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Evaluation of Statistical Properties of Discharge Data of Stations Discharging Into the Oceans - Europe and Selected World-Wide Stations -

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Foreword

Global coverage of observed discharge is essential to validate global circulation models and to assess teleconnections of climate-related processes between different regions. Likewise, observed discharge information is needed to compute surface water discharge and transport of matter and pollutants into the world oceans. Freshwater fluxes influence to a not yet fully understood degree the thermohaline circulation in the oceans as well as the deepwater formation especially in the Arctic region. In this situation, the evaluation of statistical properties of time series of selected rivers serve as a valuable source of information for climate and macro-scale hydrological modelling. Until recently, statistical information for a large number of globally distributed gauging stations has only been available from a publication of McMahon et al (1992). Building upon updated time-series, statistical procedures recommended by WMO (1988), a component of WMO's Hydrological Operational Multipurpose Sub-Programme (HOMS) developed by CHMI (1996), NWRI (1996) and from the Ruhruniversität Bochum (Schumann, 1995) have been customized and used for this report.

The selected statistical procedures are focused to the information requirements primarily for climate and macro-scale hydrological modelling. Therefore, statistical properties such as trends, jumps, periodicities and lag-times expressed as autocorrelation coefficients were evaluated. With this scope in mind, a selection of GRDC monthly discharge time series of 22 European and 11 non-European rivers within the period 1805 until 1996 was statistically evaluated in this report. For the non-professional statistican, each of the procedures is briefly explained and the statistical properties of each river are interpreted.

This report serves as a pilot report and a basis for discussion to shape the optimal form of reports foreseen in the future for the statistical evaluation of discharge data from other regions, continents and a selected gauging station network proposed by GRDC for global monitoring of surface water discharge into the oceans (GRDC report no 10, 3/1996).

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Distribution of gauging stations used for statistical analysis

1 Introduction

For the evaluation of streamflow data the statistical properties of the time series are of key importance: They reflect the properties of the discharge which may be used for topics as e.g.: regional and global freshwater assessment, drinking water supply, variability of flows, improvement of estimation of runoff into the oceans, which itself is needed for global circulation climate models (GCM) in order to simulate accurately possible climate changes and their impacts on changes of climate zones, consistency of time series, etc.

In this evaluation, selected statistical properties computed from the data of the Global Runoff Data Centre are compiled. Several statistical programmes were used, as no single programme covered all aspects conveniently. These programmes were:

1. Programme for analysis of long time series of hydrological data
   WCP-Water Project A.2 of the World Meteorological Organization (WMO),
   Version 4.22, July 1991, as adapted by the GRDC for its long time series,
   referred later on as programme "TS".
   (Basic reference: WMO/TD-No. 224(1988)).

2. Change Point Problem Programme from the Czech Hydrometeorological Institute (CHMI)
   English version 1.40,
   referred later on as programme "CHPP".
   (Basic reference: Czech Hydrometeorological Institute (ed., 1996): Technology for detecting changes in time series of hydrological and meteorological variables (Change point problem) - Hydrological Operational Multipurpose System [HOMS], Prague 1996, 42 pp.).

3. JUMP4-Programme from PD Dr. rer. nat. A. H. Schumann, Ruhr-Universität Bochum (RUB),
   Version of 24-April-1995,
   referred later on as programme "JUMP4".
   (Basic reference: A. H. Schumann (1995): Description of the "JUMP4"-Programme.- Ruhr-Universität Bochum (RUB), Bochum, Germany, 12 pp.)

4. Trend1-Programme from PD Dr. rer. nat. A. H. Schumann, Ruhr-Universität Bochum (RUB),
   Version of 03-May-1995,
   referred later on as programme "TREND1".
   (Basic reference: A. H. Schumann (1995): Description of the "Trend1"-Programme.- Ruhr-Universität Bochum (RUB), Bochum, Germany, 13 pp.)

5. RAISON for Windows from National Water Research Institute (NWRI),
   Version 1.0,
   referred later on as programme "RAISON".
   (Basic reference: National Water Research Institute [NWRI] (1996): Raison for Windows Version 1.0 User's Guide.- NWRI-Software, NWRI, Burlington, Ontario, Canada, Chapter 1-12, Appendix A-H)

The report is divided into two main parts following the introductory notes:

Part I: the description of statistical formulae and theory that were applied, including bibliographic references (chapters 2 and 3)
Part II: the results of the application of the respective statistical measures (chapters 4 to 7)

- common information related to all the stations including significant jumps, trends and periodicities of annual series
  (chapters 4 to 6)
- the descriptive statistics of annual and monthly statistics including trends while giving a template for the statistical evaluation of the following statistics
  (chapter 7 with sub-chapters 7.1, 7.2, 7.3 and 7.4 for template, overview, individual descriptive statistics and trends, respectively)

The results of most of the analyses and tests of the TS- and CHPP-programmes are the same, with the exception of some newer tests, improved automatic selection of maximum values of test statistics, display capacities, selection by prerequisites normal distribution and independence of observations. Respective parts of the programmes are based on the same formulas. As the results and programme aborts in special cases ($N < 5$ years, $N = 186$ years for the original version of the TS programme) were the same, it was assumed that both programmes work according to the same computational scheme.

The stations are a selected subset of European gauging stations of the GRDC database near the mouth of the rivers into the oceans with additional selected stations from other continents. The European set was chosen as a first example for the sake of the assessment of a homogeneous region and for natural conditions most familiar for the interpreter of the statistical parameters. Further stations were selected for the evaluation whether the kind of statistics and the subsequent interpretation is suitable for other regions, too.

For the evaluation of the data, special statistical values were selected for interpretation. As a basic prerequisite, the tests of normal distribution and independence of records were run with the CHPP-programme, followed by tests of changes in the mean and the variances, which showed to be the best method for detecting any changes or deviations within the time series. Monthly discharge sums and the mean annual values derived from them, were taken as the primary data base for the evaluation. It showed that most of the series of annual data were normally distributed, with a few exceptions of stations (e.g. Benue, Zambeze).

Part I
(Theory)

2 Notation of the Statistical Formulae

For better interpretability of the statistical formulae describing the statistical parameters, some basic information on the notation is given, basically derived from the notation used in WMO (1988).

In the formulae which follow it is assumed that a record of N years of **monthly data** is available, that is has no gaps and that it is divided into m subsamples of equal size. Each subsample has a length of n years and m is the largest integer less or equal N/n.

The index for
- the month is j (j = 1, 2, ..., 12)
- the year is i (i = 1, 2, ..., n)
- the subsample is k (k = 1, 2, ..., m).

In summary, the following basic notation is used:

N	-	total number of years
n	-	number of years in a subsample
m	-	total number of subsamples
X_{ijk}	-	value in year i, month j, subsample k of the variable
N = m*n = N´	-	total length of m subsamples, each of length n

(1) Mean (cf. YEVJEVICH 1972a)

Arithmetical mean of the values of a subsample k. It is a descriptive statistic with the basic property of being the value closest to all sampled values.

Formula:

$$\overline{X_k} = \frac{\sum_{i=1}^{n} \overline{X}_{ik}}{n}$$

with

$$\overline{X_{ik}} = \frac{\sum_{j=1}^{12} X_{jik}}{12}$$

(2) Minimum and Maximum; Range (cf. YEVJEVICH 1972a)

Although not statistical parameters, the minimum and maximum values X_{min} and X_{max}, respectively of a sample of time series are characteristic for a data set, as they define the range:

Formula:

$$\text{Range} = X_{max} - X_{min}$$

(3) Standard Error of Mean

This is a measure for the deviation of the mean of a sample k from the true mean, based on the assumption of statistical distribution of the means. Increasing n decreases the standard error of the mean, but to reduce it by the factor of 2, the sampled number has to be quadrupled (SE/2 = v S_k/4n)).

Formula:

$$SE(\overline{X}_k) = \sqrt{\frac{S_k}{n}}$$

(4) Standard Deviation (cf. YEVJEVICH 1972a)

The standard deviation is defined as the average amount that individual data deviate from their mean.

Formula:

$$S_k = \sqrt{\sum_{i=1}^{n} \overline{x}_{ik}^{2} \frac{1}{n-1}}$$

with

$$x_{ik} = \overline{X_{ik}} - \overline{X_k}$$

(5) Coefficient of Variation (cf. YEVJEVICH 1972a)

Standard deviation divided by the mean; often expressed in percentage. It is a measure of relative deviations of data from the mean.

Formula:

$$CV_k = \frac{S_k}{\overline{X}_k}$$

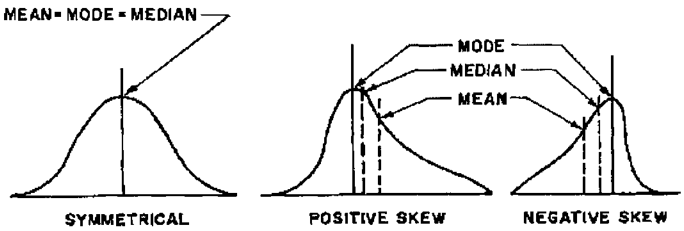
Typical critical values of CV_k for real data can be given as follows:

$\lvert CV_k \rvert$	Comments
< 0.3	small variation of data (as compared to mean)
0.3 - 0.6	relatively strong variation (as compared to mean)
> 0.6	very strong variation (as compared to mean)

It must be stated, that these values are only arbitrary limits. Depending on individual flow regimes, e.g. for arid or humid tropics regions, and application, these "critical" values may be different.

(6) Coefficient of Skewness (cf. HAAN 1977; YEVJEVICH 1972a)

Skewness means lack of symmetry, and measures of skewness show the extent to which the distribution departs from symmetry. A distribution with positive skewness is said to be skewed to the left, that is, the gravitational centre is located on the left side while some extreme values on the right side occur. A negatively skewed distribution is skewed to the right, the gravitational centre is located on the right side while some extreme values on the left side occur. Caution has to be taken, as, for small samples, the standard error is high.



Formula:

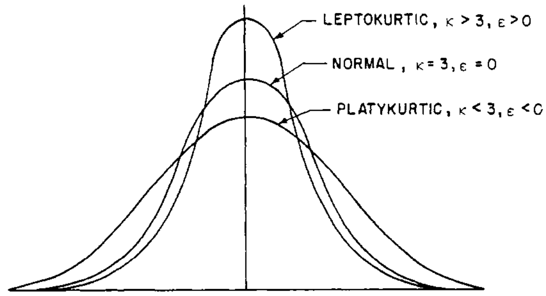
$$CS_k = \frac{n}{(n-1)(n-2)} \frac{\sum_{i=1}^{n} \bar{x}_{ik}^{3}}{S_k^3}$$

The critical values of CS_k for symmetrical distribution, positive skew, and negative skew, are as follows:

$\lvert CS_k \rvert$		Comments
Critical values	Sample values	
> 0	0.5	positive skew (right skew, left-hand steep): some more relatively big values
0	0.1	symmetrical (no skew)
< 0	-0.8	negative skew (left skew, right-hand steep): some more relatively small values

(7) Coefficient of Kurtosis (cf. HAAN 1977; YEVJEVICH 1972a)

Kurtosis may be defined as peakedness, and a measure of kurtosis serves to differentiate between a flat distribution curve, and a sharply peaked curve of . For a normal distribution, also called Gauss-distribution and having a bell-shaped probability density function, it is equal to 3, given the formula used here. If the distribution is mcre sharply peaked than the Normal, i.e. if it has long, small tails, the kurtosis is greater than 3; if it is flatter than the Normal, the kurtosis is less than 3. Unless a large set of data is available there is little point in using the kurtosis as a measure of the true shape since it is greatly affected by one or two outlying data. Caution has to be taken, as, for small samples, the standard error is high. But exactly the sensibility for extreme values can be used to assess the presence and influence of extreme values and test for normal distribution. Sometimes, the kurtosis computed by this formula is also called "excess" ε when a constant of 3 is subtracted, resulting in an value of 0 for normal distribution (YEVJEVICH 1972a). Although, the Kolmogorov- Smirnov test (see number 11) is better suited as test for normality, as it is less sensible for rare extreme values.



Formula:

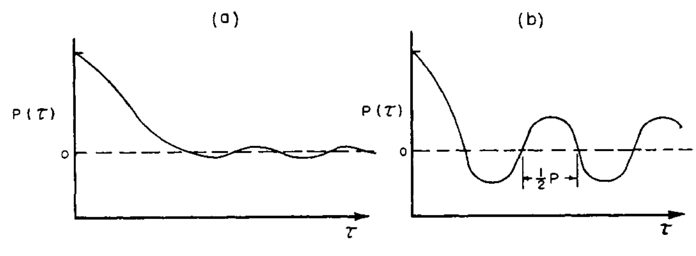
$$CK_k = \frac{n^2}{(n-1)(n-2)(n-3)} \frac{\sum_{i=1}^{n} \bar{x}_{ik}^4}{S_k^4}$$

The critical values of CK_k and for the respective excess ε, for normal, sharply peaked, and flat distribution, are as follows:

CK_k		ε		Comments
Critical values	Sample values	Critical values	Sample values	
> 3	3.6	> 0	0.4	leptokurtic (positive excess): extreme peakedness - more mean values with less bigger and smaller values
3	2.9	0	-0.1	normal distribution, bell-shaped (no excess)
< 3	2.1	< 0	-0.9	platykurtic (negative excess): peakedness combined with tailedness, lack of shoulders - less mean values with more bigger and smaller values

(8) Coefficients of Autocorrelation (cf. HAAN 1977; BOX & JENKINS 1970)

A plot of the autocorrelation function against the time lag is called a correlogram - it is useful to determine whether successive observations are independent or not. Thus, it is sometimes called the "memory" of a stochastic process. In the case of a random distribution, the correlogram will look like (a), in the case of the existence of a periodic process it will look like (b) (HAAN 1977). To test the independence of the data, the first one or the two first coefficients (r_1 = AC(1) and r_2 = AC(2), with "lags" of 1 or 2 time steps, respectively) are needed. To run this test, stationarity of the data is assumed, i.e. constant mean and variance throughout the time interval (BOX & JENKINS 1970).



Formula:

$$r_{lk} = \frac{\sum_{i=1}^{n-l} (\bar{X}_{ik} - \bar{X}_k)(\bar{X}_{i+l,k} - \bar{X}_k)}{\sum_{i=1}^{n} (\bar{X}_{ik} - \bar{X}_k)^2}$$

where lags l = 1, 2, ..., M;
The values range theoretically from $-1 = r_l = +1$, with the following critical values:

r_l		Comments
Critical values	Sample values	
> 0	0.6	strong positive autocorrelation
	0.2	positive autocorrelation: positive dependency from the antecedent values with time lag l, e.g. l = 1 : dependency on values immediately before
0	0.1	no autocorrelation, no dependency on antecedent value
< 0	-0.15	negative autocorrelation: negative dependency from the antecedent values with time lag l, e.g. l = 1 : dependency on values immediately before
	-0.6	strong negative autocorrelation

In the TS programme, maximum lag M is the largest integer less than or equal to (n-1)/6. For practical purposes, the evaluation of the ACs were confined to a maximum lag of 24 months when considering monthly values.

(9) Rescaled Adjusted Range (cf. YEVJEVICH 1972a; MAIDMENT 1992)

Descriptive statistics useful for studying the characteristics of storage. It is not appropriate for formal statistical testing.
The adjusted range R* is the minimum storage capacity that a reservoir with annual inflows X_i should have in order to provide a constant annual outflow equal to the sample mean, which is considered to be equal to the mean of the hydrological process. The reservoir maintains the smallest acceptable reserve when $RS_{s,t}^-$ occurs and is of sufficient capacity to store the water when $RS_{s,t}^+$ occurs. For the calculation, monthly discharge values are used (HAAN 1977, MAIDMENT 1992).

Formula:
Calculate the running sum of the differences of the monthly values from their overall mean $\overline{X}$, i.e.

$$RS_{s,t} = \sum_{i=1}^{s}\sum_{j=1}^{t}(X_{ij} - \overline{X}) + \sum_{j=1}^{t}(X_{s+1,j} - \overline{X})$$

$$X = \sum_{i=1}^{N}\sum_{j=1}^{12}\frac{X_{ij}}{(N * 12)}$$

where s = 0, 1, 2, ..., N-1; t = 1, 2, ..., 12

and retain the largest and smallest $RS_{s,t}$ ($RS_{s,t}^-$ and $RS_{s,t}^+$).

The **adjusted range R*** is calculated as

$$R^* = RS_{s,t}^- - RS_{s,t}^+$$

The **rescaled adjusted range R_a*** is calculated as a standardised R* by the formula

$$R_a^* = R^*/S_0$$

where S_0 is the standard deviation of the series of monthly data, all values considered together:

$$S_O = \sqrt{\sum_{i=1}^{N}\sum_{j=1}^{12}\left(X_{ij} - \overline{X}\right)^2 \frac{1}{12N - 1}}$$

(10) Hurst´s Coefficient (cf. CHOW 1964; HAAN 1977; MAIDMENT 1992)

Descriptive statistics useful for studying the characteristics of storage. It is not appropriate for formal statistical testing. For a long normal independent series and autoregressive processes, h is theoretically 0.5 (HAAN 1977; MAIDMENT 1992). Although, in various time series of natural time series (discharge, precipitation, temperature, tree-ring) h was found to be higher: $h \tilde{} 0.73 \pm 0.09$ and mean $R_a^* \sim N^h$ with $h > 0.5$ (MAIDMENT 1992).

Formula:

$$h = \frac{\ln R_a^+}{\ln (6N)}$$

For the testing of consistency and homogeneity of the time series, tests of normal distribution, independence, changes in the mean and variance including trends with the following statistics were computed. The tests were only done when the respective test assumptions were fulfilled:

(11) Kolmogorov-Smirnov Test for Normal Distribution (cf. CMHI 1996, SACHS 1984)

By Kolmogorov - Smirnov tests for one sample, we test the hypothesis that a selected continuous random variable has a probability distribution with function F(x), which does not contain any unknown parameter. In this data evaluation, the normal probability distribution function is used as a reference. The tests are based on the biggest absolute difference between empirical and theoretical distribution function. The following procedure is used:

1. The series $x_1, x_2, \ldots, x_n$ is ranked in increasing order of magnitude, so that $x'_1 = x'_2 = \ldots x'_n$,

2. Empirical cumulative distribution function is derived as follows

$$F_e(x) = \begin{cases} 0 & \text{for} \quad x < x'_1 \\ k/n & \text{for} \quad x'_k = x < x'_{k+1},\ k = 1, 2, \ldots, n-1 \\ 1 & \text{for} \quad x'_n = x \end{cases}$$

3. Maximum absolute difference between empirical and theoretical distribution is found

$$D_n = \max \mid F_e(x) - F(x) \mid \qquad \text{for} \qquad -\infty < x < \infty$$

4. D_n is subsequently compared with the respective critical value selected from a table. If $D_n = D_{n\ crit}$, the null hypothesis H_0, a distribution according to the desired - here the normal - distribution, is rejected. There are several methods of deriving the respective critical values, especially for small sample sizes and for fit to normal distribution while equally estimating mean and variance from the sample values (SACHS 1984). Here, the reference of STEPHENS 1974 used by the CHPP-programme is used, presenting almost identical critical values for the optimised fit to normal distribution according to SACHS 1984. The following table results, where

$$\sqrt{n*} = \sqrt{n} - 0.01 + 0.85/\sqrt{n}.$$

Table of critical values for the Kolmogorov-Smirnov test:

Error probability α	0.10	0.05	0.01
Significance level	0.90	0.95	0.99
Formula $D_{n\,crit}$ =	$0.819 / \sqrt{n}$*	$0.895 / \sqrt{n}$*	$1.035 / \sqrt{n}$*
n	$D_{n\,crit}$	$D_{n\,crit}$	$D_{n\,crit}$
5	0.314	0.343	0.397
10	0.239	0.262	0.303
30	0.146	0.159	0.184
50	0.114	0.125	0.144
100	0.081	0.089	0.103

That is, given a sampled D_n of 0.25 from a sample of n = 10 elements and an error probability α of 5 % ($D_{n\,crit}$ = 0.262), the H_0 is not rejected, while for an error probability α of 10 % ($D_{n\,crit}$ = 0.239), the H_0 is rejected.

(12) Test of Number of Runs and Independence (cf. WMO 1988; CMHI 1996; SNEYERS 1975)

In this test, the number of consecutive observations above or below the median value is compared with that found for a random process. Non-parametric test of randomness and independence, used for annual series and for series of individual months.

Formula:
Define a run as a set of consecutive observations above or below the median of the observations.
Let n = number of data in the series and n_r = number of runs, then:

Expected number of runs:

$$E(n_r) = 1 + \tfrac{n}{2}$$

Variance of the number of runs:

$$Var(n_r) = \frac{n(n-2)}{4(n-1)}$$

The test statistic is:

$$u = \frac{n_r - E(n_r)}{\sqrt{Var(n_r)}}$$

with corresponding quantiles of normal distribution for u.

When testing the null hypothesis H_0 , statistical independence of the observations, the H_0 is rejected for the following conditions:

Against two-sided alternative - the observations are not independent:

$|u| \geq u(\alpha/2)$

Against left-sided alternative - elements of the same kind tend to cumulate, i.e. create groups:

$u \leq -|u(\alpha)|$

Against right-sided alternative - elements of different kinds tend to alternate regularly:

$u \geq |u(\alpha)|$

Respective critical values of the standard normal distribution for $u(\alpha/2)$ and $|u(\alpha)|$ are given in the following table (CMHI 1996, SACHS 1984):

Critical parameter	Error probability α		
	0.10	0.05	0.01
$u(\alpha/2)$ (two-sided)	1.645	1.960	2.576
$\|u(\alpha)\|$ (one-sided)	1.282	1.645	2.326

That is, given an error probability α of 5 % and a sampled u of -1.05:
- the H_0 is not rejected against the two-sided alternative ($|u| < u(\alpha/2)$, i.e. $1.05 < 1.96$)
- the H_0 is not rejected against the left-sided alternative ($u > -|u(\alpha)|$, i.e. $-1.05 > -1.96$)
- the H_0 is not rejected against the right-sided alternative ($u < |u(\alpha)|$, i.e. $-1.05 < 1.96$).

(13) Periodogram and Fisher´s Test of Periodicity (cf. YEVJEVICH 1972b; CMHI 1996)

A hydrological series may be looked at as one out of several possible realisations of a continuous random hydrological process $\{x_t\}$ creating hydrological series.
The finite series of length T may be fitted by a number of trigonometric functions of the following type:

$$x_t = \mu_x + C_1\cos(2\pi f_1 t + \Theta_1) + C_2\cos(2\pi f_2 t + \Theta_2) + \ldots + C_j\cos(2\pi f_j t + \Theta_j) + \ldots + C_n\cos(2\pi f_n t + \Theta_n)$$

They have an infinite number of noncommensurate ordinary frequencies, f_j, or their corresponding angular frequencies, λ_j . They will fit every point of the series when frequencies are sufficiently dense on the line of the ordinary frequencies f_j, or on the line of their corresponding angular frequencies λ_j , while their parameters C_j and Θ_j may be estimated for each f_j and λ_j by adequate estimation method.

If only a limited number of f-values or λ-values is used in approximating the sampled series, each particular discrete value f_j or λ_j with its respective estimates of amplitude C_j and phase Θ_j has the variance $C_j^2/2$.

A plot of the variance $C_j^2/2$ (sometimes also C_j, C_j^2, or $\Sigma C_j^2/2$) with i = 1, 2, ... j versus the frequencies f_j or λ_j represents the line-spectrum, the discrete spectrum, or the periodogram.
Using angular frequencies λ_j , the **variance line-spectrum** or **discrete spectrum** of the series x_t is given by:

$$C_j^2/2 = \Psi(\lambda_j)$$

where

$j = 1, 2, \ldots$
$\Sigma C_j^2/2 = \text{variance}(x_t) = \sigma_t^2$.

When the frequency intervals $\Delta\lambda$ of the λ-line is used, and for each interval $\Delta\lambda$ at λ, the variance of all fitted trigonometric functions is defined as ΔD, then for $\Delta\lambda \to 0$ the following term

$$\lim \Delta D/\Delta\lambda = v_\lambda$$

represents the variance density at any point for λ of the λ-line. Analogous to the variance line-spectrum, the **variance density spectrum**, or **continuous spectrum** is given by:

$$v_\lambda = \Psi(\lambda)$$

For a given population series, λ has the range 0 to 2π, so that the population variance is given by the following integral:

$$\mathrm{var}(x_t) = \sigma_t^2 = \int_0^{2\pi} v_\lambda \, d\lambda = \int_0^{2\pi} \Psi(\lambda)\, d\lambda$$

The population variance densities v_λ are estimated by the sample variance densities v_λ .
The so-called frequency domain in representing properties of a series uses either the line-spectrum or the variance density spectrum, as chosen appropriate in each particular case. The use of $C_j^2/2$ in the line-spectrum and v_λ in the continuous spectrum are convenient conventional definitions of spectra, because the sums of all $C_j^2/2$ and the integrals of v_λ in the range of spectra of frequencies equal the variance of a variable.

For the estimation of parameters of periodic components, the mathematical composition of the time series is decisive. If the equation of the series is composed of a periodic and a stochastic stationary (i.e. constant mean and variance) component, for a discrete time series the description may take the form:

$$x_{p,\tau} = \mu_\tau + \sigma_x \varepsilon_{p,\tau}$$

where

$\tau = 1, 2, \ldots, \varpi$
ϖ = the basic period of the series expressed as a discrete number p = 1, 2, … , n
n = the number of the periods ù in the finite series
(when ϖ equals a year, n is the number of years, N = n ϖ is the length in years of the sampled series)
μ_τ = periodic component in the mean
σ_x = standard deviation of $x_{p,\tau}$ (assumed to be constant)
$\varepsilon_{p,\tau}$ = stochastic component

The periodic component μ_τ may be described mathematically by a Fourier composition:

$$\mu_\tau = \mu_x + \sum_{j=1}^{m} [\mathrm{A_j}\cos(2\pi\, \mathrm{f}j\tau) + \mathrm{B_j}\sin(2\pi\, \mathrm{f}j\tau)]$$

where

μ_x = the mean of the series
A_j , B_j = Fourier coefficients
m = number of significant harmonics

The Fourier coefficients may be estimated be different methods not described here. It is only important to note following definition of the frequencies

$$f_j = j / \omega$$
$$\lambda_j = 2\, \pi\, j / \omega$$

For specific applications, the periodogram is a simple and appropriate tool for describing and testing the presence of periodic components of a sampled time series. Within the CHPP-programme, the **periodogram** used for frequencies z ∈ {- π, π} is defined as:

$$I(z) = \frac{I}{2\pi n} \left| \sum_{t=1}^{n} x_t e^{-itz} \right|^2$$

Values $I(z_r)$ are calculated for $z_r = 2\,\pi r/N$ for r = 1,2 ... m (N = 2 m + 1 for odd N, and N = 2 m for even N), that is, for the interval {0, π}. The $I(z_r)$ values are then ranked in decreasing order, denoted as V_1 (the biggest), V_2 ... , V_m, and statistic W is given by

$$W = \frac{V_1}{V_1 + \ldots + V_m}$$

The distribution of statistic W can be described
for cases $m \leq 50$ by

$$P(W > x) \cong m\,(1 - x)^{m-1}$$

where

$x = g_1 = C^2_{max} / 2 * s^2_x$

C_{max} = the largest value of the sequence of C^2_j values

s^2_x = estimate of the variance of $x_{p,\tau}$,

provided only one harmonic periodicity is significant. For two or more significant harmonics an alternate scheme with g_i calculated differently is used.
and

$$P\left(W > \frac{z + \ln(m)}{m}\right) \xrightarrow{m \to \infty} 1 - \exp(-e^{-z})$$

for cases $m > 50$.

Critical value is
for $m \leq 50$

$$W_{crit} = 1 - \exp\left[\frac{1}{(m-1)} \ln\left(\frac{\alpha}{m}\right)\right]$$

and for $m > 50$

$$W_{crit} = \frac{Z + \ln(m)}{m}$$

where $Z = -\ln[-\ln(1 - \alpha)]$.

When the time series is described in the mathematical form cited above, testing the significance of periodicities might be done by **Fisher´s test**, yielding the best results when the variance of the process is estimated from the sample data. Basically, the parameter applied for the testing is the variance of the j-th harmonic $C^2_j / 2$ if the Fourier coefficients A_j and B_j are estimated in the specific manner referred to above. The $C^2_j / 2$ value is compared to a critical $C^2_j / 2$ value of an random stochastic process. Sampling of the testing parameter $C^2_j / 2$ is necessary. The respective phase for a significant periodicity may be estimated from the computed Fourier coefficients.
By the test, the series involves statistically significant frequency z'_1 (that is $V_1 = I(z'_1)$) if W is statistically significant. We can proceed by defining

$$W^{(1)} = \frac{V_2}{V_2 + \ldots + V_m}$$

and $P(W^{(1)} > x)$ for m - 1 in order to test statistical significance of frequency z'_2, etc.

In this generalised test, the hypothesis
H_0: The series does not involve any periodic component
(the series represents a "white noise process", i.e. is a random process with no significant periodicities)
is tested against alternative

H_1: The series includes statistically significant frequencies $z'_1, \dots z'_p$, or, in other words, statistically significant periods $T'_1, \dots, T'_p$ with relationship $T'_k = 2\pi / z'_k$.

As the critical values change with the sampled series and its size, while the CHPP programme equally does not specify them directly, no table of critical values and an example are given here.

(14) Test for Jump in the Mean by Testing Cumulative Deviations (cf. BUISHAND 1982)

The purpose of this test is to detect the existence of a jump in the mean after m observations, e.g. in case of change of location of gauging station, installation of a reservoir upstream, etc.:

$$E(X_i) = \begin{cases} \mu & i = 1, \dots, m \\ \mu + \Delta & i = m+1, \dots, n \end{cases}$$

The basic assumptions are that the observations are independent and normally distributed. The test can still be applied, however, when there are slight departures from normality.

Only one test of this type was used in this analysis, although others exist (cf. WMO 1988).

A plot of the cumulative deviations from an average value is sometimes called "residual mass curve". This test is used for the detection of the position of one possible jump in the mean. A normality and independence assumption is necessary (see above).

Formula:

Given the observations $X_1, \dots, X_i, \dots, X_n$ we let

$$S_0^* = 0, \; S_k^* = \sum_{i=1}^{k} (X_i - \overline{X}) \qquad k = 1, 2, \dots, n$$

$$D_y^2 = \sum_{i=1}^{n} \frac{(X_i - \overline{X})^2}{n}$$

and the rescaled adjusted partial sums

$$S_k^{**} = \frac{S_k^*}{D_y} \quad k = 0, 1, \dots, n \;\; (\text{rescaled}: \text{dividing by standard deviation})$$

The test statistic is

$$Q = \max_{0 \le k \le n} | S_k^{**} |$$

High Q values are an indication for a change in level.

Percentage points of the statistic Q are given in the following table (BUISHAND 1982):

Q/n			
n	**90 %**	**95 %**	**99 %**
10	1.05	1.14	1.29
20	1.10	1.22	1.42
30	1.12	1.24	1.46
40	1.13	1.26	1.50
50	1.14	1.27	1.52
100	1.17	1.29	1.55
∞	1.22	1.36	1.63

According to BUISHAND (1982), the test based on the cumulative deviations and Worsley's likelihood ratio test are preferable respectively in the case of a change near the middle or near the ends of the series.

For both tests, the position of maximum $|S_k^*|$ (or $|Z_k^*|$, respectively, for Worsley's likelihood test) can be taken as an estimate of the change-point m.

(15) Test for Jump in the Mean and Spectrum (cf. CMHI 1996)

For this and the following test, it is assumed (PICARD 1985; JARUŠKOVÁ 1990 b) besides normal distribution, that the random variable $x_1, \ldots, x_n$ is an autoregressive process of q-th order AR (μ, σ^2, a):

$$x_t - \mu = a_1 (x_{t-1} - \mu) + \ldots + a_q (x_{t-q} - \mu) + e_t$$

where e_t has $N(0, \sigma^2)$.

Under the above assumptions, the hypotheses are defined as follows:

Hypothesis H_0: $x_1, \ldots, x_n$ is generalised autoregressive sequence AR (μ, σ^2, a).
Alternative H_1: for some $k \in \{1, \ldots, n-1\}$, $x_1, \ldots, x_k$ is a generalised autoregressive sequence AR (μ', σ^2, a'), $x_{k+1}, \ldots, x_n$ is a generalised autoregressive sequence AR (μ'', σ''^2, a''), $\theta' = (\mu', \sigma^2, a')$, $\theta'' = (\mu'', \sigma''^2, a'')$, and $\theta' \neq \theta''$ while $\sigma' = \sigma'' = \sigma$.

It is further assumed, that the roots of polynomial $z^q - a_1 z^{q-1} \ldots a_q = 0$, where a_i are relevant autoregression parameters, are inside a unit circle.

Under the above assumptions

$$L(k) = \frac{n}{2} \ln \left(\frac{n-2q}{n-q} \cdot \frac{RSS}{RSS' + RSS''} \right)$$

where

$$RSS = \sum_{i=g+1}^{n} [(x_i - \mu) - a_1 (x_{i-1} - \mu) - \ldots - a_q (x_{i-q} - \mu)]^2$$

μ is an estimate of relevant mean, that is of $\bar{x}, \bar{x}'$, or $\bar{x}''$, and a_i are estimates of autoregression parameters calculated from the subsamples, that is

RSS	for	$i = q + 1, \ldots, n$
RSS′	for	$i = q + 1, \ldots, k$
RSS″	for	$i = k + q + 1, \ldots, n$.

The test statistic is then derived from function L(k).

A test modification is applied :

(i) The test is modified by **cutting off** the beginning and end of the series (suitable for detecting a change occurring close to the beginning and end of the series):

Supreme L(k) [Sup L(k)] is compared with critical value taken p = 1 from tables for cutting off 10 % of observations from both sides (0,1 n = k = 0,9 n) or for 15 % and 20 %, respectively.

(ii) The test is modified by **penalization** (suitable for detecting change occurring close the midpoint of the series):

$$\underset{1 \le k \le n}{Sup} \ \frac{k}{n} \left(1 - \frac{k}{n}\right) \ L(k)$$

is compared with critical value taken for p = 1 from a respective table.

The supreme, derived for relevant part of the series (for cutting off) or modified by factors, is compared with a critical value selected for p = q + 1 from the following tables (cutting off 10 %, cutting off 15 or 20 %, or penalization, respectively).

Table of critical values for likelihood ratio test as modified by cutting off 10 % (CHMI 1996):

Level of significance α	p=1	p=2	p=3	p=4
0.25	2.76	4.06	5.15	6.16
0.20	3.07	4.44	5.48	6.48
0.10	3.86	5.31	6.48	5.57
0.05	4.65	6.20	7.41	8.53

Table of critical values for likelihood ratio test as modified by cutting off 15 % and 20 %:

Level of significance α		p=1	p=2	p=3	p=4
15 %	**0.10**	3.62	5.06	6.20	7.26
	0.05	4.41	5.92	7.14	8.24
20 %	**0.10**	3.43	4.81	5.95	6.99
	0.05	4.21	5.68	6.88	7.96

Table of critical values for likelihood ratio test as modified by penalization:

Level of significance α	**p=1**	**p=2**	**p=3**	**p=4**
0.25	0.5194	0.7850	1.0089	1.3135
0.20	0.5754	0.8530	1.0854	1.2971
0.15	0.6475	0.9388	1.1811	1.4009
0.10	0.7489	1.0570	1.3115	1.5416
0.05	0.9222	1.2542	1.5265	1.7715
0.02	1.1513	1.5086	1.8001	2.0615
0.01	1.3246	1.6978	2.0018	2.2739

(16) Test for Jump in the Mean, Variance and Spectrum (cf. CMHI 1996)

This test was derived under similar assumptions to those described for the previous test (JARUŠKOVÁ 1990). As change in variance σ^2 is also taken into account, the dimension of the model is p = q + 2, where q is the order of AR process, which, with respect to the range of critical values given in tables, cannot exceed 2.

Function L(k) is defined as

$$L(k)=\frac{n}{2}\ln\left(\frac{RSS}{2(n-q)}\right)-\frac{k}{2}\ln\left(\frac{RSS'}{2(k-q)}\right)-\frac{n-k}{2}\ln\left(\frac{RSS''}{2(n-k-q)}\right)$$

were RSS, RSS′ and RSS″ are relevant to those described above, and the test statistic is again derived from this function.

3 References

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Part II
(Results)

4 Basic Information on Stations and Series

The GRDC data of the following gauging stations were selected for data evaluation and interpretation, giving the years of first and last data records of the period for which data were available:

GRDC number	River	Station	Ctry	Lat	Long	Basin size (km²)	First year	Last year
Europe								
6233650	Angerman	Solleftea	SN	6317N	1727E	30640	1965	1992
6226800	Ebro	Tortosa	SP	4082N	052E	84230	1953	1983
6338100	Ems	Versen	DL	5273N	725E	8345	1980	1984
6125100	Garonne	Mas-D'agenais	FR	4442N	023E	52000	1920	1979
6731400	Gloma	Langnes	NO	5960N	1112E	40221	1901	1984
6217100	Guadalquivir	Alcala del Rio	SP	3752N	598W	46995	1952	1993
6227500	Jucar	Masia de Mompo	SP	3715N	065W	17876	1925	1981
6340110	Labe	Neu-Darchau	DL	5323N	1088E	131950	1965	1988
6123100	Loire	Montjean	FR	4738N	083W	110000	1863	1979
6970250	Northern Dvina (Severnaya Dvina)	Ust-Pinega	RS	6410N	4217E	348000	1881	1993
6970650	Pechora	Ust-Tsilma	RS	6547N	5225E	248000	1932	1984
6335020	Rhein	Rees	DL	5177N	640E	159680	1930	1997
6122100	Seine	Poses	FR			65000	1971	1977
6609500	Severn	Bewdley	UK	5237N	232W	4330	1965	1984
6502100	Shannon	Killaloe	IE	5280N	842W	11690	1973	1979
6730500	Tana	Polmak	NO	7007N	2805E	14005	1912	1987
6604610	Tay	Ballathie	UK	5649N	337W	4587	1980	1984
6113050	Tejo	Almourol	PO	3947N	837W	67490	1976	1984
6607700	Thames	Teddington	UK	5142N	032W	9950	1965	1984
6229500	Vaenern-Goeta	Vaenersborg	SN	5838N	1232E	46830	1807	1992
6337200	Weser	Intschede	DL	5297N	913E	37788	1921	1984
6608500	Wye	Ddol Farm	UK	5224N	347W	174	1977	1989
Non-European Stations								
1362100	Nile	el Ekhsase	EG	2970N	3128E	2900000	1973	1984
1835800	Benue	Yola	NI	925N	1250E	107000	1960	1989
1891500	Zambeze	Matundo-Cais	MZ	1615S	3358E	940000	1976	1979
2181900	Changjiang (Yangtze)	Datong	CI	3077N	11762E	1705383	1923	1986
2469260	Mekong	Pakse	LA	1512N	10580E	545000	1980	1991
2903420	Lena	Kusur	RS	7070N	12765E	2430000	1935	1994
2909150	Yenisei	Igarka	RS	6748N	8650E	2440000	1936	1995
2912600	Ob	Salekhard	RS	6657N	6653E	2949998	1930	1994
3206720	Orinoco	Puente Angostura	VN	815N	6360W	836000	1923	1989
3265300	Paraná	Corrientes	AG	2797S	5885W	1950000	1904	1983
4127800	Mississippi	Vicksburg, Miss.	US	3232N	9090W	2964252	1965	1983

For the Rivers Ebro, Guadalquivir and Jucar, all situated in Spain, new data of the CEDEX institute were used instead of GRDC data. The series are identical with the data series already stored in the GRDC data base starting in the year 1965.

As data gaps were present, the following sub-series were analysed separately. If no explicit year of begin and end is mentioned, the respective first and last years of the records were used. For some selected stations, coinciding series were chosen for optimal comparability:

GRDC number	River	Station	First year	Last year	Sub-period	Begin year	End year
Europe							
6233650	Angerman	Solleftea	1965	1992			
6226800	Ebro	Tortosa	1953	1983			
6338100	Ems	Versen	1980	1984			
6125100	Garonne	Mas-D'agenais	1920	1979		1921	
6731400	Gloma	Langnes	1901	1984		1902	
6217100	Guadalquivir	Alcala del Rio	1952	1993			
6227500	Jucar	Masia de Mompo	1925	1981			
6340110	Labe	Neu-Darchau	1965	1988			
6123100	Loire	Montjean	1863	1979			
6970250	Northern Dvina (Severnaya Dvina)	Ust-Pinega	1881	1993		1882	1985
6970650	Pechora	Ust-Tsilma	1932	1984			
6335020	Rhein	Rees	1930	1997			1996
6122100	Seine	Poses	1971	1977			
6609500	Severn	Bewdley	1965	1984	1	1965	1972
					2	1976	1984
6502100	Shannon	Killaloe	1973	1979			
6730500	Tana	Polmak	1912	1987	1	1912	1943
					2	1947	1987
6604610	Tay	Ballathie	1980	1984			
6113050	Tejo	Almourol	1976	1984			
6607700	Thames	Teddington	1965	1984			
6229500	Vaenern-Goeta	Vaenersborg	1807	1992			
6337200	Weser	Intschede	1921	1984			
6608500	Wye	Ddol Farm	1977	1991			1989
Non-European Stations							
1362100	Nile	el Ekhsase	1973	1984			
1835800	Benue	Yola	1960	1989			
1891500	Zambeze	Matundo-Cais	1976	1979			
2181900	Changjiang (Yangtze)	Datong	1923	1986		1947	
2469260	Mekong	Pakse	1980	1991		1982	
2903420	Lena	Kusur	1935	1994		1936	1994
2909150	Yenisei	Igarka	1936	1995		1936	1994
2912600	Ob	Salekhard	1930	1994		1936	1994
3206720	Orinoco	Puente Angostura	1923	1989		1925	
3265300	Paraná	Corrientes	1904	1983		1905	1982
4127800	Mississippi	Vicksburg, Miss.	1965	1983		1969	1982

As some gaps in the records still existed, for the stations with short records or important rivers an estimation of missing values was done. First, an multiple regression with monthly values of the months adjacent to the one whose data were missing was tried. Alternatively, when no significant estimation was possible, an estimation by the mean, as it was observed that only in few cases missing values could be estimated by a regression with statistical significance. Even a enhancement of the desired significance level of 5 % error probability could not substantially change that situation. Therefore, the respective monthly mean value was used as it represents the most central value of the time series.

In short, the following missing data were estimated for the considered periods :

GRDC number	River	Station	Year	Months	Estimation method
6502100	Shannon	Killaloe	1976	1-12	Mean
2181900	Changjiang (Yangtze)	Datong	1947	1	Regression
			1949	3	Regression
			1949	4-6	Mean
2469260	Mekong	Pakse	1982	1-4	Mean
			1985	4-12	Mean
4127800	Mississippi	Vicksburg, Miss.	1979	10-12	Mean

The cited records of these stations were checked for normal distribution, independence and changes in mean, or mean and variance, in special cases also for changes in spectrum, to check for inconsistency and homogeneity within the records. The series consisted of monthly values, which were transformed to annual series by the evaluation programmes, if necessary. So the consistency of the records was retained.

Most of the series of annual values showed normal distribution, with only some exceptions. As a measure of normality, a Kolmogorov-Smirnov test for deviations of normal distribution was applied, rejecting normality only in three cases. Alternatively, a log-normal distribution was found to be the appropriate distribution type. I.e. a logarithmically transformed series is normally distributed.

The following time series, sorted alphabetically by river name, did show deviations from normality:

GRDC number	River	Station	First Year	Last Year	Distribution	Remarks
1835800	Benue	Yola	1960	1980	log-normal, two-parameter	total series
6217100	Guadalquivir	Alcala del Rio	1952	1993	log-normal, two-parameter	extremely low runoff at the end of the series
2909150	Yenisei	Igarka	1936	1994	normal	with 1 % error probability at Kolmogorov-Smirnov test
1891500	Zambeze	Matundo-Cais	1976	1979	log-normal, two-parameter	monthly series

5 Significant Jumps and Trends

Statistical significant jumps within the annual series that have been detected by the JUMP4- and CHPP-programme are shown here. There were only a few jumps detected by the CHPP-programme, while the JUMP4-programme detected more and seems to very sensitive, perhaps sometimes too sensitive. However, for monthly series of individual months, jumps are occasionally observed when no jump in the annual series is observed. These jumps are not shown in this report so far.

Statistical significant trends are tabulated only for annual series of selected rivers, too. For individual months, significant trends are sometimes observed when no trend is significant for the annual series. It was concluded that this was possibly an effect of inner-annual storage by newly built reservoirs, not affecting long-term inter-annual changes. Therefore, as the main focus was on long-term properties, the monthly trends are not shown in this report so far.

In the following table, for respective annual series the statistically significant jumps, trends, the year of completion of dams and its maximum capacity within the considered river basin, taken from data compiled by VÖROSMARTY ET AL. 1997a and 1997b are listed:

Jumps and Trends in Annual Series and Respective Dam Completion				
River	**Jump (JUMP4, CHPP)**	**Trends (TREND1)**	**Dam construction Completion year**	**Dam maximum capacity**
	Year of first significant jump within sequence	**Starting year of most significant trend**	**Year**	**km³**
Angerman	1978/79	-	-	-
Ebro	1972/73	1970	1966	1.5
Garonne	1962/63	1953	-	-
Gloma	1967/68	1976	-	-
Guadalquivir	1972/73	1986	-	-
Jucar	1935/36 (CHPP) 1954/55 1966/67 1973/74	1970	1955	1.1
Loire	-	1971	-	-
Orinoco	-	1981	1957 1967 1982 unknown unknown unknown unknown	1.8 1.2 1.0 0.8 0.9 0.8 3.8
Paraná	-	1968	1968 1973 1982	3.7 21.2 29.0
Tana	-	1969	-	-
Thames	-	1977	-	-
Vaenern-Goeta	-	1970	-	-
Weser	-	1972	-	-
Yenisei	1970/71 1972/73 (CHPP)	1966	1956 1964 1965 1977 unknown	46.0 169 71.3 59.3 58.2

For all series, the characteristics of the overall trend of the annual series including the correlation coefficient, irrespective of any statistical significance, are listed in the following table:

Trends of Complete Annual Series (Programme TREND1)							
River	**Begin year**	**End year**	**Mean**	**StdDev**	**Slope**	**Intercept**	**R**
ANGERMAN	1965	1992	489.38	79.32	5.23	-9864.27	0.550
BENUE	1960	1989	21.93	8.80	-0.41	826.96	-0.414
CHANGJIA	1947	1986	28472.18	4461.38	-105.82	236563.94	-0.277
EBRO	1953	1983	469.53	146.99	-4.60	9529.28	-0.285
EMS	1980	1984	86.05	17.77	-0.90	1869.85	-0.100
GARONNE	1921	1979	608.53	182.46	0.05	511.76	0.005
GLOMA	1902	1984	672.62	108.35	-0.02	703.62	-0.004
GUADALQ	1952	1993	120.72	112.40	-3.78	7574.14	-0.412
JUCAR	1925	1981	48.95	16.89	-0.49	997.29	-0.477
LABE	1965	1988	783.84	197.06	-2.42	5557.37	-0.089
LENA	1936	1994	16569.46	1985.71	22.55	-27741.27	0.195
LOIRE	1863	1979	838.09	278.12	1.22	-1507.81	0.149
MEKONG	1982	1991	9311.88	1025.25	66.59	-122959.90	0.210
MISSISSIPPI	1969	1982	18002.83	4644.60	-87.67	191185.86	-0.083
NILE	1973	1984	1251.33	81.61	14.50	-27443.26	0.662
N_DVINA	1882	1985	3315.40	647.46	-4.65	12313.75	-0.217
OB	1936	1994	12667.13	1937.17	3.31	6170.29	0.029
ORINOCO	1925	1989	30641.63	3506.51	31.57	-31139.65	0.170
PARANA	1905	1982	16357.74	3446.89	2.27	11936.38	0.015
PECHORA	1932	1984	3404.85	448.29	6.35	-9025.96	0.219
RHEIN	1930	1996	2280.13	492.79	3.03	-3661.61	0.120
SEINE	1971	1977	333.60	74.88	17.63	-34464.03	0.556
SEVERN1	1965	1972	68.16	10.75	-3.76	7467.61	-0.880
SEVERN2	1976	1984	64.76	10.24	0.79	-1505.49	0.229
SHANNON	1973	1979	172.68	22.91	5.29	-10271.89	0.545
TANA1	1912	1943	164.71	31.41	-0.80	1703.31	-0.238
TANA2	1947	1987	167.08	29.59	0.42	-653.96	0.169
TAY	1980	1984	180.05	19.32	7.08	-13859.11	0.676
TEJO	1976	1984	370.85	268.71	-47.40	94222.85	-0.514
THAMES	1965	1984	81.56	22.22	-1.22	2490.68	-0.333
VAENERN_	1807	1992	534.09	99.12	-0.19	891.92	-0.102
WESER	1921	1984	316.65	92.12	0.49	-636.95	0.099
WYE	1977	1989	6.65	0.63	-0.06	125.25	-0.386
YENISEI	1936	1994	17990.86	1377.18	13.74	-8998.83	0.171
ZAMBEZE	1976	1979	no data	no data	no data	no data	no data

The respective trends for the individual months are given in chapter 7.4.

For the first four most significant linear trends of the annual series, the coefficients of the trend equation are listed in the following table, together with the mean and standard deviation of the respective period and the ratio of the slope with the total mean of the series, a measure of the intensity of the trend:

Statistical Significant Partial Trends (1st - 4th) of Annual Series (Programme TREND1)							
River	**Begin year**	**End year**	**Mean**	**StdDev**	**Slope**	**Intercept**	**Slope/ Total mean**
GARONNE	1952	1979	615.5	146.7	10.54	-20095.8	1.7
GARONNE	**1953**	**1979**	**616.1**	**149.4**	**11.61**	**-22214.6**	**1.9**
GARONNE	1955	1979	631.4	141.6	10.59	-20197.8	1.7
GARONNE	1956	1979	634.3	143.9	11.21	-21428.1	1.8
GLOMA	1969	1984	614.7	58.1	7.28	-13773.3	1.1
GLOMA	1973	1984	623.4	60.7	10.3	-19762.3	1.5
GLOMA	1975	1984	627.2	66.2	14.95	-28962.3	2.2
GLOMA	**1976**	**1984**	**629.0**	**70.0**	**19.18**	**-37354.0**	**2.9**
GUADALQ	1984	1993	53.7	27.3	-6.39	12760.0	-5.3
GUADALQ	1985	1993	54.0	28.9	-9.02	17999.9	-7.5
GUADALQ	**1986**	**1993**	**51.1**	**29.5**	**-10.38**	**20708.8**	**-8.6**
JUCAR	1965	1981	42.8	11.6	-1.60	3201.7	-3.3
JUCAR	1966	1981	42.4	11.8	-1.76	3514.3	-3.6
JUCAR	1969	1981	40.2	10.8	-1.92	3824.7	-3.9
JUCAR	**1970**	**1981**	**39.4**	**10.9**	**-1.99**	**3978.1**	**-4.1**
LOIRE	1945	1979	816.3	276.0	13.26	-25195.0	1.6
LOIRE	1946	1979	822.0	278.0	13.42	-25519.1	1.6
LOIRE	1953	1979	863.3	248.9	13.11	-24917.1	1.6
LOIRE	**1971**	**1979**	**902.3**	**310.2**	**92.86**	**-182490.2**	**11.1**
ORINOCO	1979	1989	3226.2	3054.7	-587.23	1197336.1	-1.9
ORINOCO	1980	1989	3229.1	3218.3	-802.51	1624871.8	-2.6
ORINOCO	**1981**	**1989**	**3207.7**	**3336.7**	**-942.44**	**1902812.6**	**-3.1**
ORINOCO	1982	1989	3144.8	2941.9	-807.18	1634108.9	-2.6
PARANA	1967	1982	1658.2	3776.9	623.24	-1213998.0	3.8
PARANA	**1968**	**1982**	**1675.9**	**3840.3**	**681.01**	**-1328239.0**	**4.2**
PARANA	1969	1982	1721.4	3540.6	628.10	-1223594.0	3.8
PARANA	1970	1982	1757.4	3408.8	605.36	-1178623.0	3.7
TANA2	**1969**	**1987**	**165.4**	**28.9**	**2.75**	**-5268.3**	**1.6**
TANA2	1970	1987	166.8	29.1	2.74	-5263.5	1.6
THAMES	**1977**	**1984**	**79.6**	**20.3**	**-6.89**	**13717.1**	**-8.4**
VAENERN_	**1970**	**1992**	**498.8**	**129.3**	**8.43**	**-16210.2**	**1.6**
YENISEI	**1966**	**1994**	**1817.2**	**1493.4**	**69.90**	**-120232.6**	**0.4**

6 Significant Periodicities

Statistically significant periods have been detected for annual series only in exceptional cases listed in the following table. For the River Zambeze, because of the extremely short length of the series, the monthly sequence of values was taken instead of the derived annual series.

Statistical Significant Periods (Programme CHPP)							
River	**Begin year**	**End year**	**Type of series**	**Trans-formation**	**Period of annual series**	**Period of monthly sequence**	**Remarks**
					Years	**Months**	
GUADALQ	1952	1993	annual	no	-	nil	periodicity of length of series
GUADALQ	1952	1993	annual	log-normal, 2 parameter	8.2	nil	1/5 of length of series; other periodicity: length of series
PARANA	1905	1982	annual	no	8.6	nil	1/9 of length of series
ZAMBEZE	1976	1979	monthly sequence	no	nil	-	no periodicity
ZAMBEZE	1976	1979	monthly sequence	log-normal, 2 parameter	nil	7.8	1/6 of length of series

7 Basic Descriptive Annual and Monthly Statistical Properties

7.1 Sample Interpretation

7.1.1 Example for Interpretation of Data - Overview of Annual Descriptive and Monthly Autocorrelation Statistics

While the selected European rivers have quite often small mean discharge in comparison to big streams like the Mississippi, Orinoco, Changjiang (Yangtze), and Mekong, some rivers discharging into the Arctic Ocean like the Rivers Lena, Ob, and Yenisei, have substantially comparable mean discharge amount.
Similarly, the River Nile has roughly half the discharge of the River Rhine, with only 6.5 % variation coefficient also the most constant flow as compared to a value of 21.6 % for the latter. But, besides this anomaly of an epirheic stream with its water sources in an more humid region and crossing an arid region only later on, it may be observed that the more arid the climate at the river basin, the more elevated the discharge variation is, taking 30 % coefficient of variation as a threshold: Rivers Ebro, Guadalquivir, Jucar and Tejo (72.5 %), River Benue, a tributary of the River Niger, in Africa (40.1 %).

The maximum discharge value augments with the mean discharge. Although, the frequency distribution is different for the rivers: Some rivers show nearly symmetrical normal distribution as observed by the coefficient of skewness - River Labe 0.054 or River Angerman 0.09, others have extreme maximum values - Rivers Loire (coefficient of skewness 0.725) or Tana (0.983 for 1912-1943).

As for the kurtosis, most streams show small deviations of the bell-shaped normal distribution with values of 2.5 up to 3.5. Some have extreme numbers of values close to the mean together with relatively few extreme values. This feature seems to be more prominent with the rivers in humid regions:

River	CF Kurtosis	Remarks
Ems	7.3	short period 1980-1984.
Tana	5.8	

Considering the annual series' autocorrelation, the situation is quite indifferent:
For long, homogeneous series with no trends, the AC(1) should be around 0 - River Pechora 0.04 (1932-1984).
Positive trends show positive AC(1), negative trends. Opposite trends occur at the same station: River Severn 1965-1972: +0.67, 1976-1984: - 0.33.
With monthly series, the river regime represented by AC(1), AC(6), and AC(12) is different from river to river: Often AC(1) and AC(6) have opposite trends, AC(1)being positive and AC(6) being negative, reflecting the seasonal river discharge and runoff regime. Nevertheless, some deviations exist:

River	AC(1)	AC(6)	Remarks
Angerman	0.50	0.16	very low correlation
Rhine	0.36	0.03	no inter-seasonal correlation
Vaenern-Goeta	0.75	0.35	strongly correlated

Even opposite trends occur for AC(1) and AC(12), showing dependency on the former year's value being stronger than on the value of the preceding month:

River	AC(1)	AC(12)	Remarks
Yenisei	0.33	0.91	arctic river
Lena	0.41	0.93	arctic river

Hurst's coefficient, being theoretically 0.5 for long, independent series, is sometimes more or less about the theoretical value of 0.5, while mostly being within the empirical range stated by literature of 0.73 ± 0.03 (MAIDMENT 1992).

The adjusted range, a measure for monthly variability and storage needs, normally increases with mean discharge:

River	mean discharge	adjusted range
Ems	86	539
Rhein	2280	60500
Mekong	9310	74600

Nevertheless, positive deviations exist:

River	mean discharge	adjusted range
Parana	16400	571000
Lena	16600	307000
Mississippi	18000	279000

These three rivers show extreme differences of monthly values (see section with monthly descriptive statistics).

7.1.2 Example for Interpretation of Data - Monthly Descriptive Statistics

For the first set of results together with the overview of the annual statistics, some conclusions are drawn to provide assistance how the statistical results of the data may be interpreted.

Basic Descriptive Statistics											
River:	**ANGERMAN**										
Station:	**Solleftea**										
GRDC#:	**6233650**										
Time interval	**Begin year**	**End year**	**# year**	**Mean**	**Min**	**Max**	**SE Mean**	**Std Dev**	**CF Var**	**CF Skw**	**CF Kur**
JAN	1965	1992	28	487	301	612	14	76	0.155	-0.510	3.176
FEB	1965	1992	28	502	325	617	15	79	0.157	-0.680	3.048
MAR	1965	1992	28	462	247	642	17	88	0.191	-0.363	3.716
APR	1965	1992	28	446	235	767	26	138	0.310	0.488	2.999
MAY	1965	1992	28	703	412	1097	35	183	0.261	0.432	2.688
JUN	1965	1992	28	572	337	1063	32	171	0.299	1.149	4.651
JUL	1965	1992	28	437	204	951	33	173	0.396	1.147	4.628
AUG	1965	1992	28	421	188	894	36	192	0.458	1.107	3.806
SEP	1965	1992	28	416	207	1001	32	171	0.411	1.834	7.394
OCT	1965	1992	28	458	223	881	27	143	0.311	1.238	5.076
NOV	1965	1992	28	498	318	701	16	86	0.174	0.177	3.558
DEC	1965	1992	28	472	321	572	12	63	0.133	-1.047	4.394
MTHS	1965	1992	28	489	188	1097	9	156	0.318	1.015	4.865
ANNL	1965	1992	28	489	338	632	15	79	0.162	0.090	2.629

The River Angerman, with a mean discharge of 489 m^3/s (annual maximum 632 m^3/s and annual minimum 338 m^3/s) for about 31000 km^2 basin size has a fairly high mean discharge per unit area of 16.0 $l/(s*km^2)$. Mean monthly discharge maximum is observed in May (703 m^3/s) and mean monthly minimum in August/September (421/416 m^3/s), while the absolute maximum and minimum discharges occur in May (1097 m^3/s) and August (188 m^3/s), respectively.
For the annual and the consecutive monthly series the mean discharges are, of course, identical. However, the range of the values (Maximum - Minimum) of the monthly series is greater by a factor of about 3 (900 vs. 300 m^3/s). That means, that inner-annual variations are greater than inter-annual variations in discharge and runoff, respectively.
The standard error of the mean for monthly series is smaller than that one for annual series, meaning a better confidence for the expected mean of sampled values for the monthly series.
However, the standard deviation and the respective coefficient of variation of the monthly values is higher than

for the annual values, indicating that monthly values are substantially higher variable than annual values and thus describing the effect of the different range relative to the mean. The coefficient of variation shows small up to relatively strong variations of the discharge for the winter period November-March (< 0.2) and the summer period April - October (≥ 0.3). That means, a relatively high inter-annual variation of monthly discharge in summer is present.

The extreme discharges in summer are relatively high with respect to the mean, as the skewness coefficient is positive, even extremely positive for the period of June - October (September. +1.8), indicating relatively extremely high values. The different values of skewness and kurtosis of the different time intervals occurring are sometimes really contradictory.

Positive skew means that some extremely high values are present, while negative skew means that some extremely low values are observed:

June: + 1.15
December: - 1.05.

For the kurtosis, with a value of 3.0 for standard normal distribution shape, the relations are more equalised. In September many values occurred within a relatively small interval, while in May the distribution was broader and equal to that one of the annual values, near to standard normal conditions:

September: + 7.39
May: + 2.67
Annual: + 2.63

7.2 Overview of Annual Descriptive and Monthly Autocorrelation Statistics

The evaluation by the TS-programme and the CHPP-programme showed the following basic characteristics of the annual time series, recalculated from the monthly data, data units are m³/s. For the River Zambeze, because of the short length of the series, the monthly sequence of values was used instead of the derived annual series

River / Time Series	Begin year	End year	# year	Mean	Min	Max	SE Mean	Std Dev	CF Var	CF Skw	CF Kur	AC(1)
ANGERMAN	1965	1992	28	489	338	632	15	79	0.162	0.090	2.629	0.329
BENUE	1960	1989	30	22	9	46	2	9	0.401	1.066	4.517	0.115
CHANGJIA	1947	1986	40	28472	21377	42933	705	4461	0.157	0.977	4.658	0.078
EBRO	1953	1983	31	470	244	888	26	147	0.313	0.640	3.801	0.417
EMS	1980	1984	5	86	70	114	8	18	0.207	1.201	7.298	-0.573
GARONNE	1921	1979	59	609	170	1022	24	182	0.300	-0.091	2.466	0.364
GLOMA	1902	1984	83	673	479	979	12	108	0.161	0.397	2.858	0.136
GUADALQ	1952	1993	42	121	10	526	17	112	0.931	1.902	7.005	0.124
JUCAR	1925	1981	57	49	21	111	2	17	0.345	1.195	6.089	0.458
LABE	1965	1988	24	784	448	1132	40	197	0.251	0.054	2.381	0.549
LENA	1936	1994	59	16569	12478	22626	259	1986	0.120	0.525	3.426	0.257
LOIRE	1863	1979	117	838	282	1967	26	278	0.332	0.725	4.395	0.216
MEKONG	1982	1991	10	9312	7596	11126	324	1025	0.110	0.111	4.056	-0.189
MISSISSIPPI	1969	1982	14	18003	12311	27807	1241	4645	0.258	0.653	3.343	0.285
NILE	1973	1984	12	1251	1131	1390	24	82	0.065	0.254	2.716	0.309
N_DVINA	1882	1985	104	3315	1785	5245	63	647	0.195	0.437	3.427	0.412
OB	1936	1994	59	12667	8791	17812	252	1937	0.153	0.278	2.856	0.408
ORINOCO	1925	1989	65	30642	21245	37109	435	3507	0.114	-0.165	2.820	0.212
PARANA	1905	1982	78	16358	9413	25583	390	3447	0.211	0.347	2.846	0.283
PECHORA	1932	1984	53	3405	2576	4346	62	448	0.132	-0.033	2.551	0.041
RHEIN	1930	1996	67	2280	1246	3280	60	493	0.216	-0.140	2.433	0.211
SEINE	1971	1977	7	334	244	431	28	75	0.224	0.251	2.925	-0.376
SEVERN1	1965	1972	8	68	48	80	4	11	0.158	-0.870	4.563	0.666
SEVERN2	1976	1984	9	65	43	75	3	10	0.158	-1.149	5.152	-0.326
SHANNON	1973	1979	7	173	138	205	9	23	0.133	-0.154	4.283	-0.488
TANA1	1912	1943	32	165	102	268	6	31	0.191	0.983	5.835	-0.005
TANA2	1947	1987	41	167	106	235	5	30	0.177	-0.115	2.906	0.062
TAY	1980	1984	5	180	157	208	9	19	0.107	0.430	6.711	0.048
TEJO	1976	1984	9	371	90	884	90	269	0.725	1.016	4.007	-0.073
THAMES	1965	1984	20	82	41	112	5	22	0.272	-0.405	2.523	0.487
VAENERN_	1807	1992	186	534	225	768	7	99	0.186	-0.102	2.670	0.268
WESER	1921	1984	64	317	150	532	12	92	0.291	0.472	2.875	-0.096
WYE	1977	1989	13	7	5	8	0	1	0.095	-0.214	3.428	0.695
YENISEI	1936	1994	59	17991	15543	20966	179	1377	0.077	0.210	2.294	0.105
ZAMBEZE	1976	1979	4	*3337*	*540*	*12382*	*353*	*2448*	*0.733*	*1.816*	*6.850*	*no data*

Explanation of abbreviations:

# year:	Number of years
Mean:	Mean of annual series
Min:	Minimum annual value
Max:	Maximum annual value
SEMean:	Standard error of the annual mean
StdDev:	Standard deviation of annual values
CFVar:	Coefficient of variation
CFSkw:	Coefficient of skewness
CFKur:	Coefficient of kurtosis
AC(1):	Autocorrelation coefficient of annual series with lag M = 1

The following characteristics of the monthly series were calculated by the TS-programme:

River	Adj. Range	Resc A.R.	CF Hrst	AC (1)	AC (2)	AC (3)	AC (4)	AC (5)	AC (6)	AC (7)	AC (8)	AC (9)	AC (10)	AC (11)	AC (12)
ANGERMAN	9093	58.34	0.7936	0.502	0.167	0.133	0.079	0.100	0.162	0.132	0.093	0.050	0.023	0.160	0.319
BENUE	914	28.43	0.6446	0.536	0.226	-0.078	-0.240	-0.324	-0.339	-0.328	-0.247	-0.115	0.168	0.444	0.603
CHANGJIA	504832	33.71	0.6419	0.802	0.470	0.061	-0.351	-0.634	-0.734	-0.635	-0.362	0.018	0.396	0.666	0.777
EBRO	15664	43.89	0.7237	0.640	0.340	0.120	-0.071	-0.243	-0.319	-0.239	-0.076	0.113	0.254	0.367	0.426
EMS	539	10.04	0.6782	0.496	0.238	-0.075	-0.187	-0.377	-0.468	-0.472	-0.209	0.011			
GARONNE	40083	83.58	0.7541	0.611	0.328	0.065	-0.143	-0.280	-0.334	-0.254	-0.101	0.091	0.257	0.386	0.432
GLOMA	25701	47.56	0.6218	0.592	0.171	-0.100	-0.290	-0.400	-0.429	-0.386	-0.278	-0.114	0.146	0.515	0.747
GUADALQ	16409	73.93	0.7782	0.576	0.330	0.139	0.000	-0.072	-0.089	-0.060	0.021	0.114	0.293	0.332	0.325
JUCAR	3317	145.0	0.8530	0.760	0.577	0.446	0.337	0.254	0.229	0.249	0.299	0.359	0.416	0.442	0.441
LABE	15517	37.24	0.7279	0.699	0.407	0.147	-0.046	-0.133	-0.170	-0.126	-0.013	0.122	0.276	0.363	0.431
LENA	307118	14.15	0.4514	0.407	0.099	-0.074	-0.272	-0.405	-0.415	-0.397	-0.263	-0.066	0.102	0.400	0.927
LOIRE	66374	94.87	0.6946	0.678	0.378	0.125	-0.106	-0.287	-0.343	-0.304	-0.169	0.034	0.236	0.353	0.399
MEKONG	74606	8.60	0.5256	0.785	0.329	-0.137	-0.443	-0.591	-0.630	-0.580	-0.418	-0.121	0.295	0.676	0.839
MISSISSIPPI	278680	29.47	0.7636	0.701	0.426	0.201	-0.006	-0.163	-0.236	-0.199	-0.023	0.114	0.236	0.389	0.468
NILE	4894	19.86	0.6988	0.622	0.131	-0.206	-0.319	-0.194	-0.086	-0.139	-0.257	-0.180	0.085	0.504	0.774
N_DVINA	172681	44.44	0.5895	0.313	-0.110	-0.188	-0.166	-0.116	-0.096	-0.121	-0.175	-0.201	-0.104	0.288	0.805
OB	261961	24.17	0.5427	0.724	0.247	-0.147	-0.375	-0.490	-0.521	-0.483	-0.362	-0.132	0.235	0.664	0.884
ORINOCO	512851	24.42	0.5356	0.843	0.458	-0.017	-0.448	-0.739	-0.841	-0.739	-0.453	-0.033	0.426	0.788	0.926
PARANA	570856	98.15	0.7460	0.762	0.507	0.314	0.162	0.027	-0.062	-0.035	0.051	0.126	0.233	0.334	0.364
PECHORA	63554	14.48	0.4639	0.359	-0.096	-0.164	-0.169	-0.234	-0.277	-0.227	-0.161	-0.162	-0.074	0.399	0.757
RHEIN	60510	62.38	0.6893	0.559	0.336	0.182	0.081	0.029	0.024	0.040	0.063	0.073	0.122	0.180	0.184
SEINE	2009	12.52	0.6763	0.671	0.423	0.154	-0.148	-0.358	-0.419	-0.393	-0.265	-0.013	0.220	0.263	0.379
SEVERN1	710	14.85	0.6970	0.319	0.290	0.037	-0.212	-0.347	-0.407	-0.359	-0.146	-0.023	0.231	0.434	0.436
SEVERN2	526	10.71	0.5943	0.582	0.256	-0.015	-0.291	-0.497	-0.630	-0.521	-0.290	0.058	0.307	0.400	0.521
SHANNON	1063	9.05	0.5894	0.692	0.301	-0.037	-0.353	-0.565	-0.662	-0.591	-0.353	-0.024	0.259	0.566	0.687
TANA1	3196	16.52	0.5334	0.272	-0.055	-0.095	-0.147	-0.203	-0.223	-0.203	-0.151	-0.111	-0.070	0.296	0.681
TANA2	2976	16.11	0.5048	0.342	-0.040	-0.117	-0.165	-0.234	-0.279	-0.229	-0.152	-0.104	-0.021	0.368	0.687
TAY	938	8.49	0.6290	0.584	0.300	-0.060	-0.288	-0.493	-0.537	-0.414	-0.247	-0.009			
TEJO	14084	26.52	0.8217	0.617	0.407	0.194	0.007	-0.065	-0.077	-0.084	-0.028	0.038	0.160	0.299	0.313
THAMES	1439	26.24	0.6825	0.714	0.470	0.132	-0.131	-0.310	-0.397	-0.349	-0.183	0.003	0.189	0.304	0.367
VAENERN_	25732	196.1	0.7522	0.887	0.738	0.600	0.488	0.403	0.348	0.326	0.329	0.354	0.388	0.412	0.403
WESER	10360	52.72	0.6663	0.596	0.361	0.159	0.011	-0.125	-0.173	-0.146	-0.047	0.078	0.239	0.346	0.357
WYE	68	12.84	0.5859	0.418	0.148	-0.071	-0.264	-0.436	-0.518	-0.361	-0.173	0.055	0.229	0.356	0.437
YENISEI	282067	13.81	0.4473	0.331	-0.030	-0.110	-0.188	-0.307	-0.347	-0.298	-0.179	-0.102	-0.023	0.337	0.906
ZAMBEZE	29752	12.16	0.7860												

Explanation of abbreviations:

River: River / Time Series
Adj.Range: Adjusted Range
Res.A.R.: Rescaled Adjusted Range
CFHrst: Hurst's coefficient
AC(i): Autocorrelation coefficient of monthly series with lag i = 1, ... ,12

The following autocorrelation coefficients for lags i = 13, ... ,24 of the monthly series were calculated by the TS-programme:

River	**AC (13)**	**AC (14)**	**AC (15)**	**AC (16)**	**AC (17)**	**AC (18)**	**AC (19)**	**AC (20)**	**AC (21)**	**AC (22)**	**AC (23)**	**AC (24)**
ANGERMAN	0.105	-0.050	-0.019	-0.009	0.055	0.120	0.071	0.042	0.019	0.036	0.133	0.297
BENUE	0.388	0.120	-0.126	-0.250	-0.307	-0.319	-0.303	-0.237	-0.102	0.170	0.420	0.638
CHANGJIA	0.659	0.375	-0.008	-0.387	-0.652	-0.745	-0.630	-0.352	0.016	0.385	0.648	0.741
EBRO	0.357	0.204	0.032	-0.117	-0.262	-0.336	-0.286	-0.141	-0.010	0.133	0.287	0.362
EMS												
GARONNE	0.331	0.195	0.001	-0.157	-0.286	-0.323	-0.279	-0.131	0.030	0.140	0.268	0.341
GLOMA	0.514	0.140	-0.128	-0.299	-0.388	-0.429	-0.382	-0.282	-0.123	0.142	0.501	0.726
GUADALQ	0.305	0.226	0.100	-0.012	-0.078	-0.108	-0.090	-0.038	0.060	0.141	0.277	0.289
JUCAR	0.394	0.316	0.246	0.181	0.127	0.104	0.105	0.145	0.192	0.222	0.227	0.229
LABE	0.372	0.241	0.072	-0.091	-0.199	-0.204	-0.152	-0.070	0.015	0.118	0.194	0.239
LENA	0.387	0.092	-0.075	-0.271	-0.400	-0.408	-0.392	-0.263	-0.068	0.095	0.385	0.909
LOIRE	0.345	0.205	0.009	-0.184	-0.328	-0.386	-0.338	-0.199	-0.003	0.189	0.325	0.405
MEKONG	0.658	0.273	-0.124	-0.392	-0.519	-0.552	-0.504					
MISSISSIPPI	0.404	0.207	0.050	-0.149	-0.311	-0.370	-0.364	-0.286	-0.106	0.036	0.199	0.270
NILE	0.486	0.045	-0.233	-0.319	-0.198	-0.107	-0.170	-0.280	-0.226	0.013	0.397	
N_DVINA	0.278	-0.107	-0.196	-0.174	-0.119	-0.101	-0.131	-0.180	-0.207	-0.116	0.284	0.814
OB	0.656	0.223	-0.154	-0.377	-0.489	-0.520	-0.483	-0.363	-0.134	0.226	0.637	0.841
ORINOCO	0.784	0.422	-0.034	-0.450	-0.732	-0.831	-0.731	-0.451	-0.037	0.414	0.769	0.906
PARANA	0.286	0.150	0.023	-0.092	-0.198	-0.242	-0.193	-0.112	-0.024	0.066	0.164	0.217
PECHORA	0.381	-0.078	-0.162	-0.162	-0.225	-0.279	-0.228	-0.153	-0.157	-0.079	0.376	0.767
RHEIN	0.159	0.086	0.030	-0.029	-0.064	-0.084	-0.124	-0.116	-0.066	0.013	0.085	0.126
SEINE	0.261											
SEVERN1	0.358	0.174	0.035									
SEVERN2	0.479	0.236	-0.003	-0.286	-0.486							
SHANNON	0.562											
TANA1	0.279	-0.049	-0.116	-0.146	-0.195	-0.222	-0.195	-0.151	-0.116	-0.053	0.317	0.632
TANA2	0.324	-0.048	-0.133	-0.167	-0.232	-0.274	-0.224	-0.149	-0.114	-0.046	0.336	0.609
TAY												
TEJO	0.318	0.245	0.119	0.041	-0.059							
THAMES	0.320	0.172	-0.017	-0.257	-0.415	-0.472	-0.415	-0.303	-0.087	0.148	0.364	0.481
VAENERN_	0.335	0.234	0.128	0.051	-0.002	-0.037	-0.042	-0.009	0.037	0.095	0.142	0.158
WESER	0.298	0.177	0.021	-0.139	-0.253	-0.275	-0.256	-0.179	-0.064	0.119	0.240	0.271
WYE	0.344	0.204	0.018	-0.232	-0.414	-0.427	-0.336	-0.243	0.014	0.277	0.371	0.469
YENISEI	0.329	-0.029	-0.109	-0.186	-0.300	-0.341	-0.292	-0.178	-0.101	-0.027	0.330	0.901
ZAMBEZE												

Explanation of abbreviations:

River: River / Time Series
AC(i): Autocorrelation coefficient of monthly series with lag i = 13, ... , 24

7.3 Monthly Descriptive Statistics

7.3.1 Europe (GRDC Region #6)

Basic Descriptive Statistics											
River:	ANGERMAN										
Station:	Solleftea										
GRDC#:	6233650										
Time interval	Begin year	End year	# year	Mean	Min	Max	SE Mean	Std Dev	CF Var	CF Skw	CF Kur
JAN	1965	1992	28	487	301	612	14	76	0.155	-0.510	3.176
FEB	1965	1992	28	502	325	617	15	79	0.157	-0.680	3.048
MAR	1965	1992	28	462	247	642	17	88	0.191	-0.363	3.716
APR	1965	1992	28	446	235	767	26	138	0.310	0.488	2.999
MAY	1965	1992	28	703	412	1097	35	183	0.261	0.432	2.688
JUN	1965	1992	28	572	337	1063	32	171	0.299	1.149	4.651
JUL	1965	1992	28	437	204	951	33	173	0.396	1.147	4.628
AUG	1965	1992	28	421	188	894	36	192	0.458	1.107	3.806
SEP	1965	1992	28	416	207	1001	32	171	0.411	1.834	7.394
OCT	1965	1992	28	458	223	881	27	143	0.311	1.238	5.076
NOV	1965	1992	28	498	318	701	16	86	0.174	0.177	3.558
DEC	1965	1992	28	472	321	572	12	63	0.133	-1.047	4.394
MTHS	1965	1992	28	489	188	1097	9	156	0.318	1.015	4.865
ANNL	1965	1992	28	489	338	632	15	79	0.162	0.090	2.629

The River Angerman, with its basin of about 31000 km² size, shows medium-sized mean discharge of 489 m³/s (annual maximum 632 m³/s, annual minimum 338 m³/s) and elevated mean discharge per unit area of 16.0 l/(s*km²).

Mean monthly maximum occurs in May (703 m³/s), mean minimum in August/September (416 m³/s), the extremes in May (1097 m³/s) and August (188 m³/s).

Inter-annual variations are small and the annual series shows normal frequency, slightly platykurtic distribution (coefficient of skewness: 0.1, coefficient of kurtosis: 2.6).

The monthly series' variability is high in summer and small in winter.

For further interpretation of the values, see detailed interpretation on page 26.

Basic Descriptive Statistics											
River:	**EBRO**										
Station:	**Tortosa**										
GRDC#:	**6226800**										
Time interval	**Begin year**	**End year**	**# year**	**Mean**	**Min**	**Max**	**SE Mean**	**Std Dev**	**CF Var**	**CF Skw**	**CF Kur**
JAN	1953	1983	31	690	232	1983	68	378	0.548	1.449	6.327
FEB	1953	1983	31	755	266	1801	77	430	0.570	1.060	3.318
MAR	1953	1983	31	720	201	1407	57	320	0.444	0.361	2.896
APR	1953	1983	31	610	114	1357	57	316	0.518	0.391	2.765
MAY	1953	1983	31	502	43	1571	55	308	0.613	1.440	6.636
JUN	1953	1983	31	482	111	1115	48	269	0.558	0.562	2.942
JUL	1953	1983	31	203	20	372	16	91	0.446	0.371	2.655
AUG	1953	1983	31	130	23	461	16	88	0.673	2.000	8.925
SEP	1953	1983	31	193	49	488	20	110	0.571	1.290	4.595
OCT	1953	1983	31	307	46	1254	42	235	0.767	2.440	10.956
NOV	1953	1983	31	466	73	1216	57	316	0.679	1.103	3.319
DEC	1953	1983	31	577	161	2171	73	404	0.699	2.255	10.099
MTHS	1953	1983	31	470	20	2171	19	357	0.760	1.398	5.423
ANNL	1953	1983	31	470	244	888	26	147	0.313	0.640	3.801

The River Ebro, with a basin size of about 84000 km², has a mean discharge of 470 m³/s (annual maximum 888 m³/s, minimum 244 m³/s) and a small mean discharge per unit area of 5.6 l/(s*km²).

Mean monthly maximum occurs in February (690 m³/s), the minimum in August (130 m³/s), while the absolute extremes occur in December (2171 m³/s) and July/August (20/23 m³/s), respectively. This discharge regime is similar to that of River Garonne, to the North of the Pyrenees mountain range.

The annual series shows medium inter-annual variability, combined with small right-sided skew and a slightly leptokurtic distribution.

The monthly variability, however, is strong and culminating at a variation coefficient of 76.7 % in October while the smallest variability is observed in March and July, attaining variation coefficients of about 44.5 %.

The skewness is strongly right-sided as on the River Garonne, now in August, October and December combined with extraordinary values of the coefficient of kurtosis. I.e., during these months, relatively high floods may occur. In January and May the skew and kurtosis are strong, too, but markedly minor to those of the months mentioned before.

Basic Descriptive Statistics											
River:	**EMS**										
Station:	**Versen**										
GRDC#:	**633810**										
Time interval	**Begin year**	**End year**	**# year**	**Mean**	**Min**	**Max**	**SE Mean**	**Std Dev**	**CF Var**	**CF Skw**	**CF Kur**
JAN	1980	1984	5	151	96	212	20	45	0.299	0.319	6.002
FEB	1980	1984	5	154	121	182	11	26	0.166	-0.138	5.210
MAR	1980	1984	5	133	71	258	34	75	0.564	1.570	8.852
APR	1980	1984	5	86	60	130	13	28	0.330	1.023	7.243
MAY	1980	1984	5	72	38	124	15	35	0.480	0.901	6.480
JUN	1980	1984	5	52	34	82	8	19	0.364	1.339	8.098
JUL	1980	1984	5	68	30	135	21	47	0.693	0.844	5.277
AUG	1980	1984	5	33	21	51	6	13	0.400	0.585	4.959
SEP	1980	1984	5	34	19	44	5	12	0.361	-0.622	4.082
OCT	1980	1984	5	58	25	119	17	39	0.667	1.285	7.396
NOV	1980	1984	5	78	34	119	16	36	0.465	-0.151	4.743
DEC	1980	1984	5	113	79	181	18	41	0.359	1.546	8.607
MTHS	1980	1984	5	86	19	258	7	54	0.624	0.946	3.719
ANNL	1980	1984	5	86	70	114	8	18	0.207	1.201	7.298

The River Ems, with its mouth into the North Sea, has only small discharge with a mean of 86 m^3/s (annual maximum 114 m^3/s, minimum 70 m^3/s), corresponding to its basin size of only about 8000 km^2 size, and a mean discharge per unit area of 10.3 $l/(s*km^2)$.

A marked peak in discharge in winter occurs, especially in January/February (151/154 m^3/s), and a mean minimum is observed in August/September (33/34 m^3/s), while the absolute extremes are observed in March (258 m^3/s) and August/September (21/19 m^3/s).

The annual series shows small inter-annual variability, with strong right-sided skew and leptokurtic distribution (coefficient of skewness: 1.2, coefficient of kurtosis: 7.3).

The monthly series, however, shows mostly fairly high variability, especially in March, July and October.

It has marked right-sided skew in some months, corresponding to the high variation coefficients with the exception of December, although also negative values of the skewness coefficient are observed.

The short period of record of only 5 years is limiting the reliability of the figures.

Basic Descriptive Statistics											
River:	**GARONNE**										
Station:	**Mas-D'agenais**										
GRDC#:	**6125100**										
Time interval	**Begin year**	**End year**	**# year**	**Mean**	**Min**	**Max**	**SE Mean**	**Std Dev**	**CF Var**	**CF Skw**	**CF Kur**
JAN	1921	1979	59	878	144	2684	65	497	0.567	1.244	5.237
FEB	1921	1979	59	1010	96	2279	68	526	0.521	0.527	2.652
MAR	1921	1979	59	907	166	2400	69	528	0.582	1.010	3.552
APR	1921	1979	59	856	141	2453	56	429	0.501	0.845	4.848
MAY	1921	1979	59	804	231	1844	49	379	0.471	0.712	3.215
JUN	1921	1979	59	568	190	1337	37	282	0.497	1.013	3.686
JUL	1921	1979	59	295	72	1222	24	182	0.619	3.160	16.282
AUG	1921	1979	59	185	42	665	13	99	0.533	2.393	12.274
SEP	1921	1979	59	204	52	655	15	119	0.582	1.613	6.365
OCT	1921	1979	59	289	60	855	24	188	0.649	1.348	4.630
NOV	1921	1979	59	480	98	1200	35	271	0.565	0.883	3.527
DEC	1921	1979	59	826	103	2910	80	615	0.744	1.498	5.348
MTHS	1921	1979	59	609	42	2910	18	480	0.788	1.438	5.349
ANNL	1921	1979	59	609	170	1022	24	182	0.300	-0.091	2.466

The River Garonne, with a medium-sized basin of about 52000 km², by a mean discharge of 609 m³/s (annual maximum 1022 m³/s, minimum 170 m³/s) and a mean discharge per unit area of 11.7 l/(s*km²), has somewhat higher discharge than River Angerman with 31000 km² basin size.

Mean monthly maximum occurs in February (1010 m³/s), the minimum in August (183 m³/s), while the absolute extremes occur in December (2910 m³/s) and August (42 m³/s), respectively.

The annual series shows small to medium inter-annual variability, with no skew and a slightly platykurtic distribution.

The monthly variability, however, is strong and generally higher than at River Angerman, culminating at a variation coefficient of 74.4 % in December.

Furthermore, the skewness is strongly right-sided, especially in the summer and autumn months of June, July and September, combined with extraordinary values of the coefficient of kurtosis. I.e., during these months, relatively high floods may occur.

Basic Descriptive Statistics											
River:	**GLOMA**										
Station:	**Langnes**										
GRDC#:	**6731400**										
Time interval	**Begin year**	**End year**	**# year**	**Mean**	**Min**	**Max**	**SE Mean**	**Std Dev**	**CF Var**	**CF Skw**	**CF Kur**
JAN	1902	1984	83	224	70	570	12	111	0.497	1.325	4.223
FEB	1902	1984	83	186	73	555	11	101	0.545	1.603	5.116
MAR	1902	1984	83	197	82	454	11	99	0.505	0.986	2.837
APR	1902	1984	83	491	146	1182	24	220	0.448	1.100	4.769
MAY	1902	1984	83	1574	720	2874	55	502	0.319	0.582	2.923
JUN	1902	1984	83	1490	734	3010	46	420	0.282	0.861	4.198
JUL	1902	1984	83	1044	458	2436	38	343	0.329	1.438	6.352
AUG	1902	1984	83	818	348	1813	36	327	0.400	0.881	3.744
SEP	1902	1984	83	683	233	1682	36	327	0.480	0.949	3.410
OCT	1902	1984	83	612	212	1425	31	279	0.455	0.793	3.268
NOV	1902	1984	83	456	126	1169	23	211	0.463	0.937	4.248
DEC	1902	1984	83	298	96	763	16	145	0.485	1.083	4.225
MTHS	1902	1984	83	673	70	3010	17	540	0.803	1.265	4.347
ANNL	1902	1984	83	673	479	979	12	108	0.161	0.397	2.858

The River Gloma, with a basin of about 40000 km² size, has a mean discharge of 673 m³/s (annual maximum 979 m³/s, minimum 479 m³/s) and a fairly high mean discharge per unit area of 16.6 l/(s*km²).
Extreme monthly discharges are of similar order of magnitude but different timing than those of the River Garonne.

Mean monthly maximum is observed in June (1490 m³/s), the minimum in February (186 m³/s) (Garonne: February and August), while the absolute extremes occur in June (3010 m³/s) and January (70 m³/s), respectively. This may be possible outcome of snow accumulation in winter and snow melt in spring.

Annual series shows slightly right-sided skewed, distribution with normal kurtosis while the inter-annual variability is small.

The monthly series' variability is small up to medium sized, culminating in May.

The respective skewness is strongly right-sided, especially in February and July, in conjunction with high kurtosis. I.e., during these months, relatively high floods may occur.

Basic Descriptive Statistics											
River:	**GUADALQUIVIR**										
Station:	**Alcala del Rio**										
GRDC#:	**6217100**										
Time interval	**Begin year**	**End year**	**# year**	**Mean**	**Min**	**Max**	**SE Mean**	**Std Dev**	**CF Var**	**CF Skw**	**CF Kur**
JAN	1952	1993	42	254	7	1640	57	368	1.450	2.621	10.140
FEB	1952	1993	42	286	8	1415	59	379	1.329	1.939	5.979
MAR	1952	1993	42	250	3	1298	52	334	1.336	1.985	6.222
APR	1952	1993	42	139	5	602	25	162	1.166	1.550	4.393
MAY	1952	1993	42	74	5	331	11	74	1.007	1.759	5.872
JUN	1952	1993	42	46	2	179	5	34	0.749	2.163	8.856
JUL	1952	1993	42	32	2	82	2	14	0.439	0.919	5.896
AUG	1952	1993	42	33	1	64	2	13	0.379	-0.087	3.899
SEP	1952	1993	42	33	3	139	3	22	0.658	2.741	15.278
OCT	1952	1993	42	45	0	314	8	54	1.203	3.398	17.529
NOV	1952	1993	42	85	1	497	17	107	1.270	2.797	11.231
DEC	1952	1993	42	172	1	1198	38	244	1.420	2.448	9.909
MTHS	1952	1993	42	121	0	1640	10	222	1.838	3.919	20.601
ANNL	1952	1993	42	121	10	526	17	112	0.931	1.902	7.005

The River Guadalquivir, with a basin size of roughly 47000 km², has a mean discharge of 121 m³/s (annual maximum 526 m³/s, minimum 10 m³/s) and a very small mean discharge per unit area of only 2.5 l/(s*km²).

Mean monthly maximum occurs in February (286 m³/s), the minimum from July to September (32-33 m³/s), while the absolute extremes are observed in January (1640 m³/s) and October (0 m³/s), respectively. The maximum is timed similar to that of River Ebro to the South of the Pyrenees mountain range, while the absolute minimum discharge is extraordinarily low, possibly due to abstractions for irrigation within the catchment, and not constrained to October, but with equally low values up to 3 m³/s also present throughout the year besides January, February, April, and May.

The annual series shows strong inter-annual variability, combined with very strongly right-sided skew and a equally strongly leptokurtic distribution.

The monthly variability, however, is even stronger and culminating at a variation coefficient of 142-145 % in December and January while the smallest variability is observed in August with a variation coefficient of 37.9 %, when also no skew and only moderately high right-sided kurtosis are observed.

The skewness is strongly right-sided as on the River Ebro, now in June, and the period from September to January, each time combined with extraordinary values of the coefficient of kurtosis. I.e., during these months, relatively high floods may occur. In the rest of the year, besides August, the skew and kurtosis are strong, too, but markedly minor to those of the months mentioned before.

Basic Descriptive Statistics											
River:	**JUCAR**										
Station:	**Masia de Mompo**										
GRDC#:	**6227500**										
Time interval	**Begin year**	**End year**	**# year**	**Mean**	**Min**	**Max**	**SE Mean**	**Std Dev**	**CF Var**	**CF Skw**	**CF Kur**
JAN	1925	1981	57	54	20	141	3	26	0.482	1.478	5.690
FEB	1925	1981	57	61	21	172	4	34	0.556	1.724	6.102
MAR	1925	1981	57	61	20	185	5	35	0.566	1.701	6.428
APR	1925	1981	57	53	17	138	3	24	0.455	1.487	5.795
MAY	1925	1981	57	52	21	126	3	22	0.424	1.757	6.840
JUN	1925	1981	57	48	23	108	2	15	0.321	1.253	6.066
JUL	1925	1981	57	43	21	82	1	10	0.230	0.776	7.011
AUG	1925	1981	57	40	17	65	1	9	0.215	-0.395	4.997
SEP	1925	1981	57	41	14	108	2	15	0.366	1.585	9.618
OCT	1925	1981	57	42	12	89	2	16	0.371	0.470	3.823
NOV	1925	1981	57	44	12	136	3	22	0.489	2.069	9.838
DEC	1925	1981	57	48	11	91	2	18	0.380	0.540	3.184
MTHS	1925	1981	57	49	11	185	1	23	0.467	2.200	10.449
ANNL	1925	1981	57	49	21	111	2	17	0.345	1.195	6.089

The River Jucar, with a basin size of about 18000 km², has a mean discharge of 49 m³/s (annual maximum 111 m³/s, minimum 21 m³/s) and a very small mean discharge per unit area of only 2.7 l/(s*km²), only slightly bigger than that of River Guadalquivir (2.5 l/(s*km²)).

Mean monthly maximum occurs in February/March (61 m³/s), the minimum in August/September (40-41 m³/s), while the absolute maximum is observed in March (185 m³/s) and the respective minimum from October to December (12-11 m³/s).

The annual series shows medium inter-annual variability, combined with strongly right-sided skew and a strongly leptokurtic distribution.

The monthly variability, however, is small in July and August (22-23 % variation coefficient) and stronger in the other months culminating in March (56.6 %).

The skewness is strongly right-sided in January up to June and also in September and November, combined with extraordinary values of the coefficient of kurtosis especially in September and November. I.e., during these months, relatively high floods may occur. While in October and December right-sided skew and leptokurtic kurtosis are small to moderate, in the summer months of July and August markedly peaked distributions combined with fairly high right-sided skew or even slightly left-sided skew are observed. I.e., in plain summer many values are markedly constantly about mean while only a few are higher (especially in July) or lower (especially in August).

Basic Descriptive Statistics											
River:	**LABE**										
Station:	**Neu-Darchau**										
GRDC#:	**6340110**										
Time interval	**Begin year**	**End year**	**# year**	**Mean**	**Min**	**Max**	**SE Mean**	**Std Dev**	**CF Var**	**CF Skw**	**CF Kur**
JAN	1965	1988	24	936	264	2037	99	483	0.516	0.791	3.234
FEB	1965	1988	24	1015	420	1673	73	360	0.355	0.284	2.371
MAR	1965	1988	24	1054	420	1843	78	384	0.365	0.462	2.698
APR	1965	1988	24	1232	490	2398	106	521	0.423	0.730	3.198
MAY	1965	1988	24	930	414	1824	76	374	0.402	1.011	3.907
JUN	1965	1988	24	734	360	1836	65	320	0.435	2.016	8.345
JUL	1965	1988	24	576	200	1140	48	235	0.409	0.850	3.640
AUG	1965	1988	24	534	197	1149	51	249	0.466	1.211	4.063
SEP	1965	1988	24	493	218	1093	43	212	0.431	1.512	5.842
OCT	1965	1988	24	514	291	894	37	181	0.352	0.702	2.940
NOV	1965	1988	24	606	325	1492	61	298	0.491	1.540	5.528
DEC	1965	1988	24	783	347	1901	82	400	0.511	1.469	5.300
MTHS	1965	1988	24	784	197	2398	25	417	0.532	1.203	4.243
ANNL	1965	1988	24	784	448	1132	40	197	0.251	0.054	2.381

The River Labe, also called Elbe or Elba, with a basin size of about 132000 km², has a mean discharge of 784 m³/s (annual maximum 1132 m³/s, minimum 448 m³/s) and a small mean discharge per unit area of 5.9 l/(s*km²).

Mean monthly maximum is observed in April (1232 m³/s), the respective minimum in September (493 m³/s), while the absolute extremes occur in April (2398 m³/s) and August (197 m³/s), respectively.

The annual series' variability is small, and the distribution is without skew, slightly platykurtic.

The monthly series' variability is strong, the highest is observed in winter, in December and January (about 51 % variation coefficient), the lowest in February and October.

The skewness is strongly right-sided, besides in February, in conjunction with high kurtosis, especially in June (skew: +2.0, kurtosis: 8.4), September, November-December. I.e., during this month, relatively high floods may occur.

Basic Descriptive Statistics											
River:	**LOIRE**										
Station:	**Montjean**										
GRDC#:	**6123100**										
Time interval	**Begin year**	**End year**	**# year**	**Mean**	**Min**	**Max**	**SE Mean**	**Std Dev**	**CF Var**	**CF Skw**	**CF Kur**
JAN	1863	1979	117	1397	336	3850	69	749	0.536	1.078	3.896
FEB	1863	1979	117	1518	231	4150	77	829	0.546	1.027	3.598
MAR	1863	1979	117	1376	323	3330	63	682	0.496	0.689	2.915
APR	1863	1979	117	1113	247	2870	55	597	0.536	0.679	2.730
MAY	1863	1979	117	806	178	1990	40	430	0.533	0.886	3.372
JUN	1863	1979	117	576	110	1840	31	333	0.577	1.484	5.691
JUL	1863	1979	117	358	77	1140	19	209	0.584	1.749	6.529
AUG	1863	1979	117	259	60	1100	15	159	0.614	2.324	10.696
SEP	1863	1979	117	268	78	875	15	158	0.590	1.737	6.417
OCT	1863	1979	117	417	90	1490	26	277	0.662	1.392	5.093
NOV	1863	1979	117	813	128	3590	58	630	0.775	1.874	7.325
DEC	1863	1979	117	1156	191	4200	71	768	0.664	1.525	5.878
MTHS	1863	1979	117	838	60	4200	19	700	0.835	1.543	5.589
ANNL	1863	1979	117	838	282	1967	26	278	0.332	0.725	4.395

The River Loire, with a long period of record of 117 years and a basin of 110000 km^2 size, has a mean discharge of 838 m^3/s (annual maximum 1967 m^3/s, minimum 282 m^3/s) and a small mean discharge per unit area of 7.6 $l/(s*km^2)$, i.e. slightly more than the bigger River Labe basin.

Mean monthly maximum is highest in February (1518 m^3/s), i.e. winter, and lowest in July (358 m^3/s), whereas the absolute monthly extremes occur in December and February (4200/4150 m^3/s) and August (60 m^3/s), respectively.

The annual series has fair variability while having a right-tailed and markedly leptokurtic distribution, pointing at some relatively high values.

The monthly series' variability is strong, the highest is observed in winter, like at the River Labe, in November (about 78 % variation coefficient), the lowest in January, April and May.

The skewness is strongly right-sided, and in extreme cases combined with high kurtosis, as in the period June - December, culminating in August (skew: 2.3, kurtosis: 10.7). During these months, relatively high floods may occur.

Basic Descriptive Statistics											
River:	**NORTHERN DVINA (SEVERNAYA DVINA)**										
Station:	**Ust-Pinega**										
GRDC#:	**6970250**										
Time interval	**Begin year**	**End year**	**# year**	**Mean**	**Min**	**Max**	**SE Mean**	**Std Dev**	**CF Var**	**CF Skw**	**CF Kur**
JAN	1882	1985	104	1030	369	1910	32	329	0.320	0.417	2.616
FEB	1882	1985	104	823	319	1990	25	258	0.314	1.143	5.962
MAR	1882	1985	104	716	348	1280	18	186	0.260	0.745	3.442
APR	1882	1985	104	2329	488	10900	214	2178	0.935	1.865	6.337
MAY	1882	1985	104	13699	5830	20800	323	3295	0.241	-0.070	2.288
JUN	1882	1985	104	7079	2300	16100	292	2977	0.421	0.938	3.881
JUL	1882	1985	104	2957	1180	5820	103	1051	0.355	0.789	3.031
AUG	1882	1985	104	2159	546	6510	105	1071	0.496	1.669	6.201
SEP	1882	1985	104	2306	790	7580	123	1254	0.544	1.682	6.485
OCT	1882	1985	104	2904	918	8510	142	1451	0.500	1.299	5.223
NOV	1882	1985	104	2380	566	9750	142	1445	0.607	1.942	9.612
DEC	1882	1985	104	1402	491	3900	60	613	0.437	1.454	5.895
MTHS	1882	1985	104	3315	319	20800	110	3886	1.172	2.236	7.573
ANNL	1882	1985	104	3315	1785	5245	63	647	0.195	0.437	3.427

The River Northern Dvina (Severnaya Dvina), with a long period of record of 104 years and the biggest basin of the selected European rivers with 348000 km^2 size, has a mean discharge of 3315 m^3/s (annual maximum 5245 m^3/s, minimum 1785 m^3/s) and a mean discharge per unit area of 9.5 $l/(s*km^2)$.

Mean monthly maximum discharge is observed in May (13699 m^3/s), i.e. spring, and the respective minimum in March (716 m^3/s), i.e. late winter, almost coinciding with the absolute monthly extremes in May (20800 m^3/s) and February (316 m^3/s), respectively. Thus, as for the River Gloma, snow accumulation or ice jams in winter combined with snow melt in spring may be deduced.

The annual series has small variability and slightly right-tailed and leptokurtic distribution.

The monthly series has fairly high variability, the highest is observed at the end of winter in April (about 78 % variation coefficient), the lowest in January, April and May.

The skewness is mostly strongly right-sided, and in extreme cases combined with high kurtosis, especially in April and November. During these months, relatively high floods may occur. Only in May, the month with only small variability, there is no skew in the distribution and the shape is clearly platykurtic.

Basic Descriptive Statistics											
River:	**PECHORA**										
Station:	**Ust-Tsilma**										
GRDC#:	**6970650**										
Time interval	**Begin year**	**End year**	**# year**	**Mean**	**Min**	**Max**	**SE Mean**	**Std Dev**	**CF Var**	**CF Skw**	**CF Kur**
JAN	1932	1984	53	707	426	1000	20	145	0.204	0.005	2.358
FEB	1932	1984	53	560	331	832	18	132	0.236	-0.008	2.090
MAR	1932	1984	53	481	250	712	17	125	0.260	-0.102	2.197
APR	1932	1984	53	796	251	4390	108	784	0.985	3.490	15.781
MAY	1932	1984	53	8936	1790	18400	592	4309	0.482	0.059	2.438
JUN	1932	1984	53	13760	5700	24300	652	4750	0.345	0.514	2.883
JUL	1932	1984	53	4787	1950	11800	276	2012	0.420	1.493	5.761
AUG	1932	1984	53	2292	1150	5170	130	949	0.414	1.219	4.362
SEP	1932	1984	53	2953	981	5750	181	1314	0.445	0.667	2.643
OCT	1932	1984	53	3029	779	5990	167	1216	0.402	0.497	2.720
NOV	1932	1984	53	1559	457	4000	95	689	0.442	1.467	5.610
DEC	1932	1984	53	998	305	1430	32	230	0.230	-0.302	3.350
MTHS	1932	1984	53	3405	250	24300	174	4389	1.289	2.218	7.902
ANNL	1932	1984	53	3405	2576	4346	62	448	0.132	-0.033	2.551

The River Pechora, with a basin of 248000 km² size second largest of the selected European rivers, has a mean discharge of 3405 m³/s (annual maximum 4346 m³/s, minimum 2576 m³/s) and a mean discharge per unit area of 13.7 l/(s*km²), i.e. slightly lower than that of the River Gloma basin at comparable climatic conditions, but higher than those located more to the south-west of Europe..

Mean monthly maximum occurs in June (13760 m³/s), the mean minimum in March (481 m³/s), while the absolute monthly extremes are observed in June (24300 m³/s) and March/April (250/251 m³/s), respectively.

The annual series has small variability while having a no skew and only slightly leptokurtic distribution.

The monthly series' variability is different according to the seasons: In the winter period of December and January, small variability is coupled with normal or slightly left-sided skew, mostly platykurtic, i.e. some relatively small values tend to occur. On the other hand, in April the highest variability (variation coefficient of 98.5 %) is combined with elevated numbers of high discharge values, as the coefficients of skewness and kurtosis are extremely high. To a smaller extent, this holds to be true for the months of July and November.

Basic Descriptive Statistics											
River:	**RHEIN**										
Station:	**Rees**										
GRDC#:	**6335020**										
Time interval	**Begin year**	**End year**	**# year**	**Mean**	**Min**	**Max**	**SE Mean**	**Std Dev**	**CF Var**	**CF Skw**	**CF Kur**
JAN	1930	1996	67	2639	1030	6094	143	1174	0.445	0.965	3.760
FEB	1930	1996	67	2835	870	5920	146	1192	0.421	0.433	2.446
MAR	1930	1996	67	2683	952	6351	127	1039	0.387	0.818	3.888
APR	1930	1996	67	2503	1170	5100	102	834	0.333	0.680	3.558
MAY	1930	1996	67	2288	977	4970	96	786	0.344	0.967	4.204
JUN	1930	1996	67	2301	1159	4371	77	628	0.273	1.131	5.191
JUL	1930	1996	67	2156	1013	4650	82	668	0.310	1.012	4.984
AUG	1930	1996	67	1884	830	3664	68	557	0.296	0.469	3.441
SEP	1930	1996	67	1697	800	3500	69	565	0.333	0.910	4.140
OCT	1930	1996	67	1771	690	3820	88	723	0.408	1.003	3.779
NOV	1930	1996	67	1991	770	4621	112	916	0.460	1.088	3.868
DEC	1930	1996	67	2613	810	6917	163	1336	0.511	1.247	4.428
MTHS	1930	1996	67	2280	690	6917	34	970	0.425	1.224	4.971
ANNL	1930	1996	67	2280	1246	3280	60	493	0.216	-0.140	2.433

The River Rhein, with a basin size of 160000 km² one of the biggest rivers in Central Europe, has a mean discharge of 2280 m³/s (annual maximum 3280 m³/s, minimum 1246 m³/s) and a fairly high mean discharge per unit area of 14.3 l/(s*km²).

Mean monthly maximum occurs in February (2835 m³/s), i.e. winter, and the minimum in September (1697 m³/s), while the absolute monthly maximum and minimum occur in December and October (6917 and 690 m³/s) and August (60 m³/s), respectively.

The annual series has small variability while having a slightly left-tailed and platykurtic distribution.

The monthly series has elevated variability above 30 % variation coefficient, being strongest in winter from November to January, while the skewness is generally right-sided, and in extreme cases combined with high kurtosis, as in June. During these months, relatively high floods may occur.

Basic Descriptive Statistics											
River:	**SEINE**										
Station:	**Poses**										
GRDC#:	**6122100**										
Time interval	**Begin year**	**End year**	**# year**	**Mean**	**Min**	**Max**	**SE Mean**	**Std Dev**	**CF Var**	**CF Skw**	**CF Kur**
JAN	1971	1977	7	390	254	695	57	152	0.390	1.648	7.016
FEB	1971	1977	7	591	409	990	72	191	0.324	1.848	8.106
MAR	1971	1977	7	433	326	625	42	112	0.258	0.805	4.411
APR	1971	1977	7	381	256	640	50	133	0.350	1.395	6.412
MAY	1971	1977	7	307	200	431	32	85	0.278	0.655	3.997
JUN	1971	1977	7	244	146	336	25	67	0.276	-0.211	3.842
JUL	1971	1977	7	208	136	285	20	53	0.257	0.050	3.588
AUG	1971	1977	7	203	120	313	27	72	0.355	0.573	3.785
SEP	1971	1977	7	202	142	257	16	41	0.203	-0.051	3.649
OCT	1971	1977	7	242	165	433	35	92	0.378	1.864	8.031
NOV	1971	1977	7	347	203	610	55	146	0.422	0.923	5.116
DEC	1971	1977	7	454	225	730	59	155	0.341	0.531	6.091
MTHS	1971	1977	7	334	120	990	18	160	0.481	1.359	5.547
ANNL	1971	1977	7	334	244	431	28	75	0.224	0.251	2.925

The River Seine, by its basin of 65000 km² about half the size of river Labe, has a mean discharge of 334 m³/s (annual maximum 431 m³/s, minimum 224 m³/s) and a small mean discharge per unit area of 5.1 l/(s*km²).

Mean monthly maximum occurs in February (591 m³/s), i.e. winter, and the minimum in August/September (203/202 m³/s), while the absolute monthly maximum and minimum occur in February (990 m³/s) and August (120 m³/s), respectively.

The annual series has small variability and fairly normal, slightly right-tailed distribution.

The monthly series has small to elevated variability, being strongest in November with 42.2 % variation coefficient.

The skewness and kurtosis, however, are partly distinct:
While in the period October - May, right-sided skew with very high coefficients of kurtosis are observed, culminating in February (skew: 1.8, kurtosis: 8.1), in the summer part of the rest of the year normal distribution, slightly leptokurtic, is observed.

The short period of record of 7 years is limiting the reliability of the figures.

Basic Descriptive Statistics											
River:	**SEVERN (Sub-Series No. 1)**										
Station:	**Bewdley**										
GRDC#:	**6609500**										
Time interval	**Begin year**	**End year**	**# year**	**Mean**	**Min**	**Max**	**SE Mean**	**Std Dev**	**CF Var**	**CF Skw**	**CF Kur**
JAN	1965	1972	8	121	77	186	13	36	0.302	1.009	4.486
FEB	1965	1972	8	98	29	155	15	43	0.437	-0.137	3.936
MAR	1965	1972	8	82	63	107	5	15	0.184	0.787	4.091
APR	1965	1972	8	64	32	112	10	28	0.432	0.678	3.714
MAY	1965	1972	8	62	25	133	13	36	0.584	1.214	5.456
JUN	1965	1972	8	34	14	49	4	11	0.321	-0.420	5.191
JUL	1965	1972	8	29	14	94	9	27	0.923	2.630	10.679
AUG	1965	1972	8	28	19	35	2	6	0.207	-0.361	3.104
SEP	1965	1972	8	36	15	71	8	22	0.625	0.793	3.411
OCT	1965	1972	8	54	14	150	16	46	0.850	1.493	6.560
NOV	1965	1972	8	79	55	94	5	14	0.173	-0.922	4.074
DEC	1965	1972	8	132	52	300	28	80	0.602	1.575	6.535
MTHS	1965	1972	8	68	14	300	5	48	0.702	1.670	7.985
ANNL	1965	1972	8	68	48	80	4	11	0.158	-0.870	4.563

The River Severn, with its basin size of about 4000 km², has a mean discharge of 68 m³/s (annual maximum 80 m³/s, minimum 48 m³/s) and a relatively high mean discharge per unit area of 15.8 l/(s*km²) during the period 1965 - 1972.

Mean monthly maximum is observed in December (132 m³/s), i.e. winter, and the minimum in July/August (29/28 m³/s), while the absolute monthly maximum occurs in December (300 m³/s) and the respective minimum in June, July, September, October, perhaps also in August (14 - 19 m³/s), respectively.

The annual series has small variability and a distribution skewed to the left and strongly leptokurtic, i.e. markedly peaked.

The monthly series has small to very strong variability, being strongest in July with November with 92.3 % and 85.0 % variation coefficient, respectively.

In cases of high variation coefficients, distribution is right-tailed and extremely peaked, e.g. in July, October, and December.

However, the short period of record of 8 years is limiting the reliability of the figures.

Basic Descriptive Statistics											
River:	**SEVERN (Sub-Series No. 2)**										
Station:	**Bewdley**										
GRDC#:	**6609500**										
Time interval	**Begin year**	**End year**	**# year**	**Mean**	**Min**	**Max**	**SE Mean**	**Std Dev**	**CF Var**	**CF Skw**	**CF Kur**
JAN	1976	1984	9	121	82	162	11	33	0.276	0.001	2.329
FEB	1976	1984	9	108	56	214	17	51	0.476	1.252	5.193
MAR	1976	1984	9	99	42	176	17	51	0.515	0.384	2.911
APR	1976	1984	9	50	22	93	8	25	0.503	0.720	3.619
MAY	1976	1984	9	39	13	91	9	27	0.679	0.789	4.126
JUN	1976	1984	9	27	9	37	4	11	0.389	-0.727	3.089
JUL	1976	1984	9	14	5	22	2	5	0.369	-0.299	3.837
AUG	1976	1984	9	18	3	33	3	10	0.542	0.228	3.446
SEP	1976	1984	9	26	15	39	3	8	0.314	0.142	3.085
OCT	1976	1984	9	63	21	112	11	33	0.524	0.291	3.209
NOV	1976	1984	9	93	32	147	13	39	0.416	0.016	3.195
DEC	1976	1984	9	118	84	175	11	32	0.268	0.855	3.556
MTHS	1976	1984	9	65	3	214	5	49	0.759	0.838	2.897
ANNL	1976	1984	9	65	43	75	3	10	0.158	-1.149	5.152

For the River Severn in the slightly longer period 1976 - 1984 basically the same mean annual conditions prevail: mean discharge of 65(formerly in 1965 - 1972: 68) m^3/s (annual maximum 75 (80) m^3/s, minimum 43 (48) m^3/s) and a relatively high mean discharge per unit area of 15.0 (15.8) $l/(s*km^2)$.

The annual series has still small variability and a distribution slightly more skewed to the left and more strongly leptokurtic.

However, mean monthly maximum is now observed in January (December) (121 m^3/s), i.e. winter, and the minimum in July (July/August) (14 m^3/s), while the absolute monthly maximum occurs now in February (December) (214 m^3/s) and the respective minimum in July/August (June - October) (5 m^3/s), respectively.
The monthly series has small to strong variability, culminating in May (July/November) with 67.9 % variation coefficient (formerly 92.3/85.0), to a less extent in august and October, while the distribution is often normal with relatively extremely high values in February (skew: 1.3, kurtosis: 5.2) and relatively extremely low values in June and July (skew < 0).

The short period of record of 9 years is limiting the reliability of the figures another times.

Basic Descriptive Statistics												
River:	**SHANNON**											
Station:	**Killaloe**											
GRDC#:	**6502100**											
Time interval	**Begin year**	**End year**	**# year**	**Mean**	**Min**	**Max**	**SE Mean**	**Std Dev**	**CF Var**	**CF Skw**	**CF Kur**
JAN	1973	1979	7	311	229	417	27	72	0.231	0.417	3.727
FEB	1973	1979	7	318	194	400	27	72	0.228	-0.684	4.775
MAR	1973	1979	7	215	140	291	23	60	0.277	0.088	3.475
APR	1973	1979	7	151	84	222	22	59	0.392	0.016	2.664
MAY	1973	1979	7	105	56	189	18	48	0.461	0.959	4.742
JUN	1973	1979	7	57	21	173	20	52	0.916	2.351	9.806
JUL	1973	1979	7	43	15	63	6	16	0.369	-0.711	5.206
AUG	1973	1979	7	63	36	99	9	25	0.391	0.218	3.364
SEP	1973	1979	7	105	36	292	34	89	0.848	1.943	8.465
OCT	1973	1979	7	135	87	182	12	31	0.228	-0.256	4.959
NOV	1973	1979	7	240	157	337	27	72	0.300	0.346	3.683
DEC	1973	1979	7	328	182	477	34	91	0.278	0.048	5.686
MTHS	1973	1979	7	173	15	477	13	117	0.680	0.565	2.362
ANNL	1973	1979	7	173	138	205	9	23	0.133	-0.154	4.283

The River Shannon, with a basin size of roughly 12000 km², has a mean discharge of 173 m³/s (annual maximum 205 m³/s, minimum 138 m³/s) and a relatively high mean discharge per unit area of 14.8 l/(s*km²).

Mean monthly maximum is reached in December (328 m³/s), i.e. winter, and the minimum occurs in July (43 m³/s), while the respective absolute monthly maximum occurs in December (477 m³/s) and the respective minimum in July (15 m³/s), respectively.

Although the annual series has small variability and a distribution only slightly skewed to the left, the distribution is markedly leptokurtic, i.e. markedly peaked.

The monthly series' variability is high in some months, combined with extremely positively skewed and leptokurtic distribution in June and September.
In cases of high variation coefficients, distribution is right-tailed and extremely peaked, e.g. in July, October, and December.

Another times, the short period of record of 7 years is limiting the reliability of the figures.

Basic Descriptive Statistics											
River:	**TANA (Sub-Series No. 1)**										
Station:	**Polmak**										
GRDC#:	**6730500**										
Time interval	**Begin year**	**End year**	**# year**	**Mean**	**Min**	**Max**	**SE Mean**	**Std Dev**	**CF Var**	**CF Skw**	**CF Kur**
JAN	1912	1943	32	55	39	73	1	7	0.131	-0.343	4.071
FEB	1912	1943	32	48	33	63	1	6	0.128	-0.068	4.691
MAR	1912	1943	32	45	34	59	1	5	0.106	0.412	5.227
APR	1912	1943	32	48	35	62	1	6	0.125	0.453	3.539
MAY	1912	1943	32	410	54	1038	40	226	0.550	0.616	3.869
JUN	1912	1943	32	562	231	1377	54	303	0.540	0.895	3.193
JUL	1912	1943	32	197	92	613	17	96	0.488	2.703	13.571
AUG	1912	1943	32	156	60	407	13	74	0.476	1.509	6.166
SEP	1912	1943	32	154	75	443	13	71	0.460	2.321	10.982
OCT	1912	1943	32	134	64	246	7	42	0.314	0.963	3.813
NOV	1912	1943	32	98	55	188	6	32	0.325	1.362	4.714
DEC	1912	1943	32	69	46	90	2	12	0.172	-0.085	2.638
MTHS	1912	1943	32	165	33	1377	10	194	1.175	2.846	12.448
ANNL	1912	1943	32	165	102	268	6	31	0.191	0.983	5.835

The River Tana has a basin size of approximately 14000 km² and a mean discharge of 165 m³/s (annual maximum 268 m³/s, minimum 102 m³/s) and a mean discharge per unit area of 11.7 l/(s*km²) during the period 1912 - 1943.

Mean monthly maximum is reached in June (562 m³/s), and the minimum occurs in February - April (45 - 48 m³/s), while the respective absolute monthly maximum occurs in June (1377 m³/s) and the respective minimum in the period of February - April (33 - 34 m³/s).

Although the annual series has small variability, the distribution is markedly skewed to the right and prominently leptokurtic, i.e. strongly peaked.

The monthly series' variability is only high in some months, between May and November. The highest variation coefficient does not coincide with the highest skew, only to be negative in the period December - February, and the highest kurtosis: The highest coefficients are observed in July and August.

Basic Descriptive Statistics											
River:	**TANA (Sub-Series No. 2)**										
Station:	**Polmak**										
GRDC#:	**6730500**										
Time interval	**Begin year**	**End year**	**# year**	**Mean**	**Min**	**Max**	**SE Mean**	**Std Dev**	**CF Var**	**CF Skw**	**CF Kur**
JAN	1947	1987	41	53	37	79	1	8	0.152	0.889	5.124
FEB	1947	1987	41	45	34	58	1	6	0.129	0.236	2.501
MAR	1947	1987	41	42	32	53	1	5	0.122	0.237	2.681
APR	1947	1987	41	51	33	145	4	23	0.448	2.924	11.835
MAY	1947	1987	41	466	79	979	32	208	0.446	0.242	2.891
JUN	1947	1987	41	517	153	1253	38	244	0.471	0.770	4.038
JUL	1947	1987	41	200	92	449	14	88	0.440	1.113	4.324
AUG	1947	1987	41	165	60	339	11	68	0.414	0.912	3.443
SEP	1947	1987	41	163	65	432	12	78	0.478	1.847	7.068
OCT	1947	1987	41	144	76	381	8	54	0.373	2.217	11.266
NOV	1947	1987	41	94	51	160	3	22	0.235	0.753	4.099
DEC	1947	1987	41	66	40	114	2	12	0.186	1.359	8.278
MTHS	1947	1987	41	167	32	1253	8	185	1.106	2.324	8.969
ANNL	1947	1987	41	167	106	235	5	30	0.177	-0.115	2.906

For the River Tana in the longer period 1947 - 1987 basically the same mean annual conditions prevail: mean discharge of 167(formerly in 1912 - 1943: 165) m^3/s (annual maximum 235 (268) m^3/s, minimum 106 (102) m^3/s) and a relatively high mean discharge per unit area of 11.9 (11.7) $l/(s*km^2)$.

The annual series has still small variability, but the distribution now is more or less normal !

Mean monthly maximum is still observed in June (June) (517 m^3/s), and the minimum now only in February/March (February - April) (42 - 45 m^3/s), while the absolute monthly maximum occurs also in June (June) (1253 m^3/s) and the respective minimum in February - April (February - April) (32 - 34 m^3/s), respectively.
The monthly series has strong variability, too, now between April and October, shifted backward for one month. This time, highest skew and kurtosis are observed in April (July/August).

Basic Descriptive Statistics											
River:	**TAY**										
Station:	**Ballathie**										
GRDC#:	**6604610**										
Time interval	**Begin year**	**End year**	**# year**	**Mean**	**Min**	**Max**	**SE Mean**	**Std Dev**	**CF Var**	**CF Skw**	**CF Kur**
JAN	1980	1984	5	301	170	471	50	111	0.369	0.785	7.864
FEB	1980	1984	5	227	172	269	17	38	0.166	-0.719	6.466
MAR	1980	1984	5	243	173	297	21	47	0.194	-0.601	7.001
APR	1980	1984	5	144	100	209	18	40	0.278	1.278	9.009
MAY	1980	1984	5	103	45	231	33	74	0.718	1.918	9.935
JUN	1980	1984	5	75	50	126	14	32	0.431	1.344	7.503
JUL	1980	1984	5	47	31	66	7	15	0.314	0.372	4.863
AUG	1980	1984	5	58	25	109	16	35	0.613	0.796	5.973
SEP	1980	1984	5	150	68	208	29	64	0.428	-0.622	4.421
OCT	1980	1984	5	259	184	390	39	87	0.335	0.935	6.509
NOV	1980	1984	5	288	114	408	54	120	0.418	-0.609	6.154
DEC	1980	1984	5	267	149	342	33	74	0.279	-1.128	7.865
MTHS	1980	1984	5	180	25	471	14	110	0.613	0.473	2.636
ANNL	1980	1984	5	180	157	208	9	19	0.107	0.430	6.711

The River Tay, with a basin size of about 5000 km², has a mean discharge of 180 m³/s (annual maximum 208 m³/s, minimum 157 m³/s) and a extremely high mean discharge per unit area of 39.2 l/(s*km²).

Mean monthly maximum occurs in January (301 m³/s), i.e. winter, and the minimum in July (47 m³/s), while the respective absolute monthly extremes are reached in the same months: January (471 m³/s) and July/August (25 - 31 m³/s).

Although the annual series has small inter-annual variability and a distribution only slightly skewed to the right, the kurtosis is very high, i.e. extremely peaked.

The monthly series' inner-annual variability is mostly small, extremely elevated only in the months of May and August.

The skew and kurtosis show distributions strongly skewed to the right and to the left without a interpretable scheme, which together with the mostly extremely high kurtosis points at the probable missing of reliable information on extreme values as a consequence of the short period of record of only 5 years. The mean monthly discharge, however, seems to be reliable for all months except for May and August with variation coefficients above 60 %.

Basic Descriptive Statistics											
River:	**TEJO**										
Station:	**Almourol**										
GRDC#:	**6113050**										
Time interval	**Begin year**	**End year**	**# year**	**Mean**	**Min**	**Max**	**SE Mean**	**Std Dev**	**CF Var**	**CF Skw**	**CF Kur**
JAN	1976	1984	9	629	96	1636	172	517	0.823	0.962	4.373
FEB	1976	1984	9	919	40	3841	429	1288	1.401	1.825	6.734
MAR	1976	1984	9	512	42	1932	222	665	1.298	1.512	5.470
APR	1976	1984	9	291	50	1087	116	349	1.199	1.841	6.904
MAY	1976	1984	9	220	36	537	63	188	0.853	1.027	3.881
JUN	1976	1984	9	177	40	439	45	135	0.764	1.165	4.427
JUL	1976	1984	9	144	25	369	41	123	0.854	1.191	4.248
AUG	1976	1984	9	133	36	304	31	92	0.692	0.957	4.061
SEP	1976	1984	9	126	63	217	18	54	0.426	0.430	3.315
OCT	1976	1984	9	200	46	613	60	179	0.897	1.715	7.139
NOV	1976	1984	9	440	104	1212	122	366	0.830	1.411	5.462
DEC	1976	1984	9	659	143	1333	152	455	0.690	0.362	2.683
MTHS	1976	1984	9	371	25	3841	51	531	1.432	3.584	20.546
ANNL	1976	1984	9	371	90	884	90	269	0.725	1.016	4.007

The River Tejo, with a basin size of about 67000 km², has a mean discharge of 371 m³/s (annual maximum 884 m³/s, minimum 90 m³/s) and a relatively low mean discharge per unit area of 5.5 l/(s*km²).
Mean monthly discharge culminates in February (919 m³/s), i.e. winter, and is least in September (126 m³/s), while the respective absolute monthly maximum occurs in February (3841 m³/s) and the minimum in July (25 m³/s), respectively.

The annual series has very high variability of 72.5 % variation coefficient and a distribution strongly skewed to the right and markedly leptokurtic, i.e. markedly peaked.

The monthly series' variability is equally very high, even extraordinarily high between February and April (120 - 140 % variation coefficient).

Extreme right-tailedness and at least strong peakedness of the distribution are combined in all months besides September and December, culminating in February - April and October - November. This indicates that relatively high floods can occur in the winter season

Another times, the short period of record of 9 years for this river crossing relatively arid regions is limiting the reliability of the figures.

Basic Descriptive Statistics											
River:	THAMES										
Station:	Teddington										
GRDC#:	6607700										
Time interval	Begin year	End year	# year	Mean	Min	Max	SE Mean	Std Dev	CF Var	CF Skw	CF Kur
JAN	1965	1984	20	138	35	221	11	51	0.368	-0.257	2.895
FEB	1965	1984	20	136	36	258	13	60	0.437	-0.152	3.077
MAR	1965	1984	20	126	30	205	12	52	0.414	-0.263	2.496
APR	1965	1984	20	91	25	186	9	38	0.421	0.676	4.305
MAY	1965	1984	20	77	20	137	8	36	0.473	0.091	2.320
JUN	1965	1984	20	54	15	142	7	31	0.575	1.365	5.574
JUL	1965	1984	20	36	9	92	4	18	0.519	1.365	6.753
AUG	1965	1984	20	34	9	71	4	18	0.529	0.445	2.794
SEP	1965	1984	20	38	11	145	7	29	0.772	2.834	12.423
OCT	1965	1984	20	55	15	137	8	36	0.646	1.053	3.465
NOV	1965	1984	20	81	20	228	11	49	0.607	1.377	6.026
DEC	1965	1984	20	113	41	197	10	46	0.404	0.099	2.512
MTHS	1965	1984	20	82	9	258	4	55	0.672	0.784	2.774
ANNL	1965	1984	20	82	41	112	5	22	0.272	-0.405	2.523

The River Thames, with about 10000 km^2 basin size, has a mean discharge of 82 m^3/s (annual maximum 112 m^3/s, minimum 41 m^3/s) and a mean discharge per unit area of only 8.2 $l/(s*km^2)$.

Mean monthly maximum is observed in January/February (138/136 m^3/s), the minimum in January/August/September (36/34/38 m^3/s) with absolute extremes in February (258 m^3/s) and July/August (9 m^3/s).

Inter-annual variability of the annual series is relatively small, while a distribution slightly skewed to the left and platykurtic, indicating some relatively small values.

The monthly series´ variability is high, especially in the period September – November.

While the skew is not present or slightly left-sided in the winter season (December – March) and May, combined with platykurtic distribution. In other months, skew is fairly to extremely high, combined with elevated kurtosis, culminating in 2.8 and 12.4, respectively in September.

Basic Descriptive Statistics											
River:	VAENERN-GOETA										
Station:	Vaenersborg										
GRDC#:	6229500										
Time interval	**Begin year**	**End year**	**# year**	**Mean**	**Min**	**Max**	**SE Mean**	**Std Dev**	**CF Var**	**CF Skw**	**CF Kur**
JAN	1807	1992	186	540	251	878	10	133	0.246	0.293	2.698
FEB	1807	1992	186	537	204	921	10	134	0.249	0.364	3.005
MAR	1807	1992	186	533	193	912	10	134	0.252	0.487	3.223
APR	1807	1992	186	532	263	911	9	127	0.238	0.537	3.443
MAY	1807	1992	186	543	249	912	9	123	0.227	0.204	3.370
JUN	1807	1992	186	551	157	880	10	138	0.250	-0.528	3.189
JUL	1807	1992	186	530	155	859	11	149	0.281	-0.703	3.228
AUG	1807	1992	186	529	162	792	9	128	0.243	-0.471	3.134
SEP	1807	1992	186	523	192	857	9	128	0.244	-0.273	3.005
OCT	1807	1992	186	520	191	816	9	123	0.237	-0.060	2.884
NOV	1807	1992	186	531	166	984	9	125	0.235	0.218	3.567
DEC	1807	1992	186	540	173	934	10	131	0.243	0.034	2.933
MTHS	1807	1992	186	534	155	984	3	131	0.246	-0.020	3.115
ANNL	1807	1992	186	534	225	768	7	99	0.186	-0.102	2.670

The River Vaenern-Goeta, with a basin size of roughly 47000 km², has a mean annual discharge of 534 m³/s (annual maximum 768 m³/s, minimum 225 m³/s) and a mean discharge per unit area of 11.4 l/(s*km²).

Mean monthly maximum occurs in June (550 m³/s), the minimum in October or September (520/523 m³/s), while the absolute maximum is observed in November (984 m³/s) and the respective minimum in July or June (155/157 m³/s).

Inter-annual variability is small, with a distribution slightly skewed to the left side and platykurtic.

The monthly series' variability is very distinct from that one of other European rivers: Mean monthly values have an extremely small range of 520 – 550 m³/s, very constant standard deviation, corresponding to an inner-annual variability of 24 – 28 % variation coefficient, while the standard error of the mean is surprisingly constant.

The kurtosis is more or less within ranges of normal distribution, reaffirming the symmetry of the standard deviation. However, the skewness shows some deviations from symmetry: right-sided skew in March and April (some relatively high values), left-sided skew between June and August (some relatively low values).

Basic Descriptive Statistics											
River:	**WESER**										
Station:	**Intschede**										
GRDC#:	**6337200**										
Time interval	**Begin year**	**End year**	**# year**	**Mean**	**Min**	**Max**	**SE Mean**	**Std Dev**	**CF Var**	**CF Skw**	**CF Kur**
JAN	1921	1984	64	460	149	1155	28	226	0.492	0.881	4.016
FEB	1921	1984	64	485	116	1439	31	250	0.516	1.099	5.131
MAR	1921	1984	64	461	131	1050	26	207	0.449	0.880	3.371
APR	1921	1984	64	407	123	867	21	169	0.415	0.755	3.292
MAY	1921	1984	64	285	127	647	14	111	0.389	1.133	4.634
JUN	1921	1984	64	236	101	720	14	109	0.462	2.175	9.335
JUL	1921	1984	64	219	87	893	16	132	0.604	2.719	13.302
AUG	1921	1984	64	192	73	466	10	83	0.431	1.062	3.947
SEP	1921	1984	64	183	68	553	10	82	0.448	1.627	8.320
OCT	1921	1984	64	206	65	498	12	100	0.484	1.030	3.725
NOV	1921	1984	64	284	90	786	19	149	0.522	1.115	4.460
DEC	1921	1984	64	381	97	1040	28	221	0.581	1.185	3.862
MTHS	1921	1984	64	317	65	1439	7	197	0.621	1.529	5.867
ANNL	1921	1984	64	317	150	532	12	92	0.291	0.472	2.875

The River Weser, with its basin size of 38000 km², has a mean annual discharge of 317 m³/s (annual maximum: 532 m³/s, minimum: 150 m³/s) and a mean discharge per unit area of 8.4 l/(s*km²).

Mean monthly maximum discharge occurs in February (485 m³/s); the minimum in September (183 m³/s), the absolute maximum and minimum in February (1439 m³/s) and September/October (68/65 m³/s).

While annual series show more or less variability and normal kurtosis, the skew is slightly positive to the right side.

Throughout the year, the variability of the monthly series is high, culminating in December (58 % variation coefficient).

Skewness is always fairly up to extremely right-sided, especially in July, June and September, when also the kurtosis is extremely positive, i.e. skewed to the right side, indicating possible high floods in mid-summer.

Basic Descriptive Statistics											
River:	**WYE**										
Station:	**Ddol Farm**										
GRDC#:	**6608500**										
Time interval	**Begin year**	**End year**	**# year**	**Mean**	**Min**	**Max**	**SE Mean**	**Std Dev**	**CF Var**	**CF Skw**	**CF Kur**
JAN	1977	1989	13	11.0	4.3	18.4	1.3	4.8	0.433	0.352	2.562
FEB	1977	1989	13	8.2	1.5	16.2	1.1	3.8	0.461	0.421	4.219
MAR	1977	1989	13	9.9	2.3	19.2	1.4	5.0	0.500	0.544	3.558
APR	1977	1989	13	4.5	0.7	9.3	0.7	2.5	0.561	0.207	3.127
MAY	1977	1989	13	2.7	0.0	8.3	0.8	2.7	1.016	1.050	3.794
JUN	1977	1989	13	2.3	0.2	8.3	0.6	2.1	0.919	2.141	9.046
JUL	1977	1989	13	1.4	0.0	3.9	0.4	1.3	0.942	0.926	3.144
AUG	1977	1989	13	2.7	0.1	9.4	0.7	2.6	0.979	1.325	5.613
SEP	1977	1989	13	4.3	1.1	9.5	0.7	2.3	0.541	0.884	4.271
OCT	1977	1989	13	9.3	2.0	18.3	1.5	5.2	0.565	0.426	2.794
NOV	1977	1989	13	11.2	3.3	17.6	1.4	5.1	0.457	-0.109	2.357
DEC	1977	1989	13	12.3	6.0	17.5	1.2	4.2	0.337	-0.403	2.414
MTHS	1977	1989	13	6.7	0.0	19.2	0.4	5.3	0.793	0.732	2.575
ANNL	1977	1989	13	6.7	5.4	7.7	0.2	0.6	0.095	-0.214	3.428

The River Wye, with 174 km^2 the smallest of the selected basins, has the least mean annual discharge of 6.7 m^3/s (annual maximum 77 m^3/s, minimum 5.4 m^3/s), though the biggest mean discharge per unit area of 38.5 $l/(s*km^2)$.

Mean monthly maximum discharge is observed in December (12.3 m^3/s), the minimum in July (1.4 m^3/s), while the absolute extremes range from 19.2 m^3/s in March to 0.0 m^3/s in July.

The annual series shows very small variability, with normal distribution, slightly skewed to the left side.

Nevertheless, the monthly series shows marked and even extreme variability in the period from May to August with the exception of December with a somewhat smaller variation coefficient.

Skewness in winter (October – April) is around normal distribution, with skew to the left side in November and December, pointing at some relatively low values. For winter this period, mostly platykurtic distribution prevails. While for the months with marked right-sided skew (May – September) the kurtosis shows leptokurtic distributions, culminating in May (May: skew 2.1, kurtosis: 9.0).

7.3.2 Non-European Regions

7.3.2.1 Africa (GRDC Region #1)

Basic Descriptive Statistics											
River:	**NILE**										
Station:	**el Ekhsase**										
GRDC#:	**1362100**										
Time interval	**Begin year**	**End year**	**# year**	**Mean**	**Min**	**Max**	**SE Mean**	**Std Dev**	**CF Var**	**CF Skw**	**CF Kur**
JAN	1973	1984	12	1239	735	1528	67	232	0.187	-0.646	4.283
FEB	1973	1984	12	1035	822	1198	31	106	0.102	-0.469	3.875
MAR	1973	1984	12	1126	1008	1340	28	98	0.087	0.858	4.335
APR	1973	1984	12	1110	968	1469	38	131	0.118	1.995	8.489
MAY	1973	1984	12	1170	1067	1433	27	94	0.081	2.216	9.194
JUN	1973	1984	12	1542	1447	1643	16	57	0.037	0.071	3.375
JUL	1973	1984	12	1742	1642	1877	24	82	0.047	0.479	2.851
AUG	1973	1984	12	1560	1500	1657	16	54	0.034	0.704	2.830
SEP	1973	1984	12	1191	1076	1308	22	77	0.065	0.068	2.504
OCT	1973	1984	12	1103	974	1238	29	100	0.091	-0.031	2.091
NOV	1973	1984	12	1075	949	1226	26	89	0.083	0.059	2.628
DEC	1973	1984	12	1124	955	1347	37	129	0.115	0.426	2.801
MTHS	1973	1984	12	1251	735	1877	21	246	0.197	0.708	2.574
ANNL	1973	1984	12	1251	1131	1390	24	82	0.065	0.254	2.716

The River Nile, with a basin size of 2900000 km, has a mean discharge of 1251 m^3/s (annual maximum 1390 m^3/s, minimum 1131 m^3/s and a mean discharge per unit area of only 0.4 $l/(s*km^2)$ due to its epirheic character – the lower portion of the basin, does not contribute much to the river's runoff.

Mean monthly maximum discharge occurs in July (1742 m^3/s) and the minimum in February (1035 m^3/s), while the absolute maximum is observed in July (1877 m^3/s) and the respective minimum in January (735 m^3/s).

The annual series shows small variability with approximately normal distribution. The monthly series is characterised by little variability (around 10 % variation coefficient), only more prominent in January (19 %), very low in summer (June – August).

The skewness, however, has a very variable pattern:
Some months show symmetrical skew and prevailing platykurtic distribution (September – June). July, August and December are months of moderate right-sided skew with kurtosis of about normal distribution. In January and February, left-sided skew is combined with higher kurtosis, pointing at some relatively low-values.

March and April show considerable up to extremely right-sided skew combined with high positive kurtosis, culminating in May (2.2/9.2). The relatively short period of record of 12 years for a river with partly arid environmental conditions may be one cause of the variable distribution pattern.

Basic Descriptive Statistics											
River:	**BENUE**										
Station:	**Yola**										
GRDC#:	**1835800**										
Time interval	**Begin year**	**End year**	**# year**	**Mean**	**Min**	**Max**	**SE Mean**	**Std Dev**	**CF Var**	**CF Skw**	**CF Kur**
JAN	1960	1989	30	5	1	13	1	4	0.78	1.21	3.194
FEB	1960	1989	30	3	0	10	1	3	0.889	1.278	3.732
MAR	1960	1989	30	3	0	8	0	2	0.947	0.731	2.59
APR	1960	1989	30	2	0	6	0	2	1.129	0.989	2.845
MAY	1960	1989	30	4	0	17	1	4	0.939	1.816	7.469
JUN	1960	1989	30	7	2	16	1	3	0.521	1.484	4.825
JUL	1960	1989	30	22	7	52	2	10	0.472	0.884	4.187
AUG	1960	1989	30	51	14	114	4	24	0.477	0.86	3.663
SEP	1960	1989	30	89	23	174	8	44	0.495	0.607	2.705
OCT	1960	1989	30	40	0	77	4	21	0.522	0.061	2.222
NOV	1960	1989	30	30	5	199	7	38	1.281	3.175	15.525
DEC	1960	1989	30	8	2	21	1	7	0.791	1.302	3.313
MTHS	1960	1989	30	22	0	199	2	32	1.466	2.506	10.484
ANNL	1960	1989	30	22	9	46	2	9	0.401	1.066	4.517

The River Benue, a River Niger tributary with a basin size of 107000 km², has a mean discharge of 22 m³/s (annual maximum 46 m³/s, minimum 9 m³/s) and a mean discharge per unit area of only 0.2 l/(s*km²), pointing at the arid condition of this region.

Monthly mean maximum is reached in September (89 m³/s), the minimum in April (2 m³/s). While the respective absolute maximum is observed in November (199 m³/s) or September (174 m³/s), the absolute minimum either between February or May, or October.

The annual series' variability is high, as is the right-sided skew and the kurtosis, indicating some extremely high values.

The monthly series' variability is high throughout the year, with more or less about 50 % variation coefficient during June – October, the wet season period, the higher values being observed in the dry season period of December up to May, as in November. The extremes are reached in April (113 %) or November (128 %).

The distributions are markedly skewed to the right side with the exception of the month of October, while the kurtosis is not directly linearly depending on skew and platykurtic, but also extremely leptokurtic distributions are encountered.

Most prominent extreme skew and kurtosis are present before and after the wet season in May – June and November, indicating possible relatively high flood discharge in this month. Extreme skew without extremely positive, right-sided kurtosis is observed between December and February.

Basic Descriptive Statistics											
River:	ZAMBEZE										
Station:	Matundo-Cais										
GRDC#:	1891500										
Time interval	**Begin year**	**End year**	**# year**	**Mean**	**Min**	**Max**	**SE Mean**	**Std Dev**	**CF Var**	**CF Skw**	**CF Kur**
JAN	1976	1979	4								
FEB	1976	1979	4								
MAR	1976	1979	4								
APR	1976	1979	4								
MAY	1976	1979	4								
JUN	1976	1979	4								
JUL	1976	1979	4								
AUG	1976	1979	4								
SEP	1976	1979	4								
OCT	1976	1979	4								
NOV	1976	1979	4								
DEC	1976	1979	4								
MTHS	1976	1979	4	3337	540	12382	353	250	0.733	1.816	6.850
ANNL	1976	1979	4	3337							

The TS-programme did not yield results of sufficient reliability for this short period of time of only four years, only the CHPP-programme for the monthly sequence of the values.

7.3.2.2 Asia (GRDC Region #2)

Basic Descriptive Statistics											
River:	**CHANGJIANG (YANGTZE)**										
Station:	**Datong**										
GRDC#:	**2181900**										
Time interval	**Begin year**	**End year**	**# year**	**Mean**	**Min**	**Max**	**SE Mean**	**Std Dev**	**CF Var**	**CF Skw**	**CF Kur**
JAN	1947	1986	40	10164	1110	17800	466	2949	0.290	0.308	5.685
FEB	1947	1986	40	11105	6730	19400	424	2680	0.241	0.891	4.082
MAR	1947	1986	40	15047	7980	25100	696	4404	0.293	0.576	2.696
APR	1947	1986	40	23267	12800	36700	819	5179	0.223	-0.107	3.393
MAY	1947	1986	40	34497	23900	51800	1223	7735	0.224	0.466	2.454
JUN	1947	1986	40	40482	27200	60600	1307	8264	0.204	0.275	2.579
JUL	1947	1986	40	49233	32800	75200	1500	9484	0.193	0.664	3.371
AUG	1947	1986	40	43778	25900	84200	1682	10638	0.243	1.356	7.373
SEP	1947	1986	40	40570	21600	71300	1531	9683	0.239	0.614	4.672
OCT	1947	1986	40	34838	16800	51600	1336	8450	0.243	0.182	2.906
NOV	1947	1986	40	24108	13200	39000	992	6275	0.260	0.558	2.733
DEC	1947	1986	40	14579	8310	24400	594	3758	0.258	0.719	3.254
MTHS	1947	1986	40	28472	1110	84200	684	14975	0.526	0.464	2.566
ANNL	1947	1986	40	28472	21377	42933	705	4461	0.157	0.977	4.658

The River Changjiang or Yangtze, with a basin size of about 1705000 km², has a mean discharge of 28472 m³/s (annual maximum 42933 m³/s, minimum 21377 m³/s) and a fairly high mean discharge per unit area of 16.7 l/(s*km²).

Mean monthly discharge reaches its maximum in July (49233 m³/s), its minimum in January (10164 m³/s), while the absolute maximum is reached in August (84200 m³/s), the respective minimum in Jan (1110 m³/s).

The annual series shows small variability combined with marked right-sided skew and prominent leptokurtic distribution, pointing at some relatively high values.

The monthly series, however, shows still small variability culminating in January and March. Three distinct groups of months may be distinguished concerning skewness and kurtosis:
1st: Within most months, skew and kurtosis are small to fairly high, coupled with indifferent kurtosis around normal distribution. An exceptional negative, but small skew combined with small leptokurtic conditions, is observed in April.
2nd: In late summer (August and September), marked leptokurtic distribution together with a marked skew to the right-side is calling the attention, pointing at relatively high floods. The maximum monthly discharge is, therefore, observed just in August.
3rd: In the months of January and February, marked kurtosis combined with distinct right-sided skew is observed, indicating the presence of some relatively high values, too.

Basic Descriptive Statistics											
River:	**MEKONG**										
Station:	**Pakse**										
GRDC#:	**2469260**										
Time interval	**Begin year**	**End year**	**# year**	**Mean**	**Min**	**Max**	**SE Mean**	**Std Dev**	**CF Var**	**CF Skw**	**CF Kur**
JAN	1982	1991	10	2814	2060	3493	114	361	0.128	-0.389	6.356
FEB	1982	1991	10	1972	1505	2302	65	206	0.104	-1.017	6.650
MAR	1982	1991	10	1939	1482	2392	77	244	0.126	0.090	5.131
APR	1982	1991	10	1842	1551	2244	69	218	0.118	0.495	3.664
MAY	1982	1991	10	2478	1917	3305	126	398	0.160	0.767	4.911
JUN	1982	1991	10	6900	4271	10740	587	1857	0.269	0.799	4.785
JUL	1982	1991	10	14566	9611	20645	1137	3596	0.247	0.479	3.403
AUG	1982	1991	10	25831	19874	32022	1328	4201	0.163	0.230	2.921
SEP	1982	1991	10	23888	18677	26803	770	2435	0.102	-1.037	5.016
OCT	1982	1991	10	16817	13416	21109	656	2074	0.123	0.568	5.411
NOV	1982	1991	10	8291	6187	10667	379	1200	0.145	0.405	5.255
DEC	1982	1991	10	4404	3685	5516	166	526	0.119	1.099	5.186
MTHS	1982	1991	10	9312	1482	32022	792	8672	0.931	0.984	2.711
ANNL	1982	1991	10	9312	7596	11126	324	1025	0.110	0.111	4.056

The River Mekong, with a basin size of 5945000 km², has a mean discharge of 9312 m³/s (annual maximum: 11126 m³/s, minimum: 7596 m³/s) and a fairly high mean discharge per unit area of 17.1 l/ (s*km²).

Mean monthly maximum discharge is observed in August (25831 m³/s), minimum in April (1842 ³/s), with a high maximum/minimum ratio of 14 ! The absolute maximum is observed in August (32022), the respective minimum in March (1482 m³/s).

Annual series shows small variability in significant slightly positive skew, but prominent kurtosis, pointing at some extreme values.

Monthly series' variability is small, around 12 % variation coefficient, except for June and July when relatively high values of about 25 % are observed.

Considering skew and kurtosis, the months of April, July and August show somewhat right-tailed skew, combined with normal or slightly leptokurtic distribution.
The other months show all marked kurtosis (about > 5), while the skewness is indifferently:

- no skew in March
- fairly right-sided skew in the periods May – June and October – December
- fairly high left-sided skew in January, February and September

Basic Descriptive Statistics											
River:	**LENA**										
Station:	**Kusur**										
GRDC#:	**2903420**										
Time interval	**Begin year**	**End year**	**# year**	**Mean**	**Min**	**Max**	**SE Mean**	**Std Dev**	**CF Var**	**CF Skw**	**CF Kur**
JAN	1936	1994	59	2777	1530	4199	85	652	0.235	0.376	2.436
FEB	1936	1994	59	2131	1020	3530	79	610	0.286	0.441	2.579
MAR	1936	1994	59	1656	692	2969	74	572	0.346	0.754	2.786
APR	1936	1994	59	1351	429	2730	63	481	0.356	0.909	3.449
MAY	1936	1994	59	6260	563	32000	932	7159	1.144	2.314	7.918
JUN	1936	1994	59	73969	44400	100480	1418	10890	0.147	0.145	3.308
JUL	1936	1994	59	39536	25000	58100	1094	8407	0.213	0.316	2.266
AUG	1936	1994	59	27254	12854	42906	837	6427	0.236	0.176	3.127
SEP	1936	1994	59	23848	13219	36000	817	6279	0.263	0.148	2.134
OCT	1936	1994	59	13624	2300	21700	502	3857	0.283	-0.060	3.114
NOV	1936	1994	59	3499	1900	9360	142	1092	0.312	2.657	16.205
DEC	1936	1994	59	2927	1890	6530	100	767	0.262	1.879	10.181
MTHS	1936	1994	59	16569	429	100480	816	21709	1.310	1.725	5.341
ANNL	1936	1994	59	16569	12478	22626	259	1986	0.120	0.525	3.426

The River Lena, with its 2340000 km² basin size, has a mean discharge of 16569 m³/s (annual maximum 22626 m³/s, min 12478 m³/s) and a mean discharge per unit area of only 7.1 l/(s*km²).

Mean monthly maximum is reached in June (73969 m³/s), minimum in April (1315 m³/s), only 2 months before, while the absolute maximum and minimum is observed in the same months (100480 and 429 m³/s), suspected to be due to different times of snow and ice jam breaking in different years.

The annual series shows variability with faintly right-sided skew and slightly leptokurtic distribution.

Monthly series are small to moderately variable (20 – 35 % variation coefficient) besides the outstanding 114 % variability of the month of May.

Skewness is only small in the period of July to October, with platykurtic or normal distribution.
In the plain winter (the January – March), the distribution is fairly skewed to the right-side and platykurtic, in April somewhat more skewed and slightly leptokurtic.
For the other winter months of November to December and in the spring month May, the kurtosis is extremely high. In November and December the skew is extremely to the right side, in early spring including May, too.

Basic Descriptive Statistics											
River:	**YENISEI**										
Station:	**Igarka**										
GRDC#:	**290915**										
Time interval	**Begin year**	**End year**	**# year**	**Mean**	**Min**	**Max**	**SE Mean**	**Std Dev**	**CF Var**	**CF Skw**	**CF Kur**
JAN	1936	1994	59	6006	4000	9260	190	1461	0.243	0.470	2.082
FEB	1936	1994	59	5927	3770	8790	213	1635	0.276	0.245	1.552
MAR	1936	1994	59	5928	3380	9668	269	2065	0.348	0.486	1.793
APR	1936	1994	59	5914	3120	10380	300	2303	0.389	0.453	1.753
MAY	1936	1994	59	27448	6180	65000	1726	13259	0.483	0.941	3.675
JUN	1936	1994	59	77468	41900	112000	1784	13705	0.177	-0.054	3.959
JUL	1936	1994	59	26519	17629	36700	634	4872	0.184	0.135	2.300
AUG	1936	1994	59	17473	12000	25600	445	3418	0.196	0.710	2.930
SEP	1936	1994	59	16830	11035	23800	366	2808	0.167	0.054	2.721
OCT	1936	1994	59	13895	8220	20800	319	2454	0.177	0.502	3.466
NOV	1936	1994	59	6743	4640	11441	188	1445	0.214	1.205	5.149
DEC	1936	1994	59	5740	4200	8778	162	1243	0.217	0.949	2.959
MTHS	1936	1994	59	17991	3120	112000	768	20425	1.135	2.370	8.193
ANNL	1936	1994	59	17991	15543	20966	179	1377	0.077	0.210	2.294

The River Yenisei, has a basin of 2440000 km² and a mean discharge of 17991 m³/s (annual maximum 20966 km², minimum 15543 km²) and a mean discharge per unit area of only 7.4 l/(s*km²) and a discharge regime similar to River Lena.

Mean monthly maximum is observed in June (77468 m³/s), minimum in April (5914 m³/s), 2 months before. The absolute maximum and minimum occur equally in June (112000 m³/s) and in April (3120 m³/s).

The annual series shows very small variability, a faintly right-sided skewed and some platykurtic distribution.

The monthly series' variability is small from July to February and only moderately high for the rest of the year, culminating in 48.3 % variation coefficient in May.

As for River Lena, the skewness is mostly small for most of the period July to October, besides August, while normal to platykurtic distribution prevails. Moderate right-sided skew and leptokurtic distribution characterises also the period January – April. November, December and May show prominent right-sided skew with normal to strong leptokurtic distribution.

Basic Descriptive Statistics											
River:	OB										
Station:	Salekhard										
GRDC#:	2912600										
Time interval	Begin year	End year	# year	Mean	Min	Max	SE Mean	Std Dev	CF Var	CF Skw	CF Kur
JAN	1936	1994	59	4771	3050	6930	124	954	0.200	0.377	2.678
FEB	1936	1994	59	3906	2400	5649	93	713	0.183	0.479	3.142
MAR	1936	1994	59	3460	2120	6050	88	677	0.196	1.106	5.655
APR	1936	1994	59	3539	2400	6131	103	791	0.224	1.128	4.458
MAY	1936	1994	59	14933	5260	26041	625	4802	0.322	0.270	2.922
JUN	1936	1994	59	32918	21900	39747	437	3355	0.102	-0.720	3.974
JUL	1936	1994	59	30022	14400	42587	720	5530	0.184	-0.482	3.478
AUG	1936	1994	59	22382	9290	43423	1172	8999	0.402	0.380	2.278
SEP	1936	1994	59	14057	6640	33080	749	5756	0.410	1.466	5.084
OCT	1936	1994	59	10381	5860	20000	314	2408	0.232	1.164	6.773
NOV	1936	1994	59	6199	3350	10400	229	1762	0.284	0.354	2.590
DEC	1936	1994	59	5438	3390	7866	152	1168	0.215	0.143	2.125
MTHS	1936	1994	59	12667	2120	43423	407	10839	0.856	1.066	2.766
ANNL	1936	1994	59	12667	8791	17812	252	1937	0.153	0.278	2.856

The River Ob, with a basin size of approximately 2950000 km, has a mean discharge of 12667 m^3/s (annual maximum 17812 m^3/s, minimum 8791 m^3/s) and a mean discharge per unit area of 5.1 $l/(s*km^2)$.

Mean annual maximum discharge is observed in June (32918 m^3/s), minimum in March (3460 m^3/s), 3 months earlier. Absolute maximum and minimum discharge occur in the same months: June (39747 m^3/s) and March (2120 m^3/s).

The annual series shows little variability with slightly right-sided skew and slight platykurtic kurtosis.

The monthly series' variability is mostly small, only elevated in May, August and September (32.2/40.2/41.0 % variation coefficient).

More or less small to medium right-sided skew, together with platykurtic distributions are observed in January – February, May, August, November – December.
In late winter (March – April) strong right-sided skew and high kurtosis are combined as is the case in early winter (September – October), pointing at high variability with especially relatively high floods.
In June and July, however, the distributions are somewhat leptokurtic, but distinctly skewed to the left side, i.e. some relatively small values occur.

7.3.2.3 South America (GRDC Region #3)

Basic Descriptive Statistics											
River:	**ORINOCO**										
Station:	**Puente Angostura**										
GRDC#:	**3206720**										
Time interval	**Begin year**	**End year**	**# year**	**Mean**	**Min**	**Max**	**SE Mean**	**Std Dev**	**CF Var**	**CF Skw**	**CF Kur**
JAN	1925	1989	65	13123	8635	19656	300	2423	0.185	0.437	2.832
FEB	1925	1989	65	8051	4599	13944	255	2060	0.256	0.726	3.222
MAR	1925	1989	65	7127	3951	14308	265	2140	0.300	0.941	3.800
APR	1925	1989	65	8897	3398	15988	331	2669	0.300	0.466	2.851
MAY	1925	1989	65	19540	5274	32986	727	5862	0.300	0.215	2.978
JUN	1925	1989	65	34684	16936	48618	944	7613	0.220	-0.101	2.810
JUL	1925	1989	65	53181	30666	71436	1101	8876	0.167	-0.332	2.971
AUG	1925	1989	65	65331	43964	85963	1141	9198	0.141	-0.110	2.976
SEP	1925	1989	65	60149	44660	73904	869	7007	0.116	-0.207	2.587
OCT	1925	1989	65	45868	29857	58335	794	6403	0.140	-0.190	2.604
NOV	1925	1989	65	30524	22595	47475	635	5116	0.168	0.960	4.297
DEC	1925	1989	65	21225	15076	33824	461	3716	0.175	0.880	4.535
MTHS	1925	1989	65	30642	3398	85963	752	21003	0.685	0.521	2.020
ANNL	1925	1989	65	30642	21245	37109	435	3507	0.114	-0.165	2.820

The River Orinoco, with its basin of 836000 km² size, has a mean discharge of 30642 m³/s (annual maximum 37109 m³/s, minimum 21245 m³/s) and a high mean discharge per unit area of 36.6 l/(s*km²).

Mean monthly discharge culminates in August (65331 m³/s), the minimum is reached in March (7127 m³/s). Absolute monthly discharge ranges form a maximum of 85963 m³/s in August to a minimum of 3398 m³/s in April.

The annual series has small variability with slightly negative skew and platykurtic distribution.

The monthly series is of small variability, culminating between March and May.

Negative skew prevails between June and October, combined with normal or slightly platykurtic distribution. January, April, May show small to medium skew to the right, with small platykurtic distribution. February, March and November – December are periods with strong right-sided skew with leptokurtic distribution.

Basic Descriptive Statistics											
River:	**PARANA**										
Station:	**Corrientes**										
GRDC#:	**3265300**										
Time interval	**Begin year**	**End year**	**# year**	**Mean**	**Min**	**Max**	**SE Mean**	**Std Dev**	**CF Var**	**CF Skw**	**CF Kur**
JAN	1905	1982	78	18211	7444	33800	621	5486	0.301	0.397	3.304
FEB	1905	1982	78	20917	10800	34000	629	5551	0.265	0.420	2.819
MAR	1905	1982	78	21096	10500	36600	646	5709	0.271	0.473	3.247
APR	1905	1982	78	19210	11000	30600	532	4701	0.245	0.454	2.223
MAY	1905	1982	78	16699	9844	31700	510	4504	0.270	1.042	4.231
JUN	1905	1982	78	16795	7955	40300	617	5450	0.324	1.375	6.521
JUL	1905	1982	78	15073	6706	33400	554	4894	0.325	1.088	4.769
AUG	1905	1982	78	12483	5348	25200	477	4214	0.338	1.095	4.526
SEP	1905	1982	78	12001	4619	26700	471	4156	0.346	0.803	3.902
OCT	1905	1982	78	13946	4092	29100	581	5127	0.368	0.668	3.154
NOV	1905	1982	78	14450	6136	25400	524	4627	0.320	0.209	2.637
DEC	1905	1982	78	15413	6562	41000	680	6007	0.390	1.300	6.188
MTHS	1905	1982	78	16358	4092	41000	190	5816	0.356	0.690	3.534
ANNL	1905	1982	78	16358	9413	25583	390	3447	0.211	0.347	2.846

The River Paraná with a basin of 195000 km² size has a mean discharge of 16358 m³/s (annual maximum 25583 m³/s, minimum 9413 m³/s) and a mean discharge per unit area of 8.3 l/(s*km²).

Mean monthly maximum is reached in March (21096 m³/s), its minimum in September (12001 m³/s), absolute maximum is reached in December (41000 m³/s), the respective minimum in October (4092 m³/s).

The annual series' variability is small, with slightly right-sided skew and leptokurtic distribution.

The monthly series' variability is around 30 % variation coefficient, culminating in October (36,8 %) and its minimum in April (24,5 %).

With the exception of small skew in November, all months show medium to strong right-sided skew. The kurtosis for January – April and November is about normal or platykurtic (April, November).
While strongly leptokurtic in the rest of the year (December, May – September), especially in June and December, pointing at relatively extremely high values, confirmed by almost the same absolute maximum discharge (40300 and 4100 m³/s, respectively).

7.3.2.4 North America (GRDC Region #4)

Basic Descriptive Statistics											
River:	MISSISSIPPI										
Station:	Vicksburg, Miss.										
GRDC#:	4127800										
Time interval	Begin year	End year	# year	Mean	Min	Max	SE Mean	Std Dev	CF Var	CF Skw	CF Kur
JAN	1969	1982	14	19677	4930	34900	2137	7996	0.406	0.078	4.001
FEB	1969	1982	14	21690	7180	39100	2592	9698	0.447	0.387	2.756
MAR	1969	1982	14	23833	3410	38500	2481	9281	0.389	-0.375	4.119
APR	1969	1982	14	29037	12421	50200	2983	11160	0.384	0.522	3.080
MAY	1969	1982	14	25473	12600	52400	2869	10735	0.421	1.199	5.187
JUN	1969	1982	14	19477	7330	35200	2161	8088	0.415	0.657	3.541
JUL	1969	1982	14	14412	10052	20920	905	3385	0.235	0.478	2.978
AUG	1969	1982	14	11229	7870	16600	633	2368	0.211	0.784	4.119
SEP	1969	1982	14	10090	5560	17100	746	2792	0.277	1.147	5.781
OCT	1969	1982	14	10336	7170	15500	740	2768	0.268	0.612	2.726
NOV	1969	1982	14	12344	7265	23100	1183	4427	0.359	1.115	4.714
DEC	1969	1982	14	18436	7790	32573	2246	8403	0.456	0.405	2.494
MTHS	1969	1982	14	18003	3410	52400	730	9456	0.525	1.138	4.122
ANNL	1969	1982	14	18003	12311	27807	1241	4645	0.258	0.653	3.343

The River Mississippi, with about 2964000 km² basin size, has a mean discharge of 18003 m³/s (annual maximum 27807 m³/s, minimum 12311 m³/s) and a mean discharge per unit area of 6.1 l/(s*km²).

Mean monthly discharge reaches its maximum in April (29037 m³/s), its minimum in September (10090 m³/s), the respective absolute maximum and minimum are observed in May (52400 m³/s) and March (3410 m³/s), i.e. at the end of winter.

The annual series shows still small variability, though marked right-sided skew and some leptokurtic distribution.

The monthly series have small variability from mid-summer up to early autumn (July – October), and a stronger one during the rest of the year, but not exceeding the 46 % variation coefficient of December.

The skewness and kurtosis show complex behaviour:
All months have positive, right-sided skew, some of them very distinct ones, with the exception of the months of January (no skew) and March (negative skew).
Nevertheless, in winter (December – March), mid-summer (June – July) and mid-autumn (October) the skewness and kurtosis coefficients show generally normal or slightly right-sided skew combined with moderate platykurtic, normal or moderate leptokurtic distribution. Outstanding right-sided skew with respective leptokurtic distributions are observed in spring (May), early autumn (September), and early winter (November), pointing at relatively high floods in these months

7.4 Trends of Annual and Monthly Series

Trends of Annual and Monthly Series (Programme TREND1)					
River:	**ANGERMAN**				
Total period:	**1965-1992**				
Time interval	**Mean**	**StdDev**	**Slope**	**Intercept**	**R**
JAN	487.04	75.51	3.66	-6755.01	0.405
FEB	501.75	79.02	5.16	-9702.09	0.545
MAR	462.43	88.24	4.97	-9361.85	0.470
APR	446.11	138.19	6.76	-12926.37	0.409
MAY	702.75	183.07	2.31	-3876.39	0.106
JUN	571.86	171.02	1.12	-1635.14	0.055
JUL	436.61	172.92	3.38	-6241.24	0.164
AUG	420.57	192.43	9.78	-18928.01	0.425
SEP	415.50	170.68	10.56	-20471.92	0.516
OCT	458.43	142.7	8.13	-15632.72	0.476
NOV	497.96	86.48	3.79	-6992.07	0.366
DEC	471.50	62.75	3.19	-5848.44	0.426
ANNL	**489.38**	**79.32**	**5.23**	**-9864.27**	**0.550**

Trends of Annual and Monthly Series (Programme TREND1)					
River:	**BENUE**				
Total period:	**1960-1989**				
Time interval	**Mean**	**StdDev**	**Slope**	**Intercept**	**R**
JAN	4.87	3.79	0.09	-180.50	0.222
FEB	3.33	2.96	0.08	-161.83	0.253
MAR	2.57	2.43	0.11	-211.36	0.399
APR	1.83	2.07	0.12	-239.32	0.527
MAY	3.90	3.66	0.17	-337.41	0.422
JUN	6.53	3.40	0.03	-47.06	0.072
JUL	22.07	10.41	-0.57	1141.32	-0.486
AUG	51.17	24.39	-0.87	1765.62	-0.319
SEP	88.77	43.90	-2.08	4188.44	-0.423
OCT	39.83	20.80	-1.03	2081.10	-0.444
NOV	30.00	38.44	-1.03	2062.04	-0.240
DEC	8.27	6.54	0.07	-137.57	0.101
ANNL	**21.93**	**8.80**	**-0.41**	**826.96**	**-0.414**

Trends of Annual and Monthly Series (Programme TREND1)					
River:	**CHANGJIANG**				
Total period:	**1947-1986**				
Time interval	**Mean**	**StdDev**	**Slope**	**Intercept**	**R**
JAN	10164.42	2949.39	-84.16	175664.59	-0.334
FEB	11104.75	2679.91	-49.04	107542.57	-0.214
MAR	15046.55	4403.67	-0.28	15594.45	-0.001
APR	23266.68	5178.77	28.95	-33672.34	0.065
MAY	34497.43	7735.15	-119.14	268779.34	-0.180
JUN	40482.05	8263.97	-88.22	213974.94	-0.125
JUL	49232.50	9483.92	-41.23	130309.12	-0.051
AUG	43777.50	10637.87	-300.14	634004.19	-0.330
SEP	40570.00	9683.17	-287.15	605247.00	-0.347
OCT	34837.50	8450.24	-149.28	328392.03	-0.207
NOV	24107.50	6275.45	-136.73	292979.34	-0.255
DEC	14579.25	3758.47	-43.41	99952.28	-0.135
ANNL	**28472.18**	**4461.38**	**-105.82**	**236563.94**	**-0.277**

Trends of Annual and Monthly Series (Programme TREND1)					
River:	**EBRO**				
Total period:	**1953-1983**				
Time interval	**Mean**	**StdDev**	**Slope**	**Intercept**	**R**
JAN	690.07	378.22	-11.79	23900.53	-0.284
FEB	754.80	430.29	-6.16	12884.48	-0.130
MAR	719.83	319.53	-11.23	22822.79	-0.320
APR	610.11	315.91	-5.48	11397.58	-0.158
MAY	501.91	307.61	-2.97	6353.32	-0.088
JUN	481.72	268.74	-1.16	2770.13	-0.039
JUL	203.07	90.75	2.25	-4231.63	0.226
AUG	130.03	87.55	1.17	-2168.63	0.121
SEP	193.02	110.10	2.24	-4211.06	0.185
OCT	306.80	235.38	-4.49	9149.22	-0.174
NOV	465.64	316.09	-5.24	10784.62	-0.151
DEC	577.34	403.70	-12.36	24899.99	-0.278
ANNL	**469.53**	**146.99**	**-4.60**	**9529.28**	**-0.285**

Trends of Annual and Monthly Series (Programme TREND1)					
River:	**EMS**				
Total period:	**1980-1984**				
Time interval	**Mean**	**StdDev**	**Slope**	**Intercept**	**R**
JAN	150.80	45.14	7.90	-15507.00	0.341
FEB	154.40	25.66	2.80	-5395.20	0.214
MAR	132.80	74.91	-12.10	24115.00	-0.315
APR	86.00	28.35	-2.10	4248.20	-0.146
MAY	72.20	34.64	17.70	-35009.20	0.878
JUN	51.60	18.77	10.70	-21155.80	0.944
JUL	68.20	47.28	-21.90	43474.00	-0.817
AUG	33.20	13.27	-5.80	11528.80	-0.781
SEP	33.80	12.21	-1.60	3205.00	-0.257
OCT	57.80	38.54	11.30	-22338.80	0.555
NOV	78.40	36.43	-3.10	6222.60	-0.168
DEC	113.40	40.71	-14.60	29050.60	-0.663
ANNL	**86.05**	**17.77**	**-0.90**	**1869.85**	**-0.100**

Trends of Annual and Monthly Series (Programme TREND1)					
River:	**GARONNE**				
Total period:	**1921-1979**				
Time interval	**Mean**	**StdDev**	**Slope**	**Intercept**	**R**
JAN	877.71	497.26	1.25	-1565.89	0.043
FEB	1009.59	526.14	5.94	-10577.81	0.194
MAR	907.30	528.47	-3.59	7915.88	-0.117
APR	856.04	428.84	-3.44	7557.13	-0.138
MAY	804.27	379.17	-0.65	2067.72	-0.029
JUN	568.35	282.45	0.95	-1285.29	0.058
JUL	294.57	182.39	0.07	153.00	0.007
AUG	185.30	98.70	0.02	138.80	0.004
SEP	203.96	118.66	0.57	-899.54	0.082
OCT	289.16	187.56	1.23	-2115.20	0.113
NOV	479.75	271.23	-1.34	3102.17	-0.085
DEC	826.41	614.82	-0.42	1650.17	-0.012
ANNL	**608.53**	**182.46**	**0.05**	**511.76**	**0.005**

Trends of Annual and Monthly Series (Programme TREND1)					
River:	**GLOMA**				
Total period:	**1902-1984**				
Time interval	**Mean**	**StdDev**	**Slope**	**Intercept**	**R**
JAN	223.94	111.30	2.61	-4843.39	0.565
FEB	185.80	101.17	2.33	-4346.66	0.556
MAR	196.93	99.36	1.83	-3364.97	0.445
APR	490.84	219.85	0.41	-313.53	0.045
MAY	1574.24	501.95	-3.17	7741.29	-0.152
JUN	1489.57	420.26	-3.27	7838.43	-0.187
JUL	1044.00	343.39	-2.49	5873.28	-0.174
AUG	817.71	326.68	-3.88	8350.84	-0.286
SEP	682.67	327.35	-1.21	3035.26	-0.089
OCT	612.04	278.65	2.07	-3402.39	0.179
NOV	455.71	210.96	2.06	-3545.71	0.235
DEC	298.04	144.64	2.51	-4579.00	0.418
ANNL	**672.62**	**108.35**	**-0.02**	**703.62**	**-0.004**

Trends of Annual and Monthly Series (Programme TREND1)					
River:	**GUADALQUIVIR**				
Total period:	**1952-1993**				
Time interval	**Mean**	**StdDev**	**Slope**	**Intercept**	**R**
JAN	254.13	368.55	-7.40	14843.82	-0.246
FEB	285.52	379.46	-7.19	14473.94	-0.233
MAR	250.13	334.16	-10.42	20811.14	-0.383
APR	139.28	162.47	-7.06	14061.86	-0.533
MAY	73.56	74.00	-2.31	4624.18	-0.382
JUN	45.62	34.28	-0.74	1512.56	-0.266
JUL	32.42	14.15	-0.30	615.49	-0.256
AUG	33.32	12.64	-0.27	563.08	-0.261
SEP	33.40	21.98	-0.53	1085.66	-0.298
OCT	44.99	54.21	-1.48	2957.21	-0.334
NOV	84.55	107.23	-2.30	4622.30	-0.263
DEC	171.72	243.98	-5.35	10718.38	-0.269
ANNL	**120.72**	**112.40**	**-3.78**	**7574.14**	**-0.412**

Trends of Annual and Monthly Series (Programme TREND1)					
River:	**JUCAR**				
Total period:	**1925-1981**				
Time interval	**Mean**	**StdDev**	**Slope**	**Intercept**	**R**
JAN	54.33	26.19	-0.65	1321.55	-0.411
FEB	60.88	33.94	-0.83	1688.83	-0.408
MAR	61.49	34.80	-0.92	1864.93	-0.440
APR	52.54	23.87	-0.72	1451.34	-0.498
MAY	51.82	21.88	-0.56	1152.19	-0.427
JUN	47.85	15.41	-0.48	989.21	-0.519
JUL	43.20	9.95	-0.11	260.60	-0.186
AUG	40.44	8.73	-0.03	102.84	-0.061
SEP	40.84	14.92	-0.27	565.44	-0.299
OCT	41.93	15.48	-0.22	468.14	-0.234
NOV	44.30	21.60	-0.43	892.61	-0.334
DEC	47.76	18.11	-0.59	1209.76	-0.545
ANNL	**48.95**	**16.89**	**-0.49**	**997.29**	**-0.477**

Trends of Annual and Monthly Series (Programme TREND1)					
River:	**LABE**				
Total period:	**1965-1988**				
Time interval	**Mean**	**StdDev**	**Slope**	**Intercept**	**R**
JAN	935.50	483.13	1.24	-1515.36	0.019
FEB	1014.58	360.05	3.01	-4942.42	0.061
MAR	1054.46	384.38	2.90	-4667.94	0.055
APR	1231.75	521.36	11.58	-21649.25	0.161
MAY	930.04	374.19	-14.61	29811.86	-0.282
JUN	734.46	319.71	-11.12	22719.15	-0.252
JUL	575.54	235.42	-9.50	19353.15	-0.292
AUG	533.58	248.59	0.67	-800.12	0.020
SEP	492.79	212.27	-4.84	10068.50	-0.165
OCT	513.88	180.76	-1.71	3890.25	-0.068
NOV	606.29	297.61	-3.90	8322.38	-0.095
DEC	783.21	400.42	-2.69	6098.27	-0.049
ANNL	**783.84**	**197.06**	**-2.42**	**5557.37**	**-0.089**

Trends of Annual and Monthly Series (Programme TREND1)					
River:	**LENA**				
Total period:	**1936-1994**				
Time interval	**Mean**	**StdDev**	**Slope**	**Intercept**	**R**
JAN	2777.19	651.92	18.60	-33773.23	0.490
FEB	2131.01	610.44	23.26	-43575.67	0.654
MAR	1656.07	572.21	24.92	-47314.78	0.748
APR	1350.89	481.18	20.78	-39490.01	0.742
MAY	6260.32	7158.83	83.16	-157141.09	0.200
JUN	72267.55	14057.21	-104.33	277283.72	-0.127
JUL	39536.05	8407.01	75.11	-108048.00	0.153
AUG	27254.27	6426.82	29.51	-30727.81	0.079
SEP	23848.44	6278.55	-45.39	113039.23	-0.124
OCT	13624.43	3857.45	-24.48	61722.76	-0.109
NOV	3498.93	1092.25	13.37	-22770.09	0.210
DEC	2926.96	766.96	15.29	-27127.26	0.343
ANNL	**16427.68**	**1839.05**	**10.82**	**-4826.85**	**0.101**

Trends of Annual and Monthly Series (Programme TREND1)					
River:	**LOIRE**				
Total period:	**1863-1979**				
Time interval	**Mean**	**StdDev**	**Slope**	**Intercept**	**R**
JAN	1397.34	748.90	1.89	-2242.87	0.086
FEB	1518.13	829.32	5.92	-9860.55	0.242
MAR	1375.66	681.77	1.80	-2081.12	0.090
APR	1112.55	596.54	1.32	-1420.05	0.075
MAY	805.72	429.57	1.48	-2037.64	0.117
JUN	576.36	332.84	1.27	-1864.90	0.130
JUL	357.58	208.80	0.51	-627.09	0.083
AUG	259.11	159.15	0.61	-903.23	0.129
SEP	268.20	158.36	0.88	-1416.18	0.188
OCT	417.49	276.54	-0.75	1855.52	-0.092
NOV	812.65	629.80	-0.67	2091.34	-0.036
DEC	1156.32	767.60	0.39	413.05	0.017
ANNL	**838.09**	**278.12**	**1.22**	**-1507.81**	**0.149**

Trends of Annual and Monthly Series (Programme TREND1)					
River:	MEKONG				
Total period:	**1982-1991**				
Time interval	**Mean**	**StdDev**	**Slope**	**Intercept**	**R**
JAN	2814.30	361.21	-52.73	107569.15	-0.467
FEB	1972.30	206.00	-33.28	68080.70	-0.516
MAR	1939.10	244.47	-16.32	34361.27	-0.216
APR	1841.60	217.77	-26.10	53683.24	-0.385
MAY	2478.40	397.71	-57.03	115769.11	-0.459
JUN	6900.20	1856.58	225.70	-441446.81	0.391
JUL	14566.30	3596.29	472.22	-923507.13	0.421
AUG	25830.90	4200.69	561.41	-1089414.00	0.429
SEP	23888.10	2435.08	-15.99	55660.09	-0.021
OCT	16816.70	2074.35	-167.41	349380.91	-0.261
NOV	8290.70	1199.57	-41.93	91591.28	-0.113
DEC	4403.90	525.63	-49.51	102753.72	-0.304
ANNL	**9311.88**	**1025.25**	**66.59**	**-122959.90**	**0.210**

Trends of Annual and Monthly Series (Programme TREND1)					
River:	MISSISSIPPI				
Total period:	**1969-1982**				
Time interval	**Mean**	**StdDev**	**Slope**	**Intercept**	**R**
JAN	19677.43	7996.21	-556.48	1119010.63	-0.303
FEB	21690.14	9697.95	-791.03	1584375.75	-0.355
MAR	23833.07	9281.33	633.53	-1227709.00	0.297
APR	29037.07	11159.91	213.19	-392117.81	0.084
MAY	25472.57	10734.95	-800.33	1606515.13	-0.325
JUN	19476.86	8087.50	268.85	-511633.00	0.145
JUL	14412.07	3384.89	-27.04	67828.73	-0.035
AUG	11229.21	2368.12	150.92	-286906.31	0.278
SEP	10089.64	2791.78	279.59	-542238.38	0.435
OCT	10335.64	2767.69	-244.31	492961.13	-0.384
NOV	12344.00	4426.64	-365.42	734239.44	-0.359
DEC	18436.21	8402.87	186.55	-350096.59	0.097
ANNL	**18002.83**	**4644.6**	**-87.67**	**191185.86**	**-0.083**

Trends of Annual and Monthly Series (Programme TREND1)					
River:	NILE				
Total period:	**1973-1984**				
Time interval	**Mean**	**StdDev**	**Slope**	**Intercept**	**R**
JAN	1238.75	231.69	49.73	-97153.58	0.791
FEB	1035.25	105.71	14.60	-27860.54	0.519
MAR	1125.75	98.44	7.23	-13187.25	0.279
APR	1110.17	131.29	11.31	-21262.10	0.326
MAY	1169.75	94.23	2.19	-3167.73	0.089
JUN	1542.17	56.75	0.84	-118.11	0.056
JUL	1742.08	82.33	13.47	-24898.49	0.611
AUG	1559.50	53.78	5.36	-9052.45	0.377
SEP	1190.58	77.06	15.31	-29102.60	0.736
OCT	1102.58	100.07	18.59	-35679.53	0.690
NOV	1075.42	89.09	13.96	-26547.49	0.586
DEC	1123.92	128.83	21.44	-41289.31	0.621
ANNL	**1251.33**	**81.61**	**14.50**	**-27443.26**	**0.662**

Trends of Annual and Monthly Series (Programme TREND1)					
River:	**NORTHERN DVINA (SEVERNAYA DVINA)**				
Total period:	**1882-1985**				
Time interval	**Mean**	**StdDev**	**Slope**	**Intercept**	**R**
JAN	1030.00	329.18	-0.04	1111.32	-0.004
FEB	822.73	258.32	-0.21	1224.08	-0.024
MAR	716.14	185.97	-0.96	2576.49	-0.156
APR	2329.17	2178.43	4.86	-7070.96	0.067
MAY	13698.56	3294.75	-7.99	29144.59	-0.073
JUN	7079.04	2977.25	-14.07	34292.85	-0.143
JUL	2957.31	1050.71	-5.69	13962.77	-0.163
AUG	2159.30	1070.96	-8.67	18926.84	-0.244
SEP	2306.29	1254.02	-12.67	26800.25	-0.305
OCT	2903.92	1451.10	-8.10	18566.08	-0.168
NOV	2380.26	1445.13	-2.29	6801.70	-0.048
DEC	1402.12	612.98	-0.01	1429.06	-0.001
ANNL	**3315.40**	**647.46**	**-4.65**	**12313.75**	**-0.217**

Trends of Annual and Monthly Series (Programme TREND1)					
River:	**OB**				
Total period:	**1936-1994**				
Time interval	**Mean**	**StdDev**	**Slope**	**Intercept**	**R**
JAN	4771.39	953.92	21.40	-37279.26	0.385
FEB	3906.09	713.38	17.11	-29713.61	0.412
MAR	3459.73	676.99	24.74	-45147.79	0.628
APR	3538.74	791.29	19.82	-35414.64	0.430
MAY	14933.17	4802.29	7.92	-625.59	0.028
JUN	32918.14	3355.14	22.07	-10451.06	0.113
JUL	30021.76	5530.05	13.23	4019.33	0.041
AUG	22381.98	8998.54	-72.54	164924.53	-0.138
SEP	14056.69	5756.25	-42.61	97790.63	-0.127
OCT	10380.80	2408.46	-4.78	19763.76	-0.034
NOV	6199.26	1761.76	12.53	-18417.13	0.122
DEC	5437.85	1168.47	20.79	-35405.66	0.306
ANNL	**12667.13**	**1937.17**	**3.31**	**6170.29**	**0.029**

Trends of Annual and Monthly Series (Programme TREND1)					
River:	**ORINOCO**				
Total period:	**1925-1989**				
Time interval	**Mean**	**StdDev**	**Slope**	**Intercept**	**R**
JAN	13122.91	2422.57	8.85	-4189.61	0.069
FEB	8050.51	2059.70	9.84	-11196.60	0.090
MAR	7126.77	2140.18	25.39	-42566.57	0.224
APR	8896.97	2669.21	-5.95	20543.09	-0.042
MAY	19540.20	5861.81	-8.47	36116.28	-0.027
JUN	34683.71	7613.23	-40.79	114505.02	-0.101
JUL	53181.14	8875.62	-2.94	58933.08	-0.006
AUG	65331.00	9197.84	33.56	-338.41	0.069
SEP	60148.68	7007.14	76.41	-89387.85	0.206
OCT	45868.48	6402.52	136.66	-221581.00	0.404
NOV	30523.68	5115.74	98.61	-162453.80	0.364
DEC	21225.48	3715.87	47.67	-72059.10	0.243
ANNL	**30641.63**	**3506.51**	**31.57**	**-31139.65**	**0.170**

Trends of Annual and Monthly Series (Programme TREND1)					
River:	**PARANA**				
Total period:	**1905-1982**				
Time interval	**Mean**	**StdDev**	**Slope**	**Intercept**	**R**
JAN	18210.69	5486.36	18.36	-17477.41	0.076
FEB	20916.67	5551.38	10.30	894.04	0.042
MAR	21096.15	5708.70	-15.17	50575.89	-0.060
APR	19210.26	4700.97	-20.60	59245.68	-0.099
MAY	16698.64	4503.57	-29.41	73858.96	-0.148
JUN	16795.09	5449.81	-41.46	97380.55	-0.172
JUL	15072.81	4893.95	1.57	12028.37	0.007
AUG	12482.88	4213.96	17.46	-21453.91	0.094
SEP	12000.69	4156.10	24.16	-34952.14	0.132
OCT	13946.45	5127.20	3.97	6227.38	0.018
NOV	14449.90	4627.50	21.54	-27420.23	0.105
DEC	15412.65	6006.68	36.57	-55670.63	0.138
ANNL	**16357.74**	**3446.89**	**2.27**	**11936.38**	**0.015**

Trends of Annual and Monthly Series (Programme TREND1)					
River:	**PECHORA**				
Total period:	**1932-1984**				
Time interval	**Mean**	**StdDev**	**Slope**	**Intercept**	**R**
JAN	707.45	144.66	6.21	-11461.45	0.663
FEB	559.58	131.88	6.70	-12565.11	0.785
MAR	480.81	124.90	6.40	-12052.00	0.791
APR	795.55	783.72	4.12	-7277.69	0.081
MAY	8936.42	4308.50	30.18	-50155.65	0.108
JUN	13760.38	4749.66	-18.31	49617.57	-0.060
JUL	4786.79	2012.03	24.14	-42470.76	0.185
AUG	2291.70	949.34	5.79	-9037.61	0.094
SEP	2953.08	1314.16	21.48	-39111.09	0.252
OCT	3029.42	1216.35	-13.85	30155.66	-0.176
NOV	1558.72	689.23	-0.68	2898.78	-0.015
DEC	998.26	229.71	4.01	-6852.21	0.270
ANNL	**3404.85**	**448.29**	**6.35**	**-9025.96**	**0.219**

Trends of Annual and Monthly Series (Programme TREND1)					
River:	**RHEIN**				
Total period:	**1930-1996**				
Time interval	**Mean**	**StdDev**	**Slope**	**Intercept**	**R**
JAN	2639.21	1173.80	7.32	-11728.65	0.122
FEB	2835.31	1192.35	4.84	-6663.44	0.079
MAR	2682.57	1038.97	6.85	-10756.52	0.128
APR	2503.21	833.88	0.87	787.68	0.020
MAY	2287.55	785.90	8.90	-15187.83	0.221
JUN	2301.21	627.75	4.65	-6817.60	0.144
JUL	2156.49	667.63	-3.83	9665.92	-0.112
AUG	1883.51	556.64	-4.07	9867.12	-0.142
SEP	1697.33	565.24	-2.42	6442.90	-0.083
OCT	1771.04	723.30	-1.65	5002.50	-0.044
NOV	1990.81	915.87	-0.58	3138.23	-0.012
DEC	2613.36	1336.05	15.44	-27689.68	0.225
ANNL	**2280.13**	**492.79**	**3.03**	**-3661.61**	**0.120**

Trends of Annual and Monthly Series (Programme TREND1)					
River:	**SEINE**				
Total period:	**1971-1977**				
Time interval	**Mean**	**StdDev**	**Slope**	**Intercept**	**R**
JAN	390.14	152.07	26.32	-51568.36	0.414
FEB	591.00	191.45	64.21	-126168.00	0.768
MAR	433.00	111.72	34.86	-68375.00	0.720
APR	380.57	133.29	22.71	-44457.43	0.408
MAY	307.43	85.39	14.64	-28597.57	0.410
JUN	244.43	67.46	-0.54	1301.93	-0.019
JUL	207.86	53.38	2.79	-5291.14	0.127
AUG	203.14	72.08	-2.57	5279.14	-0.087
SEP	202.29	41.12	2.32	-4380.21	0.137
OCT	242.29	91.55	5.14	-9909.71	0.136
NOV	346.57	146.26	10.54	-20450.93	0.175
DEC	454.43	155.05	31.11	-60951.07	0.477
ANNL	**333.60**	**74.88**	**17.63**	**-34464.03**	**0.556**

Trends of Annual and Monthly Series (Programme TREND1)					
River:	SEVERN (sub-series #1)				
Total period:	**1965-1972**				
Time interval	**Mean**	**StdDev**	**Slope**	**Intercept**	**R**
JAN	120.75	36.49	-3.83	7666.67	-0.281
FEB	98.38	42.96	2.99	-5783.69	0.187
MAR	81.50	15.03	-1.81	3643.55	-0.322
APR	64.25	27.74	0.64	-1201.21	0.062
MAY	61.50	35.93	-3.86	7654.29	-0.287
JUN	34.38	11.04	0.54	-1020.18	0.131
JUL	29.00	26.76	-0.76	1528.81	-0.077
AUG	27.88	5.77	1.35	-2620.23	0.610
SEP	35.88	22.43	-6.25	12339.00	-0.719
OCT	53.63	45.58	-8.85	17465.48	-0.512
NOV	78.63	13.63	-3.46	6898.07	-0.661
DEC	132.13	79.52	-21.80	43040.74	-0.708
ANNL	**68.16**	**10.75**	**-3.76**	**7467.61**	**-0.880**

Trends of Annual and Monthly Series (Programme TREND1)					
River:	SEVERN (sub-series #2)				
Total period:	**1976-1984**				
Time interval	**Mean**	**StdDev**	**Slope**	**Intercept**	**R**
JAN	121.44	33.47	6.70	-13144.56	0.580
FEB	107.78	51.31	-4.07	8159.78	-0.234
MAR	99.11	51.04	-0.23	561.11	-0.014
APR	50.44	25.36	0.27	-477.56	0.031
MAY	39.44	26.77	0.77	-1478.56	0.085
JUN	27.00	10.5	1.05	-2052.00	0.295
JUL	14.33	5.29	0.33	-645.67	0.186
AUG	17.67	9.58	-0.13	281.67	-0.041
SEP	25.78	8.09	0.97	-1888.22	0.352
OCT	63.22	33.13	0.53	-992.78	0.048
NOV	92.78	38.64	2.68	-5220.22	0.205
DEC	118.11	31.71	0.65	-1168.89	0.061
ANNL	**64.76**	**10.24**	**0.79**	**-1505.49**	**0.229**

Trends of Annual and Monthly Series (Programme TREND1)					
River:	**SHANNON**				
Total period:	**1973-1979**				
Time interval	**Mean**	**StdDev**	**Slope**	**Intercept**	**R**
JAN	311.14	71.82	-5.04	10261.71	-0.170
FEB	318.29	72.49	-12.04	24100.86	-0.398
MAR	215.43	59.60	20.89	-41068.86	0.798
APR	151.29	59.34	24.07	-47413.86	0.902
MAY	104.86	48.39	17.36	-34192.86	0.814
JUN	57.29	52.48	12.75	-25136.71	0.572
JUL	43.14	15.93	0.46	-874.29	0.071
AUG	62.86	24.57	-5.89	11707.14	-0.565
SEP	104.57	88.71	-17.46	34614.00	-0.469
OCT	135.29	30.83	-8.61	17143.00	-0.651
NOV	240.00	72.02	12.36	-24177.71	0.411
DEC	328.00	91.14	24.57	-48225.14	0.631
ANNL	**172.68**	**22.91**	**5.29**	**-10271.89**	**0.545**

Trends of Annual and Monthly Series (Programme TREND1)					
River:	**TANA (sub-series #1)**				
Total period:	**1912-1943**				
Time interval	**Mean**	**StdDev**	**Slope**	**Intercept**	**R**
JAN	55.06	7.19	-0.10	253.61	-0.134
FEB	47.81	6.12	-0.20	437.83	-0.310
MAR	44.88	4.78	-0.13	304.89	-0.265
APR	48.09	6.02	-0.04	117.69	-0.056
MAY	410.09	225.72	0.70	-941.21	0.029
JUN	561.97	303.32	-11.42	22567.48	-0.353
JUL	197.41	96.36	-0.98	2080.04	-0.095
AUG	155.75	74.19	1.19	-2140.58	0.151
SEP	154.31	70.93	-0.16	465.91	-0.021
OCT	134.09	42.11	0.35	-541.73	0.078
NOV	98.31	31.97	0.96	-1752.17	0.282
DEC	68.78	11.82	0.25	-412.03	0.198
ANNL	**164.71**	**31.41**	**-0.80**	**1703.31**	**-0.238**

Trends of Annual and Monthly Series (Programme TREND1)					
River:	**TANA (sub-series #2)**				
Total period:	**1947-1987**				
Time interval	**Mean**	**StdDev**	**Slope**	**Intercept**	**R**
JAN	52.51	7.98	-0.15	350.65	-0.227
FEB	45.15	5.84	-0.03	110.94	-0.069
MAR	41.51	5.07	0.03	-18.46	0.072
APR	50.85	22.80	0.17	-275.72	0.087
MAY	466.34	207.95	5.41	-10174.65	0.312
JUN	517.27	243.72	-0.07	653.66	-0.003
JUL	199.71	87.93	-0.36	902.89	-0.049
AUG	164.56	68.16	-0.02	194.72	-0.003
SEP	162.80	77.84	0.35	-516.05	0.053
OCT	144.1	53.77	0.42	-680.40	0.093
NOV	94.32	22.17	-0.53	1136.76	-0.286
DEC	65.83	12.21	-0.20	468.14	-0.201
ANNL	**167.08**	**29.59**	**0.42**	**-653.96**	**0.169**

Trends of Annual and Monthly Series (Programme TREND1)					
River:	**TAY**				
Total period:	**1980-1984**				
Time interval	**Mean**	**StdDev**	**Slope**	**Intercept**	**R**
JAN	300.60	110.91	46.40	-91664.20	0.754
FEB	227.20	37.77	2.00	-3736.80	0.105
MAR	242.80	47.19	8.40	-16406.00	0.346
APR	143.60	39.90	19.10	-37712.60	0.838
MAY	102.80	73.82	21.10	-41717.40	0.542
JUN	74.60	32.14	2.60	-5078.60	0.159
JUL	47.20	14.81	-8.60	17092.40	-0.954
AUG	57.60	35.32	-18.70	37121.00	-0.900
SEP	150.00	64.22	-34.60	68727.20	-0.910
OCT	259.20	86.89	6.60	-12822.00	0.150
NOV	287.80	120.41	16.80	-33009.80	0.273
DEC	267.20	74.47	23.90	-47102.60	0.602
ANNL	**180.05**	**19.32**	**7.08**	**-13859.11**	**0.676**

Trends of Annual and Monthly Series (Programme TREND1)					
River:	**TEJO**				
Total period:	**1976-1984**				
Time interval	**Mean**	**StdDev**	**Slope**	**Intercept**	**R**
JAN	628.56	517.00	-50.13	99892.55	-0.286
FEB	919.00	1287.75	-180.38	358078.00	-0.411
MAR	512.44	664.93	-110.82	219929.44	-0.487
APR	290.89	348.76	-40.57	80612.89	-0.342
MAY	220.11	187.77	-11.18	22363.11	-0.176
JUN	177.11	135.35	-10.62	21198.11	-0.232
JUL	143.89	122.82	-16.05	31922.89	-0.384
AUG	133.22	92.24	-9.25	18448.22	-0.296
SEP	125.89	53.64	-8.43	16823.89	-0.460
OCT	199.89	179.24	-9.33	18679.89	-0.154
NOV	440.33	365.61	-25.53	50996.33	-0.207
DEC	658.89	454.68	-96.50	191728.89	-0.613
ANNL	**370.85**	**268.71**	**-47.40**	**94222.85**	**-0.514**

Trends of Annual and Monthly Series (Programme TREND1)					
River:	**THAMES**				
Total period:	**1965-1984**				
Time interval	**Mean**	**StdDev**	**Slope**	**Intercept**	**R**
JAN	137.70	50.63	-0.95	2017.19	-0.114
FEB	136.35	59.52	-1.49	3080.28	-0.152
MAR	126.15	52.28	1.15	-2152.69	0.134
APR	90.80	38.22	0.22	-345.67	0.035
MAY	76.50	36.17	-0.33	723.78	-0.055
JUN	53.95	31.05	-0.75	1540.02	-0.148
JUL	35.60	18.46	-1.88	3738.16	-0.612
AUG	33.55	17.76	-1.53	3045.78	-0.519
SEP	38.10	29.41	-2.34	4649.23	-0.481
OCT	55.35	35.74	-2.31	4623.42	-0.393
NOV	81.45	49.43	-2.43	4887.06	-0.299
DEC	113.25	45.75	-2.01	4081.55	-0.267
ANNL	**81.56**	**22.22**	**-1.22**	**2490.68**	**-0.333**

Trends of Annual and Monthly Series (Programme TREND1)					
River:	**VAENERN-GOETA**				
Total period:	**1807-1992**				
Time interval	**Mean**	**StdDev**	**Slope**	**Intercept**	**R**
JAN	539.84	132.97	0.36	-148.75	0.147
FEB	537.17	133.55	0.55	-515.45	0.223
MAR	532.67	134.32	0.69	-774.52	0.276
APR	532.28	126.64	0.62	-646.11	0.264
MAY	542.72	123.12	-0.10	733.78	-0.044
JUN	551.05	137.51	-0.84	2150.31	-0.330
JUL	530.37	149.22	-1.33	3055.22	-0.480
AUG	528.69	128.42	-0.99	2402.21	-0.413
SEP	522.70	127.51	-0.74	1926.11	-0.312
OCT	520.01	123.40	-0.52	1502.54	-0.226
NOV	531.49	124.77	-0.13	787.01	-0.058
DEC	540.03	131.36	0.16	230.75	0.067
ANNL	**534.09**	**99.12**	**-0.19**	**891.92**	**-0.102**

Trends of Annual and Monthly Series (Programme TREND1)					
River:	**WESER**				
Total period:	**1921-1984**				
Time interval	**Mean**	**StdDev**	**Slope**	**Intercept**	**R**
JAN	460.47	226.47	-0.86	2134.49	-0.070
FEB	485.44	250.38	-0.10	687.84	-0.008
MAR	461.09	206.96	0.73	-964.03	0.066
APR	407.36	168.96	1.71	-2939.29	0.189
MAY	284.77	110.70	1.33	-2321.74	0.225
JUN	236.13	109.13	1.76	-3203.82	0.301
JUL	218.55	131.99	1.42	-2561.49	0.201
AUG	191.94	82.70	0.69	-1163.91	0.156
SEP	182.52	81.73	0.15	-109.51	0.034
OCT	206.23	99.79	-0.09	390.53	-0.018
NOV	284.30	148.53	-1.92	4030.39	-0.241
DEC	380.97	221.38	1.03	-1622.85	0.086
ANNL	**316.65**	**92.12**	**0.49**	**-636.95**	**0.099**

Trends of Annual and Monthly Series (Programme TREND1)					
River:	**WYE**				
Total period:	**1977-1989**				
Time interval	**Mean**	**StdDev**	**Slope**	**Intercept**	**R**
JAN	10.97	4.76	0.12	-232.59	0.106
FEB	8.23	3.79	-0.44	876.88	-0.468
MAR	9.94	4.97	-0.21	429.52	-0.174
APR	4.46	2.50	0.05	-100.18	0.086
MAY	2.68	2.73	-0.24	478.83	-0.358
JUN	2.29	2.10	0.03	-62.70	0.064
JUL	1.43	1.35	-0.02	31.71	-0.046
AUG	2.70	2.65	0.07	-127.26	0.101
SEP	4.33	2.34	0.01	-24.02	0.025
OCT	9.29	5.24	0.50	-979.09	0.386
NOV	11.17	5.11	-0.54	1083.99	-0.430
DEC	12.34	4.15	-0.06	127.93	-0.057
ANNL	**6.65**	**0.63**	**-0.06**	**125.25**	**-0.386**

Trends of Annual and Monthly Series (Programme TREND1)					
River:	**YENISEI**				
Total period:	**1936-1994**				
Time interval	**Mean**	**StdDev**	**Slope**	**Intercept**	**R**
JAN	6005.69	1460.76	72.13	-135727.50	0.848
FEB	5926.68	1634.67	80.36	-151977.80	0.844
MAR	5928.42	2064.84	104.01	-198455.20	0.865
APR	5913.52	2303.05	112.75	-215637.80	0.841
MAY	27448.10	13258.87	-185.88	392699.91	-0.241
JUN	70339.52	22230.06	55.06	-37858.82	0.043
JUL	26518.68	4872.16	-89.36	202104.13	-0.315
AUG	17473.05	3417.76	-86.11	186681.48	-0.433
SEP	16830.36	2808.30	-69.23	152871.75	-0.423
OCT	13895.20	2454.00	-47.07	106390.55	-0.329
NOV	6743.07	1444.56	45.08	-81842.10	0.536
DEC	5739.56	1242.76	57.36	-106967.40	0.793
ANNL	**17396.82**	**2390.38**	**4.09**	**9356.74**	**0.029**

Trends of Annual and Monthly Series (Programme TREND1)					
River:	**ZAMBEZE**				
Total period:	**1976-1979**				
Time interval	**Mean**	**StdDev**	**Slope**	**Intercept**	**R**
JAN	3502.75	2276.01	77.50	-149753.50	0.066
FEB	2891.50	1841.36	110.80	-216215.50	0.116
MAR	4633.50	5189.31	993.40	-1959815.00	0.363
APR	4095.75	4192.41	332.50	-653423.00	0.153
MAY	3308.50	3122.15	475.00	-936004.00	0.291
JUN	4018.50	2749.46	200.40	-392272.50	0.141
JUL	4558.00	1676.06	161.80	-315401.50	0.186
AUG	1954.25	690.49	247.70	-487872.50	0.645
SEP	1991.00	1044.65	486.60	-960260.50	0.793
OCT	2293.00	1147.67	641.80	-1266866.00	0.895
NOV	2757.00	1907.99	719.40	-1419856.00	0.672
DEC	4041.50	828.89	-87.80	177666.00	-0.204
ANNL	**no data**	**no data**	**no data**	**no data**	**no data**

Report No. 1 (May 1993)	Second Workshop on the Global Runoff Data Centre, Koblenz, Germany, 15 - 17 June, 1992.
Report No. 2 (May 1993)	Dokumentation bestehender Algorithmen zur Übertragung von Abflußwerten auf Gitternetze. (Incl. abtract in English by the GRDC: Documentation of existing algorithms for transformation of runoff data to grid cells) by G.C. Wollenweber.
Report No. 3 (June 1993)	GRDC - Status Report 1992.
Report No. 4 (June 1994)	GRDC - Status Report 1993.
Report No. 5 (November 1994)	Hydrological Regimes of the Largest Rivers in the World - A Compilation of the GRDC Database.
Report No. 6 (December 1994)	Report of the First Meeting of the GRDC Steering Committee, Koblenz, Germany, June 20 - 21, 1994.
Report No. 7 (June 1995)	GRDC - Status Report 1994.
Report No. 8 (July 1995)	First Interim Report on the Arctic River Database for the Arctic Climate System Study (ACSYS).
Report No. 9 (August 1995)	Report of the Second Meeting of the GRDC Steering Committee, Koblenz, Germany, June 27 - 28.
Report No. 10 (March 1996)	Freshwater Fluxes from Continents into the World Oceans based on Data of the Global Runoff Data Base.
Report No. 11 (April 1996)	GRDC - Status Report 1995.
Report No. 12 (June 1996)	Second Interim Report on the Arctic River Database for the Arctic Climate System Study (ACSYS).
Report No. 13 (Februray 1997)	GRDC Status Report 1996

Report No. 14 (February 1997)	The use of GRDC - information Review of data use 1993/1994. Status: January 1997
Report No. 15 (June 1997)	Third Interim Report on the Arctic River Data Base (ARDB) for the Arctic Climate System Study (ACSYS): Plausibility Control and Data Corrections (Technical Report)
Report No. 16 (August 1997)	The GRDC Database. Concept and Implementation.
Report No. 17 (Sept. 1997)	Report on the Third Meeting of the GRDC Steering Committee, Koblenz, Germany June 25-27, 1997
Report No. 18 (July 1998)	GRDC Status Report 1997
Report No. 19 (July 1998)	Evaluation of Statistical Properties of Discharge Data of Stations Discharging Into the Oceans - Europe and Selected World-Wide Stations - (F. Portmann)
Report No. 20 (July 1998)	Water Resources Development and the Availability of Discharge Data in WMO Region II (Asia) and V (South-West Pacific)