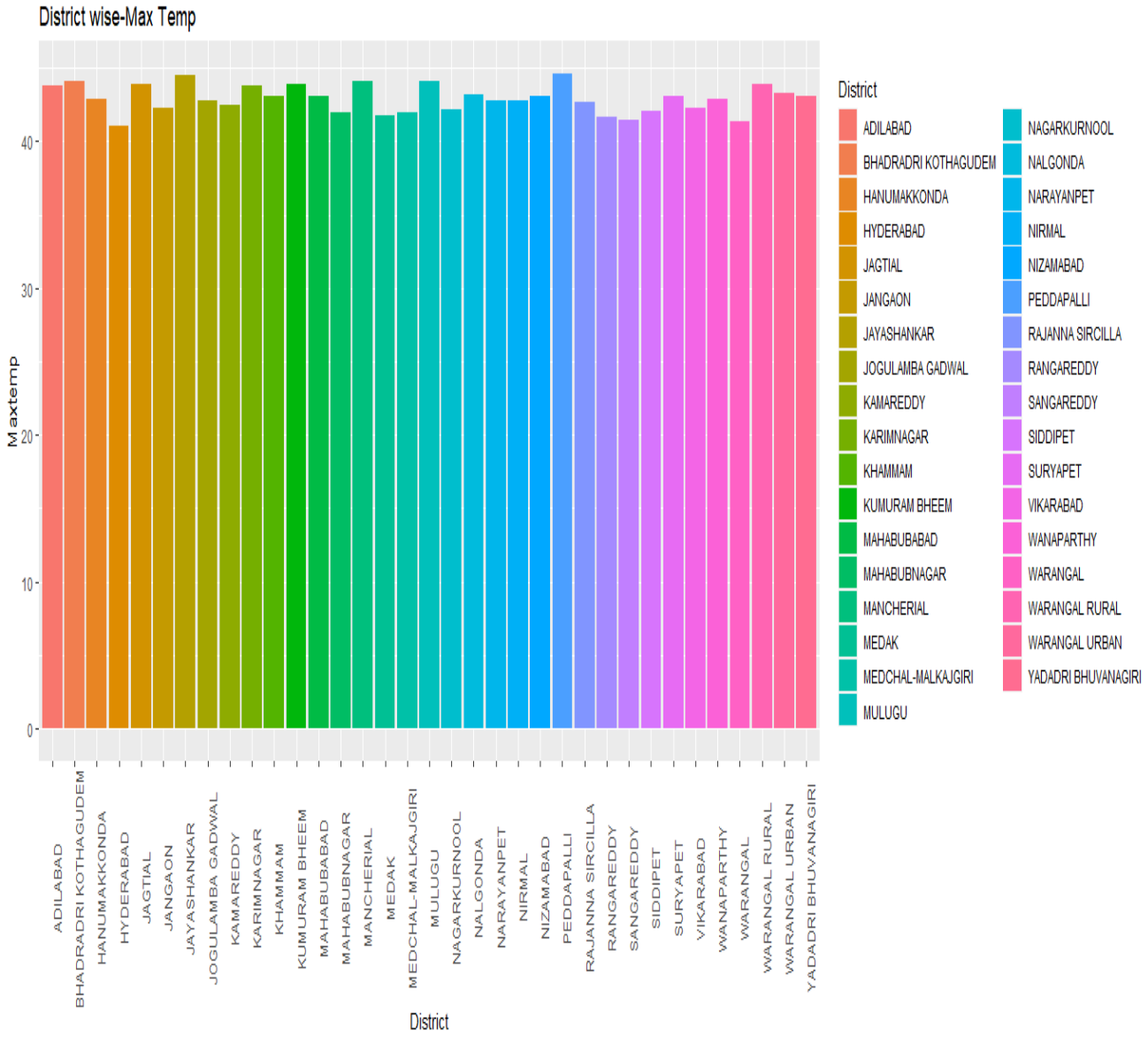
```r
Rainfall=subset(d,Rain_mm>0)
print(quantile(Rainfall$Rain_mm))
```

```
##    0%   25%   50%   75%  100%
##   0.1   1.3   5.0  15.9 388.0

#Variance
var(d$Rain_mm)

## [1] 107.9716

var(d$Max_Temp_C)

## [1] 12.33898

var(d$Min_Temp_C)

## [1] 20.87137

#Correlation
cor(d$Rain_mm,d$Max_Temp_C,method='pearson')

## [1] -0.1749382

cor(d$Rain_mm,d$Min_Temp_C,method='pearson')

## [1] 0.1163511

cor(d$Rain_mm,d$Max_Temp_C,method='spearman')

## [1] -0.215863

#Standard Deviation
sd(d$Rain_mm)

## [1] 10.39094

#Covariance
cov(d$Rain_mm,d$Max_Temp_C)

## [1] -6.385265

#Inter Quartile Range
IQR(d$Max_Temp_C)

## [1] 5.2

#T-Test
t.test(d$Rain_mm,d$Max_Temp_C)

##
##  Welch Two Sample t-test
##
## data:  d$Rain_mm and d$Max_Temp_C
## t = -1494.3, df = 341929, p-value < 2.2e-16
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
```

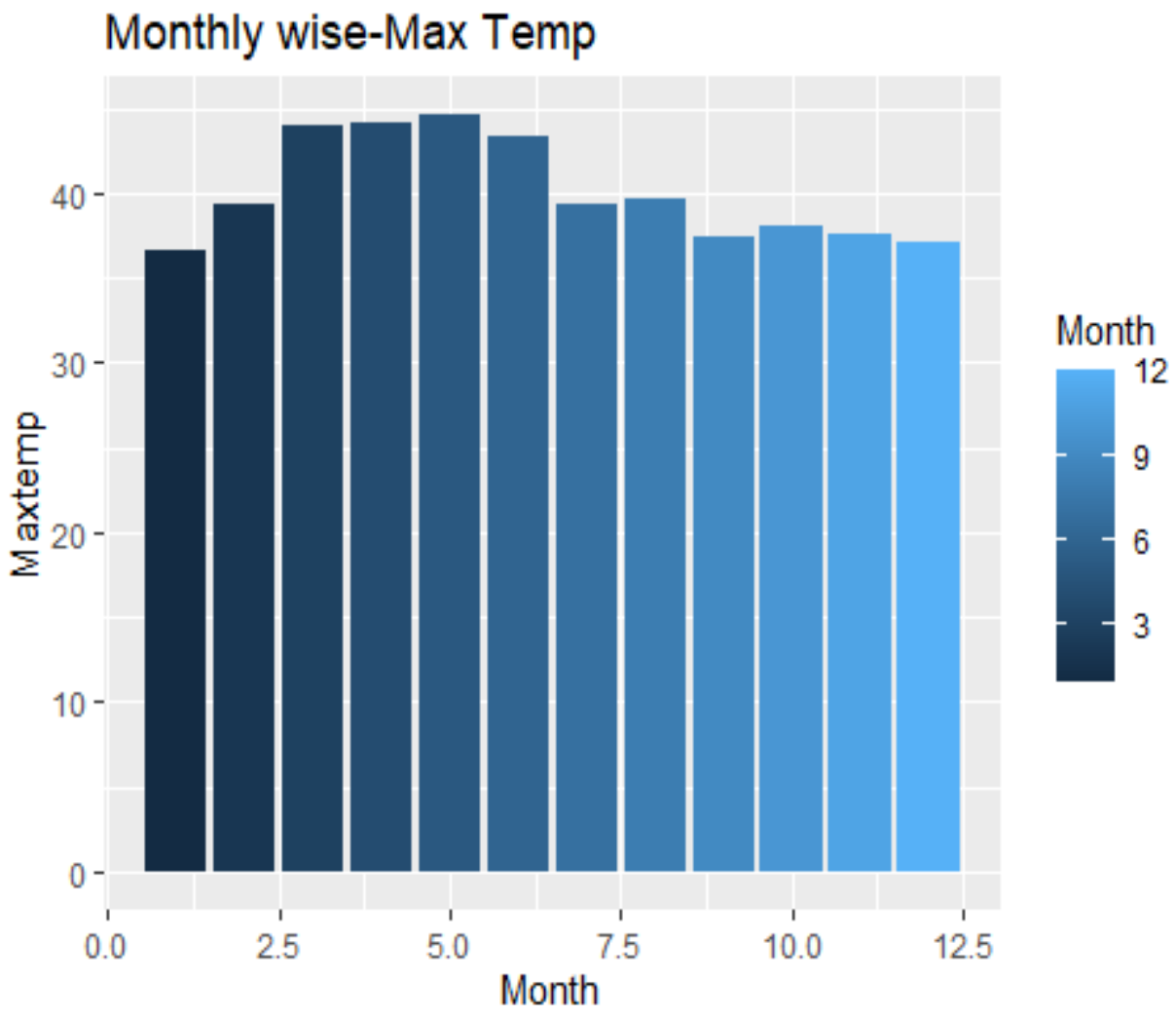
```
##  -31.07183 -30.99043
## sample estimates:
## mean of x mean of y
##  2.549664 33.580795

#Data Visualization
library('ggplot2')
library('choroplethr')

library('choroplethrMaps')

#District wise-Max Rain
Maxrain_plot=ggplot(data=districtwise,aes(x=District,y=Maxrain,fill=District)
)+geom_bar(stat='identity')+ggtitle('District wise-Max Rain')
Maxrain_plot
```



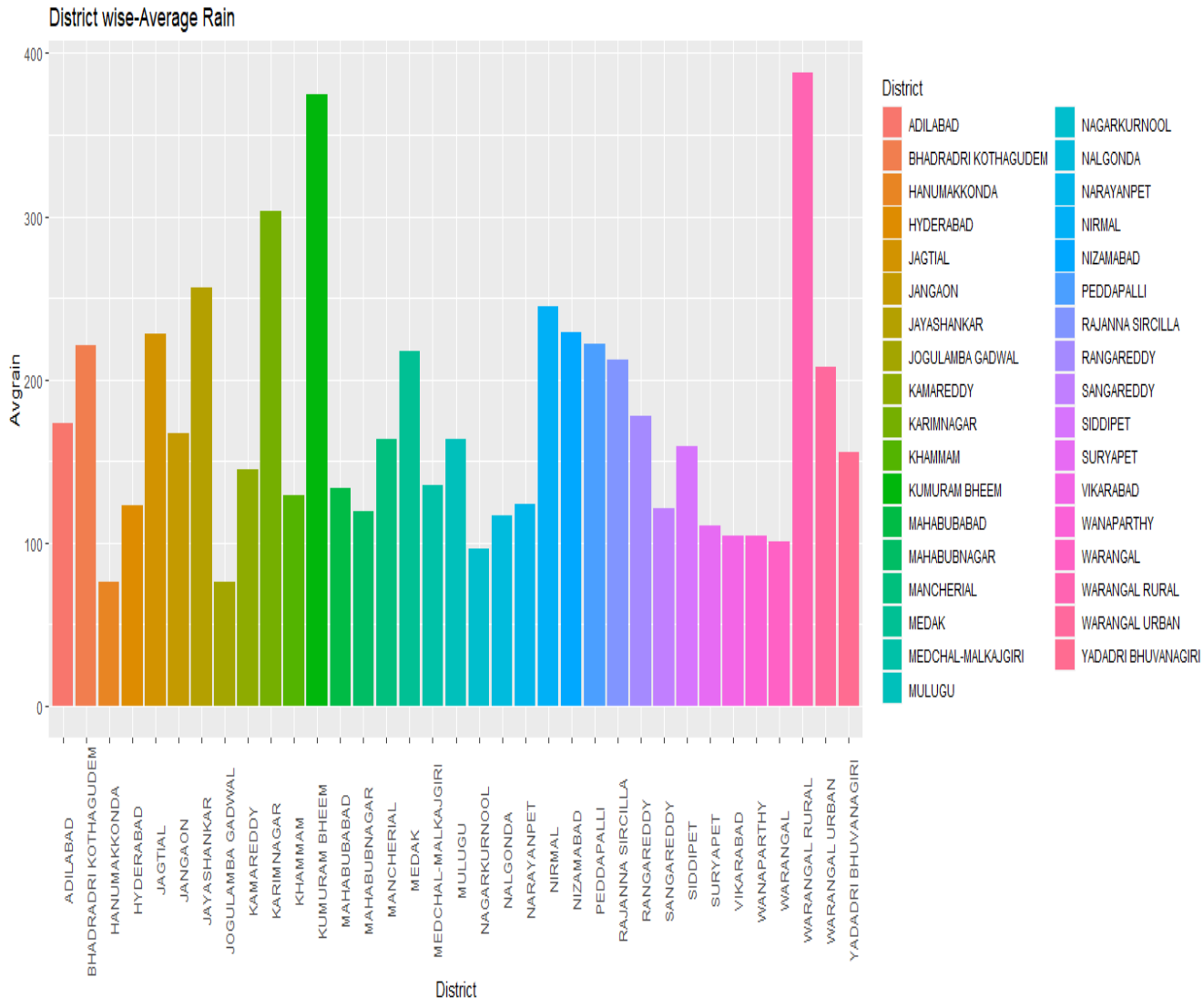
```
#District wise-Max Temp
Maxtemp_plot=ggplot(data=districtwise,aes(x=District,y=Maxtemp,fill=District)
)+geom_bar(stat='identity')+ theme(axis.text.x = element_text(angle = 90))+gg
title('District wise-Max Temp')
Maxtemp_plot
```



```r
#Monthly wise-Max Temp
Monthly=d %>% group_by(Month) %>% summarise(Maxtemp=max(Max_Temp_C,na.rm=TRUE
))
ggplot(data=Monthly,aes(x=Month,y=Maxtemp,fill=Month))+geom_bar(stat='identit
y')+ggtitle('Monthly wise-Max Temp')
```



```
#District wise-Average Rain
Avg_rain=d %>% group_by(District) %>% summarise(Avgrain=max(Rain_mm,na.rm=TRU
E))
ggplot(data=Avg_rain,aes(x=District,y=Avgrain,fill=District))+geom_bar(stat='
identity')+ theme(axis.text.x = element_text(angle = 90))+ggtitle('District w
ise-Average Rain')
```



SUMMARY:

Max Rainfall-

District	Mandal	Date	Rain_mm	Year	Month
WARANGAL RURAL	nadikuda	2021-09-07	388	2021	9

Max temperature-

District	Mandal	Date	Max_Temp_C	Year	Month
PEDDAPALLI	manthani	2021-05-30	44.6	2021	5

Min temperature-

District	Mandal	Date	Min_Temp_C	Year	Month
KUMURAM BHEEM	tiryani	2021-12-21	3.5	2021	12

REFERENCES:

https://data.telangana.gov.in/dataset/telangana-weather-data-2022

https://matplotlib.org/

https://seaborn.pydata.org/