Homogenization of monthly and daily climatological time series

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Latsis Foundation 1st International Summer School

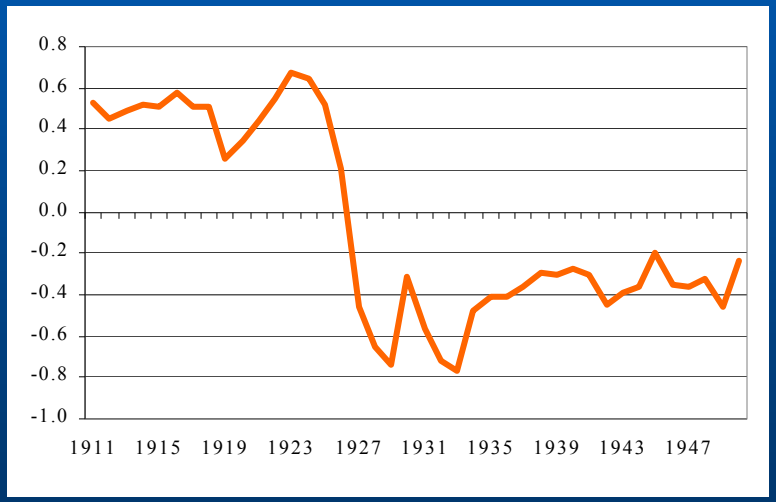
Environment: Climate – Climate change - Impacts

Climatological studies

- **Measuring and collecting data**

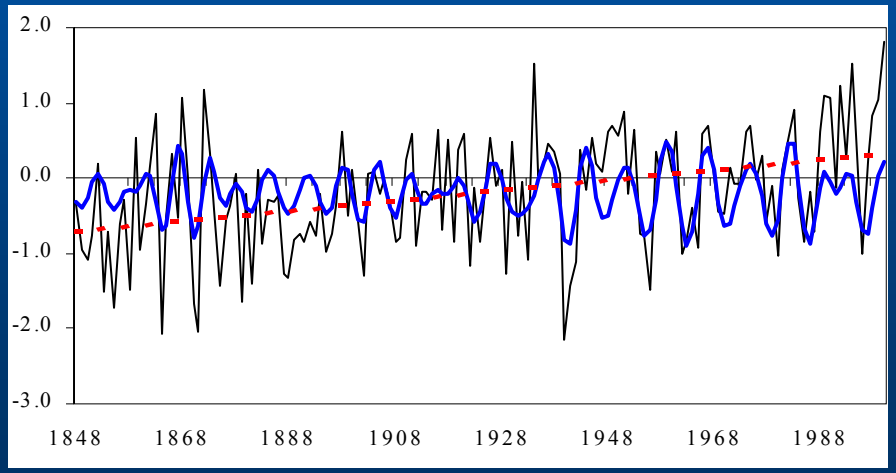
Climatological studies

- **Measuring data**
- **Data quality control and Homogenization**

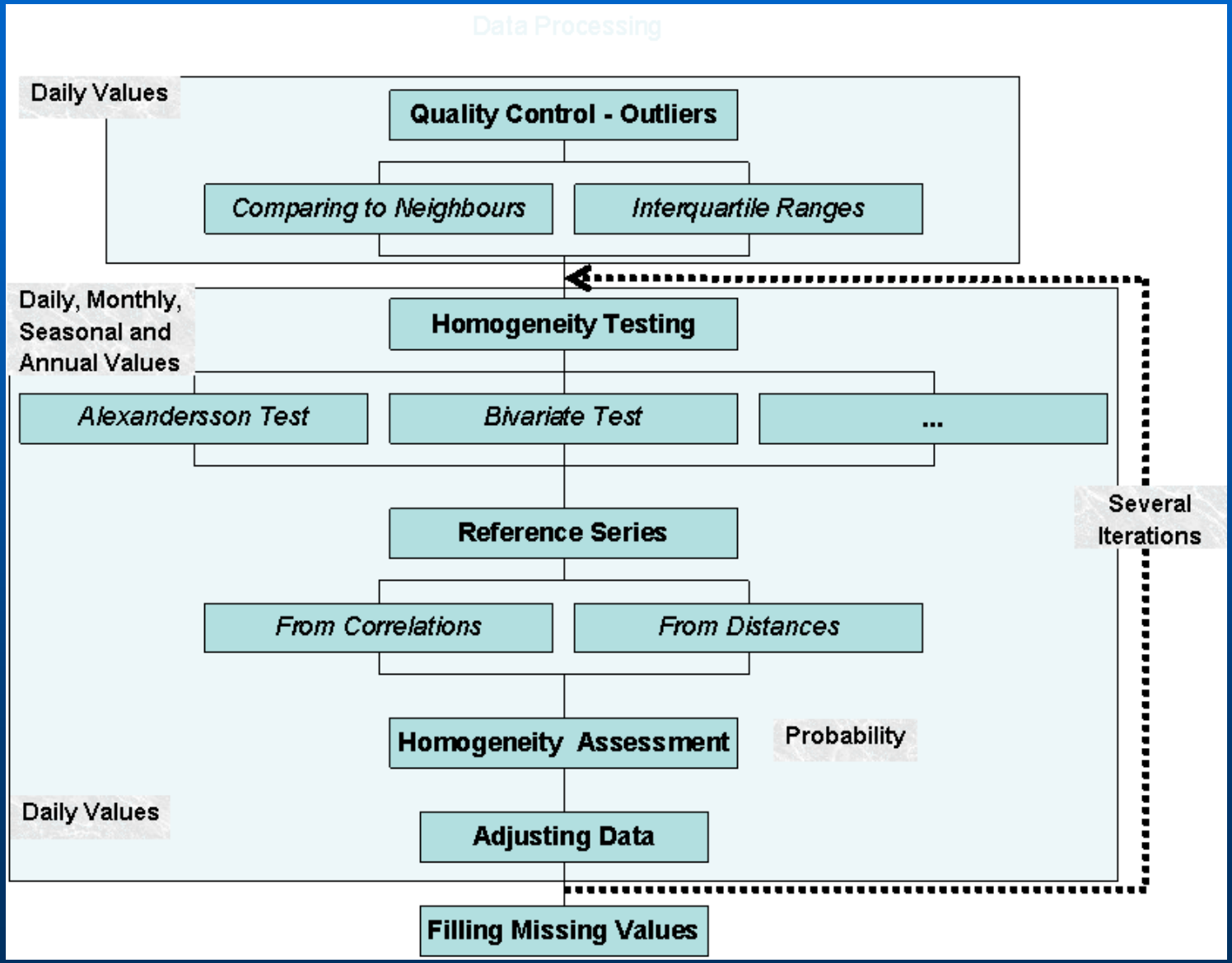


Climatological studies

- **Measuring data**
- **Homogenization**
- **Data Analysis**



Processing before any data analysis

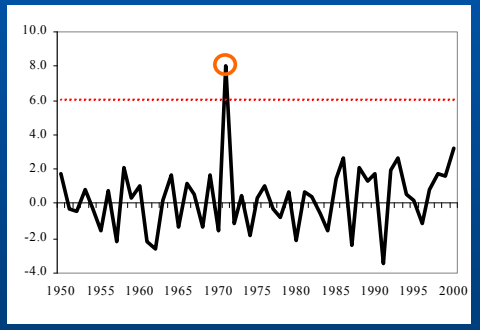


Software AnClim, ProClimDB

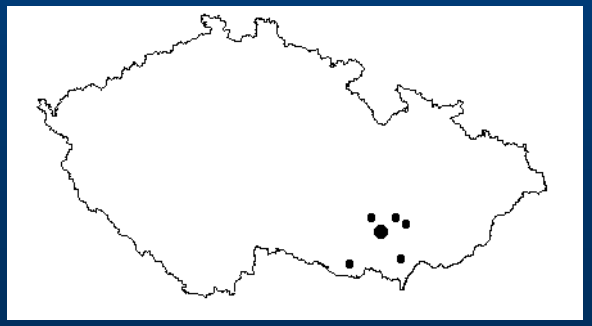
Data Quality Control
Finding Outliers

Two main approaches:

- **Using limits derived from interquartile ranges (time series)**



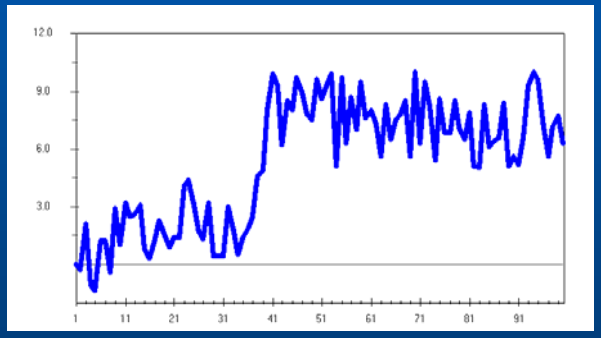
- **comparing values to values of neighbouring stations (spatial analysis)**

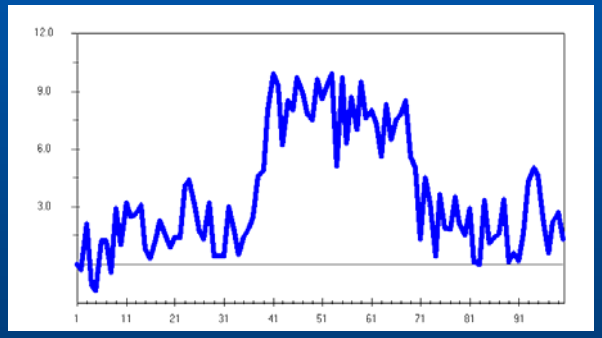


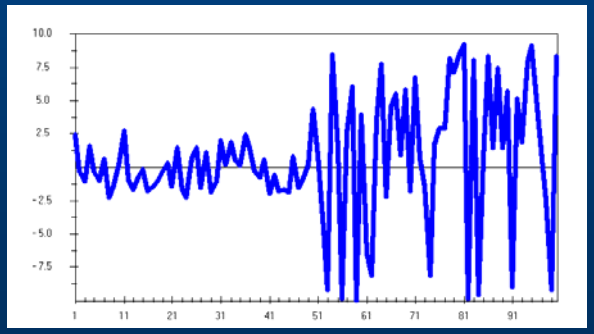
Homogenization

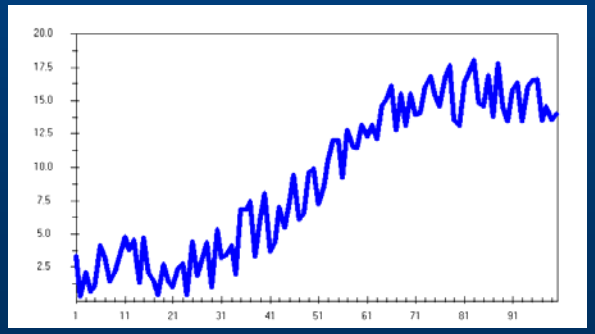
- **Change of measuring conditions**

  ⟶ inhomogeneities



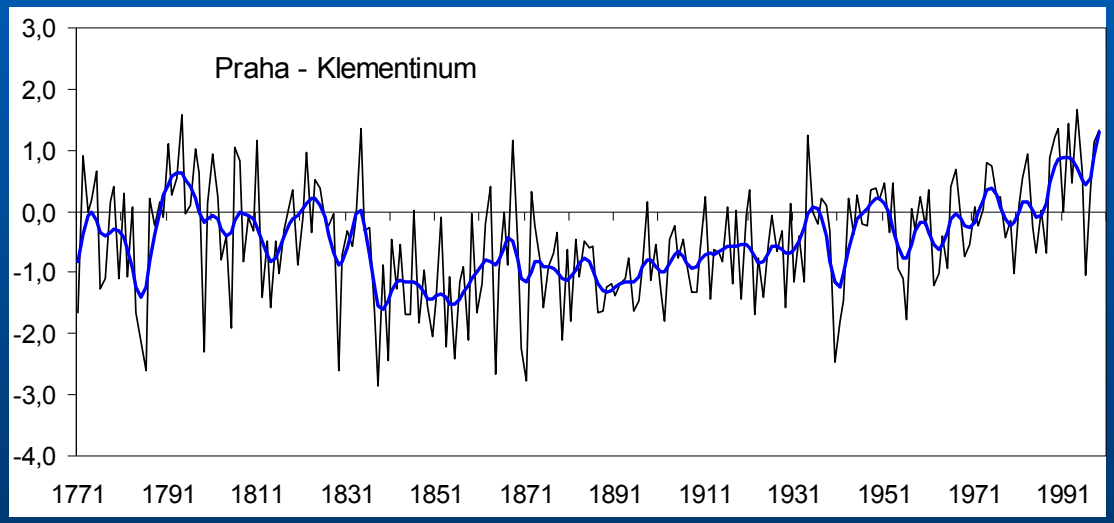






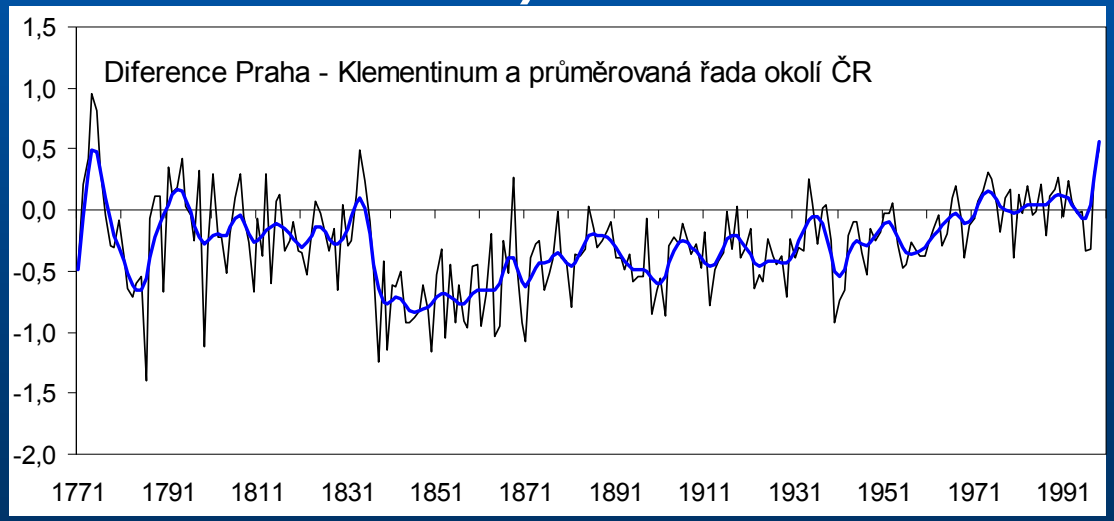
Inhomogeneity Detection

- **Absolute Homogeneity Testing**



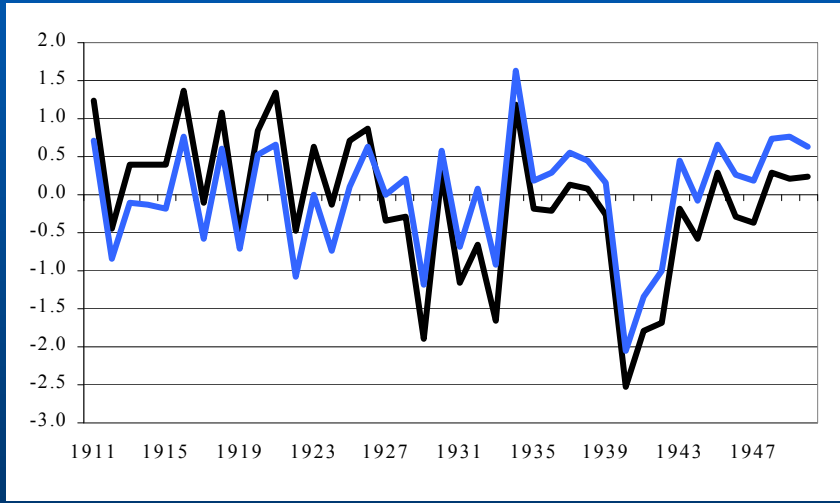
Inhomogeneity Detection

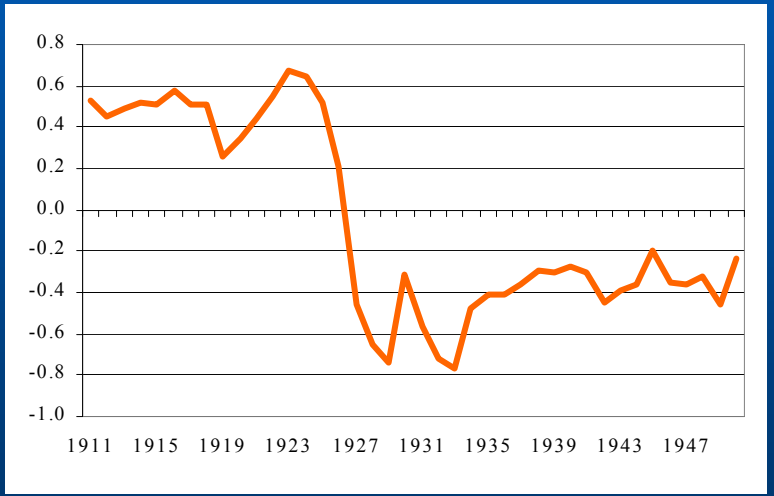
- **Absolute Homogeneity Testing**
- **Relative Homogeneity Testing**
  (differences with reference series)



Relative Homogeneity Testing

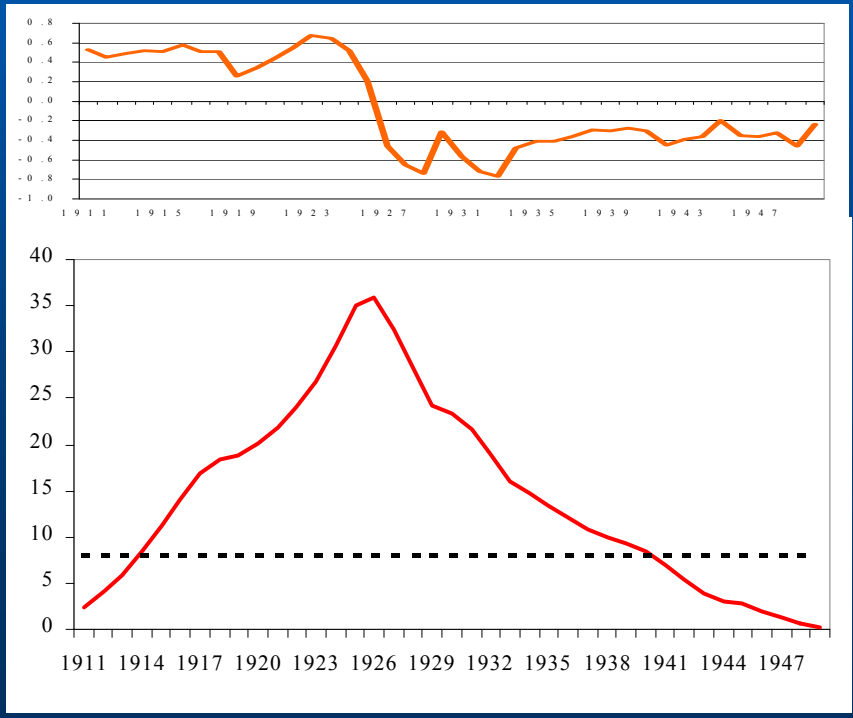
- **Creating reference Series**





Relative Homogeneity Testing

- **Creating reference Series**
- **Tests of homogeneity**



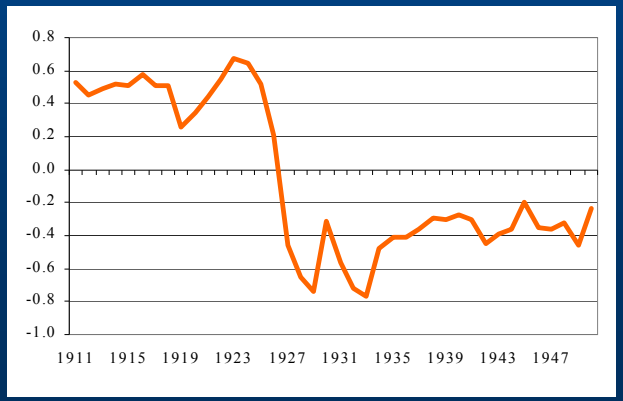
Relative Homogeneity Testing

- **Creating reference Series**
- **Tests of homogeneity**
- **Assessing homogeneity**

- Metadata

- Physically justified

- “undoubted” inhomogeneity



Relative Homogeneity Testing

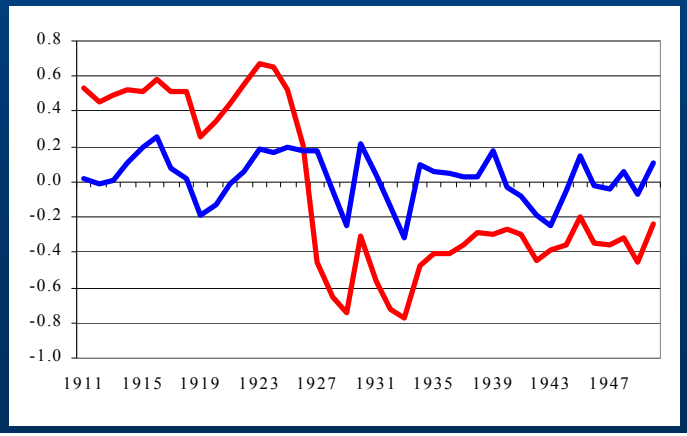
- **Creating reference Series**
- **Tests of homogeneity**
- **Assessing homogeneity**

  - Metadata

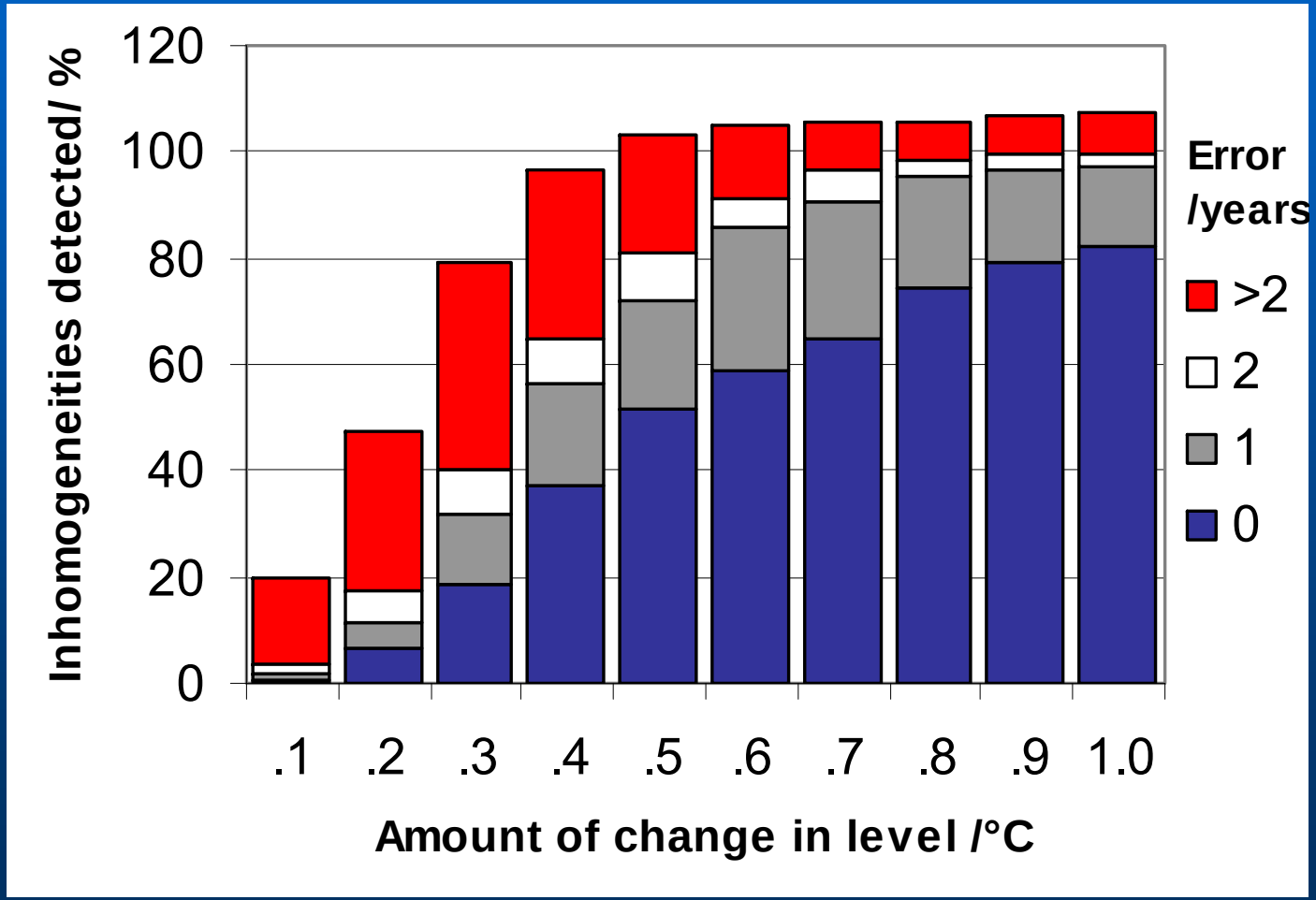
  - Physically justified

  - "undoubted" inhomogeneity

- **Adjusting Series**



Inhomogeneity Detecting by SNHT (p=0.05, 950 series)



Assessing Homogeneity – Problems:

- **most of metadata incomplete**

→ **we depend upon statistical tests results**

Assessing Homogeneity – Problems:

- **most of metadata incomplete**

  → **we depend upon statistical tests results**

- **uncertainty in test results**
  - right inhomogeneity detection is problematic
  (for smaller amount of change)

Proposed solution

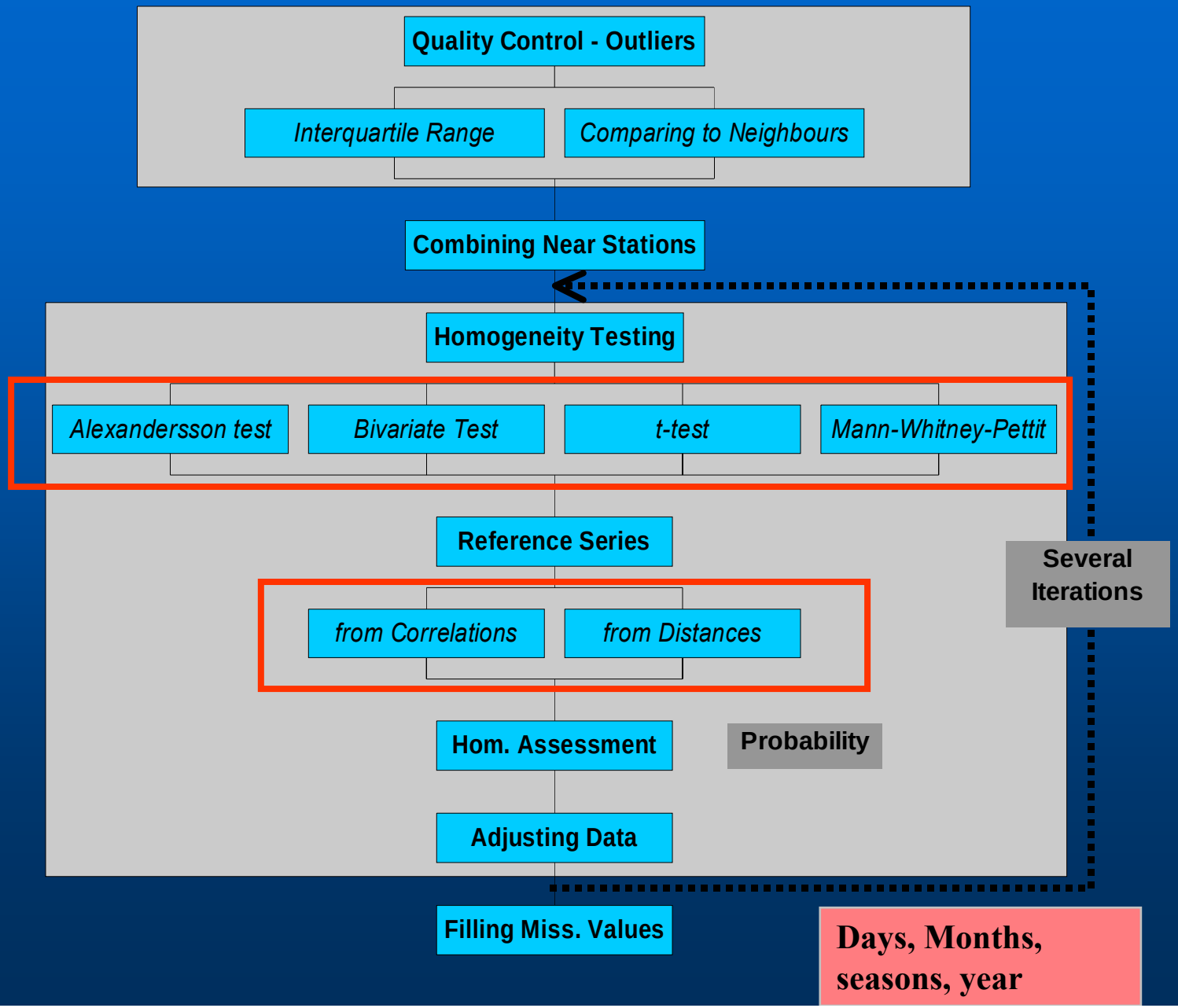
- To get as many test results for each candidate series as possible

→ **„Ensemble“ approach - processing of big amount of test results for each individual series**

Adventages of the „Ensemble“ approach

- **we know relevance (probability) of each inhomogeneity**
- **we can easily assess quality of measurements for series as a whole**

How to increase number of test results



Creating Reference Series

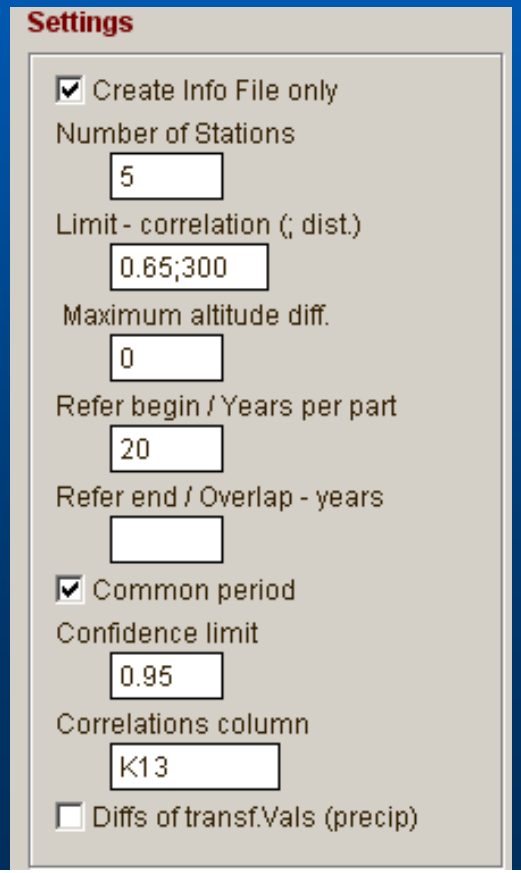
- for monthly, daily data (each month individually)
- weighted/unweighted mean from neighbouring stations
- criterions used for stations selection (or combination of it):
  - best correlated / nearest neighbours

    (correlations – from the first differenced series)
  - limit correlation, limit distance
  - limit difference in altitudes

- neighbouring stations series should be standardized to test series
  AVG and / or STD

  (temperature - elevation, precipitation - variance)

  - **missing data are not so big problem then**



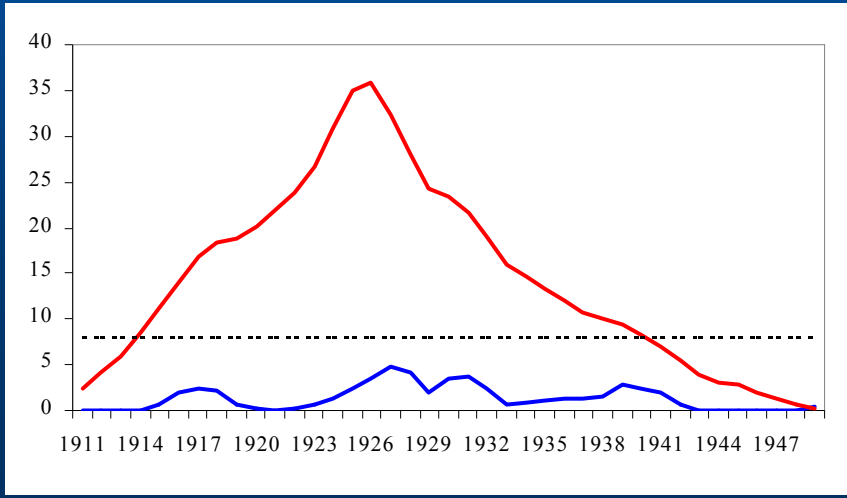
Relative homogeneity testing

- **Available statistical tests:**
  - **Alexandersson SNHT**
  - **Bivariate test of Maronna and Yohai**
  - **Mann – Whitney – Pettit test**
  - **t-test**
  - **Easterling and Peterson test**
  - **Vincent method**
  - **…**

20 year parts of the daily series **(40 for monthly series with 10 years overlap),**
in SNHT splitting into subperiods in position of detected significant changepoint
(30-40 years per one inhomogeneity)

Homogeneity Tests

Alexandersson's SNHT



Alexandersson Standart Normal Homogeneity Test

(Single shift test)

Reference series:

$$q_i = Y_i / \{[\sum_{j=1}^{k} \rho_j{}^2 X_{ji} \bar{Y} / \bar{X}_j] / \sum_{j=1}^{k} \rho_j{}^2\}$$

$$q_i = Y_i - \{\sum_{j=1}^{k} \rho_j{}^2 [X_{ji} - \bar{X}_j + \bar{Y}] / \sum_{j=1}^{k} \rho_j{}^2\}$$

Null and alternative hypothesis:

$H_0 : z_i \in N(0,1), \quad i \in \{1,..,n\}$.

$H_1 : z_i \in N(\mu_1,1), \quad i \in \{1,..,a\}$,

$z_i \in N(\mu_2,1), \quad i \in \{a+1,..,n\}$,

for $1 ? a < n$ a $\mu_1 ? \mu_2$.

$z_i = (q_i - \bar{q})/s_q$, $z_i \in N(0,1)$

Test statistic:

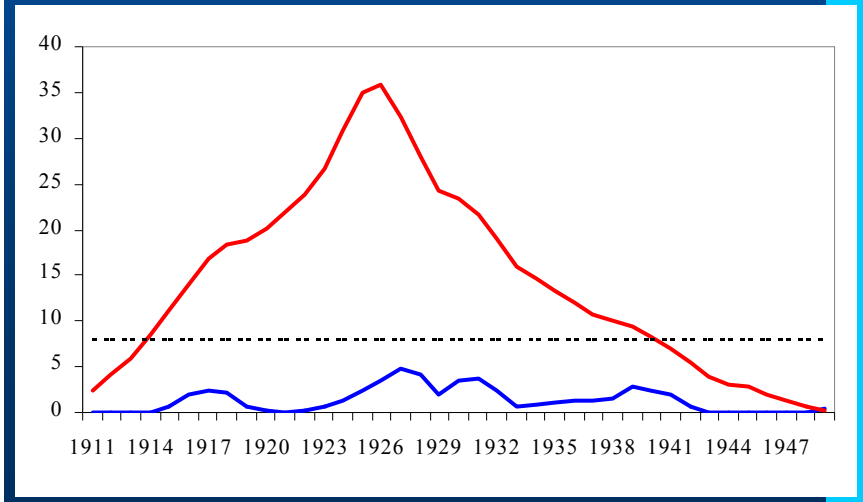
$$T_0 = \max_{1 \le a < n-1} \{T_a\} = \max_{1 \le a < n-1} \{a\bar{z}_1^2 + (n-a)\bar{z}_2^2\}$$

where $\bar{z}_1 = \frac{1}{a}\sum_{i=1}^{a} z_i$, $(\bar{z}_1 ? \mu_1)$,

$\bar{z}_2 = \frac{1}{(n-a)}\sum_{i=a+1}^{n} z_i$, $(\bar{z}_2 ? \mu_2)$.

Homogeneity Tests

Bivariate Test of Maronna and Yohai



Bivariate Test

Null and alternative hypothesis:

H_0 : vectors $\{x_i, y_i\}$ bivariate normal distributed
$N(\mu_x, \mu_y, \sigma_x^2, \sigma_y^2, \rho)$

H_1 : pro $0<i_0<n$ a d ? 0 -
$N(\mu_x, \mu_y, \sigma_x^2, \sigma_y^2, \rho)$ pro i ? i_0
$N(\mu_x, \mu_y+d, \sigma_x^2, \sigma_y^2, \rho)$ pro $i > i_0$.

Test statistic:

$$T_0 = \max_{i<n}\{T_i\}$$

where: $X_i = 1/i\sum_{j=1}^{i} x_j$, $Y_i = 1/i\sum_{j=1}^{i} y_j$, $\overline{X} = X_n$, $\overline{Y} = Y_n$

$$S_x = \sum_{j=1}^{n}(x_j - \overline{X})^2 \text{ , } S_y = \sum_{j=1}^{n}(y_j - \overline{Y})^2 \text{ , } S_{xy} = \sum_{j=1}^{n}(x_j - \overline{X})(y_j - \overline{Y}) \text{ ,}$$

$$F_i = S_x - (X_i - \overline{X})^2 ni/(n-i) \text{ , } i<n \text{ ,}$$

$$D_i = S_x(\overline{Y} - Y_i) - S_{xy}(\overline{X} - X_i)n/\left[(n-i)F_i\right],$$

$$T_i = \left[i(n-i)D_i^2 F_i\right]/(S_x S_y - S_{xy}^2)$$

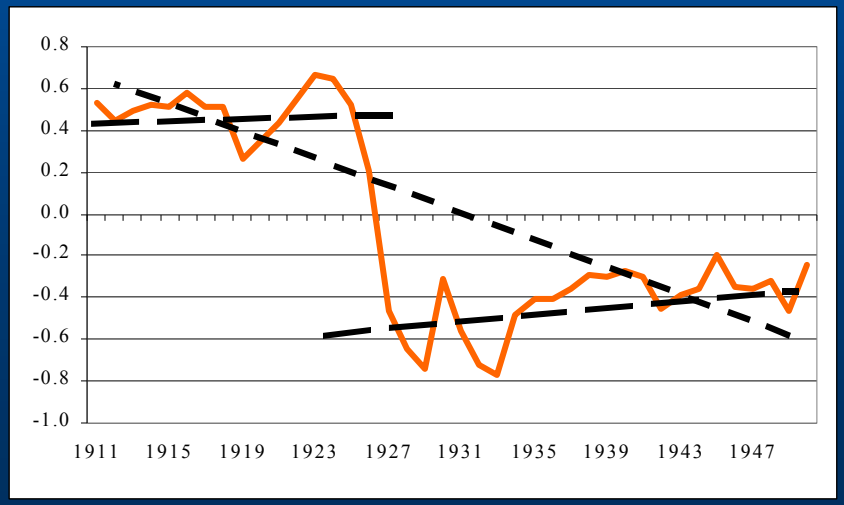
Homogeneity Tests

Two-phase linear regression
(Vincent Technique,
Easterling and Peterson test)

Easterling and Peterson

Test statistic: $U = [(RSS_1 - RSS_2)/3]/[RSS_2/(n-4)]$? F(3,n-4)

t-test: differences of levels before and after a discontinuity



Homogeneity assessment

- **Various outputs created for better inhomogeneities assessment**
- **Combining results with information from metadata whenever possible**
- **Decision about „undoubted“ inhomogeneities (without metadata) – coincidence of test results**

Homogeneity assessment

Output example: Station Čáslav, 3rd segment, 1911-1950, n=40

Test	Ref	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Win	Spr	Sum	Aut	Year
A	**avg**	1927	1929	1927	1927	1927	1928	1927	1926	1926	1926	1926	1926	1927	1927	1927	1926	1927
A			1930															
A	**corr**	1927	1927	1927	1927	1927	1928	1927	1926	1926	1926	1926	1926	1927	1927	1927	1926	1927
A				1939		1938	1939	1940	1922						1937	1937		1935
A	**dist**	1927	1928	1927	1927	1927	1928	1927	1926	1926	1926	1926	1926	1927	1927	1927	1926	1927
A			1930								1940							1918
B	**avg**	1927	1928	1927	1927	1927	1928	1927	1926	1926	1926	1926	1926	1927	1927	1927	1926	1927
B									1922									
B	**corr**	1927	1927	1927	1927	1927	1928	1927	1926	1926	1926	1926	1926	1927	1927	1927	1926	1927
B				1936		1938	1939	1944	1922					1935	1937	1937		1935
B									1937									
B	**dist**	1927	1928	1927	1927	1927	1928	1927	1926	1926	1926	1926	1926	1927	1927	1927	1926	1927
B		1930									1940			1931			1913	1918
V	**corr**													1927			1926	
V															1937	1922		1935
V																1937		
V	**dist**													1927	1927	1927		
V																		1918

Homogeneity assessment, Output II example:

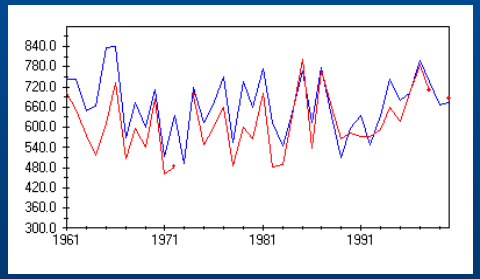
Begin	End	Length	InHomogeneity	Number	% detected inhom	% possible inhom	End	Missing
1911	1950	40		140	100	120		
			1927	60	43	51		
			1926	37	26	32		
			1928	9	6	8		4
			1937	7	5	6		
			1922	4	3	3		
			1935	4	3	3		
			1918	3	2	3		
			1930	3	2	3		
			1939	3	2	3		
			1940	3	2	3		2
			1938	2	1	2		
			1913	1	1	1	3	3
			1929	1	1	1		
			1931	1	1	1		
			1936	1	1	1		
			1944	1	1	1		
1926	1927	2		97	69	83		
1926	1931	6		111	79	95		
1935	1940	6		20	14	17		
1911	1920	10		4	3	3		
1921	1930	10		114	81	97		
1931	1940	10		21	15	18		
1941	1950	10		1	1	1		

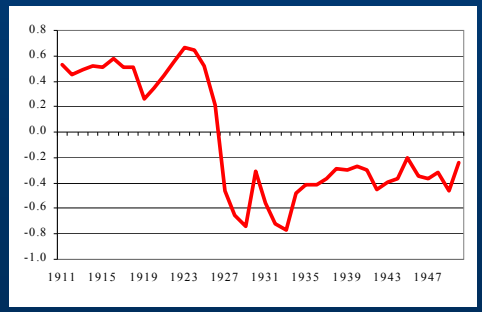
Summed numbers of detections for individual years

Homogeneity assessment

- **combining several outputs (sums of detections in individual years, metadata, graphs of differences/ratios, …)**

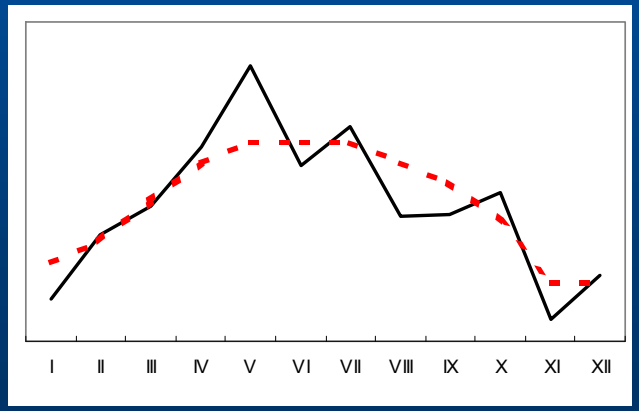
	ID	EL	YEAR	BEGIN	END	YEAR_COUN	Y_POSSIBL	YEA	MIS	X_BEGIN_D	X_END_DA	X	X	L	L	A	B	REMARK	C	C
x	B1BOJK01	x	1985			41	14.24		12	23.3.1984	31.3.2003	#	#				B	change		
	B1BOJK01	x	1985			41	14.24		12	23.3.1984	31.12.9999	#	#					obs	V	B
	B1BYSH01	x	1978			37	12.85													
?	B1BYSH01	x	1979			33	11.46													
?	B1BYSH01	x	1980			43	14.93													
?	B1HLHO01	x	1965			31	10.76	4	1											
	B1HOLE01	x	1976			33	11.46													
	B1KROM01	x		1977	1978	31	10.76													
x	B1RADE01	x	1994			44	15.28		2	1.1.1994	31.12.9999	#	#				F	change		
	B1RADE01	x	1994			44	15.28		2	1.1.1994	31.12.9999	#	#					obs	J	B
x	B1RYCH01	x	1973			49	17.01			1.5.1973	28.2.1991	#	#				V	change		
	B1RYCH01	x	1973			49	17.01			1.9.1972	28.2.1991	#	#					obs	M	B
xx?	B1STRZ01	x	1987			53	18.40													
	B1STRZ01	x	1988			30	10.42													
	B1UHBR01	x	1983			31	10.76			18.2.1984	31.1.1999	#	#				U	change		
	B1UHBR01	x	1983			31	10.76			18.2.1984	12.5.1993	#	#					obs	J	B
x	B1UHBR01	x	1984			77	26.74			18.2.1984	31.1.1999	#	#				U	change		
	B1UHBR01	x	1984			77	26.74			18.2.1984	12.5.1993	#	#					obs	J	B
	B1VELI01	x	1978			31	10.76													
?	B1VELI01	x		1977	1978	44	15.28													
?	B1VKLO01	x	1984			29	10.07													
x	B1VYSK01	x	1999			32	11.11	-1		1.4.1998	31.12.9999	#	#				V	change		
	B1VYSK01	x	1999			32	11.11	-1		1.4.1998	31.12.9999	#	#					obs	V	B
	B2BOSK01_	x	1968			33	11.46													
	B2BREC01	x	1968			35	12.15													
	B2BRUM01	x	1989			51	17.71			1.2.1989	31.3.1994	#	#				B	change		
	B2BRUM01	x	1989			51	17.71			1.2.1989	31.3.1994	#	#					obs	M	B





Adjusting monthly data

- using reference series based on correlations
- adjustment: from differences/ratios 20 years before and after a change, monhtly
- smoothing monthly adjustments (low-pass filter for adjacent values)

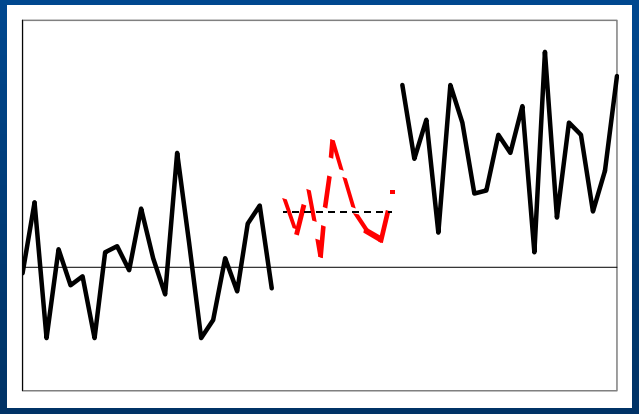


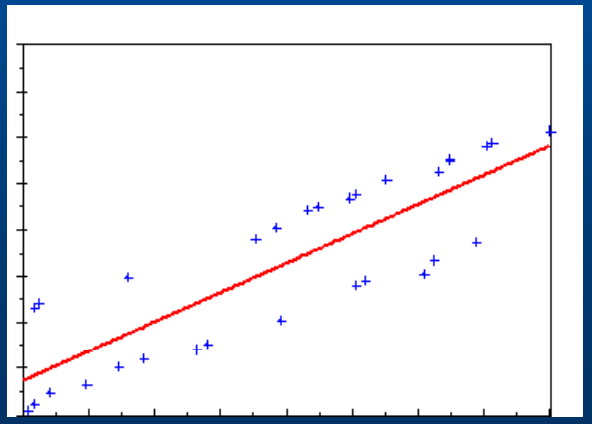
Iterative homogeneity testing

- **several iteration of testing and results evaluation**
  - **several iterations of homogeneity testing and series adjusting (3 iterations should be sufficient)**
  - **question of homogeneity of reference series is thus solved:**
    - **possible inhomogeneities should be eliminated by using averages of several neighbouring stations**
    - **if this is not true: in next iteration neighbours should be already homogenized**

Filling missing values

- **Before homogenization: influence on right inhomogeneity detection**
- **After homogenization: more precise - data are not influenced by possible shifts in the series**

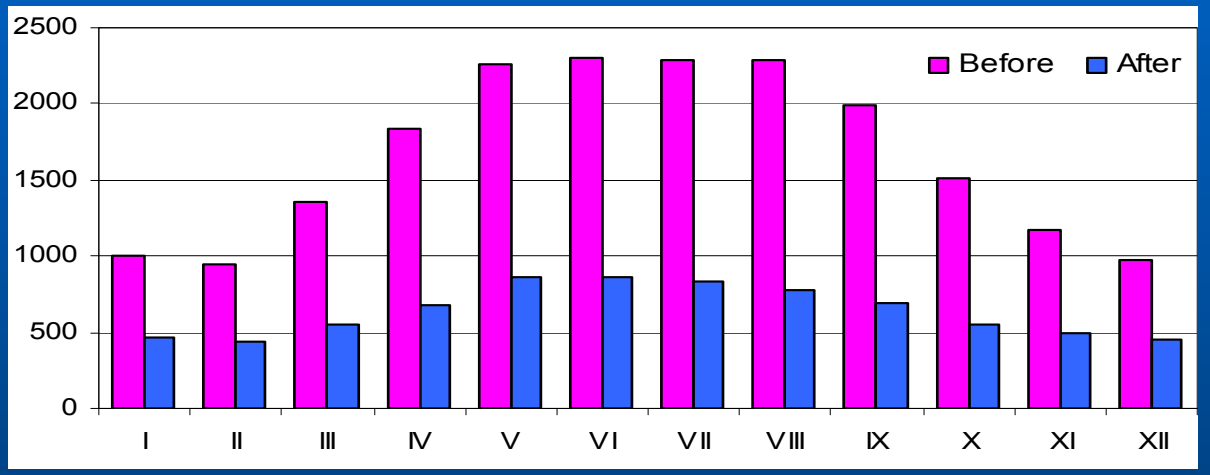


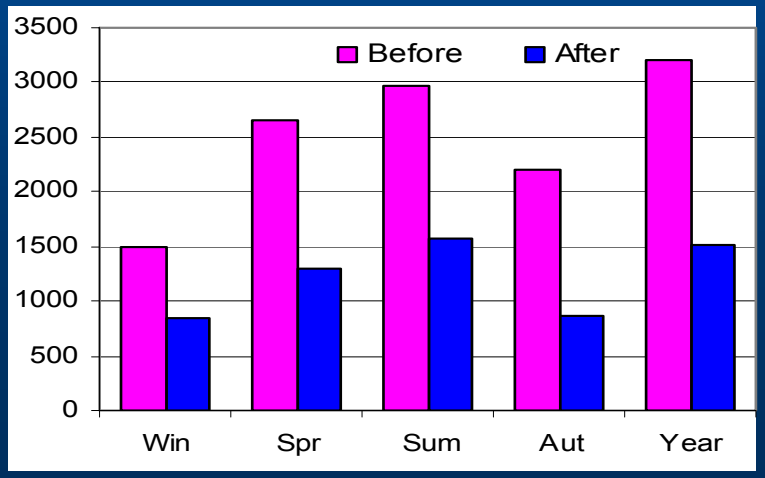


Dependence of tested series on reference series

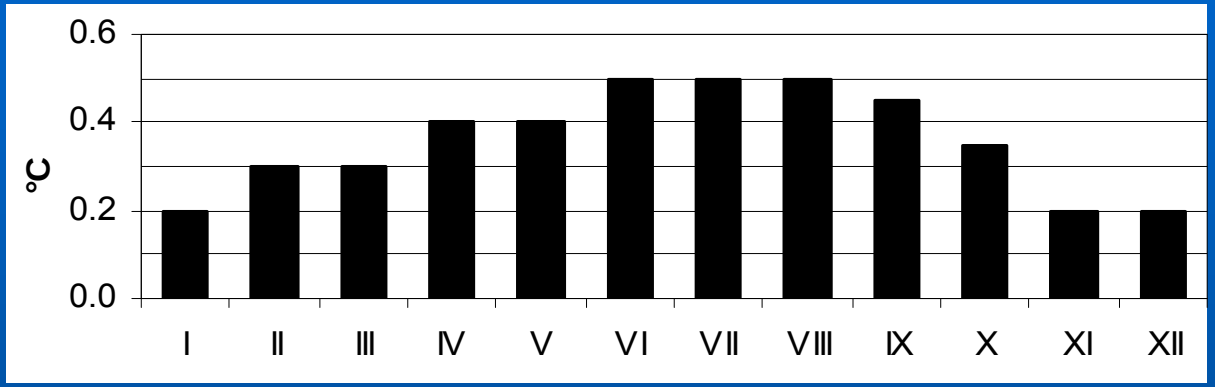
Example: CZ, air temperature (200 stations, 1848-2000)

Number of significant inhomogeneities before and after homogenization (p=0.05)

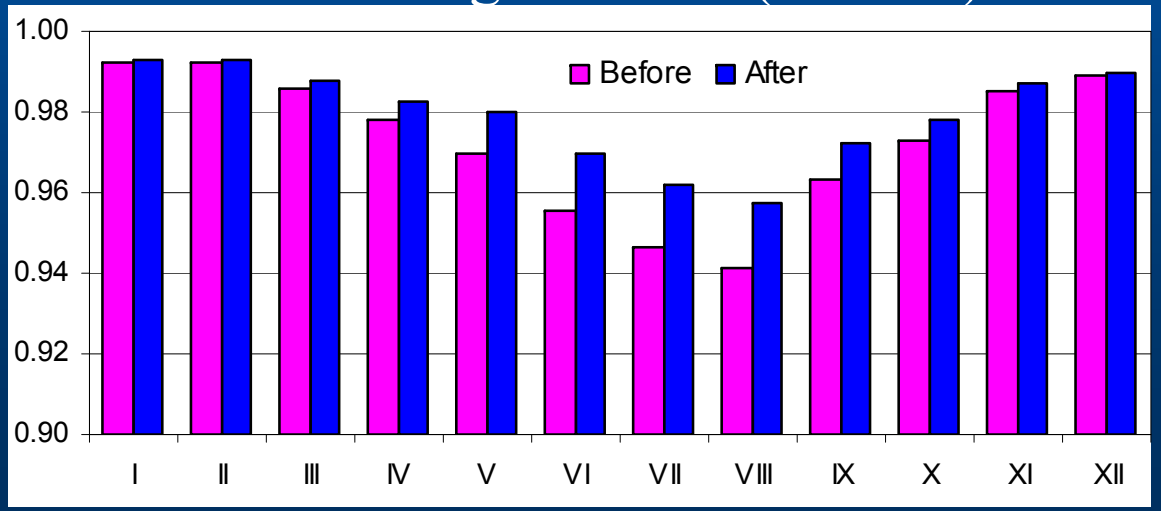




Amount of adjustments for homogenised series (absolute values) - median

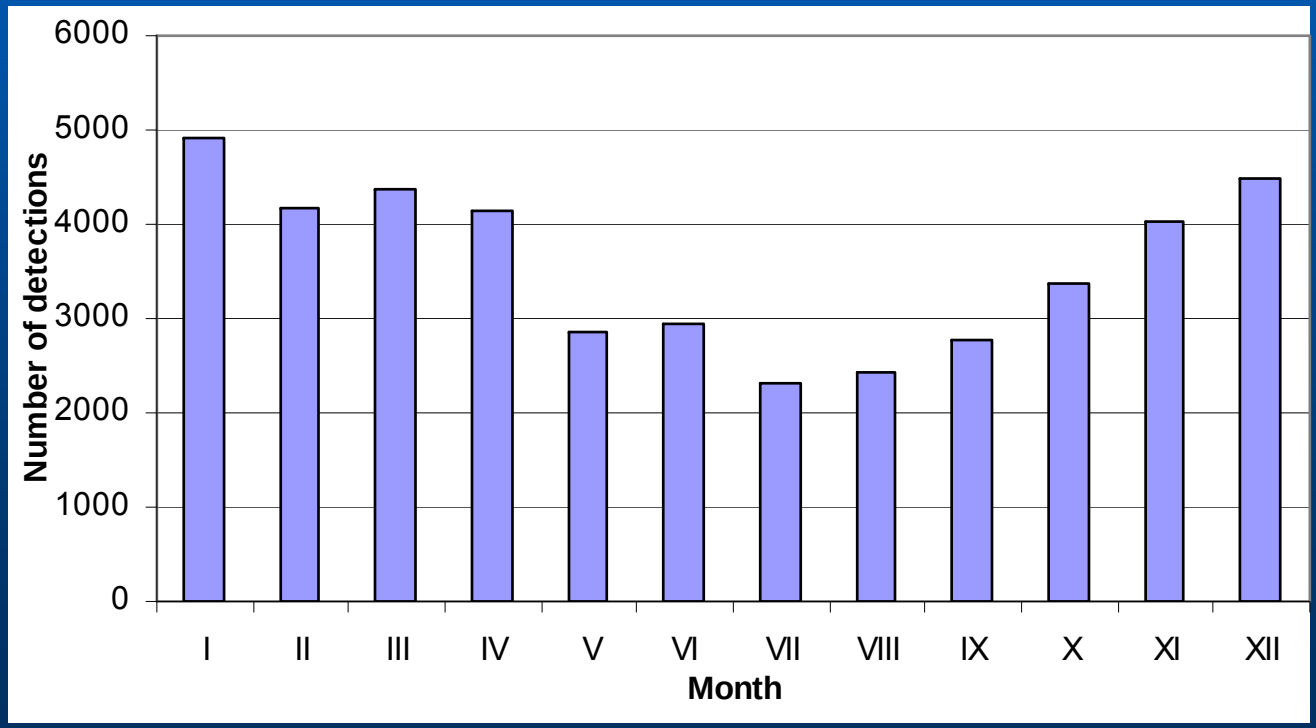


Correlation coefficients between candidate and reference series before and after homogenization (median)



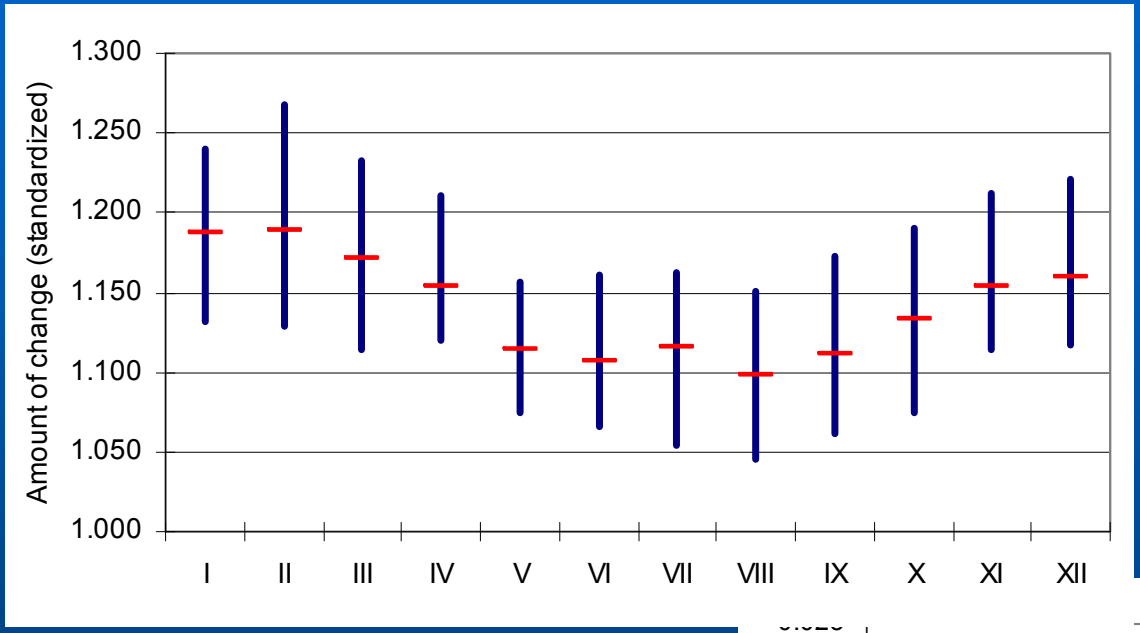
Example: CZ, precipitation (800 stations, 1961-2000)

- 4 tests, 4 reference series, 12 months + 4 seasons and year
- **Number of detected inhomogeneities (significant)**



Amount of change (ratios – standardized to be >1.0), precipitation

(reference series calculation based on correlations)

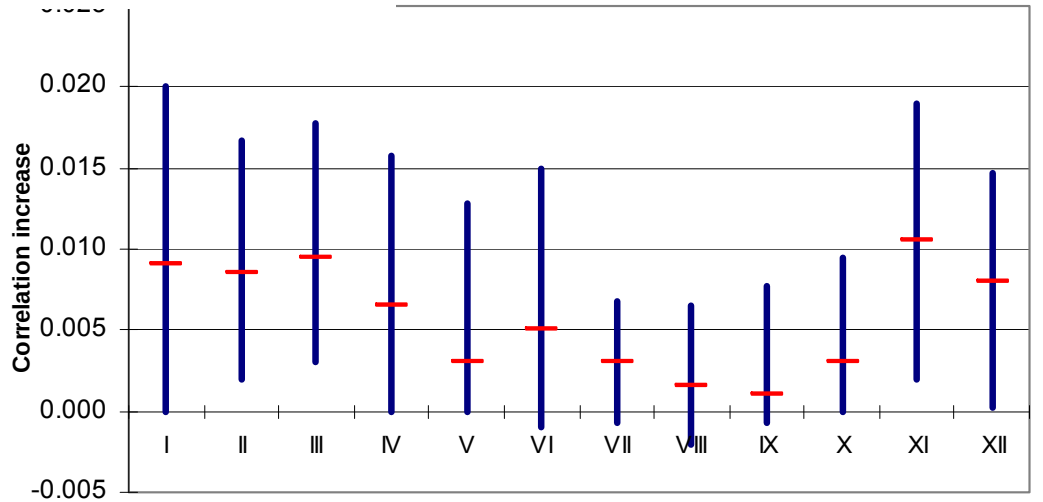


Boxplots:

- Median
- Upper and lower quartiles

(for 589 testes series)

Correlation improvement



Inhomogeneities in summer versus in winter, Air **temperature**

- Change of measuring conditions at the station (relocation etc.) is manifested in the series mainly in **summer**
- in winter: active surface role is diminished, prevailng circulation factors, in summer: active surface role increases, prevailing radiation factors

Inhomogeneities in summer versus in winter, **Precipitation**

- Change of measuring conditions at the station (relocation etc.) is manifested in the series mainly in **winter**
- in winter: errors of measurement (solid precipitation - wind, …)

Homogenization
Final remarks, recommendations 1/3

- **data quality control before homogenization is of very importance** (if it is not part of it)
- **Using series of observation hours** (complementarily to daily AVG) **is highly recommended** (different manifestation of breaks)
- **be aware of annual cycle of inhomogeneities, adjustments, …**
- **to know behavior of spatial correlations** (of element being processed) **to be able to create reference series of sufficient quality …**

Homogenization
Final remarks, recommendations 2/3

- **Because of Noise in the time series it makes sense:**
- **- „Ensemble“ approach to homogenization (combining information from different statistical tests, time frames, overlapping periods, reference series, meteorological elements, …)**
- **- more information for inhomogeneities assessment – higher quality of homogenization in case metadata are incomplete**

Homogenization of **daily values**, remarks 3/3

- **Correlation coefficients** (tested versus reference series) **are slightly lower** (compared to monthly data)**, but still high enough** (around 0.9 even in case precipitation)
- **Advantage: reliable inhomogeneities detection near the ends of series**
- **Complementary information to monthly and seasonal values detections (but problems with distribution, autocorrelations, …)**

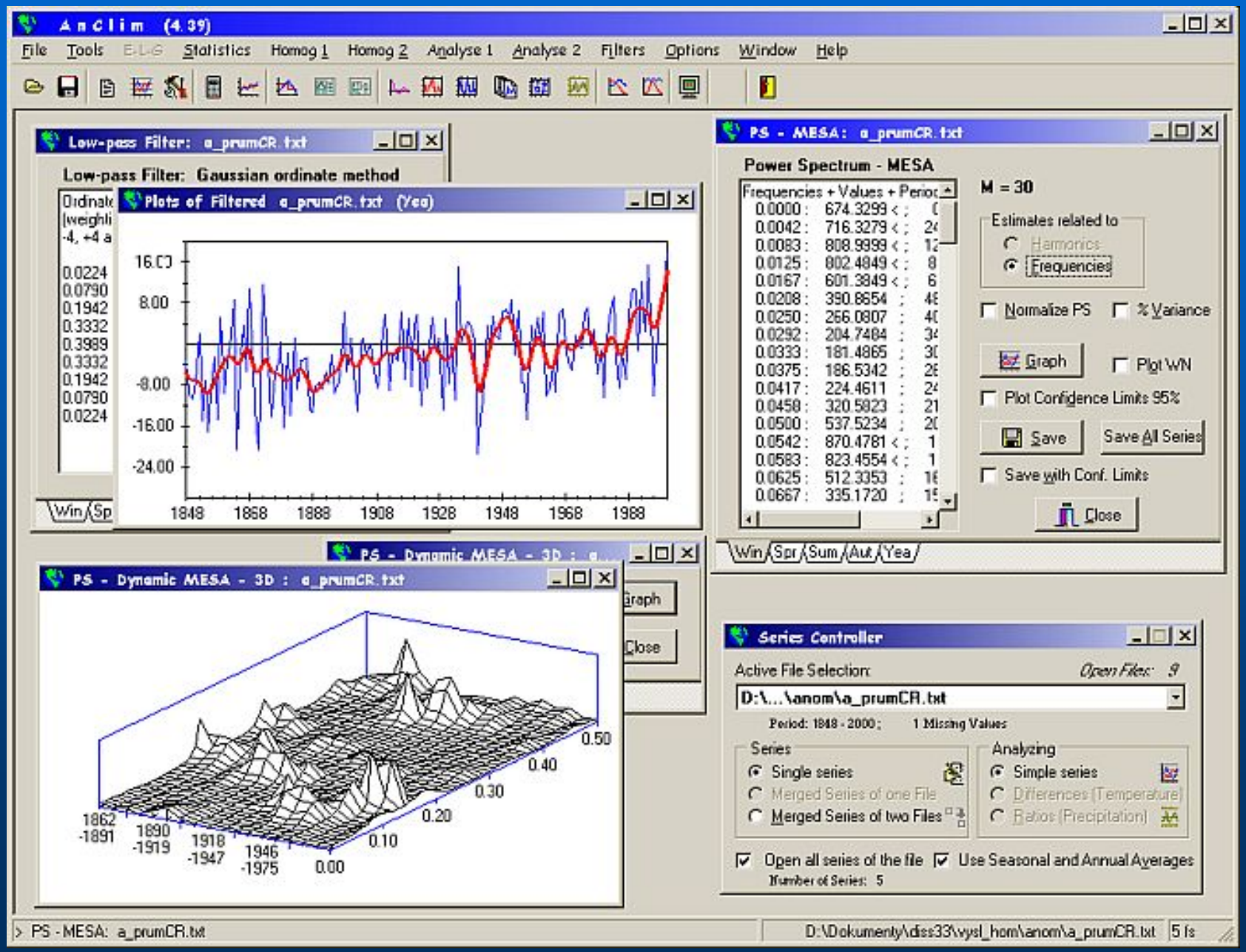
- **Correction of daily data:**
  - **“delta” method, if applied, it should be discriminated with regard to other parameters like cloudiness, …**
  - **Variable correction (such as HOM) seems to be a good choice … (preserving CDF)**

Software used for data processing

- **LoadData - application for downloading data from central database (e.g. Oracle)**
- **ProClimDB software for processing whole dataset (finding outliers, combining series, creating reference series, preparing data for homogeneity testing, extreme value analysis, RCM outputs validation, correction, …)**
- **AnClim software for homogeneity testing**

http://www.climahom.eu

AnClim software



Examples of Data formats – AnClim, monthly data

Edit precip_bohemia.txt

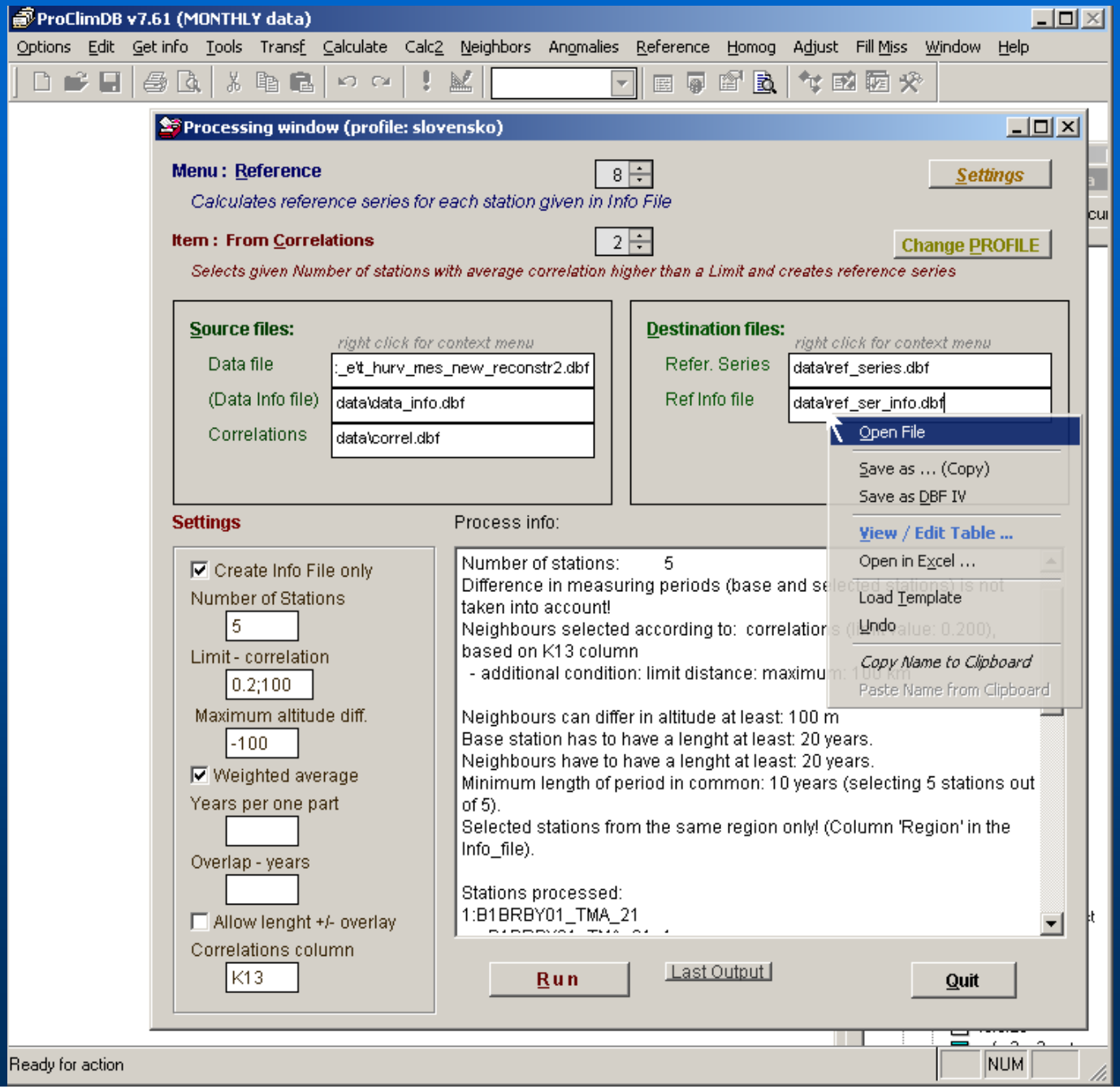
1876	19.0	78.0	76.0	37.0	42.0	69.0	55.0	60.0	91.0	16.0	39.0	50.0	632.0
1877	56.0	76.0	46.0	30.0	50.0	43.0	100.0	62.0	53.0	24.0	32.0	41.0	613.0
1878	48.0	19.0	82.0	52.0	68.0	49.0	69.0	88.0	46.0	49.0	37.0	30.0	637.0
1879	29.0	52.0	33.0	49.0	70.0	114.0	86.0	78.0	40.0	36.0	63.0	29.0	679.0
1880	32.0	22.0	34.0	48.0	114.0	82.0	93.0	117.0	53.0	85.0	41.0	98.0	819.0
1881	13.0	20.0	72.0	28.0	88.0	93.0	79.0	98.0	77.0	52.0	18.0	24.0	662.0
1882	14.0	25.0	23.0	55.0	84.0	87.0	139.0	109.0	84.0	52.0	85.0	73.0	830.0
1883	31.0	19.0	33.0	18.0	33.0	123.0	110.0	50.0	66.0	36.0	24.0	59.0	602.0
1884	44.0	12.0	40.0	27.0	32.0	121.0	84.0	60.0	36.0	104.0	36.0	61.0	657.0
1885	11.0	16.0	48.0	14.0	51.0	36.0	76.0	65.0	89.0	48.0	55.0	51.0	560.0
1886	35.0	12.0	52.0	59.0	53.0	147.0	93.0	51.0	42.0	42.0	31.0	83.0	700.0
1887	10.0	18.0	56.0	29.0	117.0	39.0	45.0	74.0	34.0	15.0	60.0	44.0	541.0
1888	38.0	47.0	80.0	56.0	28.0	104.0	95.0	123.0	67.0	65.0	32.0	15.0	750.0
1889	20.0	62.0	41.0	59.0	68.0	71.0	103.0	53.0	80.0	82.0	18.0	20.0	677.0
1890	65.0	7.0	23.0	89.0	74.0	105.0	92.0	145.0	111.0	48.0	85.0	6.0	850.0
1891	49.0	12.0	44.0	47.0	50.0	95.0	136.0	72.0	39.0	16.0	41.0	64.0	665.0
1892	52.0	47.0	34.0	48.0	52.0	97.0	71.0	27.0	85.0	62.0	12.0	38.0	625.0
1893	48.0	53.0	39.0	2.0	71.0	47.0	80.0	41.0	52.0	56.0	50.0	18.0	557.0
1894	7.0	47.0	63.0	64.0	99.0	84.0	98.0	82.0	73.0	113.0	15.0	30.0	775.0
1895	58.0	32.0	54.0	50.0	95.0	80.0	84.0	79.0	31.0	51.0	46.0	78.0	738.0
1896	34.0	14.0	56.0	55.0	96.0	103.0	92.0	98.0	75.0	28.0	29.0	24.0	704.0
1897	38.0	48.0	67.0	39.0	125.0	50.0	182.0	101.0	74.0	26.0	26.0	27.0	803.0
1898	42.0	45.0	46.0	73.0	80.0	63.0	61.0	51.0	43.0	61.0	29.0	36.0	630.0
1899	50.0	18.0	15.0	78.0	136.0	62.0	102.0	65.0	127.0	22.0	28.0	55.0	758.0
1900	91.0	81.0	81.0	51.0	52.0	95.0	99.0	40.0	31.0	64.0	55.0	64.0	804.0
1901	34.0	38.0	56.0	67.0	53.0	74.0	105.0	74.0	37.0	67.0	46.0	51.0	702.0
1902	37.0	35.0	49.0	47.0	74.0	82.0	92.0	75.0	64.0	50.0	39.0	44.0	688.0
1903	31.0	34.0	17.0	63.0	49.0	61.0	115.0	93.0	52.0	67.0	89.0	20.0	691.0
1904	21.0	57.0	31.0	68.0	61.0	39.0	23.0	16.0	54.0	66.0	74.0	35.0	545.0
1905	46.0	40.0	49.0	54.0	61.0	50.0	86.0	105.0	53.0	68.0	56.0	32.0	700.0
1906	45.0	29.0	70.0	23.0	85.0	77.0	71.0	61.0	129.0	31.0	33.0	45.0	699.0
1907	59.0	27.0	52.0	59.0	48.0	68.0	137.0	62.0	37.0	31.0	27.0	67.0	674.0
1908	32.0	56.0	28.0	51.0	65.0	66.0	69.0	84.0	49.0	1.0	30.0	12.0	543.0
1909	32.0	76.0	28.0	58.0	50.0	100.0	138.0	45.0	58.0	24.0	52.0	71.0	732.0
1910	34.0	28.0	22.0	44.0	86.0	121.0	93.0	95.0	105.0	27.0	104.0	40.0	799.0
1911	31.0	51.0	35.0	32.0	74.0	32.0	28.0	35.0	58.0	29.0	36.0	64.0	505.0

Examples of Data formats – AnClim, daily data

Data of B1BYSH01_T_07_00_3.txt

Year	Day	1	2	3	4	5	6	7	8	9	10	11	12
1917	11	0.0	-9.8	-4.6	2.0	9.2	16.2	15.0	15.4	11.8	8.4	5.3	-2.5
1917	12	-4.6	-7.6	-4.6	8.4	11.2	17.0	13.8	17.2	18.9	5.2	3.2	0.0
1917	13	-2.0	-6.8	2.4	10.0	11.0	17.8	14.4	19.2	13.0	7.7	1.2	-2.0
1917	14	-6.0	-13.2	0.8	4.0	12.4	17.6	18.0	24.6	9.0	12.3	0.2	-2.0
1917	15	-0.6	-6.8	3.4	4.6	14.2	15.4	18.0	18.7	8.6	8.7	1.0	2.0
1917	16	0.0	-10.4	-6.8	6.2	15.8	18.6	21.4	15.4	7.3	6.0	0.5	-1.2
1917	17	8.4	-11.6	-3.8	3.2	13.8	19.2	19.4	14.0	11.4	4.6	-0.8	-0.5
1917	18	-2.6	-2.6	2.2	3.2	12.2	21.8	16.4	15.2	17.3	12.8	0.2	-0.6
1917	19	-2.6	-1.6	2.2	0.0	21.0	22.4	20.0	15.4	14.6	6.4	4.4	-3.8
1917	20	-9.0	0.0	3.4	0.4	19.0	25.0	21.0	21.4	18.0	4.3	4.6	-9.0
1917	21	-14.6	-1.2	1.0	3.0	12.4	26.0	17.0	17.8	15.0	9.1	5.8	-10.8
1917	22	-13.8	-2.8	-2.8	2.4	6.6	25.0	14.2	15.6	9.3	5.6	1.8	-3.2
1917	23	-11.6	-7.0	-2.8	0.1	11.4	16.2	14.8	14.2	6.6	6.6	1.0	-4.6
1917	24	-10.4	-11.6	-1.8	1.4	15.2	12.6	16.2	23.3	8.4	7.6	6.5	-8.4
1917	25	-10.4	-0.1	-1.6	2.2	17.4	11.2	17.0	17.2	7.4	4.1	7.8	-6.0
1917	26	-11.8	0.4	-1.2	1.6	13.8	20.0	17.8	15.2	7.7	2.8	1.4	-5.0
1917	27	-11.0	0.6	3.0	5.2	11.0	20.0	19.0	18.6	8.8	6.1	-2.4	-7.1
1917	28	-13.0	-1.0	0.0	5.0	18.6	17.2	17.2	13.4	14.8	11.8	5.8	-7.2
1917	29	-11.0	missing	-1.0	4.8	21.0	22.0	23.0	21.6	11.2	14.6	8.4	-2.4
1917	30	-11.2	missing	3.8	11.4	20.0	23.4	20.6	12.4	10.2	4.2	5.6	-2.0
1917	31	-8.6	missing	4.6	missing	23.6	missing	24.0	14.2	missing	7.8	missing	-5.0
1918	1	-5.6	-3.2	4.0	3.6	9.4	12.3	12.2	13.0	13.2	8.3	6.0	-2.8
1918	2	-7.4	-1.0	7.0	12.6	7.6	9.8	11.8	17.0	13.4	7.0	4.4	-3.6
1918	3	-10.8	-1.8	10.0	8.4	9.4	9.8	15.0	16.8	11.8	4.1	4.4	-6.0
1918	4	-13.6	-2.6	6.3	5.1	11.6	7.0	13.4	17.3	10.8	5.4	6.3	0.0

ProClimDB software



http://www.climahom.eu

ACTION COST-ES0601: Advances in homogenisation methods of climate series: an integrated approach (HOME)

- 03/05/2007 - End date: 02/05/2011, Year: 3

- Inventory of existing detection and correction methods
- Compilation of a benchmark dataset with (un)known inhomogeneities
- Selection, comparison and evaluation of existing detection and correction (including those not traditionally used in climatology)
- Objective analysis of advantages and/or disadvantages of existing methods (benchmark)
- Investigation in further improvements of methods

- Documentation of practical recommendations
- Presentation and release of a new common method

- http://www.homogenisation.org/