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Assessing rainfall variability at kersa district, jimma zone, Ethiopia

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Abstract: *In Ethiopia, rainfall is highly variable climate element both in amount and distribution. Climate risk in the country was mostly due to lack of proper understanding of start, end and dry spells in the rainy season. Rainfall data (1987-2017) were collected from West Oromia meteorological service centre. Analysis of rainfall data at Jimma station indicated that average onset of the growing season starts On March 17witha coefficient of variation of 17.9%. The more preferred planting is earlier than March 25 which is in three years every four years time. The mean end date of the season falls on November 14 with coefficient of variation of 6.9%. The more preferred planting is earlier than March 25 which is in three years every four years' time. The average length of the growing season at the study area was 242 days. The probability of dry spell for 7 days was greater than 80% from Oct 26 up to March 1, while the probability was decreasing up to 10% from March1 to April 9 Climate pattern of the study area was mono modal.*

Key words: *Rain fall, Variability, Start of the season, End of the season, Dry spells and Ethiopia*

1.1. Description Study Area

The study was conducted in Kersa district of Jimma Zone, Oromia National Regional State (Figure1). Geographically, Kersa district stretches 7^{0} 35' 40"N to 7^{0} 59' 04"N latitude and 36^{0} 48' 24"E to 37^{0} 11' 82"E longitude (Socio-economic profile of *jimma Zone*, 2006). The altitude of the district ranges from 1688 to 2768 meters above sea level with Keremt season total rainfall of 1111.3 to 1864.2mm

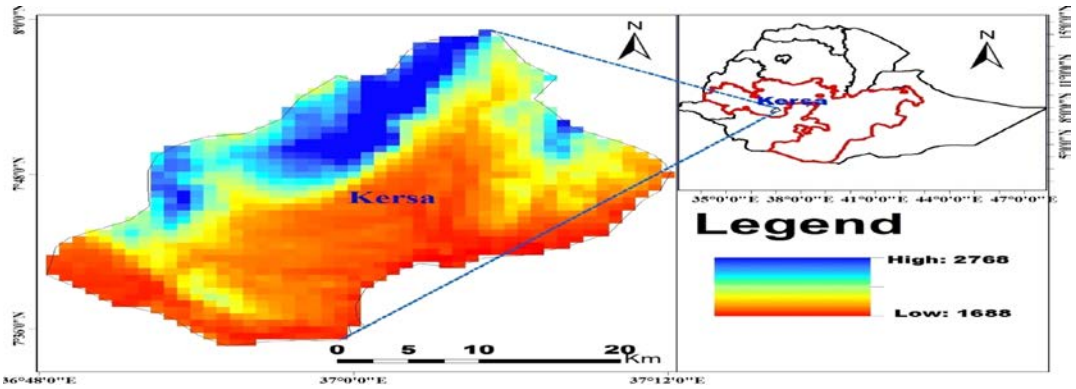

Figure 1: Map of the study area

2. Method of data analysis

Statistically, *the* start of the season, the end of the season, the length of growing period (LGP) and dry spell risk probability were identified and plotted by using instat$_{+\ v3.37}$ software. According to Stern *et al*. (2006), missing data was filled with mean values. Start of the season, End of the season, Length of growing period and dry spell risk probability, were analyzed and plotted using INSTAT$_{+\ V3.37}$ software.

2.1. Analysis of Start of the season, End of the season and Length of growing period

The start of the rain season: Defined as the first occasion proposed at first March when the rain accumulated in the three consecutive days is at least 20 mm and no dry spell of more than 10 days in the next 30-days periods (Hadgu*et al*., 2013) was computed by using INSTAT$_{+\ V3.37}$ software.

End of the rain season: According to Segele and Lamb (2005), End of the season was determined based on the following thresh hold: If the first day of a dry-spell (<0.1mm per day) of at least 20 days duration that occurred after onset.

Length of growing period (LGP): Length of growing period was determined as the difference between the start date and end date of the season (Hadgu*et al*., 2014).

2.2. Analyzing Dry spells Risk

According to NMSA (2001), a day is said to be dry if it accumulates rainfall<1 mm and dry spell length is the maximum number of consecutive dry days with rainfall less than 1 mm per day exceeding 5, 7, 10, and 15. It was analyzed using first order Markov of chain.

3. RESULT AND DISSCUSION

3.1. Determining Start of the rain season, End of the season and Length of growing period at Jimma

According to the criteria of start of rainy season that embedded in the INSTAT plus version (3.37) software, the start of seasonal rain is when total rainfall of more than 20mm is recorded in three consecutive days. These criteria normally fulfilled after fist March and no drier spell exceeding 7 day within the next 30 days. No drier spell exceeding 7 days within the 30 days taken as extra criteria that embedded in INSTAT plus version (3.37) helps to understand false onset. At Jimma station, March is identified as the starting of rain for 31 years (1987-2017). Analysis of rainfall data at Jimma station indicated that average start of the rain season starts On (March 17) with a coefficient of variation of 17.9%. According to Australian Bureau of Meteorology (ABM) (2010), the values of the coefficient of variation recorded indicate the existence of less variability. The probability of occurrence of Start of the rain season in term of quartile is: once in four years (25%percentile) was on(March5),where as probability of occurrence of Start of the rain season twice in four years(50%percentile)was on (March14) and three times in four years (75% percentile)was on (March25) .Based on the values of the quartiles. The more preferred planting is earlier than March 25 which is in three years every four years time (Table1 and Figure1).The mean end date of the rain season falls on November 14withcoefficientofvariationof 6.9%. Analysis of the quartile indicated that the 25% chance (once in four years) that the end of the rain season fall on November1. The50% quartile chance (twicein4years) for the end of the rain season is on November 21 and also ,the probability that the end of the season for three times infouryearsor75% is on November30 .The more preferred end of the rain season was earlier than November30, which is in three years every four years time (Table1 and Figure1).Results of the analysis indicated that the length of rain season at Jimmarangesfrom182 to 284(days) while the average length of the rain season at the study area was 242 days, with coefficient of variation of 11.9%.Theresults indicated that the variability in the length of the rain season ,as indicated by the CV was less variable. The probability of occurrence of length of the rain season in term of quartile was: once in four years (25%percentile) corresponds to 215 days, whereas probability of occurrence of length of the rain season twice in four years (50%percentile) corresponds to 251 days and three times in four years (75% percentile) correspondsto261 days (Table1 and Figure1).The result obtained was clear that the LGP at the study area was in less variable category, shows less risks related to drought.

Table1: Descriptive statistics of different rainfall features at Jimma (1987-2017)

Rainfall features	Minimum	Quartile 1(25%)	Quartile 2 (Median)	Quartile 3 (75%)	Maximum	Average	SD (±)	CV (%)
Onset date (DOY)	61	65	74	85	108	77	13.6	17.9

End date (DOY)	275	306	326	335	348	319	22.2	6.9
LGP(No. days)	182	215	251	261	284	242	28.8	11.9

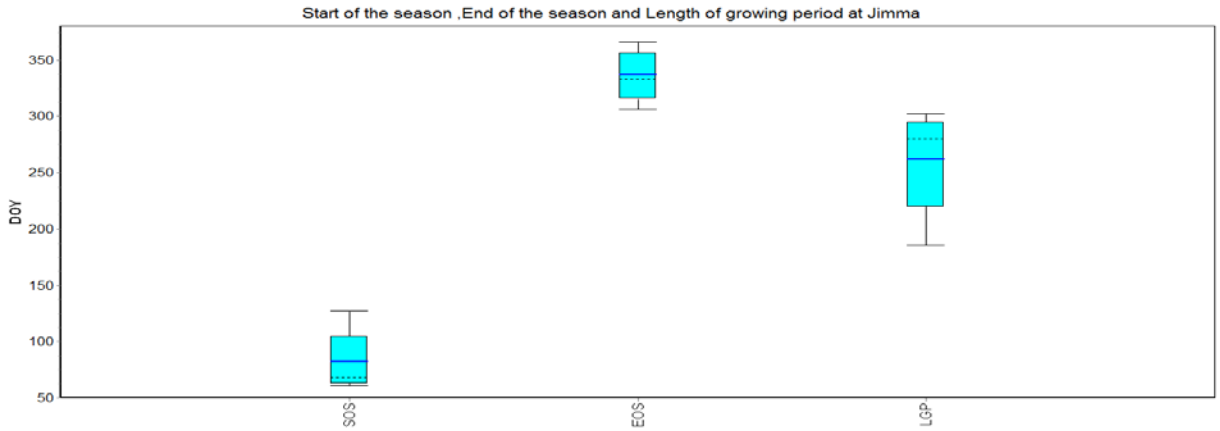

Figure1: Important Keremt season rainfall features at Jimma (1987- 2017).

3.2. Determining dry Spells at Jimma

The probability of dry spell for 7 days was greater than 80% from (Oct 26) (March 1) from 61 (March1) up to (April 9) the probability was decreasing up to 10% and also from (October 26)up to (September 6) the probability was decreasing up to 10% from (April 9) up to (September 6) the probability of dry spell was less than 10% .The probability of dry spell for 10 days was between 50% and 70% from (October 26) up to (February 19) and from (February 19) up to (March 15)the probability was deceasing from 30 % to 10% and also from (September 16)up to (October 26)the probability was increasing from 10% to 50% from (March 15) up to (September 16) the probability was less than 10 % .The probability of dry spell for 15 days was between 10% and 30% from (October 16)up to (February 19) and from (February 19) up to (October 16) the probability was less than 10%(Figure2).

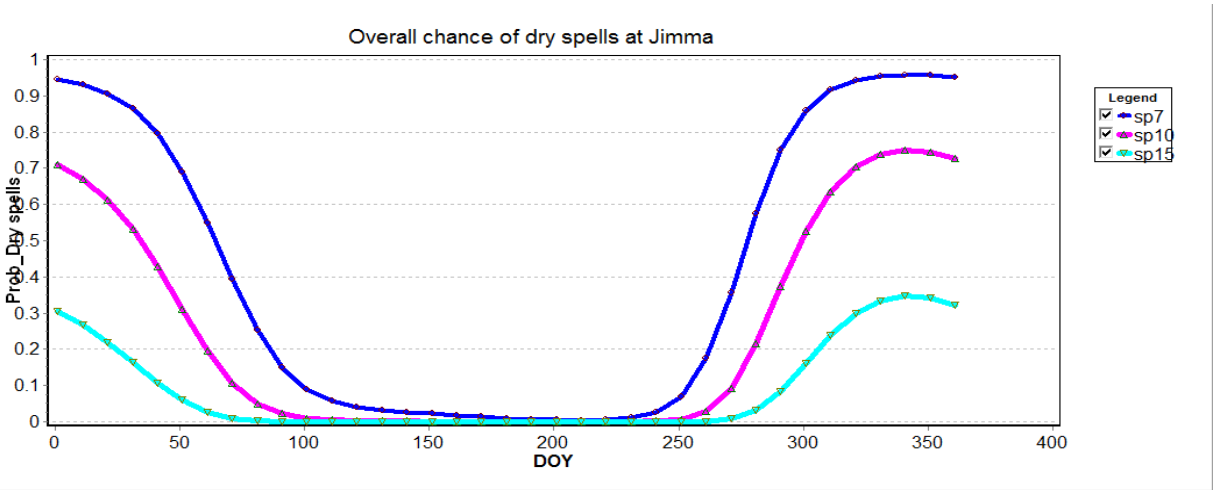

Figure 2: Probability of dry spells at Jimma (1987- 2017)

4. CONCLUSIONS

Analysis of rainfall data at Jimma station indicated that average onset of the growing season starts on March 17witha coefficient of variation of 17.9%. The values of the coefficient of variation recorded indicated the existence of less variability. The more preferred planting is earlier planting than on march 25 which is in three years every four years time. The mean end date of the season (EOS) falls on November 14 with coefficient of variation of 6.9%. The more preferred EOS is earlier than on November 30 which is in three years every four years time. The average length of the growing season at the study area was 242 days, with coefficient of variation of 11.9%. The result obtained was clear that the LGP at the study area was in less variable category, shows less risk related to drought. The probability of dry spell for 7 days was greater than 80% from Oct 26 up to March 1 and from March1 up to April 9 while probability of dry spell for 10 and 15 days were less than that of 7 days.

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