

# Spatial and Temporal Rainfall Trend Analysis: at Abrehamo woreda in Assosa Zone, Benishangul Gumez Region, Ethiopia

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**Abstract**— The main aim of this paper was to investigate the trend and variability of seasonal and annual rainfall data over western Ethiopia in Bineshungul region at abrehamo woreda since 2009-2020. according to this assessment Abrehamo has monomodal season or single maxima and amount of rainfall is show decreasing trend year to year. Mean annual rainfall of at that station is 1458.2mm and annual standard deviation is 184.8 .us result of coefficient of variance annually has less variable and in season highly variability without kiremt season. The mean annual rainfall coefficient of rainfall indicated less to high rainfall variability. Rainy season of in this area include last month belg and first month bage that means May-October. Belg and Bega Season of study area is respect high variation the range of coefficient of variance is  $>0.3$ . Kiremt and annual coefficient of variance range is  $<0.2$  it is less variability.

**Keyword**— Trend, change & variability, Abremamo Woreda, Benishangul Gumez, Ethiopia.

## I. INTRODUCTION

**Climate:** Climate is usually defined as the “average weather” or more rigorously as the statistical description in terms of the mean and variability of relevant quantities over a period of time ranging from months to thousands or millions of years. The classical period is 30 years, as defined by the World Meteorological Organization (WMO, 2007)

**Climate variability:** Variations in the mean state and other statistics (such as standard deviations, the occurrence of extremes, etc.) of the climate on all temporal and spatial scales beyond that of individual weather events (Fusel and Klein, 2006,).

**Climate change:** “A change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, usually decades or longer. Climate change may be due to natural internal processes or external forcing or to persistent anthropogenic changes in the composition of the atmosphere or in land use” (IPCC, 2007).

### Rainfall of Ethiopia

Diro et al. in 2011 [2] described the highlands of Ethiopia to exhibit three cycles of seasonal rainfall: spring mid-rainy season (February–May), summer rainy season (June–September), and dry season (October–January), locally known as Belg, Kiremt, and Bega seasons, respectively. Seasonal rainfall in Ethiopia is driven mainly by the migration of the Inter-Tropical Convergence Zone (ITCZ). (McSweeney et al 2010). There is strong intr-annual variability of rainfall across the country. Rain fall of Ethiopia is characterized by high

spatial and temporal variability due to the topographic variation and geographical location. Rainfall is one of important climate element for agricultural production. Agricultural sector remains the main source of food and income for most rural communities in Ethiopia. But due to its dependence on rainfall, the sector is expected to be affected by the anticipated climate change. For example, the most food uncertain regions and most climate change vulnerable regions in Ethiopia are those that experience both the lowest and most variable rainfall patterns (UN-OHRLLS, 2009). Therefore, understanding the variations in rainfall both spatially and temporally and improving the ability of forecasting rainfall may help in planning for any purpose example. Designing water storages, planning drainage channels for flood mitigation, human health, irrigation structure, etc. so that this study focuses on the trend and seasonal pattern of rainfall on a set of selected Area by using statistical techniques and address the temporal climate change trend of precipitation and its variation.

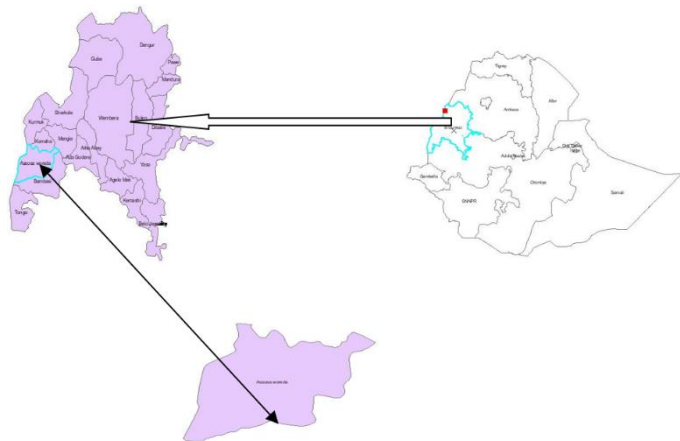
### Objective

Objective of this study is to analyze the general trend and variability in annual rainfall of Abrehamo station for historical data-period and to Investigated the temporal (annual, seasonal, monthly) dynamics of rainfall and its spatial distribution with in Abrehamo woreda, Assosa zone, BenishangulGumuz western Ethiopia.

## II. MATERIAL AND METHODS

### Description of Study Area

Abrehamo is one of the woreda found in Assosa Zone, Benishangul-Gumuz Region, western Ethiopia. Assosa is bordered on the south by the Mao-Komo special woreda, on the west by Sudan, and on the north east by the Kamahi. The capital city of benishungul gumuz is Assosa. Assosa woreda is divided in to two Abrehamo and URA since 2021/2022 .so Abrehamo is one of new woreda under assosa zone which has 41 kebele. It is geographically located Latitude  $09^{\circ}98'$  N and longitude  $34^{\circ}5'E$ . (station History profile of under Bineshungul Gumuz Meteorological service center ,2000). Abrehamo is low land area. The elevation is 1530 meter above sea level with mean annual total rainfall is around 1458.2 mm.



Assosa woreda is divided in to two URA and Abrehamo my select Area is Abrehamo

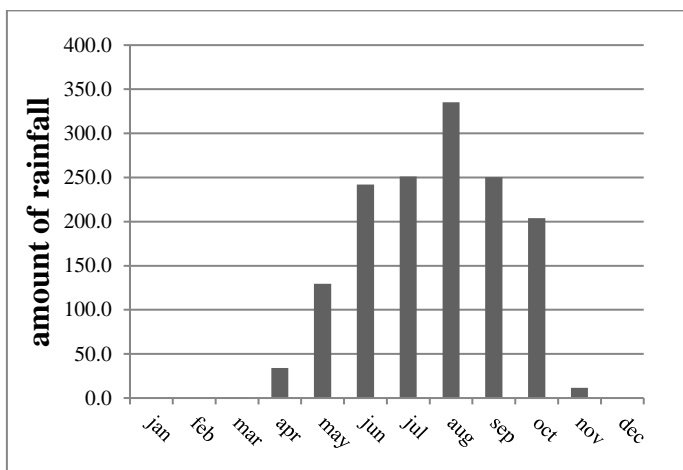
*Method of data analysis*

The study has used medium year (2009-2020) data of rainfall; from the Ethiopian Meteorology Institute of Bineshungul gmuze Meteorological service center, at Abrehamo station observed data. For assessing this observed data used Microsoft Excel by calculating different statistic indices like the coefficient of variance, standard deviation, and mean.

III. RESULT AND DISCUSSION

3.1 Rainfall statistics

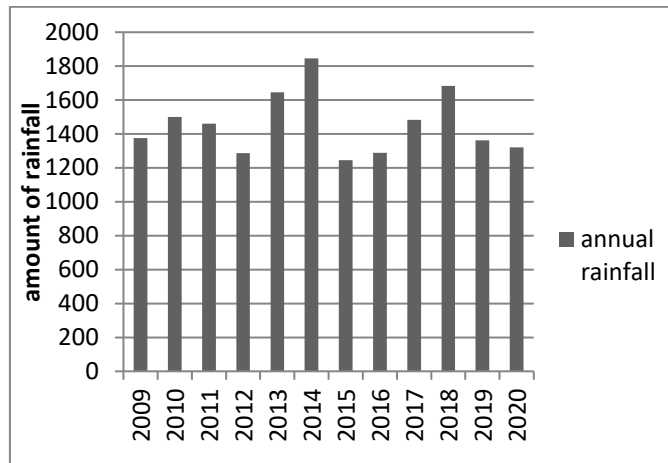
3.1.1 Mean monthly rainfall pattern of Abrehamo station (2009-2020)



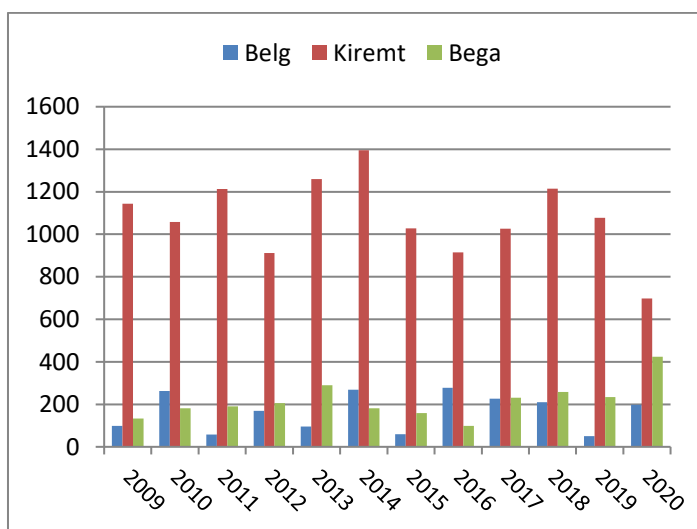
We understand from this graph the highest mean rainfall amount recorded in August (335.1mm). main rain started from May –October.

3.1.2 Annual rain fall pattern of Abrehamo Station (2009-2020)

We look below the graph it has gradually decreasing trend amount of rainfall. high amount of rainfall recorded in the year at 2014 Around 1844.4mm and minimum rainfall recoreded at 2015 Around 1245.4mm.as result of coefficient of variability, there is less variable.

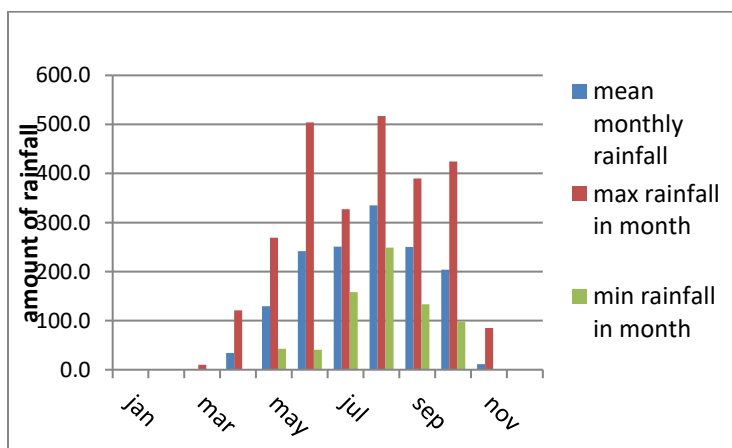


3.1.3 Seasonal Rainfall Pattern of Belg, Kiremt and Bega



As this graph shows kiremt rainfall is decreasing trend. There is significant change in magnitude of rain. Otherwise bega season is increasing trend rain amount since 2017. In belg season have high variable and also there is no significant change.

3.1.4 Min, max and mean rainfall pattern of abrehamo station (2009-2020)



When we compare amount of rainfall highest rainfall recorded at August and Jun in rainy season at study area. Other remain season minimum rainfall is zero mm without October month.

4. Statistical summery of rainfall data (2009-2020)

Month	Maximum	Minimum	Mean	Standard Deviation	Coefficient Of Variance In %	Skew
Jan	0.0	0.0	0.0	0.0	0.0	0.0
Feb	0.0	0.0	0.0	0.0	0.0	0.0
Mar	10.0	0.0	0.8	2.9	34.6	3.5
Apr	121.0	0.0	34.2	42.7	125.0	1.0
May	269.0	43.0	129.5	73.3	5.7	0.4
Jun	504.0	41.0	241.9	119.0	49.2	0.7
Jul	327.0	158.0	251.1	55.3	2.2	-0.2
Aug	517.0	249.0	335.1	78.2	23.3	1.4
Sept	390.0	133.6	250.2	67.3	2.7	0.4
Oct	424.2	98.0	203.8	86.5	42.4	1.6
Nov	85.0	0.0	11.7	25.5	21.9	2.6
Dec	0.0	0.0	0.0	0.0	0.0	0.0
Annual	0.0	0.0	1458.2	184.8	12.7	0.9

IV. CONCLUSIONS

Annual rainfall trend is decreased and there is less variability. In kiremt season indicated decreasing rainfall trend and significant change with rainfall magnitude. Belg and bega season have high varaibility.and bega season rainfall trend is gradually increasing year to year. Generally this study indicated decreasing trend and less to high rainfall variability.

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