

TRENDS AND VARIABILITY OF PRECIPITATION EXTREMES IN SARDINIA ISLAND, 1951-2000: RESULTS DEPENDENCE ON THE NETWORK DENSITY.



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NETWORK DENSITY AND DATA

Regione Sardegna network: between 250 and 300 stations (from 1951 to 2000). The station mean distance is about 10km.

One annual series of 50 elements has been made by taking the annual maxima of daily precipitation all over the network (Fig1).

12 monthly series of 50 elements by taking the monthly maxima of daily precipitation all over the network (In Fig2 the November series).

COMPARISON BETWEEN SERIES

The maximum value is about 550mm/day in October 1951. Two values of 450mm/day were recorded on November 1993 and September 1971.

Fig3 represents the 12 monthly and the annual series. The elements for annual series (the last one on the right side) are higher or equal than monthly ones, as expected. Median and quartiles for October, November and December series are higher than the other months. In Mediterranean in autumn precipitations are mainly of convective type and more intense than the other seasons.

Rank sum test (WILCOXON-MANN-WHITNEY) has been applied to compare the monthly series (Tab. I). At a 5% significance level October, November and December series elements are higher than the other ones.

TREND TEST AND MOBILE WINDOW TEST

The Mann-Kendall trend test has been applied to monthly and yearly series (Tab. II). At a 5% level only March (decreasing) and July (increasing) series present significant results. At a 10% level also February (decreasing) can be included.

The comparison of 1951-1975 and 1976-2000 periods by Wilcoxon-Mann-Whitney test presents no significant differences except for March series.

Decade mobile window Wilcoxon-Mann-Whitney test applied to yearly series (Tab. III) indicates that the decade 1965-74 has significantly higher values than the rest of yearly series, while the decade 1976-85 has lower values.

EFFECTS OF NETWORK DENSITY ON THE SERIES

A special attention has been devoted to the network density effects: in a lower resolution network many extreme events of convective type are not intercepted, as the convective cells size is a few km.

The dependence of the previous results on the network density has been investigated. A second set of data has been selected by eliminating about 20% of stations in a uniform way, so the station mean distance raises to about 12 km (Fig. 6). A third set of data has been obtained by eliminating about 80% of stations, so the station mean distance is 20 km. Fig 7 represent median, quartiles, maxima and minima obtained by the three data set for January, March, July, September, October, November and annual series. The continuous line for the median show very little differences between the original and the second data set series, while the median for the third data set is lower than the other two. The same holds for quartiles. This is verified in a quantitative way.

Comparison between the original data set series and the second one by Wilcoxon-Mann-Whitney test shows that they are very similar, on the contrary the third set values are significantly lower. In the third data set, where the stations mean distance is about 20km, many convective intense events are not intercepted by the network.

EFFECTS OF NETWORK DENSITY ON THE TRENDS

Trend test for the second and the third data set series are also made (TabIV). Results for the original and the second data set are very similar. On the contrary for the third data set their are very different. In particular for July series the third data set shows no more significant trend. For yearly series results drops from 49% with the original series to 7.3% for the third data set series.

Comparison of 1951-1975 and 1976-2000 periods by Wilcoxon-Mann-Whitney test produces very different results by using the third data set, respect to the original one. In particular for the annual series result of original data set is 16%, while for third data set it is 3.6% (1976-2000 period values significantly lower).

ANNUAL AND MONTHLY SERIES. COMPARISON BETWEEN THE SERIES

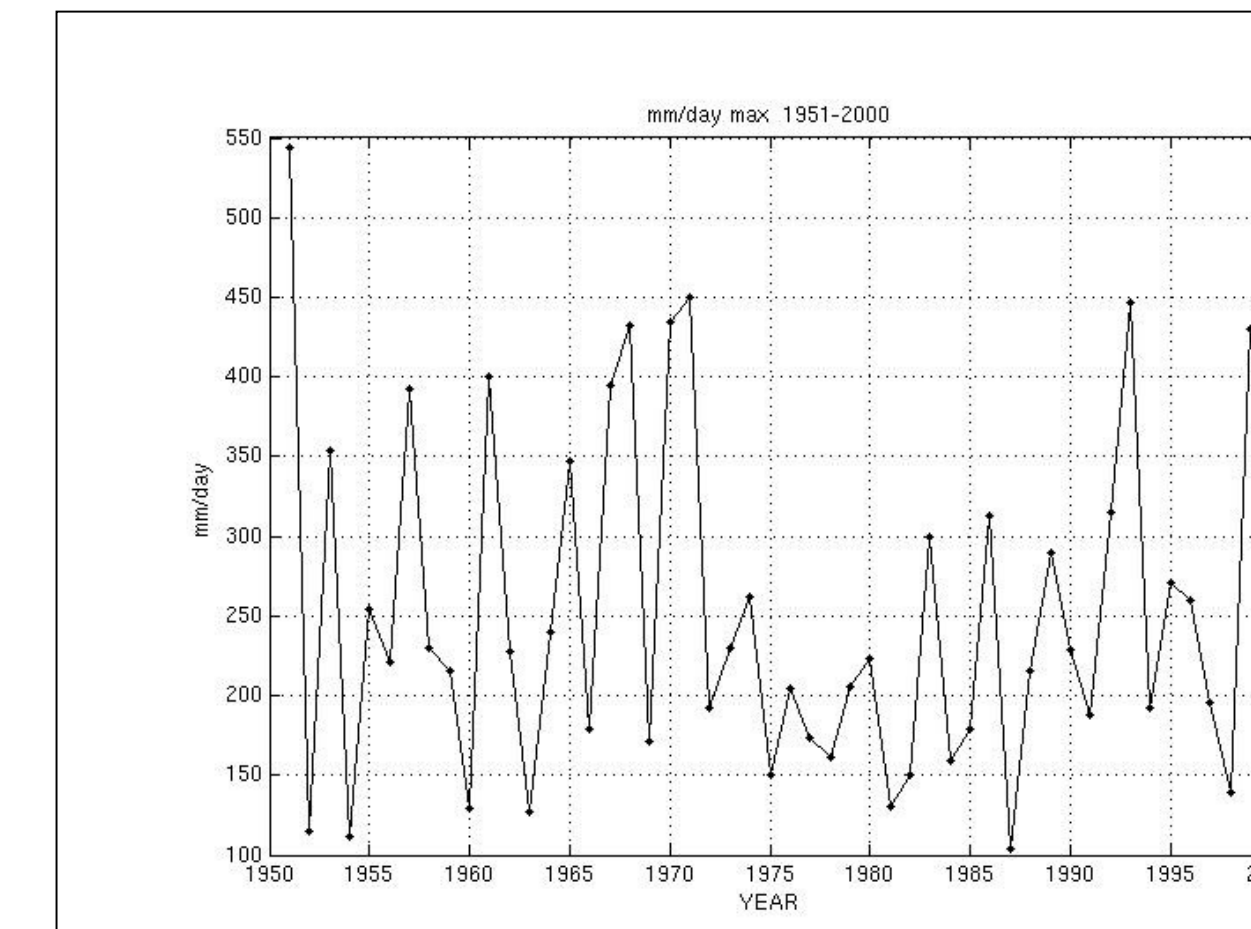


Fig1. Yearly series (series of annual maxima)

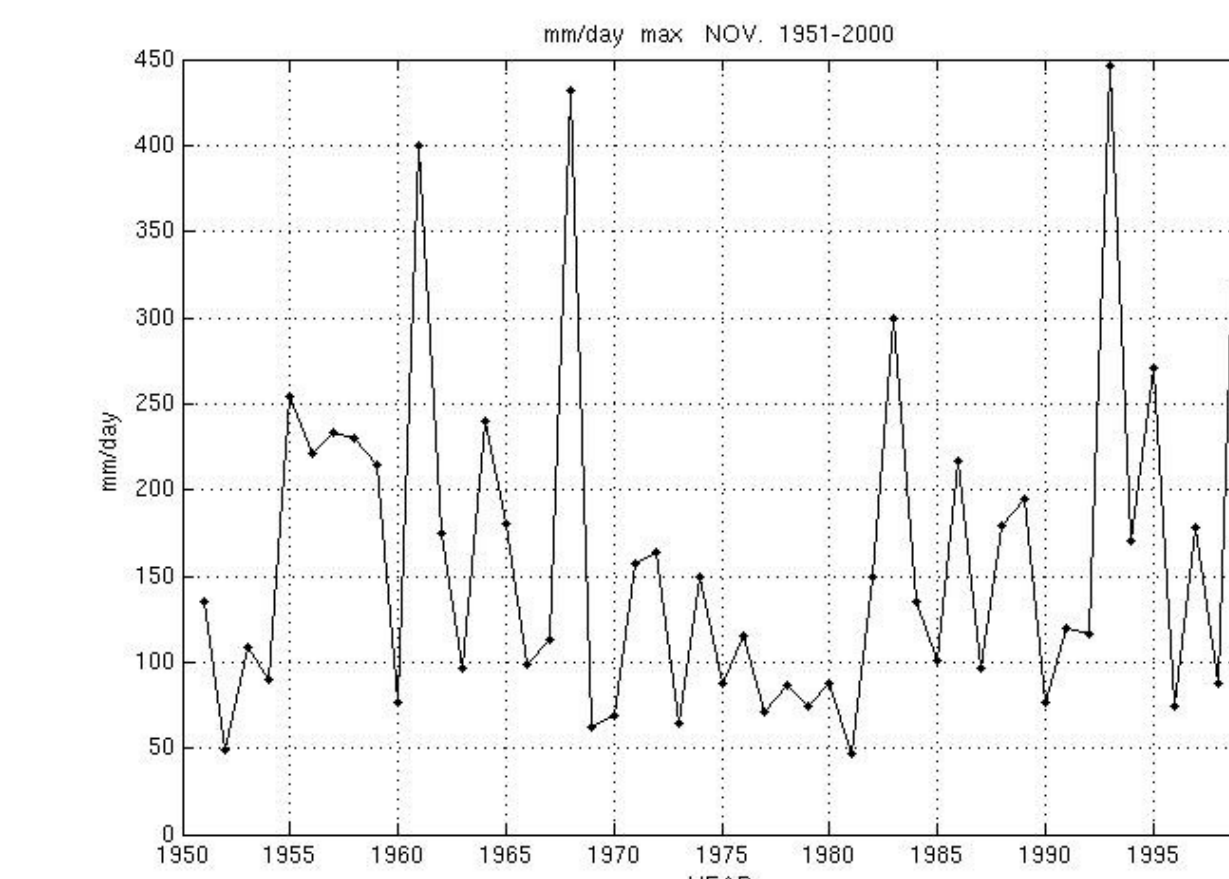


Fig2. November series

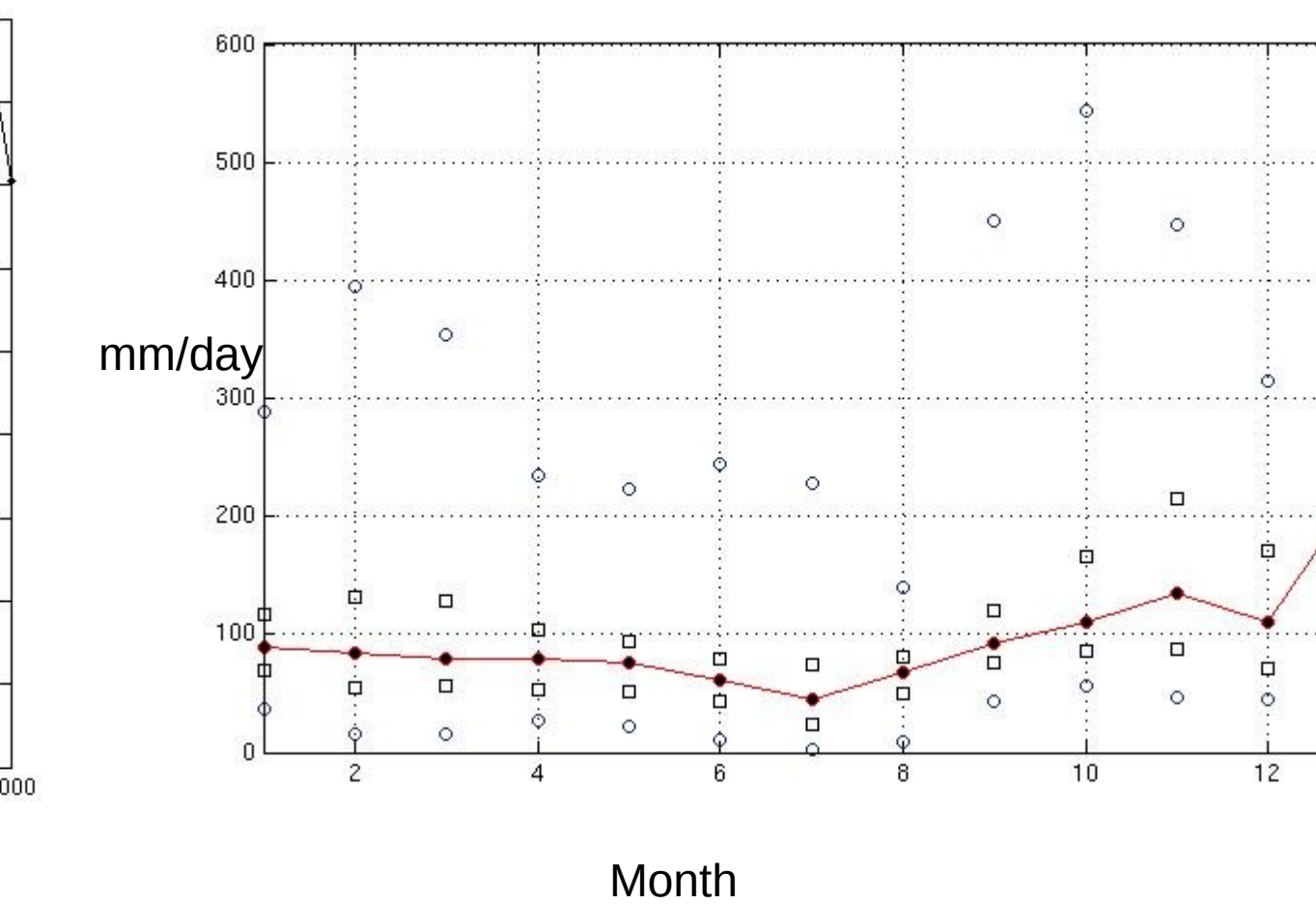


Fig 3. Plots of 12 monthly series and yearly series. Median, upper and lower quartile, minimum and maximum

RANK SUM TEST (WILCOXON-MANN-WHITNEY)

NOV	OCT	12%
NOV > DEC	4.8%	
OCT	DEC	31%
OCT > JAN	0.66%	
OCT > SEP	0.48%	
DEC > SEP	3.6%	
DEC > JAN	4.2%	
JAN	FEB	21%
JAN	MAR	24%
JAN > APR	4.3%	
FEB	MAR	48%
MAR	APR	22%

Tab. I: Comparison between monthly series. November and October values are significantly higher.

TREND TEST AND MOBILE WINDOW TEST

TREND TEST (MANN-KENDALL) MONTHLY MAXIMA SERIES

jan	31%	jul	+ 3.3%
feb	- 8.7%	aug	39%
mar	- 0.7%	sep	19%
apr	44%	oct	29%
may	18%	nov	35%
jun	47%	dec	48%

ANNUAL MAXIMA TEST 49%

Tab II: trend test (Mann-Kendall) for monthly and annual series.

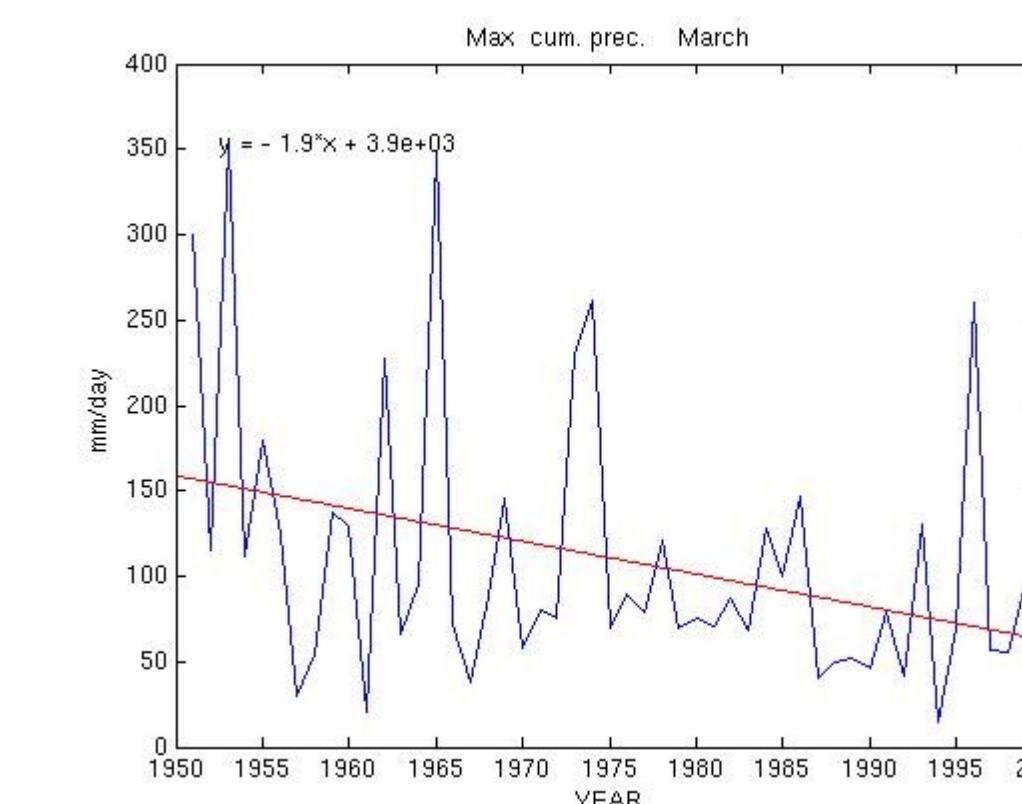


Fig 4. March series

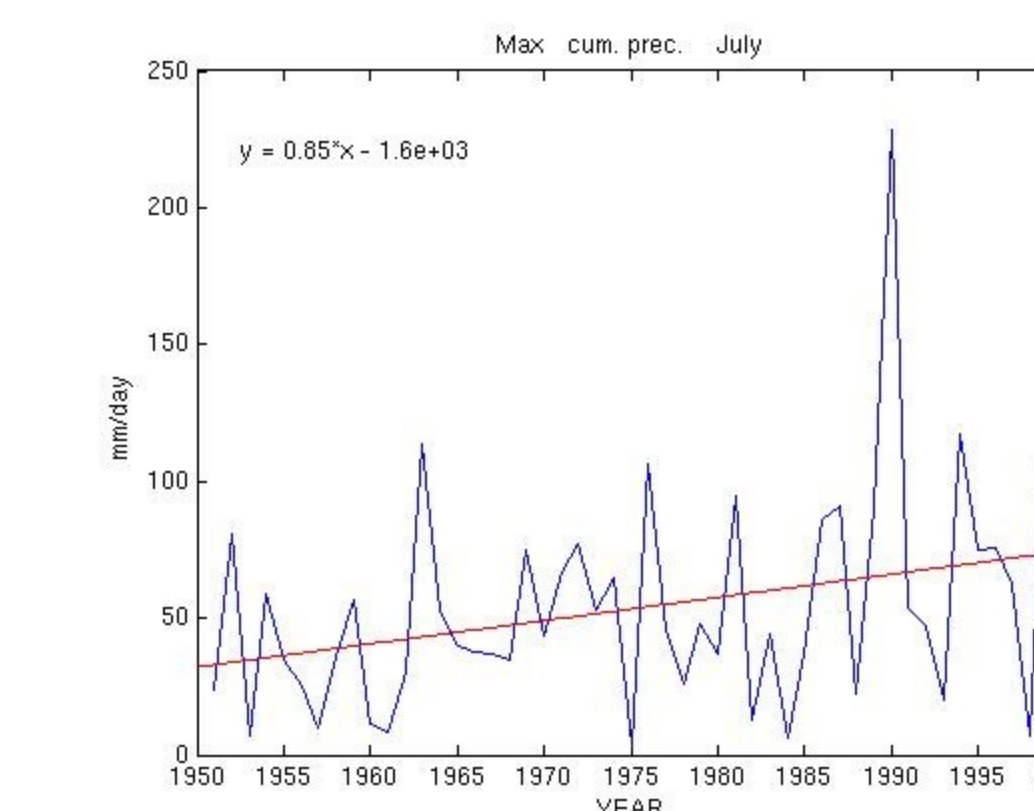


Fig 5. July series

10 YEAR MOBILE WINDOW. Wilcoxon-Mann-Whitney test

64-73	2.4%	+ Higher
65-74	2.2%	+
73-82	4.4%	- Lower
75-84	4.4%	-
76-85	2.3%	-
78-87	3.7%	-

Tab. III. Annual series. 10 years mobile window Wilcoxon test

EFFECTS OF NETWORK DENSITY

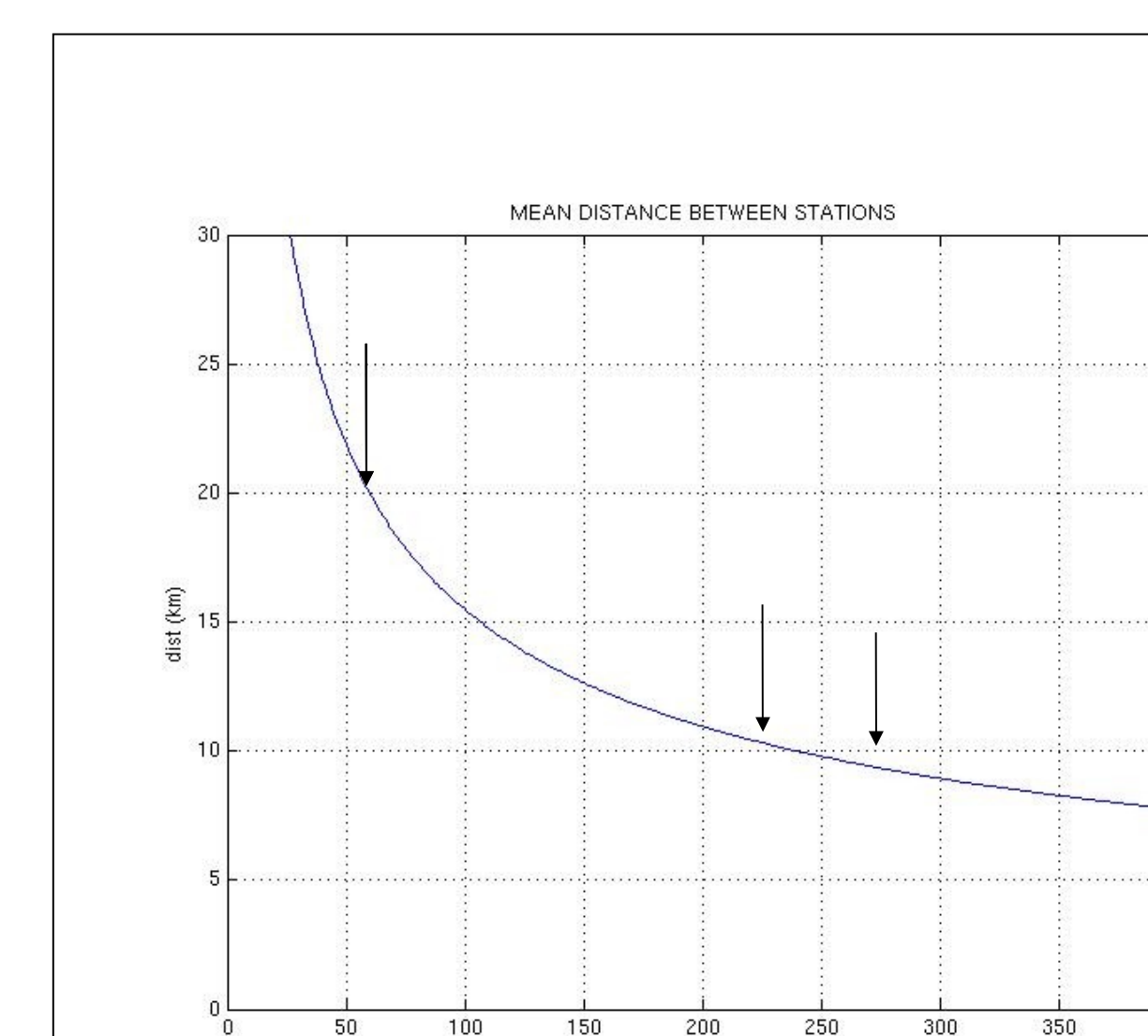


Fig 6. Mean distance between the stations vs stations number for the three data sets

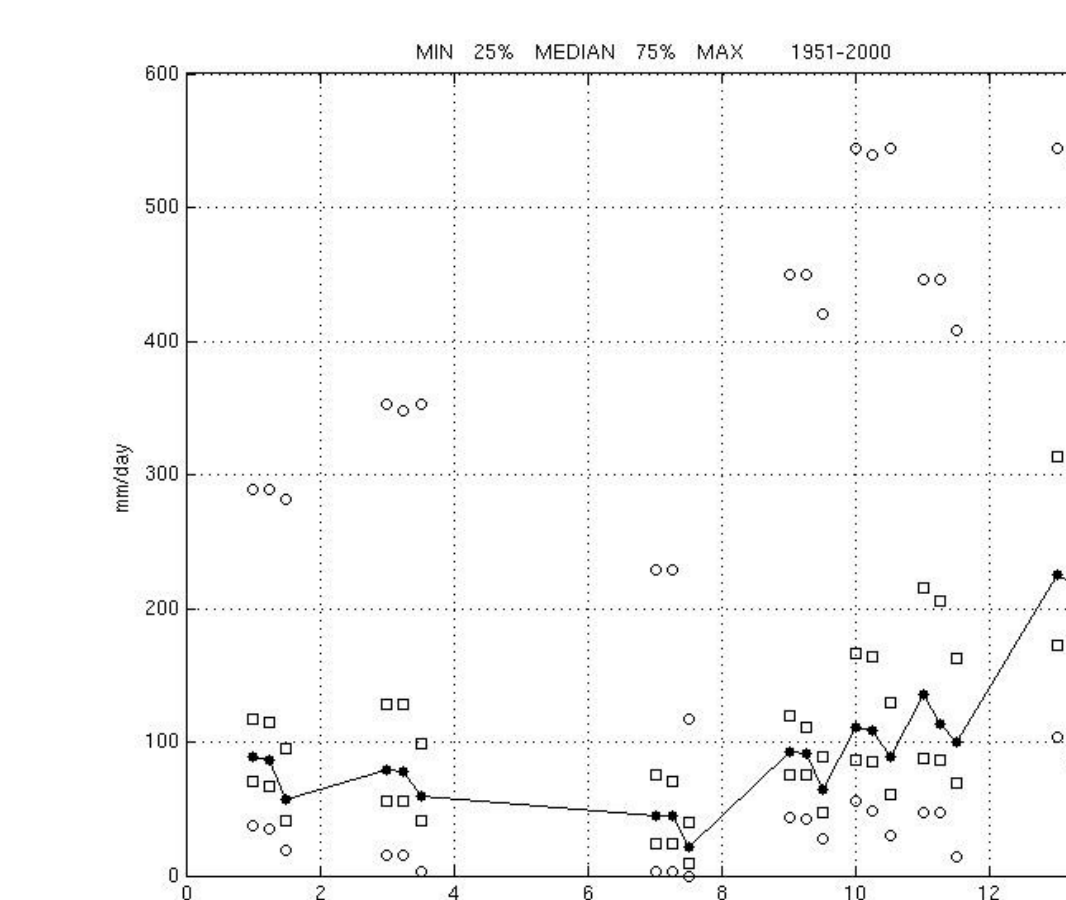


Fig 7. Plots of January, March, July, September, October, November and annual series for the three data set. Median, upper and lower quartile, minimum and maximum

TREND TEST (MANN-KENDALL)

	Complete set (280stat.)	220 stat.	Only 60 stat.
JAN	31% +	31% +	24% -
MAR	0.7% -	2.2% -	0.3% -
JUL	3.3% +	3.9% +	11.5% +
SEP	19% +	21% +	41% +
OCT	29% -	28% -	40% -
NOV	35% +	39% +	42% -

YEARLY 49% 38% 7.3% -

In July series with only 60 stations trend is no more significant. Also yearly result is complete different.

Tab. IV. Data sets comparison. Trend test.