

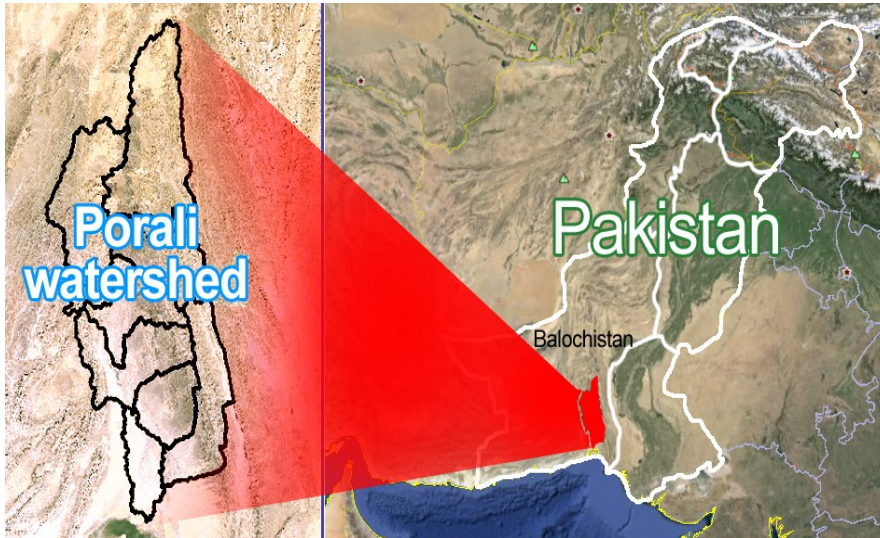
Evaluating climatic effects on a physiographically diverse watershed

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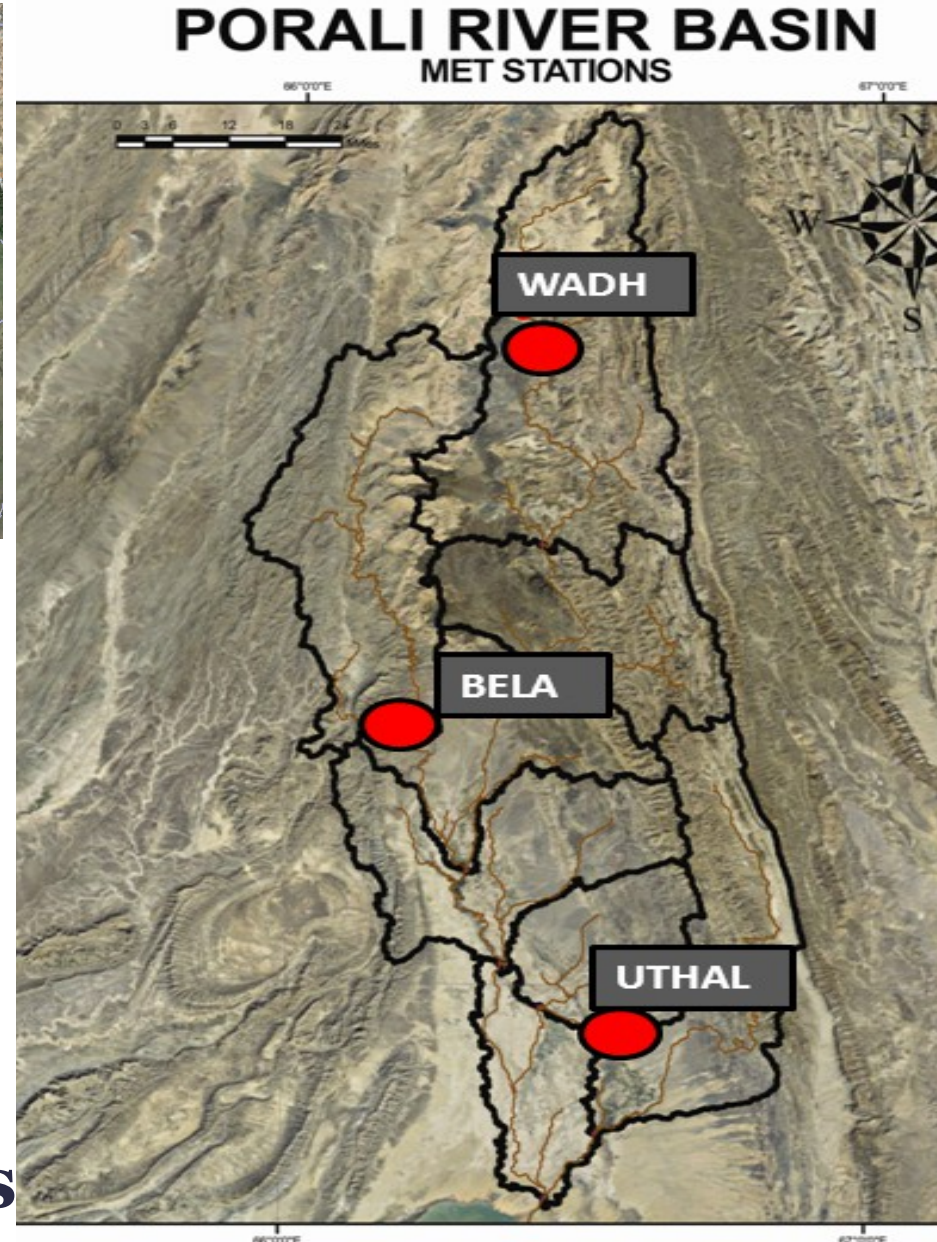
Shoaib Ahmed



Study Area



Met stations Locations



Diverse Physiography

Data availability



Uthal - Barren
Flatter topography

Bela - Cultivation
Flatter topography

Wadh - Mountainous region

Met Station	Precipitation data	Temperature data
Uthal	51 years	10 years
Bela	99 years	
Wadh	74 years	

Meteorological Parameters

Precipitation

Daily

Monthly

Annual

Decadal

Temperature

Daily

Monthl
y

Annual

-
Maximu
m

-
Minimu
m

-Average

Statistical Tests

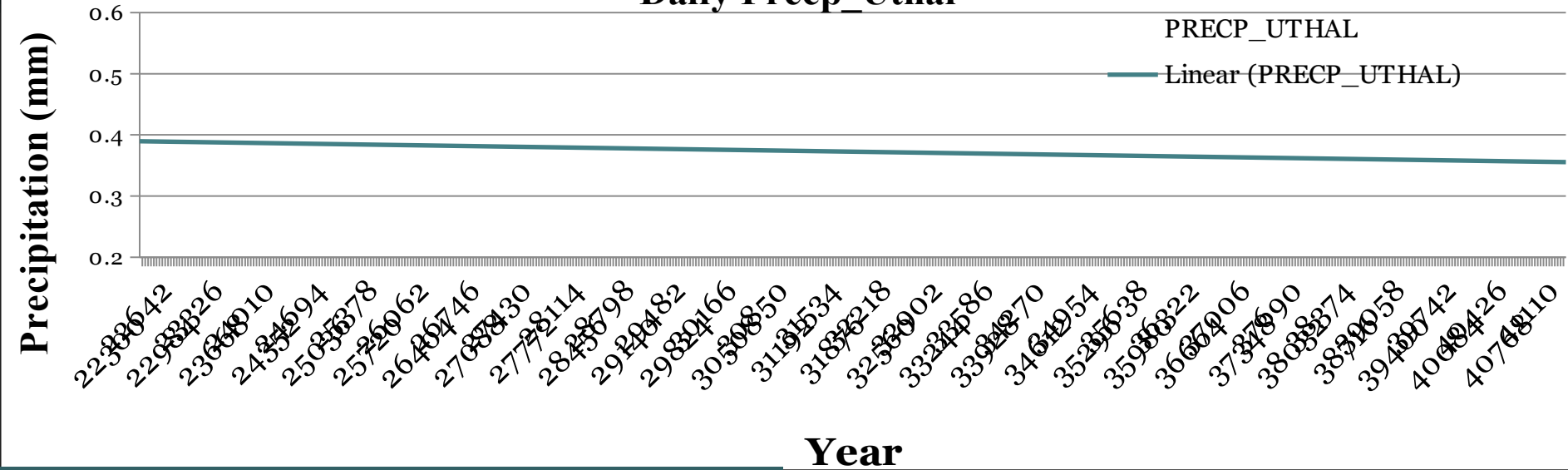
1. Linear Regression

To model the relationship between two variables by fitting a linear equation to observed data.

2. Mann-Kendall's Rank Test

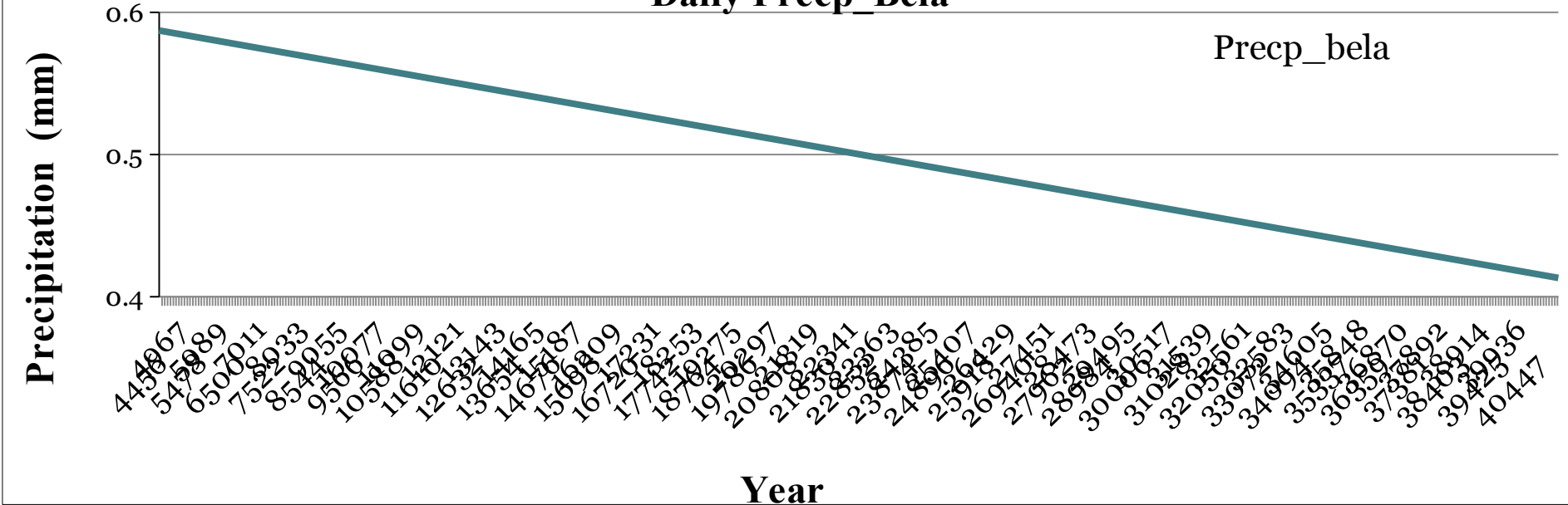
Analysis of trend in climatologic and hydrologic time series.

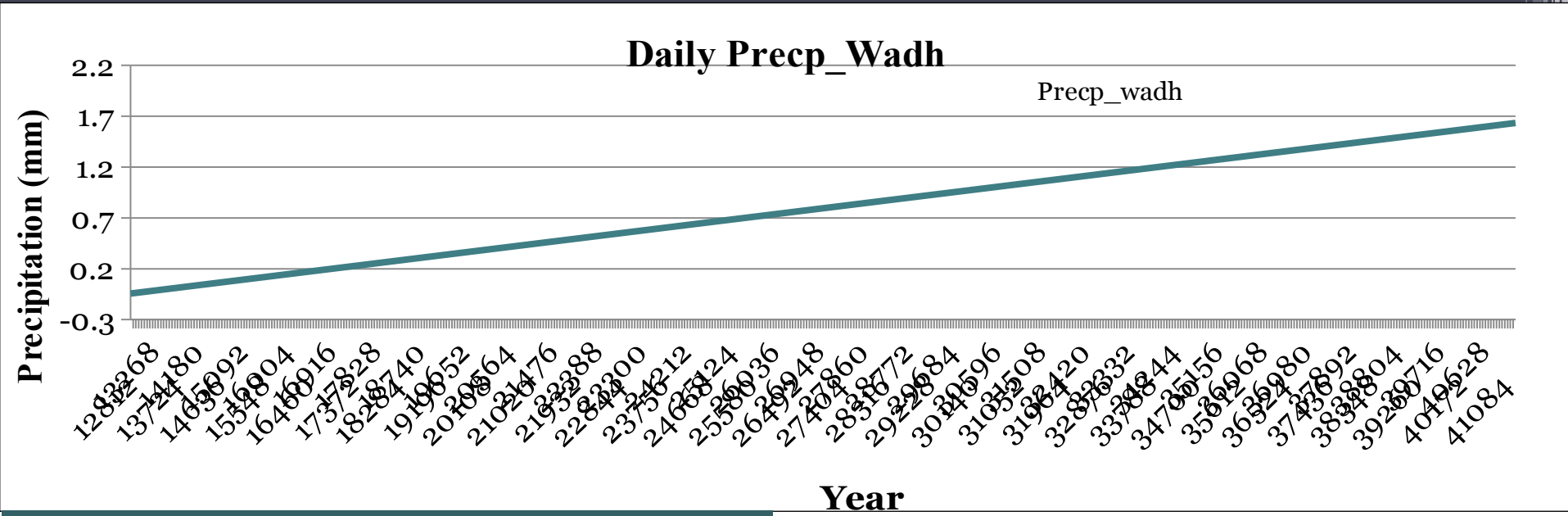
Daily Precp_Uthal



Precipitation - Daily

Daily Precp_Bela





Precipitation - Daily

Time series	MK's "s" value	LR value (mm)	MK trend	LR trend
Uthal	-1175340.000	0.13	D	I
Bela	-4071201.000	-0.14	D	D
Wadh	5353365.000	2.2	I	I



Precipitation - Monthly





Precipitation - Monthly

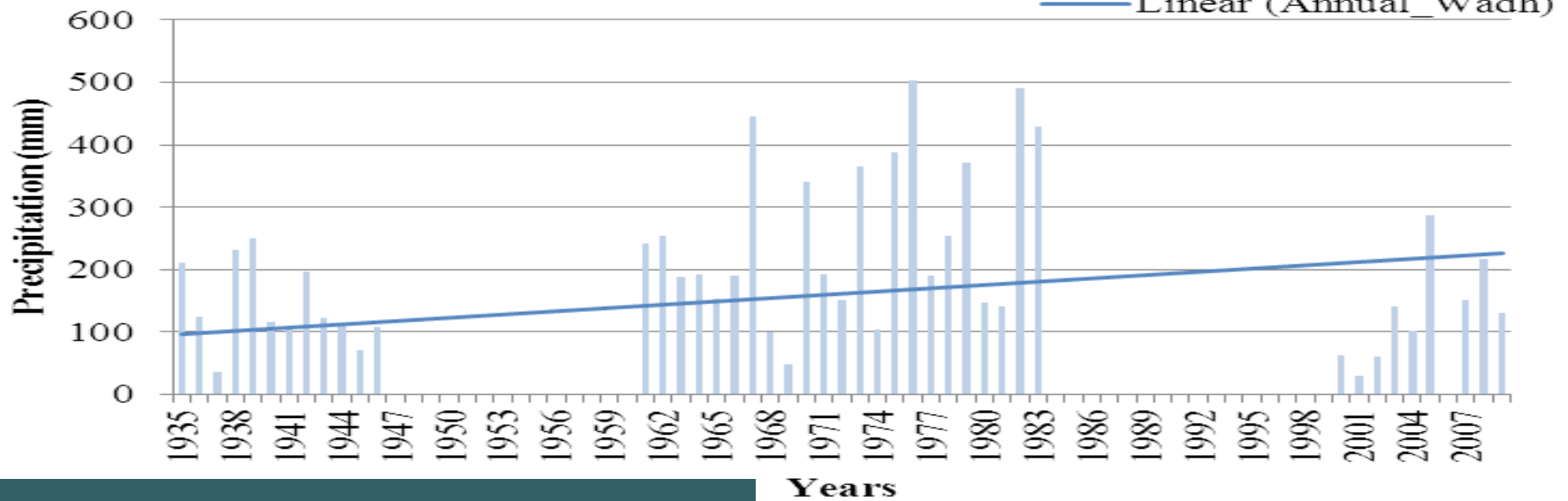
Time series	MK's "s" value	LR value (mm)	MK trend	LR trend
Uthal	-10219.000	-9	D	D
Bela	-36081.000	-13	D	D
Wadh	34761.000	2	I	I



Precipitation - Annual



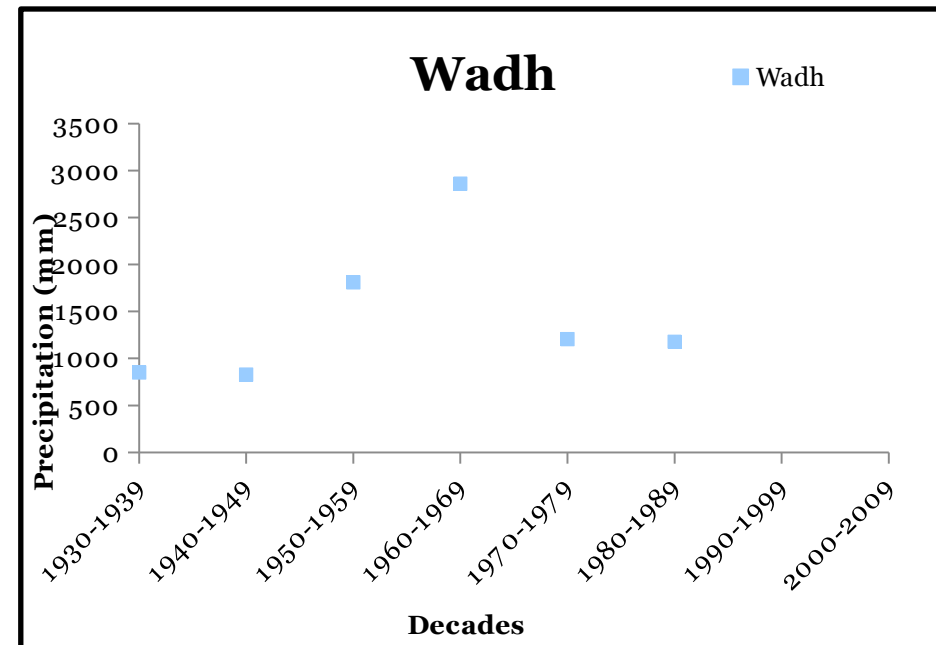
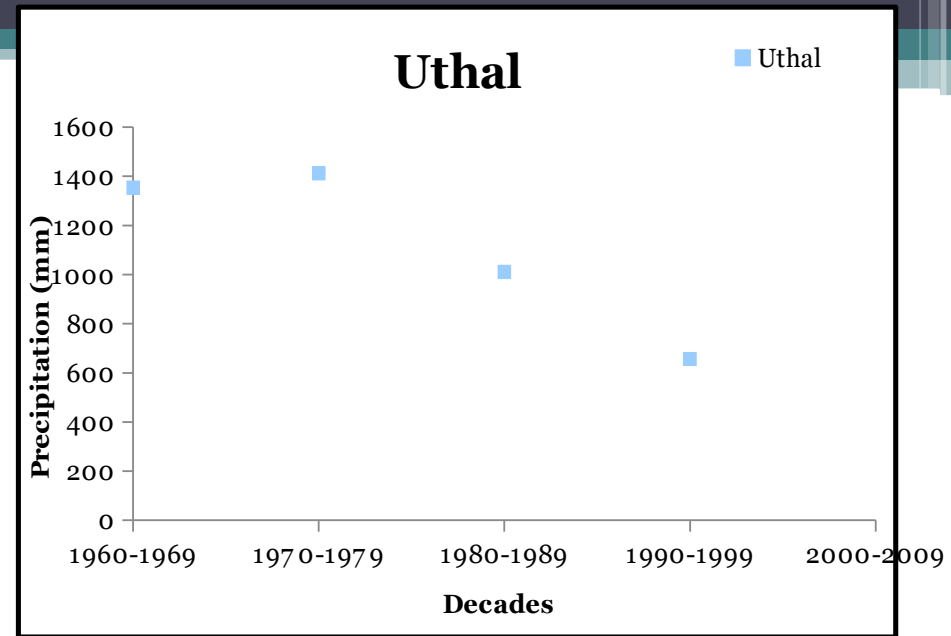
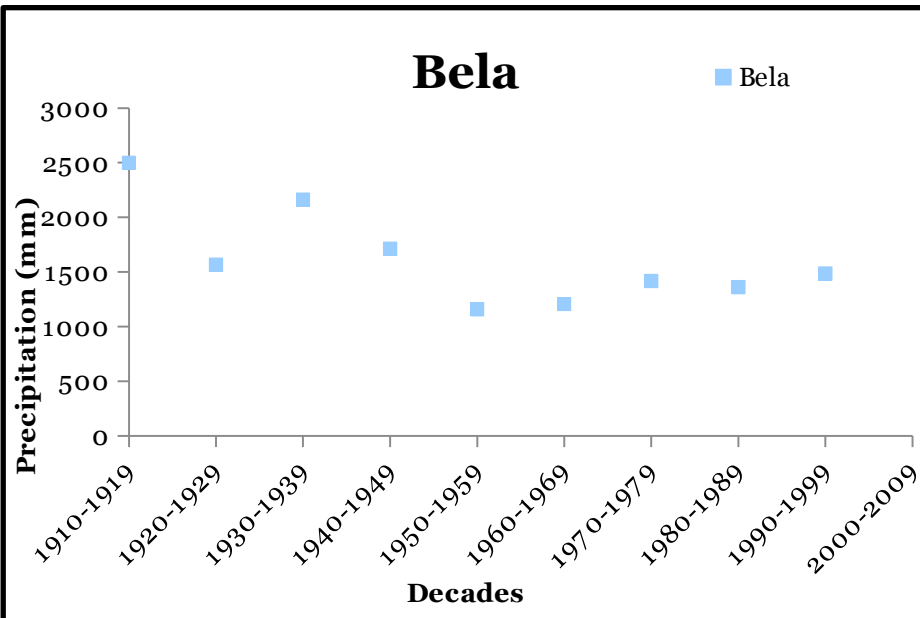
Annual_Wadh



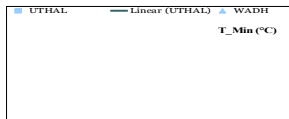
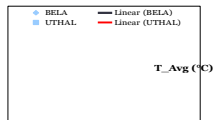
Precipitation - Annual

Time series	MK's "s" value	LR value (mm)	MK trend	LR trend
Uthal	-176.000	-210	D	D
Bela	-494.000	-169	D	D
Wadh	328.000	26	I	I

Precipitation - Decadal Analysis



Temperature -Daily



Temperature -Monthly

◆ BELA_MON_MAX_MEAN
— Linear (BELA_MON_MAX_MEAN)
■ WADH_MON_MAX_MEAN

Monthly_max
(°C)

◆ BELA_MON_AVG_MEAN
— Linear (BELA_MON_AVG_MEAN)
■ WADH_MON_AVG_MEAN

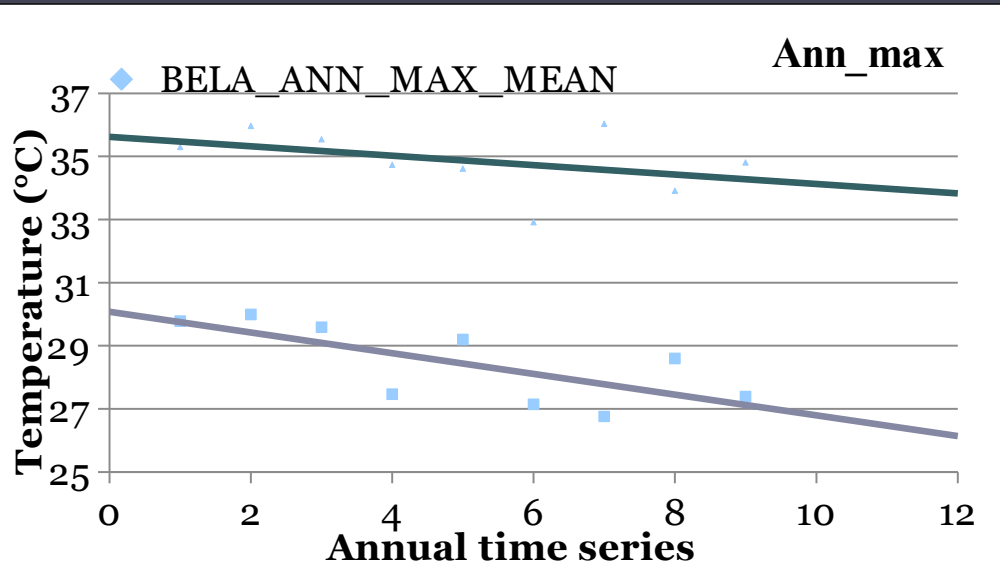
Monthly_avg

Monthly time series

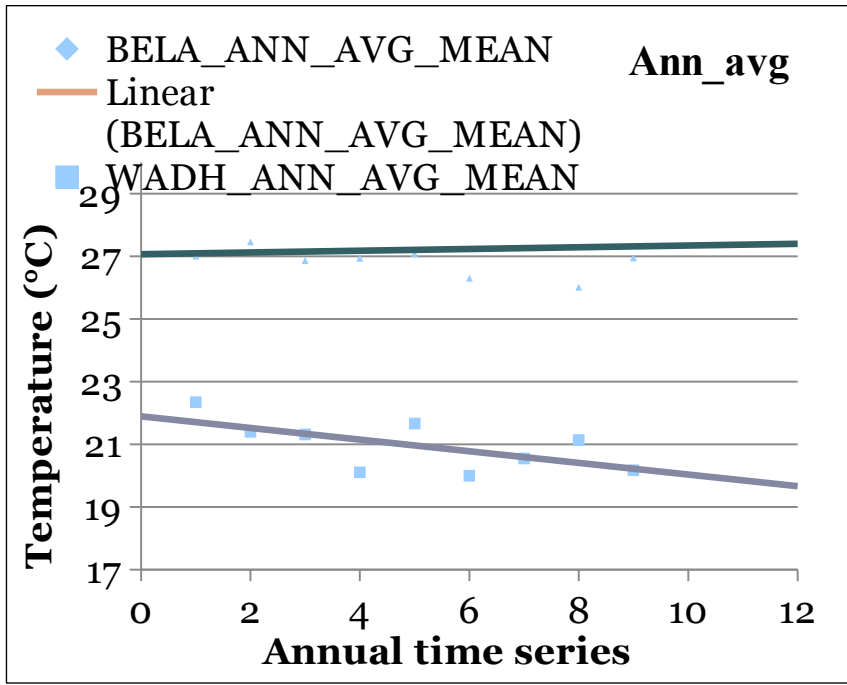
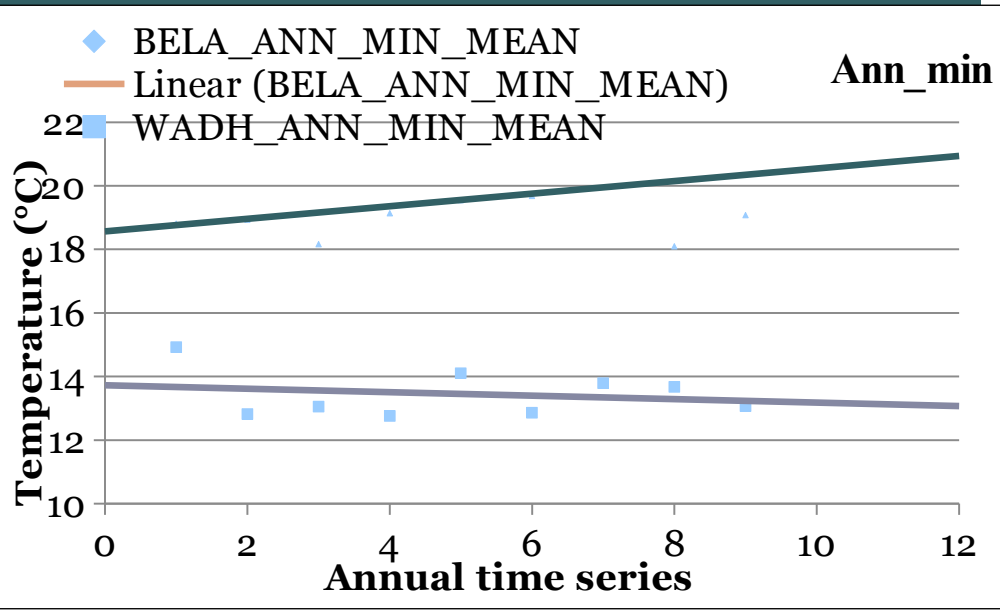
◆ BELA_MON_MIN_MEAN
— Linear (BELA_MON_MIN_MEAN)
■ WADH_MON_MIN_MEAN

Monthly_min

Monthly time series



Temperature - Annual



Uthal Temperature Analysis

Time series	MK's "s" value	LR value (°C)	MK trend	LR trend
Daily Max	-255151.000	-1.5	D	D
Daily Minimum	197702.000	1.5	I	I
Daily Mean	11739.000	0	I	--
Monthly Maximum	-376.000	-1.5	D	D
Monthly Minimum	202.000	0.65	I	I
Monthly Average	-73.000	-0.4	D	D
Annual Maximum	-10.000	-1	D	D
Annual Minimum	10.000	1.9	I	I
Annual Mean	-6.000	0.5	D	I

Bela Temperature Analysis

Time series	MK's "s" value	LR value (°C)	MK trend	LR trend
Daily Max	-53949.000	-0.05	D	D
Daily Minimum	248810.000	1.5	I	I
Daily Mean	102772.000	0.7	I	I
Monthly Maximum	12.000	0	I	I
Monthly Minimum	307.000	1.5	I	I
Monthly Average	145.000	0.8	I	I
Annual Maximum	-6.000	-0.7	D	D
Annual Minimum	20.000	1.1	I	I
Annual Mean	10.000	0.35	I	I

Wadh Temperature Analysis

Time series	MK's "s" value	LR value (°C)	MK trend	LR trend
Daily Max	-339211	-2.2	D	D
Daily Minimum	-59693.000	-0.2	D	D
Daily Mean	-202832.000	-1.2	D	D
Monthly Maximum	-287.000	-2	D	D
Monthly Minimum	-66.000	-0.1	D	D
Monthly Average	-258.000	-1.1	D	D
Annual Maximum	-22.000	-2.5	D	D
Annual Minimum	0.000	-0.3	--	D
Annual Mean	-16.000	-1.2	D	D

Conclusions

- Results from MK test are given preference over LR since MK deals with more parameters increasing its significance and resulting in less uncertainty. Only two variables (daily precipitation & annual mean temperature) for Uthal showed contrasting results.
- Precipitation for Bela and Uthal show decreasing precipitation and annual maximum temperature. Moreover, increase in minimum temperature with an average increase in annual mean temperature for Bela and decrease for Uthal. It concludes the increase in human activity in Bela.

Conclusions

- The results of Wadh are complementary to the other two stations. It can be concluded that at higher elevation the temperature (daily, monthly, and annual) is decreasing and precipitation is increasing.
- Three stations at varying physiography show varying results for climatic variables, indicating climate change to be local.