Analysis of Rainfall Readings Data in Gozo

ANDREA MUSCAT

The purpose of this article is to analyse and discuss the change in rainfall patterns in Gozo over 26 years (from 1991 till 2017). The data was gathered by a weather station in Nadur, located roughly two kilometres away from the nearest coast of San Blas Bay and at a height of approximately 150 metres above sea level. The data used in this article is entirely secondary since it has been collected and processed by Mr Joseph Meilak

Total Annual Precipitation

The most common forms of local precipitation include rain, hail and dew. Total annual rainfall between 1991 and 2017 amounted to 530.7 mm, ranging from just a trace in July to almost 100 mm in December. With regard to the periodicity of the monthly precipitation, observations show that the annual pattern of rainy winters is followed by dry and generally rainless summers, as shown in Figure 1. The month with the highest precipitation is December, amounting to an average of 95.2 mm, or 17.8 percent of the total annual precipitation.

The summer period barely comprises two percent of the total annual rainfall. Conversely, over half the total annual precipitation is recorded from October to December.

The Maltese Islands typically experience 72 days of rainfall, according to the data gathered from 1991 till 2017. Monthly variations range from zero in July to around 14 days in December, as shown in Figure 2. Rain days are days on which at least 0.1 mm of rainfall was measured.

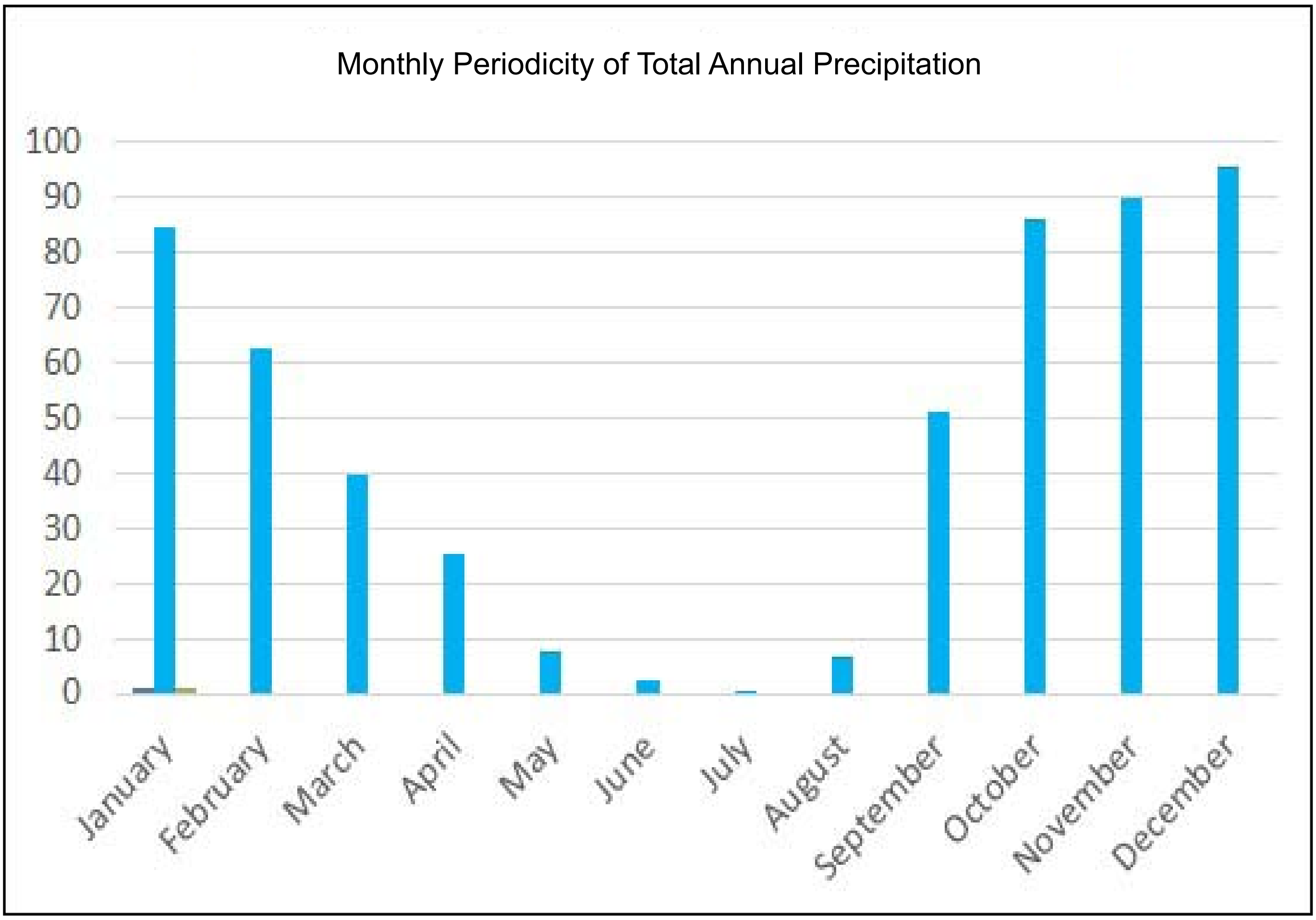

Figure 1: Monthly Periodicity of Total Annual Precipitation in mm.

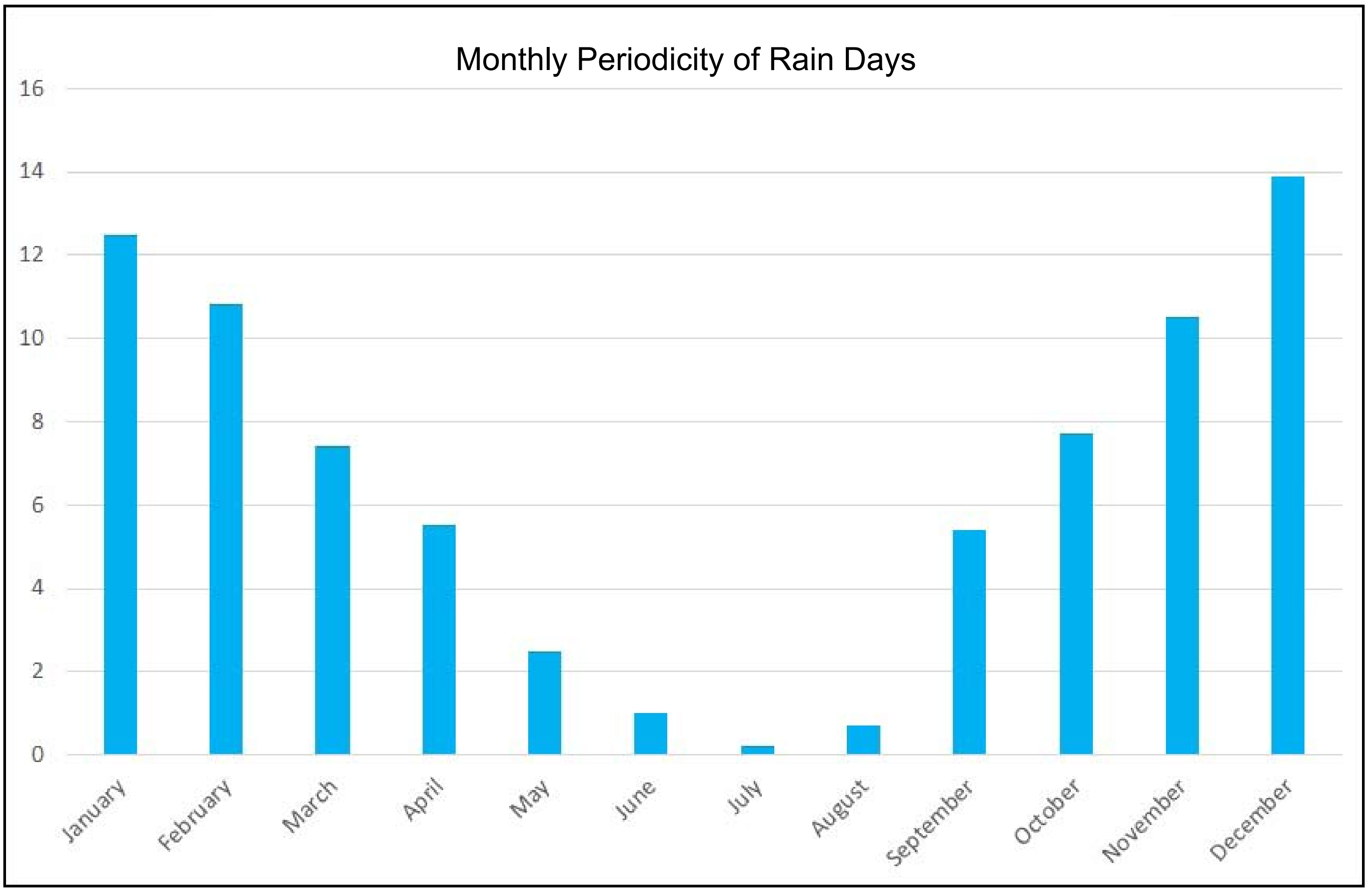

Figure 2: Monthly Periodicity of Rain Days.

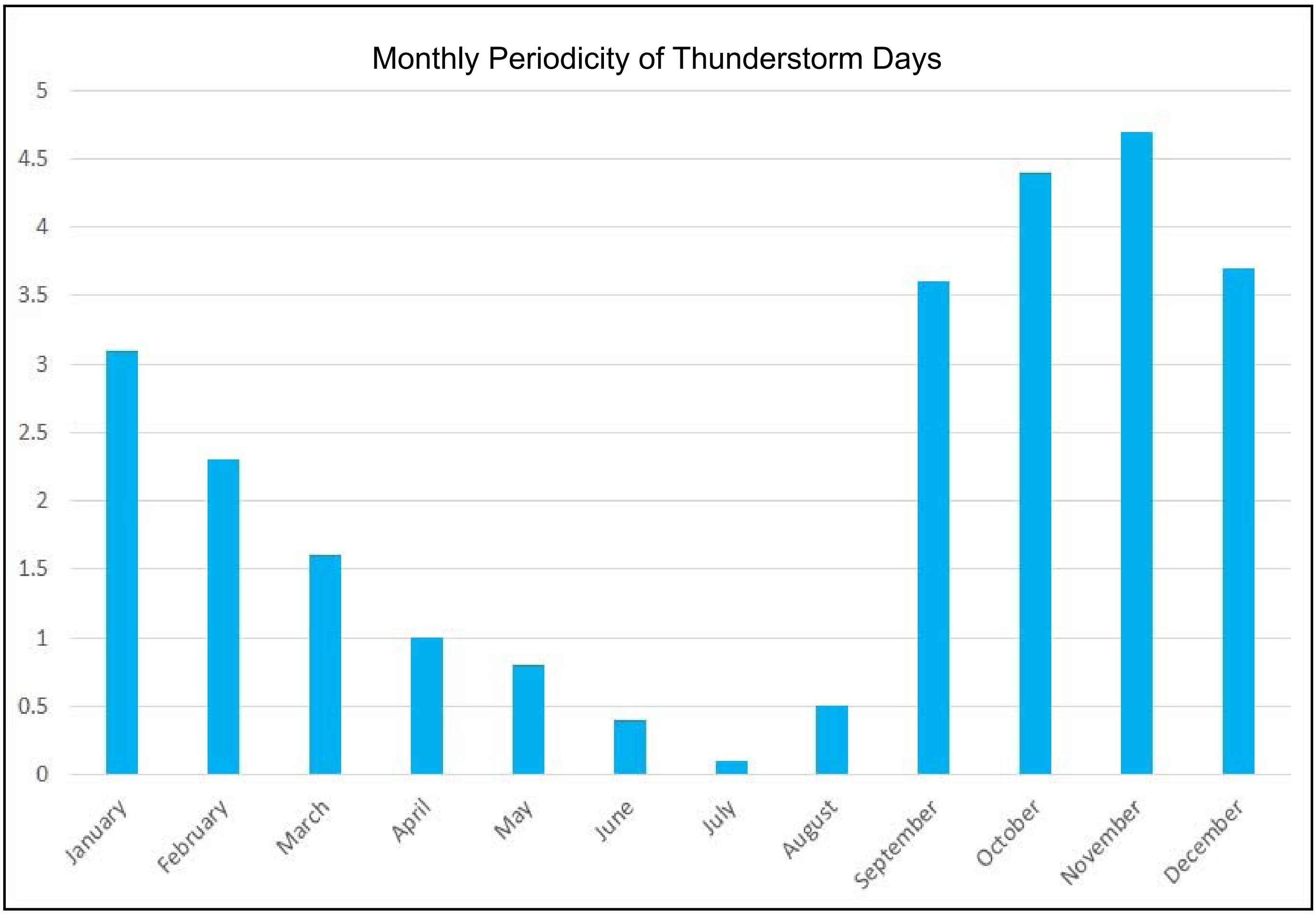

Figure 3: Monthly Periodicity of Thunderstorm Days.

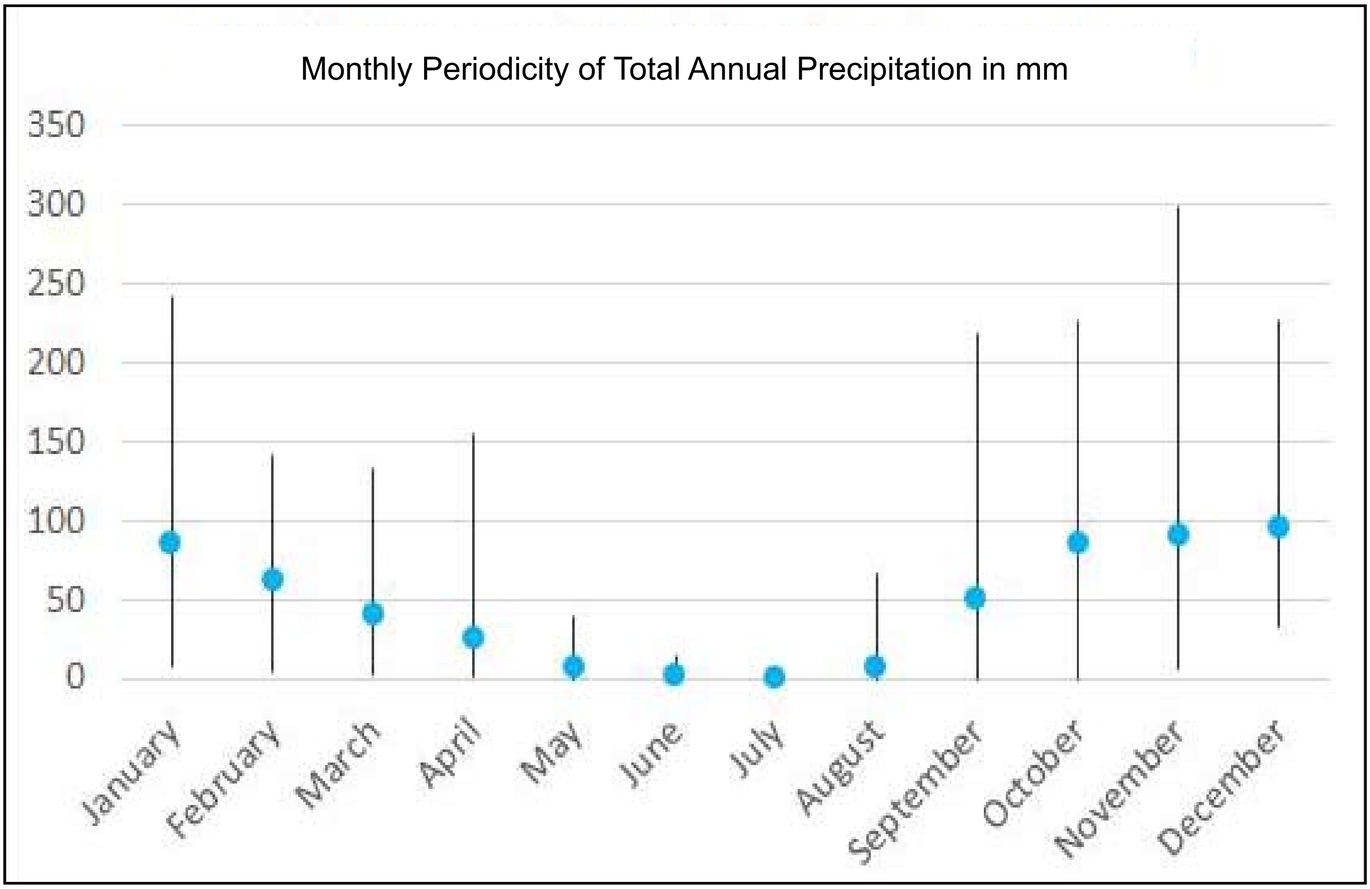

Figure 4: Monthly Periodicity of Total Annual Precipitation in mm.

In Gozo, the number of days with thunderstorms averaged 26 per year according to the data gathered from 1991 till 2017. November is normally the month with the highest frequency of thunderstorm days, as shown in Figure 3. In this analysis, thunderstorm days refer to those during which thunder has been heard.

Figure 4 shows that the highest precipitation variability throughout the year occurs in Autumn. This is attributed to the hit or miss of convective storms triggered by the movement of the continental air mass from the North African region over cooler areas in the Central Mediterranean. November has the greatest variability. The variability ranges from a minimum of 2.6 mm to a maximum of 297.0 mm.

Total 24 Hour Precipitation

The total amount of precipitation recorded in 24 hours, as shown in Figure 5, is a good indicator of the vigour and duration of storms. Undoubtedly, Autumn again shows the greatest variability. This is again attributed to the hit or miss of convective storms triggered by the movement of the continental air mass from the North African region over cooler areas in the Central Mediterranean.

Annual Precipitation Trend

As can be seen in Figure 6, total annual precipitation has tended to decline during the period under consideration. 1995 was the wettest year, with almost 900 mm of precipitation being measured. On the other hand, 2015 was the driest year, with less than 300 mm of precipitation in total.

Seasonal Precipitation Trend

A quick glance at seasonal patterns in precipitation from 1991 till 2017, reveals that rainfall has undergone a distinct decline in the winter and spring months (Figures 7 and 8)

This contrasts with changes in the Summer and Autumn months (Figures 9 and 10), where the total precipitation has remained fairly unchanged over the years.

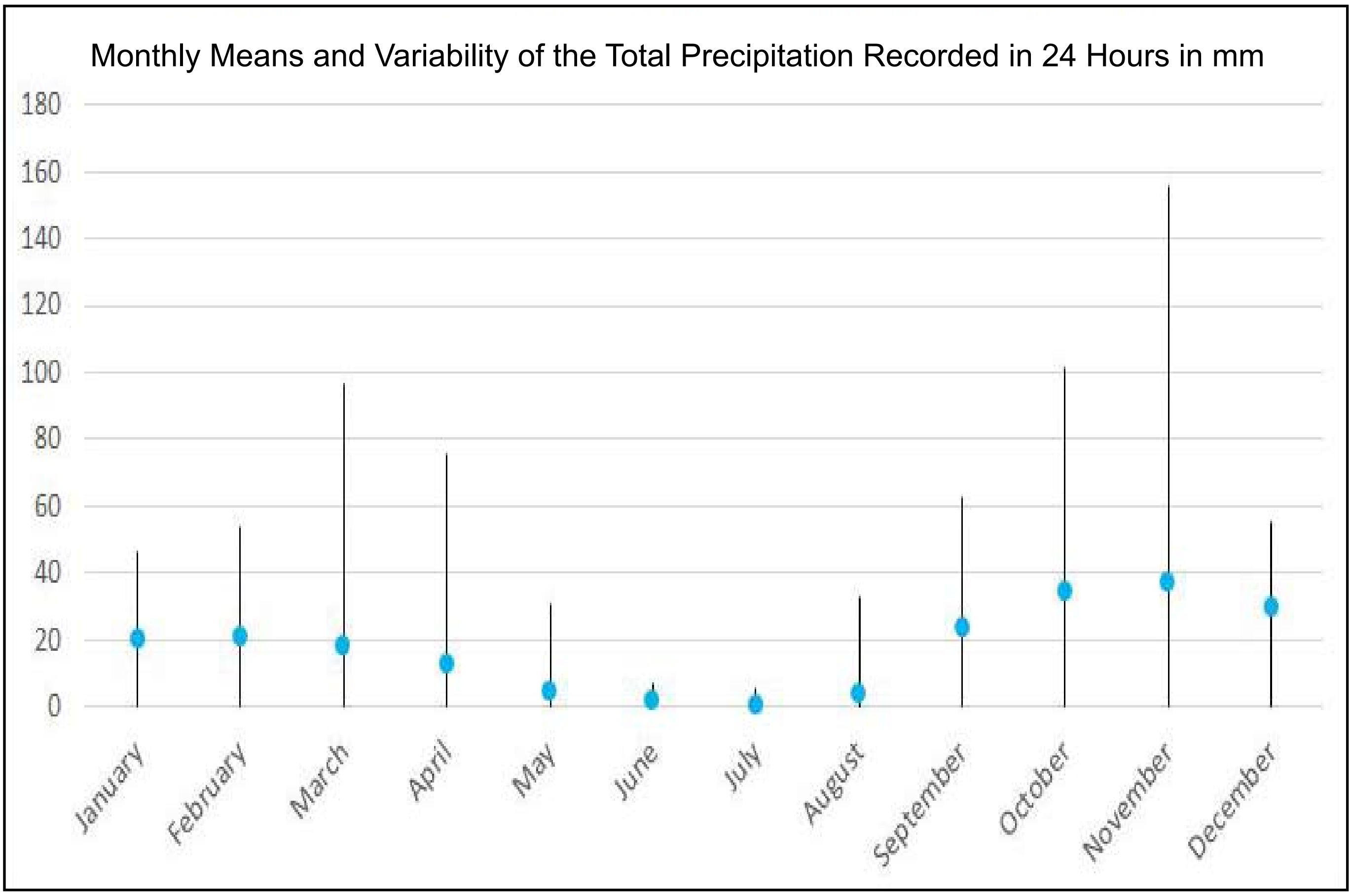

Figure 5: Monthly Means and Variability of the Total Precipitation Recorded in 24 Hours in mm.

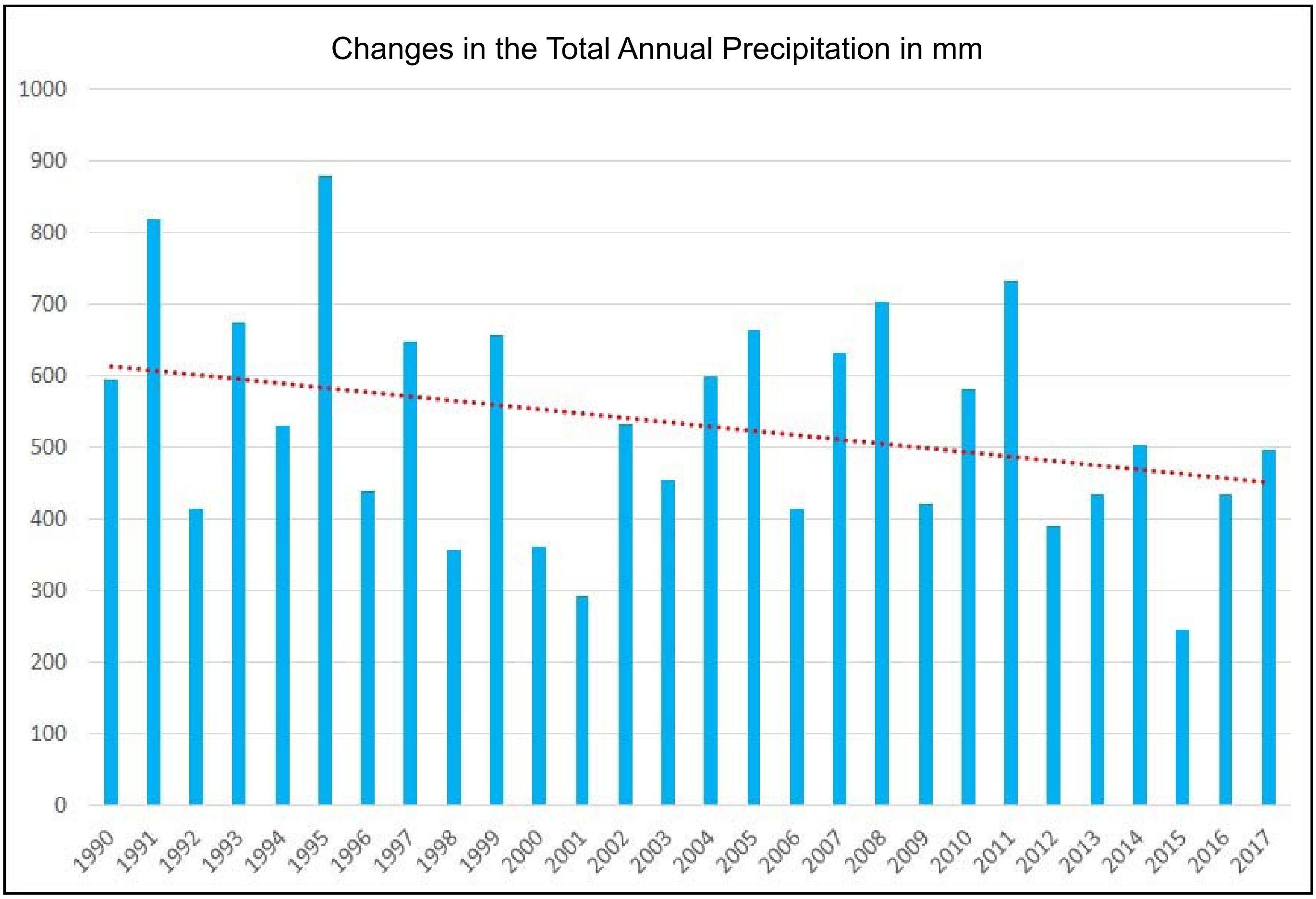

Figure 6: Changes in the Total Annual Precipitation in mm.

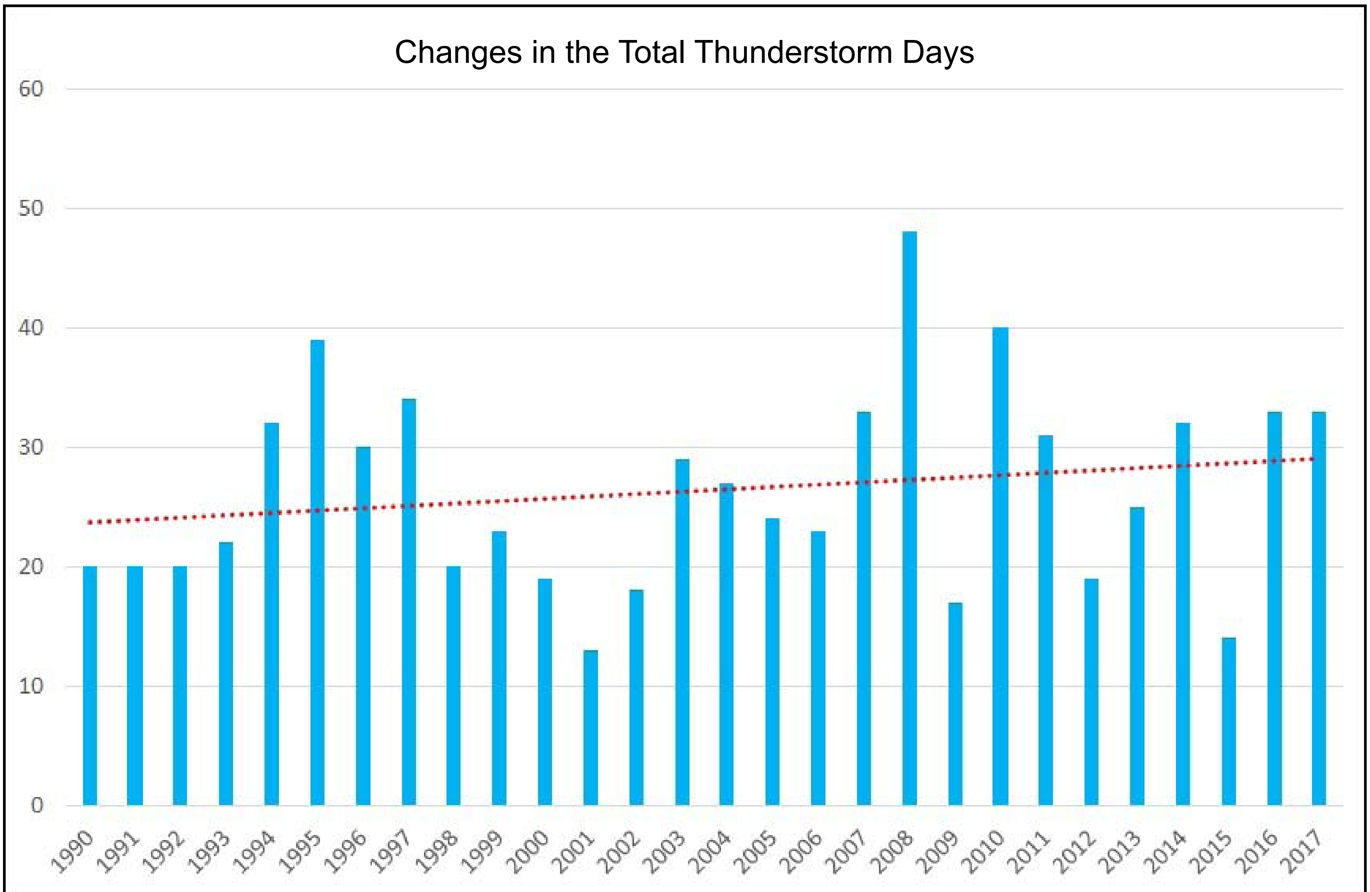

Figure 7: Changes in the Total Thunderstorm Days.

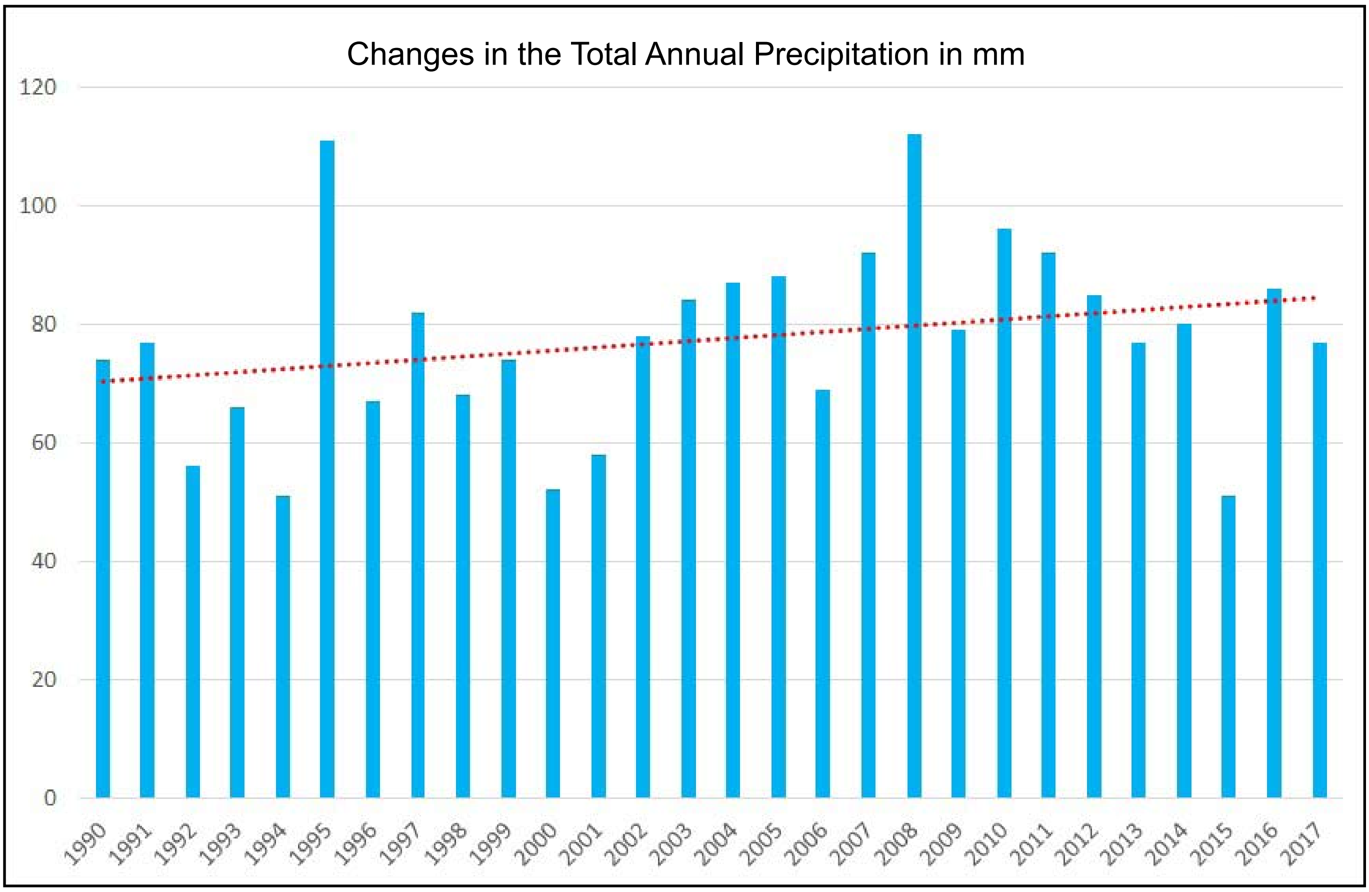

Figure 8: Changes in the Total Annual Precipitation in mm.

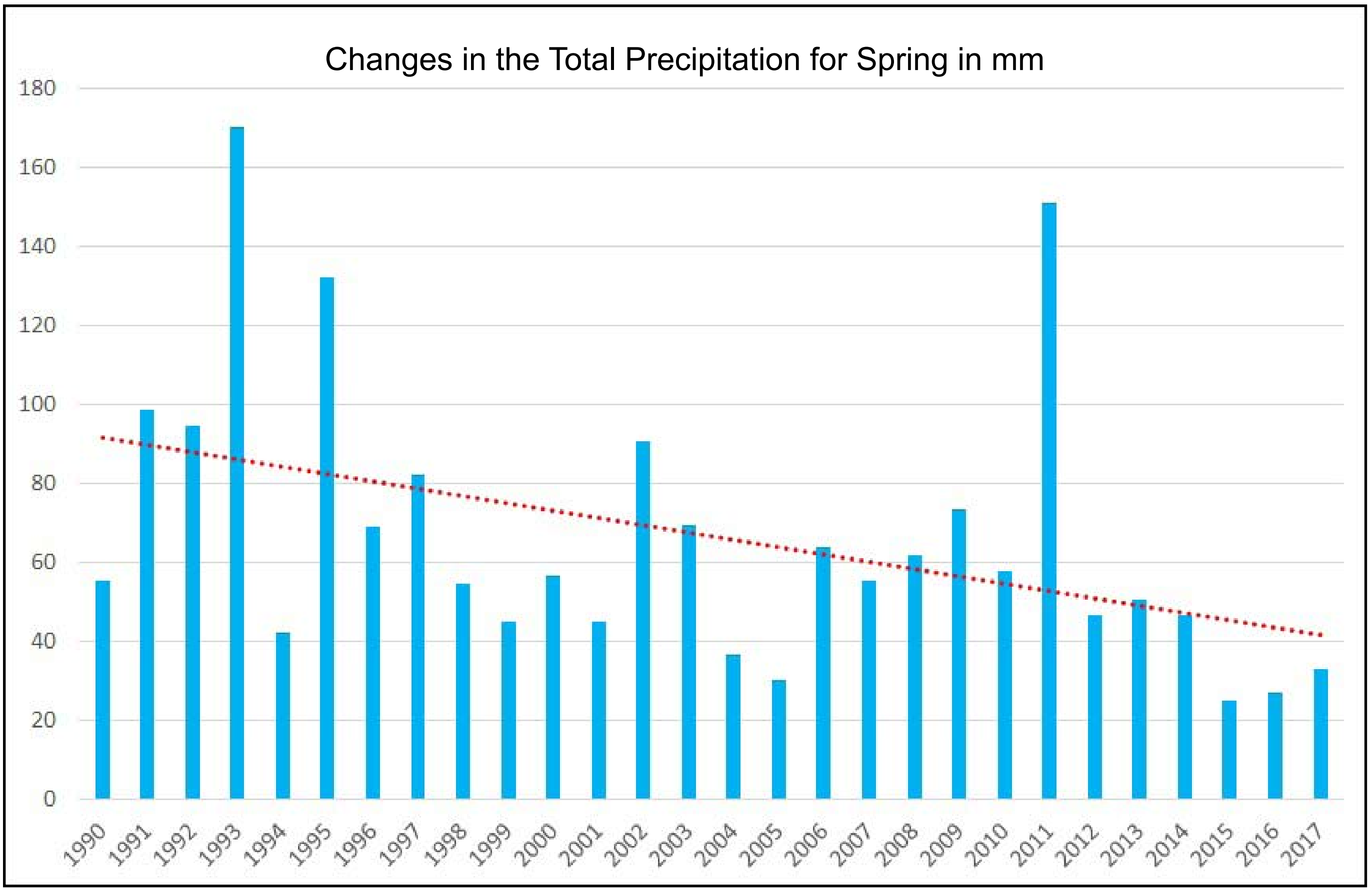

Figure 9: Changes in the Total Precipitation for Spring in mm.

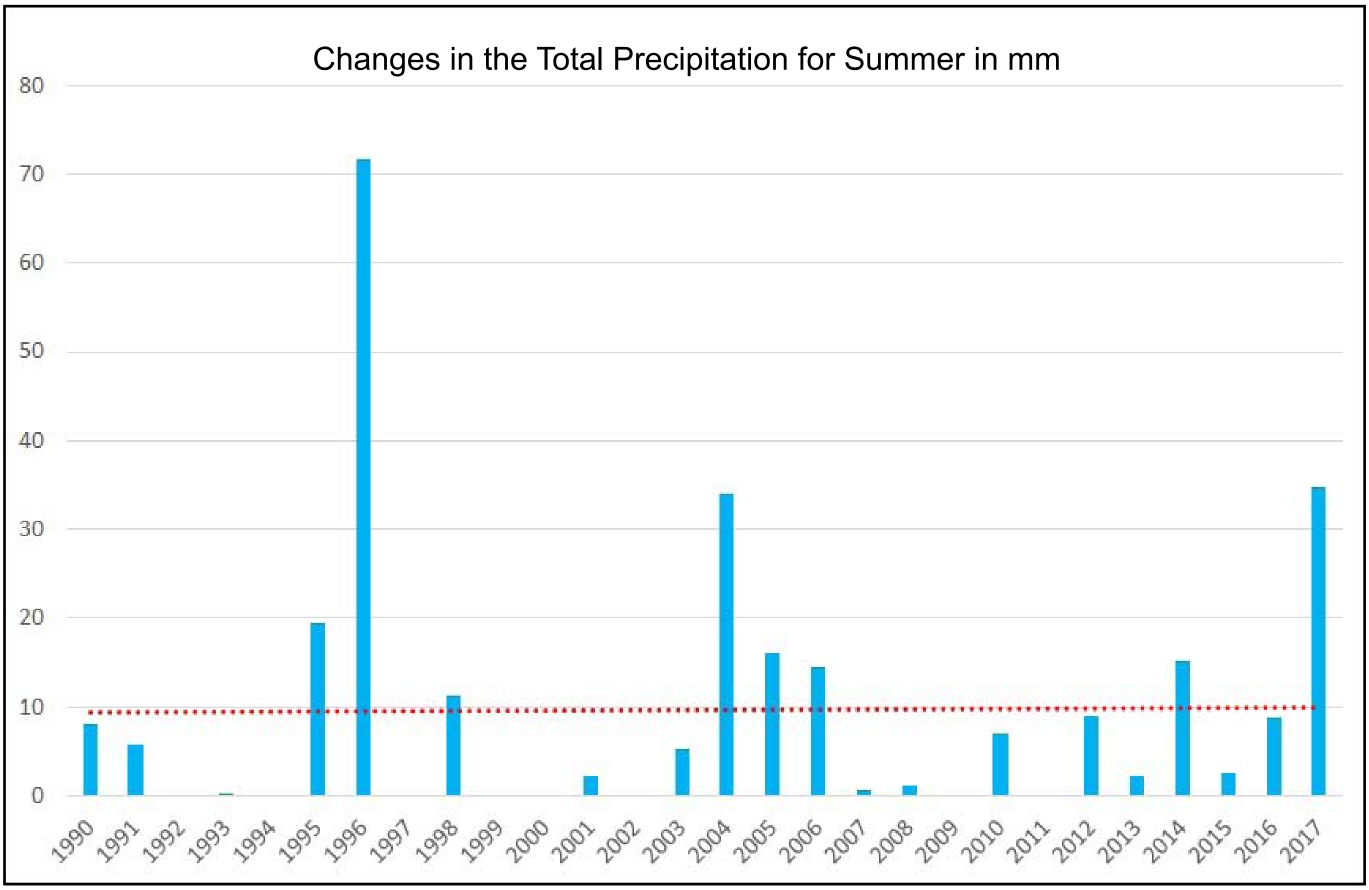

Figure 10: Changes in the Total Precipitation for Summer in mm.

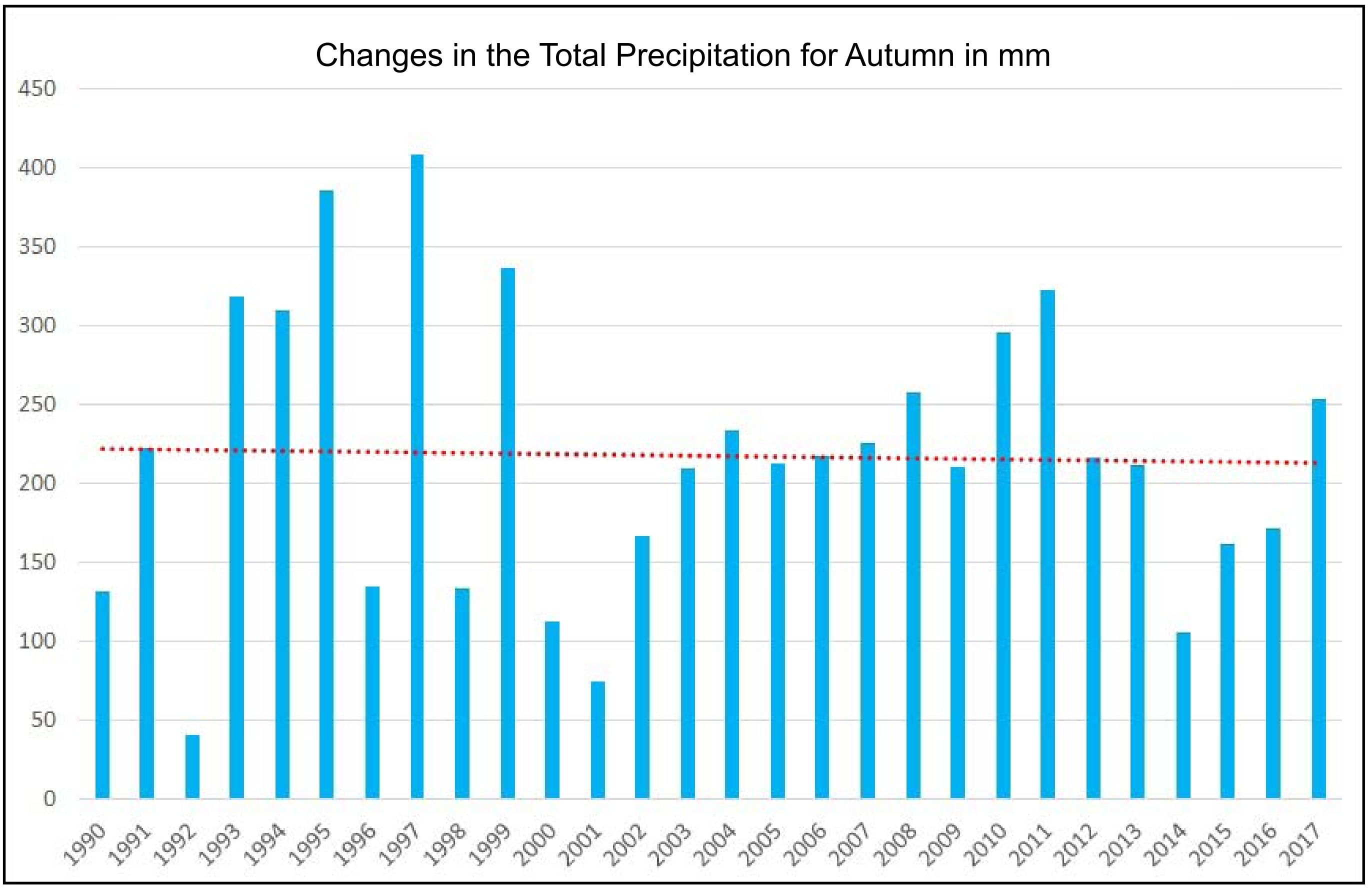

Figure 11: Changes in the Total Precipitation for Autumn in mm.

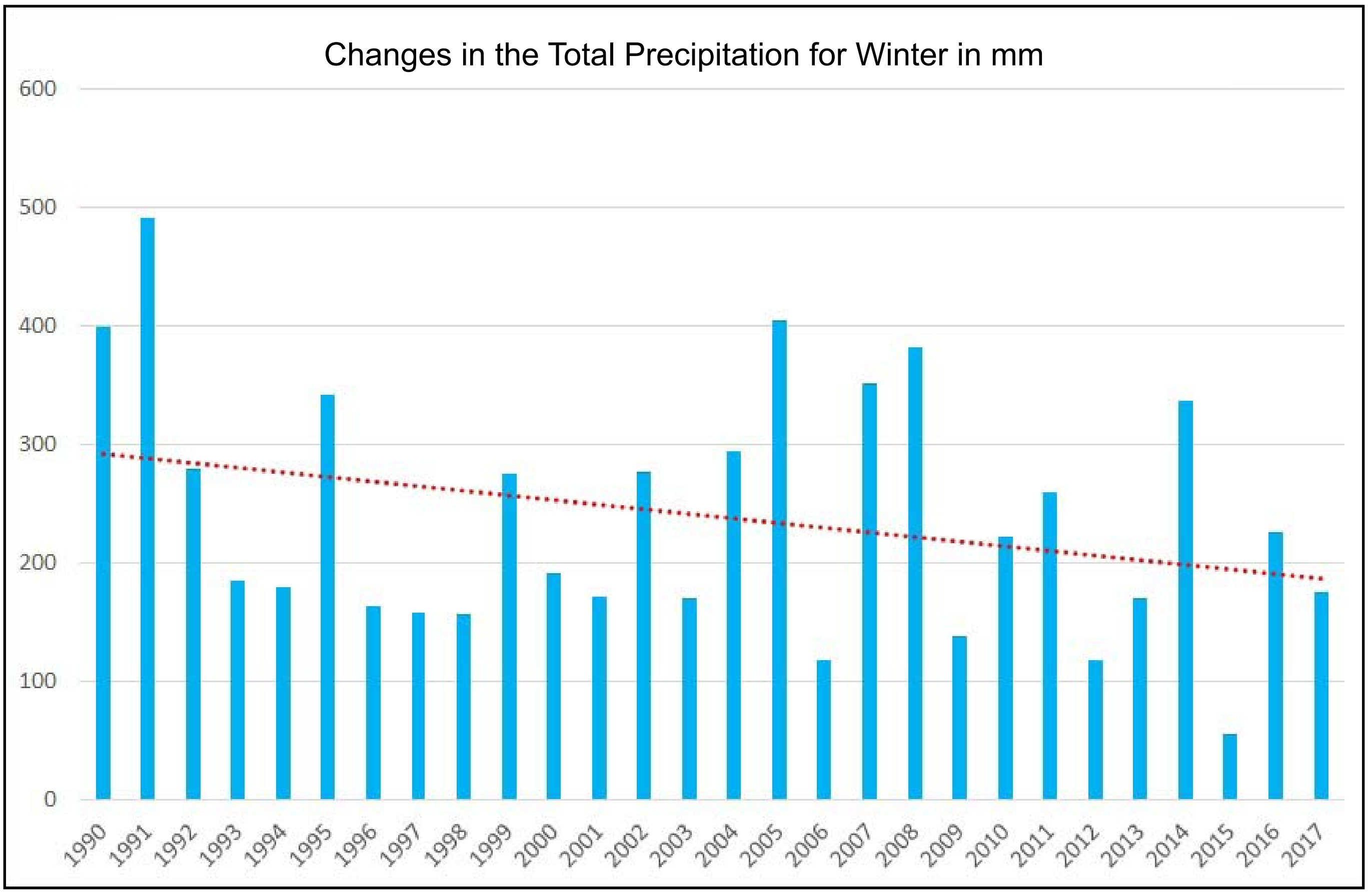

Figure 12: Changes in the Total Precipitation for Winter in mm.

Precipitation and Thunderstorm days

The regression lines for rain days and thunderstorm days, shown in Figure 11 and Figure 12 respectively, show that both tended to increase. In terms of thunderstorms, 2001 was the calmest, with just over ten thunderstorm days being registered. 2008 was the stormiest, with almost 50 thunderstorm days.

With regard to rain days, 1995 and 2008 were the wettest, with almost 120 rain days. In contrast, 2015 was the driest with just around 50 days.

From Figure 12 we note how days with precipitation were on the increase, even though total annual precipitation was on the decrease. It could be that the Mediterranean is becoming meteorologically more unstable, allowing for more days with rain. Being meteorologically more unstable does not necessarily imply that total precipitation will increase.

It could also be interpreted as a gradual increase in both the frequency and severity of exceptional rainfall events. Moreover, this could also mean that spells of dry weather in between rainfall events tended to be longer. One reason for this is that rising temperatures intensify Earth's water cycle, increasing evaporation. Increased evaporation will result in more storms, but also contribute to drier dry spells in between rainfall events.

Evidence for an increased incidence of heavy convectional rainfall is provided by the fact that the number of thunderstorm days and the average annual maximum 24-hour rainfall have increased.

The overall result is that the shift to less rain in the winter and spring months will have the greatest impact and will exacerbate dryness.

Conclusion

The findings of this article were compared with a more in-depth study conducted by Galdies (2011) for the period 1997-2007. It appears that both articles express similar views about the trends in precipitation.

The analysis of data covering the period 1991-2017 uncovered a host of interesting trends. Overall, precipitation was found to have slowly but steadily decreased. The decrease in precipitation was found to be more pronounced in the winter and spring months. Meanwhile, the frequency and intensity of exceptional rainfall events was found to be increasing.

As with all studies, there is always room for improvement. This article would benefit with a further discussion relating to the type and validity of the instruments used and the quality of the data, especially that relating to total thunderstorm days. The study can be further improved by including data covering a longer period of time. Also there is the need to identify internal and external influences on precipitation more rigorously.

References

Galdies, C. (2011). *The Climate of Malta: Statistics, trends and analysis (1951-2010).* Valletta, Malta: National Statistics Office.

Holton, J. R. (2004). *Introduction. An introduction to*

Meilak, J. (1995). *The Climate and Weather of the Maltese Islands - an update.* Unpublished B.Ed. (Hons), University of Malta, Malta.

A graduate in B.Sc. (Hons) Earth Systems from the University of Malta, Andrea Muscat has been interested in meteorology from a very young age. He is the administrator of Maltese Islands Weather, a leading local weather service provider. Apart from meteorology, he has a keen interest in astronomy, photography and the natural world.