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Research Paper

The wettest place in Sri Lanka

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Abstract: The average annual rainfall of Sri Lanka varies from 900 mm to 5,500 mm. A debate and misconception have continued on the “wettest place” or the rain gauge station that receives the highest rainfall in the country. Seven rain-gauge stations (seven locations) were selected considering the regions receiving with probable highest rainfall in Sri Lanka. The average annual total rainfall and average number of rainy days were analysed using daily rainfall data covering

the most recent five years (2015 – 2019) to detect the rain gauge station receiving the highest rainfall. Among the locations considered, the newly established rain gauge station at the Welioya Estate (6.9288 N, 80.5582E, 1,258 m amsl) reported the highest rainfall, where the estate has received an average annual rainfall of 5,081 mm. Except during the South West Monsoon (SWM) season (May to September), the three rain-gauge stations located around Watawala Estate have recorded the lowest cumulative seasonal rainfall catch resulting in the same pattern of ranks in the average annual total rainfall. This study revealed that the Welioya Estate in Hatton receives the highest average annual rainfall in Sri Lanka. However, absence of standard rain-gauges installed in many locations in Sri Lanka to collect daily observations is a drawback in conducting detailed analysis rainfall across all agro-ecological regions in Sri Lanka.

Keywords: Annual and seasonal rainfall, Watawala, Wettest place, Sri Lanka

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Introduction

Despite its relatively small aerial extent, Sri Lanka exemplifies a variety of climatic conditions, especially the rainfall regime depending on the geographical settings of respective locations. Rainfall of Sri Lanka is of multiple origins, namely, monsoonal, convectional and weather systems formed in the Bay of Bengal account for major share of the annual rainfall (Punyawardena, 2020).

The four rainfall seasons that have been recognized in the rainfall calendar of Sri Lanka are based on the monsoons (Chandrapala, 2007). These are the First Inter-Monsoon (FIM; March-April), South West Monsoon (SWM; May-September), Second Inter-Monsoon (SIM; October-November) and North East

Monsoon (NEM; December-February). The rainfall distribution during the FIM period shows that the entire southwestern sector and hill country receives over 250 mm of rainfall, with a localized area in the southwestern slopes experiencing rainfall in excess of 700 mm. Rainfall during the SWM period varies from about 100 mm to over 3,000 mm, and the highest rainfall is received in the mid elevations of the western slopes of Central highlands.

The SIM period is the most evenly balanced distribution of rainfall over Sri Lanka where almost the entire island receives in excess of 400 mm of rain during this season, with south western slopes

receiving a higher rainfall in the range of 750 to 1,200 mm. During the NEM period, the highest rainfall values are recorded in the northeastern slopes of the Central hills with over 1,200 mm (Chandrapala, 2007). Being primarily convective in nature, rains during two inter-monsoon periods usually associates with thunder and lightning along with short-duration high intensity rains, especially during the FIM period (Punyawardena, 2020).

The southwestern region of Sri Lanka, including south-western slopes of the Central highlands, stands out clearly as the wettest region of the country and is named as the Wet zone. Hence, the wettest location of the country should lie within the Wet zone in an exposure of south-western slopes of the Central highland where altitude is below 1,000 m amsl (Chandrapala, 2007), the area where SWM wind stream is most active. Rainfall during SWM period rapidly decreases towards the higher elevations with Nuwara Eliya at 1,800 m amsl registering an annual rainfall of only 1,905 (Chandrapala, 2007).

Identifying the wettest place or the location having the rain gauge that received the highest rainfall within the Wet zone of Sri Lanka has been a

debatable issue over the years. The text books of primary and secondary schools and some scholars in Sri Lanka have continued to rank Watawala location as the wettest place in Sri Lanka for decades and to-date, despite the fact that available local literature has clearly identified Ginigathhena (Kenilworth Estate; Silva 1988) and Yatiyantota (Wewaltalawa Estate; Chandrapala, 2007) as the wettest location of the country. These three locations under reference lie in the Wet zone within the mid slopes of Central highlands of Sri Lanka, with a possible exposure to high rainfall.

During extensive field studies carried out during the past decade in the effort to revisit agro-ecological boundaries of Sri Lanka by the Natural Resource Management Center of the Department of Agriculture, a location named Welioya in Hatton, within the same aforesaid exposure, was identified as relatively wetter compared to Watawala, Ginigathhena and Yatiyantota. Hence, a new standard rain gauge was established at the Welioya Estate in August 2014. The objective of this study was to compare the annual and seasonal rainfall catch in four different location to identify the wettest place in the Wet zone of Sri Lanka.

Materials and Methods

Daily rainfall data from four different locations covering seven rain-gauge stations (Table 1; Figure 1) were collected for a period of five years from 2015 to 2019. As the general public and some scholars perceive Watawala as the location with the highest rainfall in Sri Lanka, three rain-gauge stations were selected from this area for the study. All these rain-gauge stations are located in areas

where the highest annual rainfall is most likely, due to the full-swing of SWM, FIM and SIM rains.. Daily rainfall data collected from all seven rain-gauge stations were analyzed for the average annual rainfall and its standard deviation and the average number of rainy days and its standard deviation.

Table 1. Geographical locations of rain- gauge stations used in the study

Stations*	AER	Latitude-N	Longitude-E	Elevation (m amsl)	Aerial distance from Watawala town (km)
Welioya Estate (Hatton)	WU ₁	6.9288	80.5582	1,258	2.67
Lonach Estate (Watawala)	WU ₁	6.9193	80.5609	1,140	3.49
Mount Jean Estate (Watawala)	WU ₁	6.9630	80.5275	967	2.42
Carolina Estate (Watawala)	WU ₁	6.9509	80.5327	960	1.03
Wewaltalawa Estate (Yatiyantota)	WM _{1a}	7.0519	80.3900	868	20.39
Kenilworth Estate (Ginigathhena)	WM _{1a}	7.0015	80.4802	616	9.04
Maliboda Estate (Deraniyagala)	WM _{1a}	6.8911	80.4282	368	12.35

AERs: Agro-ecological Region (Punyawardena, 2007), amsl = above mean sea level; * locations within parenthesis are the nearest town areas.

Figure 1. Topography of the rain-gauge locations used in the study

Results and Discussion

Comparison of average annual total rainfall (2015-2019)

The newly established rain-gauge at Welioya Estate in Hatton has recorded the highest average annual total rainfall (5,081 mm) with the lowest variability

during the period from 2015-2019, compared to other six study locations (Table 2). Moreover, this rain-gauge station is located at the highest elevation position among the other stations of the study (Table 1).

Table 2. Average total annual rainfall (2015-2019)

Rain-gauge station	Average total annual rainfall (mm)	Rank
Welioya Estate	5,081.4±304.6	1
Maliboda Estate	4,914.7±338.1	2
Wewaltalawa Estate	4,908.9±818.3	3
Kenilworth Estate	4,536.1±618.0	4
Lonach Estate	4,493.8±677.6	5
Mount Jean	4,338.2±923.1	6
Carolina Estate	4,091.7±620.4	7

The results of the present study did not endorse the previous findings on exposure of the wettest region of the country, *i.e.*, western slopes of Central

highlands, below an altitude of about 1,000 m (Chandrapala, 2007). It is further interesting to note that all three locations (Lonach Estate, Mount

Jean Estate, and Carolina Estate) selected from Watawala area, which is commonly perceived as the wettest location of the country, has recorded the lowest average annual rainfall catch (Table 2). Even though the Carolina Estate at Watawala has

recorded the lowest average annual rainfall among the seven rain-gauge stations, it recorded the highest number of rainy days compared to the rest (Table 3) with a fair distribution of rainfall throughout the year in the said geographical area.

Table 3. Average annual number of rainy days (2015-2019)

Rain-gauge station	Average number of rainy days	Rank
Carolina Estate	211±20	1
Kenilworth Estate	204±14	2
Maliboda Estate	198±14	3
Welioya Estate	193±19	4
Lonach Estate	189±20	5
Mount Jean Estate	187±23	6
Wewaltalawa Estate	161±24	7

Comparison of rainfall during the First Inter-Monsoon (2015-2019)

During the First Inter-Monsoon (FIM) season, Wewaltalawa Estate at Yatiyantota recorded the highest rainfall, followed by the Maliboda Estate at Deraniyagala. Both these rain-gauge stations are located at relatively lower elevations (Table 1), where the topography is less complex than that of lower and upper slopes of the Central highlands. All three rain-gauge stations selected from the Watawala area recorded a comparatively lower rainfall during the FIM season along with lower standard deviations (Table 4). Generally, relatively simple topographic features is a conducive setting

to have strong land-heating resulting in enhanced convection during daytime when the sun is at its directly overhead position (April and September). This leads to more FIM rains at lower elevations than mid- and upper-slopes of the Central highlands (Punyawardena, 2008).

The number of rainy days during the FIM season ranged from 27 to 34 with a high variability at every station except at Kenilworth Estate, Ginigathhena (Table 5). The high temporal variability shown in the FIM rains, being convective in nature, is inevitable and a common feature of the rainfall climatology of the country.

Table 4. Average total rainfall during the First Inter-Monsoon season (2015-2019)

Rain-gauge station	Average total rainfall (mm)	Rank
Wewaltalawa Estate	622.0±135.6	1
Maliboda Estate	547.0±170.2	2
Welioya Estate	473.1±103.6	3
Kenilworth Estate	449.7±87.3	4
Lonach Estate	443.0±41.2	5
Carolina Estate	375.8±52.7	6
Mount Jean Estate	266.0±77.0	7

Table 5. Average number of rainy days during the First Inter-Monsoon season (2015-2019)

Rain-gauge station	Average number of rainy days	Rank
Maliboda Estate	34±16	1
Lonach Estate	32±16	2
Welioya Estate	32±17	2
Wewaltalawa Estate	32±16	2
Mount Jean Estate	29±19	3
Carolina Estate	27±16	4
Kenilworth Estate	27±5	4

Comparison of rainfall during the Southwest Monsoon (2015-2019)

The rain gauge at Welioya Estate reported the highest average seasonal rainfall during the Southwest Monsoon (SWM) period (Table 6), accounting for 63% of the average annual rainfall of the location. The lowest annual rainfall (2,605.2 mm) was recorded at Carolina Estate at Watawala. Other two rain gauge stations that recorded lower annual rainfall, namely, Wewaltalawa Estate and Maliboda Estate, are located at the lower elevations in the southwestern slopes of the Central highlands. The moisture laden SWM wind enters Sri Lanka from its southwestern coast. It is forced to ascend after hitting the southwestern slopes of the Central highlands, which acts as an orographic barrier for approaching heavily moisture laden wind, and produce heavy rains upon condensation. Therefore, southwestern slopes in the Central highlands normally receives heavy rains during the SWM

season (Punyawardena, 2008). The period with the effectiveness of SWM is the strongest rainy season of Sri Lanka. The relative contribution from SWM is the most decisive factor in identifying any location as the wettest place in the country along with complimentary contribution from other three rainfall seasons, i.e., FIM, SIM and NEM seasons, to the total annual rainfall.

Within the 153 days of the season starting from May to September, the average number of Rainy days recorded from the Carolina Estate was 116 during the SWM season. This was the highest recorded among the seven rain-gauge stations studied, despite having the lowest cumulative seasonal rainfall catch at Carolina Estate during the same season. Thus, as in the case of average annual rainfall, the rainfall distribution during the SWM period was well spread at the Carolina Estate located at Watawala (Table 7).

Table 6. Average total rainfall during the Southwest Monsoon season (2015-2019)

Rain-gauge station	Average total rainfall (mm)	Rank
Welioya Estate	3,211.7±456.4	1
Mount Jean Estate	2,838.0±601.1	2
Kenilworth Estate	2,804.2±380.8	3
Lonach Estate	2,790.1±616.1	4
Maliboda Estate	2,783.8±227.3	5
Wewaltalawa Estate	2,650.8±753.1	6
Carolina Estate	2,605.2±523.8	7

Table 7. Average number of rainy days during the Southwest monsoon season (2015 – 2019)

Rain-gauge station	Number of rainy days	Rank
Carolina Estate	116±9	1
Kenilworth Estate	113±9	2
Mount Jean Estate	107±13	3
Welioya Estate	107±13	4
Maliboda Estate	107±6	5
Lonach Estate	106±15	6
Wewaltalawa Estate	85±16	7

Comparison of rainfall during the Second Inter-Monsoon (2015-2019)

Similar to the FIM season, the second Inter-Monsoon (SIM) has also brought in a substantial amount of rains due to the convectational activity of the atmosphere, especially during the month of October (Punyawardena, 2008). The rainfall during the SIM season usually get enhanced with the passage of the Inter Tropical Convergence Zone (ITCZ) on or near Sri Lanka resulting in the formation of Weather Systems in the Bay of Bengal.

This would result in widespread rains with less spatial variability (Punyawardena, 2008). Further, the rain-gauge station at Wewaltalawa Estate at Yatiyantota has been identified as the station registering the highest rainfall during SIM season (Chandrapala, 2007). The present study has confirms that the same Estate recorded the highest amount of rainfall during the SIM season (1,268 mm), a 25% of its average annual rainfall (Table 8). Interestingly, as in the case of average annual rainfall (Table 2) and the average SWM rainfall

(Table 6), and to a certain extent on the average FIM rainfall amount (Table 4), the Carolina Estate at Watawala recorded the lowest cumulative seasonal rainfall during the SIM season. Despite recording the lowest rainfall (866.1 mm) among the seven stations used in the study, the Carolina Estate at

Watawala recorded 44 rainy days (average) during the season, and was as the highest among seven stations (Table 9). This again revealed a scenario of well distributed rainfall within the season despite the cumulative catch is relatively low.

Table 8. Average total rainfall during the Second Inter-Monsoon season (2015-2019)

Rain-gauge station	Average total rainfall (mm)	Rank
Wewaltalawa Estate	1,268.0±276.2	1
Maliboda Estate	1,240.3±279.5	2
Welioya Estate	1,014.5±275.8	3
Kenilworth Estate	991.3±150.1	4
Lonach Estate	982.3±224.9	5
Mount Jean Estate	953.3±181.6	6
Carolina Estate	866.1±239.3	7

Table 9. Average number of rainy days during the Second Inter-Monsoon season (2015 – 2019)

Rain-gauge station	Average number of rainy days	Rank
Carolina Estate	44±7	1
Maliboda Estate	44±3	2
Kenilworth Estate	43±5	3
Mount Jean Estate	41±5	4
Lonach Estate	40±6	5
Welioya Estate	39±7	6
Wewaltalawa Estate	35±7	7

Comparison of rainfall during the Northeast Monsoon (2015-2019)

The southwestern slopes in Sri Lanka lie in the leeward side of the Northeast Monsoon (NEM) winds. Hence, higher rainfalls are not expected in the southwestern parts of the country during the NEM season except during times at which atmosphere of the Bay of the Bengal becomes vibrant due to formation of Weather Systems during the period of November through mid-January.

During the NEM season, the highest rainfall was recorded at Welioya Estate at Hatton (382.1 mm) in the leeward side (Table 10). The ranking order of the average seasonal rainfall during NEM season apparently follows the order of the average total annual rainfall where in both cases the highest was at the Welioya Estate and the lowest at the Carolina Estate. In all locations, temporal variability was relatively high as shown by the standard deviation of cumulative seasonal rainfall at respective rain-gauge stations. If any rain-gauge station in a given

area possess a higher standard deviation during a particular rainy season, it means that the said rainy season is not effective over that geographical area. This study further confirms that the NEM rains are not much effective over the southwestern slopes of the Central highlands, but has only a very weak leverage on deciding the wettest place of Sri Lanka.

Similar to the average total seasonal rainfall (Table 2), the average SWM rainfall (Table 6), and the average SIM rainfall (Table 9), a comparatively higher number of rainy days was observed at the Carolina Estate at Watawala during the NEM season (Table 11). Although Carolina Estate has recorded the highest number of rainy days during the NEM season, it was not a considerable deviation from the average values of other stations considered in the present study (Table 11). However, comparatively higher standard deviation values of the number of rainy days confirmed that the NEM is not a strong rainfall season in the southwestern slopes of the Central highlands of Sri Lanka, but accounts for a higher temporal variability.

Table 10. Average total annual rainfall during the Northeast Monsoon season (2015-2019)

Rain-gauge station	Average total rainfall (mm)	Rank
Welioya Estate	382.1±132.1	1
Wewaltalawa Estate	368.1±198.6	2
Maliboda Estate	343.6±257.2	3
Kenilworth Estate	290.8±134.5	4
Mount Jean Estate	280.9±231.3	5
Lonach Estate	278.4±95.9	6
Carolina Estate	244.6±87.8	7

Table 11. Average number of rainy days during the Northeast Monsoon season (2015-2019)

Rain-gauge station	Average number of rainy days	Rank
Carolina Estate	23±8	1
Kenilworth Estate	21±5	2
Welioya Estate	21±7	3
Maliboda Estate	20±7	4
Mount Jean Estate	19±11	5
Lonach Estate	19±8	6
Wewaltalawa Estate	16±9	7

Conclusion

This study used the most recent daily rainfall data for the period 2015 - 2019 collected from seven rain-gauge stations located in the southwestern slopes of Central highlands in Sri Lanka, without any missing values. The results clearly indicated that the common belief of Watawala in Hatton as the highest rainfall receiving or the “wettest place” of the country is no longer true and acceptable. This study revealed that the Welioya Estate in Hatton receives the highest average annual rainfall in Sri Lanka. The most appropriate scientific term for the

“wettest region” in Sri Lanka should read as “the highest rainfall receiving geographical exposure of the country, which lies across an area in the southwestern slopes of the Central highlands with an altitudinal range of 300 to 1,300 m, where the SWM wind stream is most active”. It is important to note that within the foregoing exposure, there may be more locations where rain-gauges have not been installed still to collect daily observations using a standard rain-gauge.

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