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DETECTED CHANGES IN PRECIPITATION CHARACTERISTICS IN SOME CLIMATIC REGIONS IN SYRIA DURING THE PERIOD 1958-2018

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Abstract:

Monthly rainfall data for six meteorological stations located in different climatic regions in Syria were used to detect changes in annual and seasonal precipitation during the period (1958-2018). Box plots with coefficient of variation were applied to describe statistical characteristics of annual precipitation(AP). Trends with Mann-Kendall test were used to detect significant changes in annual and seasonal precipitation. To estimate changes in AP amounts and distribution at last decades, descriptive analysis with T- Test were computed for the two periods (1958-1988) (1988-2018).

Results showed that precipitation is highly variable at spatial and temporal scales with CV% ranged from 25.9% to 34.4%. tendency was absorbed in AP in all studied regions, related to decrease in spring and winter precipitation which was significant in spring in five stations. Comparison of two periods (1958-1988) (1988-2018) indicates clear changes in annual rainfall amounts and distribution toward decreasing mean, median and maximum values in all stations, and these changes which were significant in three stations.

These changes in rainfall characteristics will pose grand challenges for agricultural production, water resources management and ecosystems protection.

Key words*: climate change - precipitation change - trends- Syria*

Introduction:

Climate change is one of the most important threats to ecosystems and societies in the 21st century (Ipcc 2022). In addition to rising temperatures and increasing concentrations of carbon dioxide, global warming has led to an increase in the intensity of the hydrological cycle (1) . This intensification may be manifest in many ways, including increased interannual precipitation variability, more frequent extreme precipitation years (wet and dry) and alterations in annual precipitation amount, with some regions expected to become wetter and others drier (2).

There is a rich history of foundational studies documenting water availability as a key determinant of spatial and temporal patterns of aboveground net primary production (ANPP) (3). Soil moisture -which directly affected by precipitation amount and distribution- is one of the most important variables in the climate system because of the critical role it plays in plant transpiration and photosynthetic

activity (4 - 5) in addition to its role in water and temperature balances and nutrient cycles.

The regions surrounding the Mediterranean basin are hot spots for climate change, as the effects of global warming are expected to be greater in such areas. Therefore, the study of precipitation changes in Syria is of great importance for planning agricultural production and managing water resources.

Results:

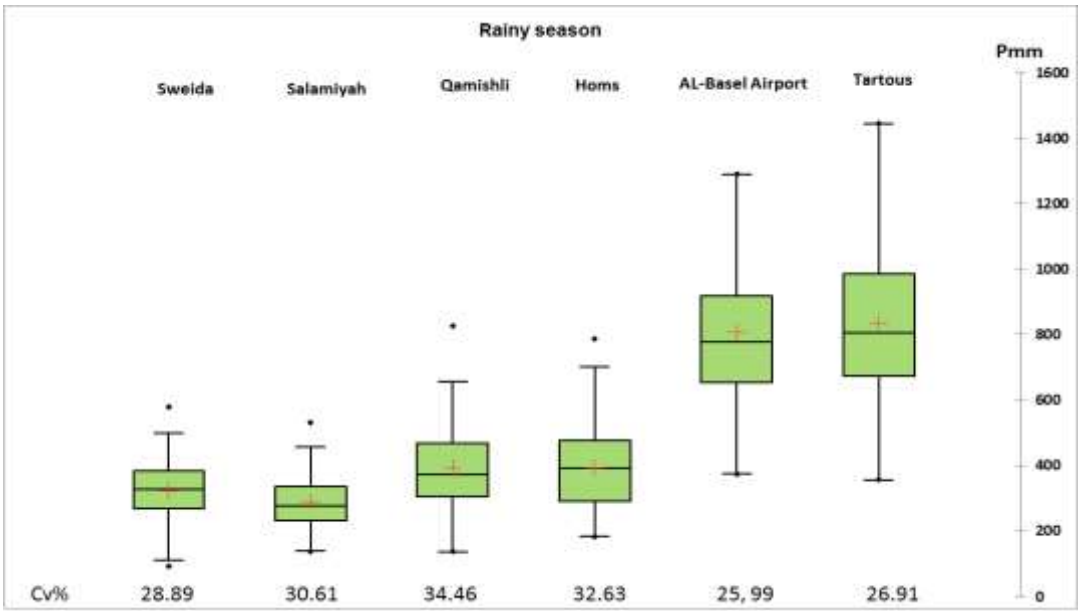


Figure 1 Statistical characteristics of rainy season at the studied stations during the period 1958-2018

The charts included in Figure1 show the statistical characteristics of the annual amounts of precipitation in the study areas. Among them, it is noted that the precipitation rates in the sub-humid coastal region (Tartous and Al-Basil Airport) are clearly higher than those in the semi-arid and arid interior regions. Also, the variation between seasons increases with increasing aridity, which reflected by the high values of the coefficient of variation.

It is clear from the analysis of the time series of the seasonal and annual precipitation amounts that there is a clear trend towards a decrease in the amounts of precipitation during the rainy season in all regions, which was more severe and significant in Qamishli, Homs and Sweida as shown in table(1). This decrease in the annual amounts of precipitation related to the sharp decrease in spring precipitation, which was significant in five stations, as well as the decrease in winter precipitation, which was less severe.

Table 1

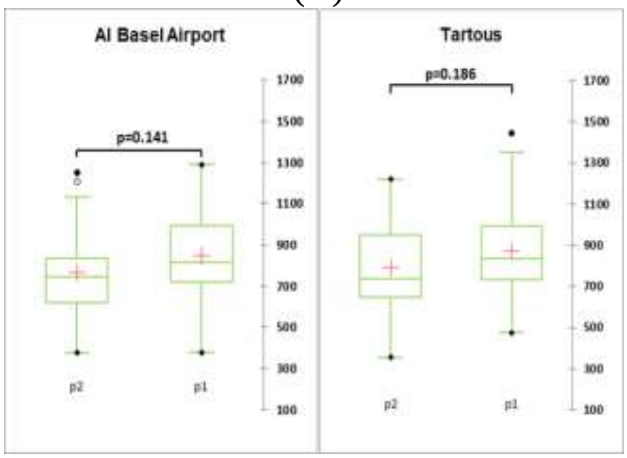
Detected Changes in annual and seasonal amounts of precipitation in different climatic regions in Syria during the period (1958-2018)

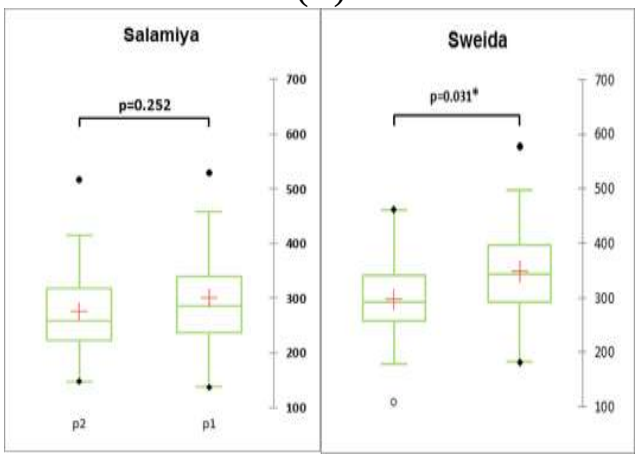
Station	Season	mm/per decade	mm/ per study period	Significance
Al Basel Airport	**Autumn**	**2.27**	**13.62**	
	Winter	**-3.08**	**-18.48**	
	Spring	**-11.23**	**-67.38**	*****

	rainy season	-12.04	-72.234	
Tartous	Autumn	4.05	24.3	
	Winter	-2.66	-15.96	
	Spring	-13.58	-81.48	+
	rainy season	-12.19	-73.14	
Homs	Autumn	-1.91	-11.5	
	Winter	-8.88	-53.28	
	Spring	-10.9	-65.4	**
	rainy season	-21.7	-130.2	**
Salamiya	Autumn	-0.59	-3.54	
	Winter	-2.31	-13.86	
	Spring	-3.21	-19.26	
	rainy season	-6.12	-36.72	
Qamishli	Autumn	-1.01	-6.06	
	Winter	-5.39	-32.34	
	Spring	-17.87	-107.2	**
	rainy season	-29.69	-178.14	**
Sweida	Autumn	-1.2	-7.2	
	Winter	-10.79	-64.74	
	Spring	-7.94	-47.64	*
	rainy season	-14.53	-87.18	*

**: The change is significant at 0.01 * at 0.05 +at 0. 1

(A) (B)





(C)

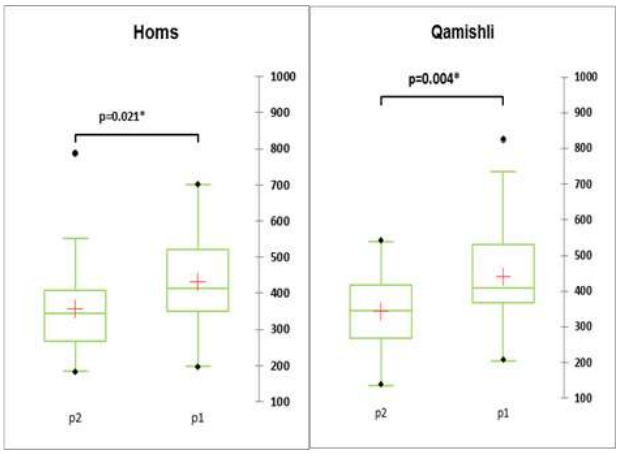


Figure 2. The change of the statistical characteristics of the annual precipitation amounts between the two periods (1958-1988) and (1988-2018) in the study areas.

Comparing the statistical characteristics of the annual precipitation amounts for the two periods (1958-1988) (1988-2018), shown in Figure 2, confirms the existence of a clear shift towards decreasing precipitation rates during the second period of the study in all regions. The precipitation rate decreased in Tartous from 870 to 793 mm, and in Al Basel Airport from 846 to 766 mm, as shown in (Figure2. A), and this change was not significant. Likewise, the precipitation rate decreased in Sweida from 349 to 297 mm, and in Salamiya from 301 to 275 mm, and the change was significant in Sweida (Figure 2.B), while in Qamishli and Homs, the change was more severe and significant, as the precipitation rate decreased in Homs from 430 to 355 mm and in Qamishli from 441 to 343 mm. (Figure 2. C)

In seasonally dry Mediterranean regions, tree growth is driven, among other factors, by favorable warm and wet climate conditions during spring and autumn, with a major growth peak in spring and a secondary peak in autumn (6). Consequently, the decrease of spring precipitation can have pronounced effects of forest ecosystems.

The critical stages of rain-fed crops coincide with the spring season, so the decrease in precipitation during this season, could lead to a decline in the productivity of crops, and adversely affects the stability of agricultural production.

Soil moisture affects the climate, and this effect becomes more evident in the transitional regions, so the decline in precipitation during the winter and spring can increase the possibility of heat waves, especially during the dry seasons (7).

Concluding remarks:

3. Results showed that there is a large inter-annual variability of precipitation, which increases with increasing aridity, and this enhanced the probability of extreme hydroclimatic events.
4. Results confirmed a clear trend towards decreasing annual precipitation rates in all regions due to the sharp and significant decrease in spring precipitation, and this will threaten the stability of agricultural production, forest ecosystems and water resources in the region.

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USING THE FIVE-POINT LIKERT SCALE TO ASSESS THE ECONOMIC AND SOCIAL IMPACTS ON THE LOCAL COMMUNITY OF THE MOST IMPORTANT NATURAL RESERVES

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***Abstract:** This research was carried out in the Al-Shouh forest located in the reserve of Cedar and Cilician fir in Slonfeh - Lattakia governorate in the Syrian coastal mountains region, which is one of the most important threatened forest ecosystems in Syria.*

The aim of the research is to assess the economic and social effects of the reserve of Cedar and Cilician fir from the local community' point of view of, and then evaluate the determinants of the population's satisfaction with this reserve using discrimintal analysis, while satisfaction was measured using the five-point Likert scale. The research was based on preliminary data for a random sample of families living in the vicinity of the reserve in 2021. The size of this sample was