Digital Assignment

Data Visulaization-CSE3020

Winter semester-2021

For India gridded, Brahmaputra and Ganga river basin data:

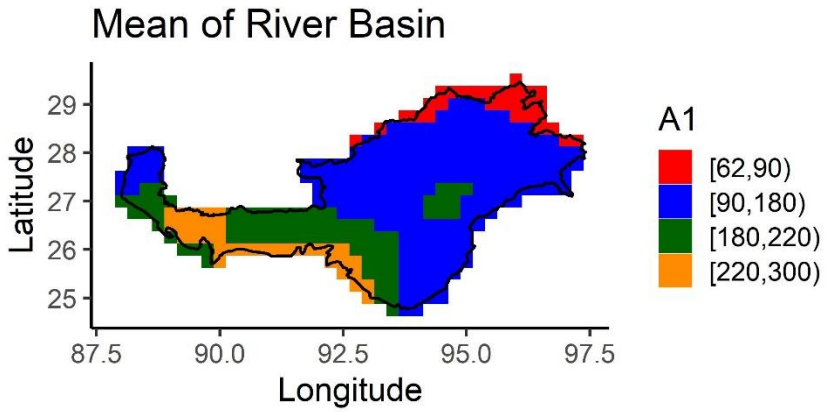
1. Number of grids:
    a. Indian grids: 354
    b. Brahmaputra river basin grids: 336
    c. Ganga river basin grids: 336
2. Time period: 1901-2014.
    a. Data points represent monthly rainfall.
    b. In each column, data are stored like this way:
        i. 1901 Jan, 1901 Feb, ……,1901 Dec, 1902 Jan, …., 1902 Dec
3. In case of River basin data span of time is 1901-2015
4. **Questions:**
    a. Calculate long term mean in each of grid. Map the derived result into geographical structure with suitable color palettes.
    b. Calculate the change in average annual rainfall with respect to global warming in each grid. Then plot the derived result.
    c. Calculate the change in seasonal average rainfall with respect to global warming in each of grids. Plot the derived results.
    d. Calculate the average seasonal (June-Sept) rainfall in each grid for the period 1901-1920. Similarly calculate the average seasonal (June-Sept) rainfall in each grid for the period 1990-last year. Calculate the change in average seasonal and plot them.
5. **Carryout these exercise for all datasets. Give proper caption to each of figure.**
6. **Based on your understanding explain each plot.**
7. **You may submit doc file or pdf file in VTOP/MS Team. Suggested to submit VTOP before the due time. If you failed to upload in VTOP, submit in MS Team.**

Note: If you have any queries, call me.

Good luck!!!!

1. **Calculate long term mean in each of grid. Map the derived result into geographical structure with suitable colour palettes.**

a. Brahmaputra Basin

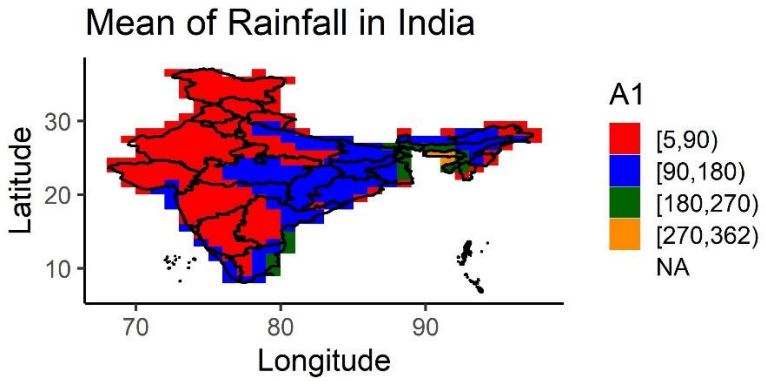


The plot expressing the mean of the rainfall in Brahmaputra river basin, labelled 'Mean of River Basin' , gives information about the mean of rainfall over the river basin ranging from the year 1901 to the year 2015, i.e., 115 years. The amount of rainfall is divided into 4 categories, represented by 4 colours: red, blue, dark green and dark orange.

The following information can be derived from the graph:

i. Minimum rainfall experienced by the area on an average is 62 mm
ii. Very less amount of area (29 grids) experiences rainfall in the range of 62-90 mm
iii. Largest area of the basin (197 grids) experiences rainfall between 90-180 mm
iv. Certain areas experienced heavy rainfall, in the area marked in dark orange and is between 220 to 300 mm. When compared to the Indian map, it is observed that this area is closest to the sea, which explains the high amount of rainfall.
v. Maximum rainfall experienced in the area is 300mm.

b. India

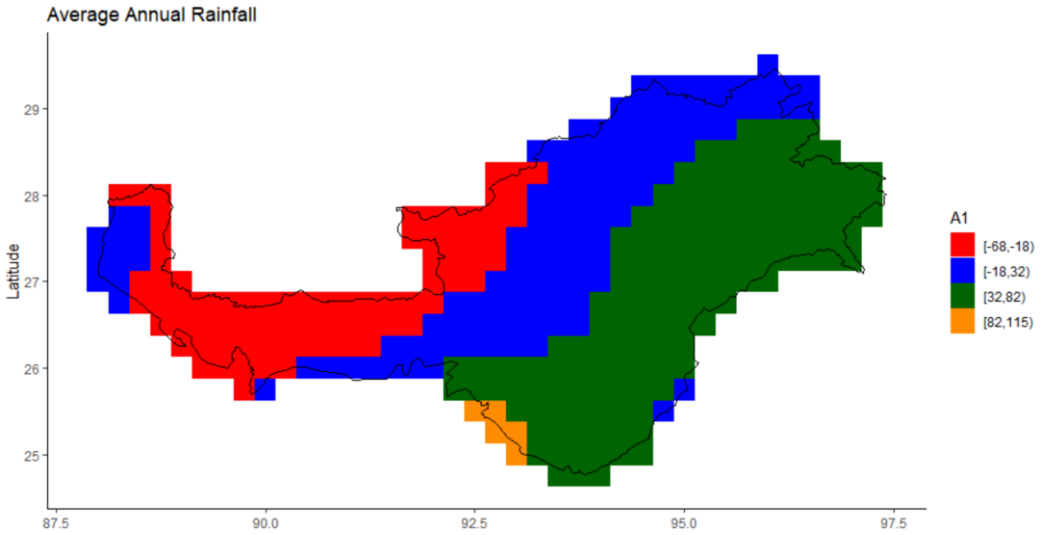


The plot expressing the mean of the rainfall in Brahmaputra river basin, labelled 'Mean of Rainfall in India' , gives information about the mean of rainfall over the country ranging from the year 1901 to the year 2015, i.e., 115 years. The amount of rainfall is divided into 4 categories, represented by 4 colours: red, blue, dark green and dark orange.

i. Minimum average rainfall experienced in the country is 5mm
ii. Maximum average rainfall experienced in the country is 362mm
iii. Very less area (22 grids) experiences rainfall between 180-270mm
iv. Heavy rainfall, between 270-362mm is observed in a total of 2 grids.
v. It is observed that a large area of the country (205 grids) receives rainfall between 5-90mm. This is majorly observed in western half of the country
vi. The distribution of rainfall in the north-eastern states is similar to the plot of Brahmaputra basin.
vii. The eastern half of the country and the western coastal regions are observed to receive rainfall between 90-180mm, making up a total of 125 grids.

2. Calculate the change in average annual rainfall with respect to global warming in each grid. Then plot the derived result.

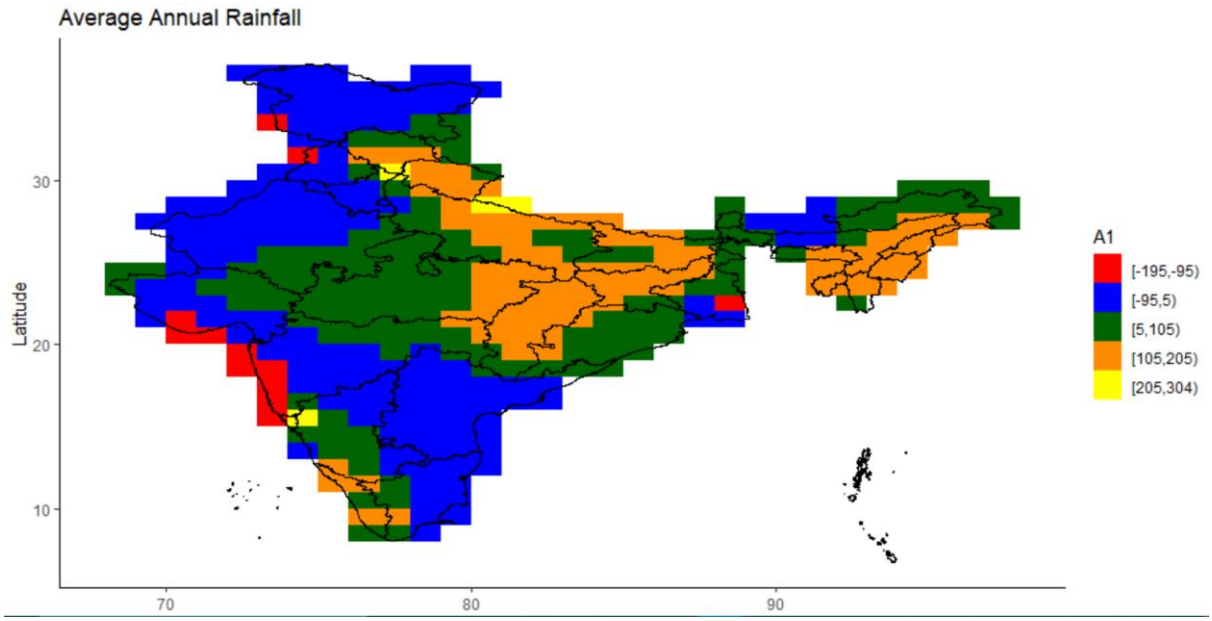
a. Brahmaputra



Here, the plot labelled 'Average Annual Rainfall' represents changing rainfall trends with respect to rainfall in the Brahmaputra basin. The dataset was divided into two parts, 1901-1970 and 1971-2015 and the difference in amount of rainfall between these two time periods was plotted. The following observations were made:

i. Rainfall significantly increased in the western area of the river basin, i.e., an increase of 18-68mm was noted.(118 grids)
ii. In the central part of the basin, while some areas experienced an increase in rainfall (about 0-18mm), other areas faced a decrease of about 0-32mm.(114 grids)
iii. The eastern part of the basin faced a decrease (32-82mm) in the amount of rainfall over the years (118 grids).
iv. A small region in the south western part of the basin faced a severe decrease in the amount of rainfall received (5 grids).

b. India

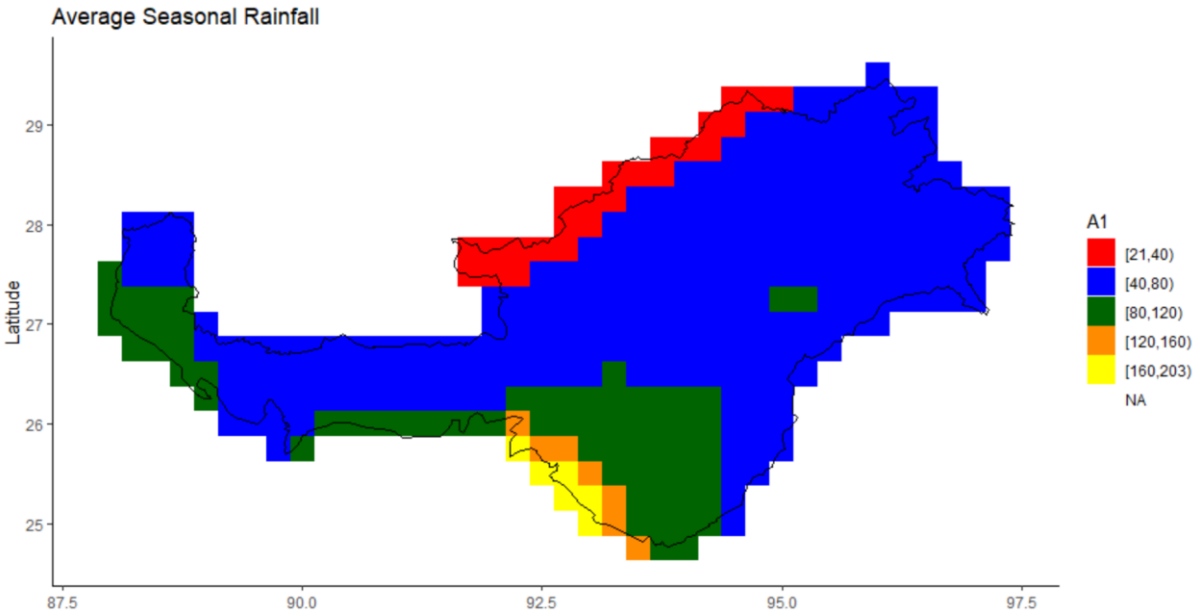


Here, the plot labelled 'Average Annual Rainfall' represents changing rainfall trends with respect to rainfall in the country. The dataset was divided into two parts, 1901-1970 and 1971-2015 and the difference in amount of rainfall between these two time periods was plotted. The following observations were made:

i. Very few areas across the country have experienced drastic changes in the level of rainfall:
   a. An increase of 95-195mm , marked in red (11 grids)
   b. A decrease of 205-304mm, marked in yellow (4 grids)
ii. The western half of the country, along with some areas located in the eastern half, marked in blue have experienced either a decrease of 0-5mm or an increase of 5-95mm. (143 grids)
iii. Some parts of South western coast, central and north-eastern regions of the country, marked in dark orange, experienced a decrease in rainfall of about 105-205mm. (68 grids)
iv. Parts of Central India, north-eastern regions of the country, parts of northern India and south western coast experienced a decrease of 5-105mm in the rainfall over the years. (128 grids)

3. Calculate the change in seasonal average rainfall with respect to global warming in each of grids. Plot the derived results.

a. Brahmaputra

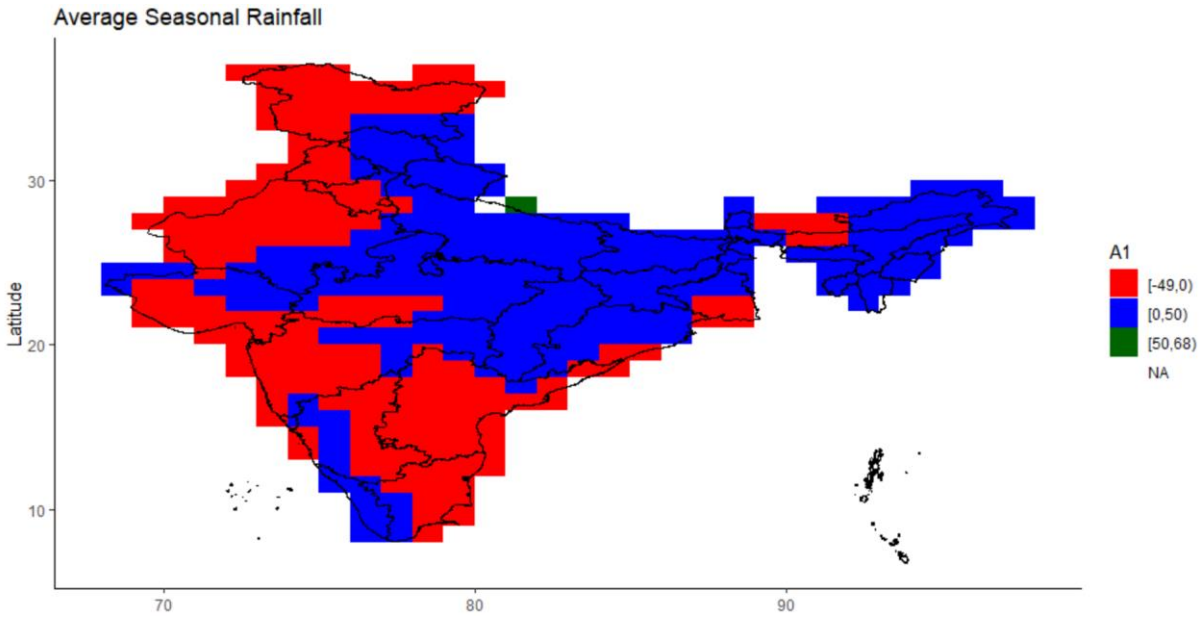


Here, the plot labelled 'Average Seasonal Rainfall' represents changing rainfall trends with respect to rainfall in the Brahmaputra basin in different seasons. The dataset was divided into two parts, 1901-1970 and 1971-2015 and the difference in amount of rainfall between these two time periods was plotted, to show the trends of rainfall with respect to global warming. The following observations were made:

i. Majority of the basin experienced a decrease in rainfall between 40-80mm
ii. A small portion of the northern part of the basin saw a decrease between 21-40mm
iii. The southern part of the basin saw a rainfall decrease of 80-120mm
iv. Small portions saw a decrease between
    a. 120-160mm
    b. 160-203mm
v. Global warning has led to an overall decrease in the rainfall of the river basin

b. India

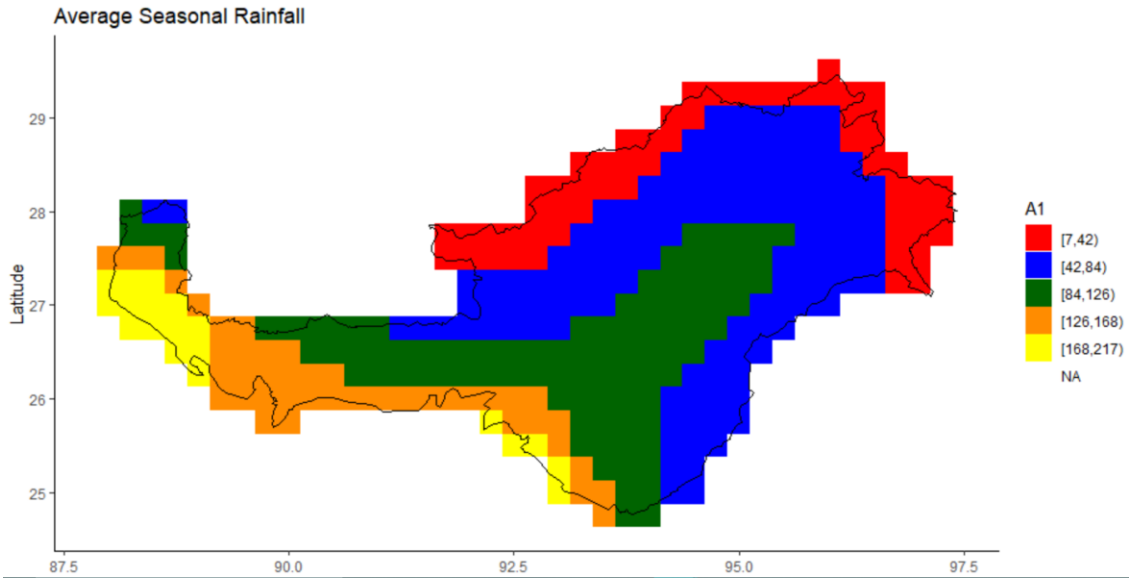
Here, the plot labelled 'Average Seasonal Rainfall' represents changing rainfall trends with respect to rainfall in the country across seasons. The dataset was divided into two parts, 1901-1970 and 1971-2015 and the difference in amount of rainfall between these two time periods was plotted, to show the trends of rainfall with respect to global warming. The following observations were made:



i. The western half of the country experienced an increase in rainfall of about 0-49mm.
ii. The eastern half of the country and some coastal regions, namely the southern and western coast experienced a decrease in rainfall of about 0-50mm.
iii. Small portion of the country experienced a rainfall decrease of 50-68mm.

4. **Calculate the average seasonal (June-Sept) rainfall in each grid for the period 1901-1920. Similarly calculate the average seasonal (June-Sept) rainfall in each grid for the period 1990-last year. Calculate the change in average seasonal and plot them.**

a. Brahmaputra

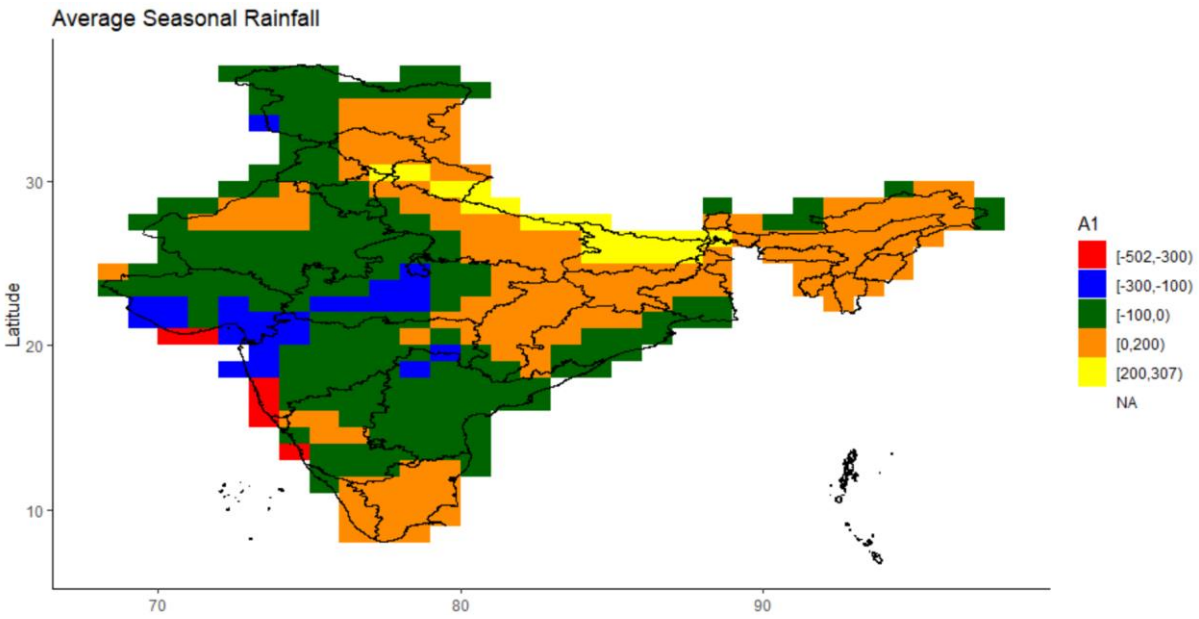


Here, the plot labelled 'Average Seasonal Rainfall' represents changing rainfall trends with respect to rainfall in the Brahmaputra basin in different seasons. The dataset was divided into two parts, 1901-1920 and 1990-2015 and the difference in amount of rainfall between these two time periods was plotted. The following observations were made:

i. Extreme north border of the basin experienced a decrease in rainfall of about 7-42mm
ii. The north-eastern part of the basin experienced a decrease in rainfall of about 42-84 mm
iii. In the central part of the basin, a decrease of 84-126mm was noted
iv. On the southern end, a decrease of 126-168mm was noted
v. On the western end of the basin, the rainfall decreased about 168-217mm

b. India

Here, the plot labelled 'Average Seasonal Rainfall' represents changing rainfall trends with respect to rainfall in the country across seasons. The dataset was divided into two parts, 1901-1920 and 1990-2015 and the difference in amount of rainfall between these two time periods was plotted. The following observations were made:



i. Increased rainfall noted in the following areas:
   a. Small portion of the western coast line, of about 300-502mm, marked by red
   b. Small portions across central and northern India, about 100-300mm, marked by blue
   c. Portions of western half, south-eastern areas and small regions in north east India, marked by green, of about 0-100mm

ii. Decreased rainfall noted in the following areas:
   a. Areas along the Nepal border, marked by yellow, of about 200-307mm
   b. Parts of eastern and southern India and some areas in western India, marked by orange of about 0-200mm