Regional cooperation of Danube Countries
within the framework of UNESCO International Hydrological Program

National committee of the Slovak Republic for IHP

PROJECT 9

FLOOD REGIME OF RIVERS
IN THE DANUBE RIVER BASIN

1. Introduction

The economical prosperity of a country results from the abundance of water in basins. In almost every European basin, man's activities have disrupted the natural hydrological regimes.

The territory of the Danube river basin is one the most flood-endangered regions in Europe. The main reason is location of the Alpine and Carpathian mountain ridges on the way of moist air masses coming from Atlantic Ocean. According to this fact, the rain and rain-snow-melting floods on the Alpine and Carpathian rivers have essential frequency, great intensity and a large spatial scope. From time to time, floods become dangerous with destructive consequences. Essential floods took place in all states of Central and Eastern Europe during last ten years (e.g. floods in November 1998, March 2001, August 2002, or April 2006). On the other hand, significant seasonal variations in runoff cause great difficulties in water use during dry seasons (2003).

In world nowadays science of hydrology underpins effective water resources management and predicting of the effects of climate and human activity changes on water resources. Since the 1990's scientific interest in integrated water management has increased as awareness of global environmental phenomena - such as Arctic Oscillation (AO), Southern Oscillation (SO), Pacific Decadal Oscillation (PDO) or North Atlantic Oscillation (NAO). Awareness of climate change has changed the classical view of the hydrological cycle. Now it is widely accepted that there are decadal or longer oscillations in the natural climate system and the statistical characteristics of hydrological quantities have non-stationary pattern and are changing accordingly (Oki et all., 2006).

Information concerning maximum levels and discharges of rivers of the Danube basin is presented in the monograph "The Danube river and its basin" (1988), including data of hydrological observations from 50 gauging stations. Proposed project will continue detailed elaboration of the Danube basin water regime characteristics, which are included in the monograph with respect to runoff long-term trends and inter- as well as intra-annual variability.

Results of this project - detailed generalization of temporal and spatial fluctuations of runoff- will have both scientific and applied value in the field of water-management and hydrological forecasting.

2. General remarks

2.1. Motivation

Economic development and higher living standards generally lead to ever-growing water use (Oki et all., 2006). According to Shiklomanov & Rodda (2003) it is predicted that in year 2020 40% of the world's population will live in areas where water resources are catastrophically low. As water problems are becoming critical in many regions, society requires better water resources management. There are many and sometimes conflicting uses of water resources (navigation, power, irrigation, manufacturing and industrial, drainage, flood control, waste assimilation, fish and wildlife, recreation). Because of the different perceptions of water as an integral part of ecosystem, a natural resource and a social and economic good, an integrated international cooperation to its management is essential.

Water resources of the Danube river basin play important role in economy of Danubian countries. Coupled with significant increase of water demand urgent need in water resources protection grows as well as in water quality conservation. At the same time, implementation of countermeasures for prevention of loses caused by dangerous hydrological phenomena such as quite frequent and sometimes catastrophic floods, is the important problem for the Danubian countries.

Therefore there is a need for obtaining complete and concrete information on flood regime and drought occurrence, and generalizations of such information on the basis of long-term observations. This information can be used for water management and design of anti-flood constructions and for improvement of methodological base of institutions and agencies responsible for hydrological warnings.

The project is aimed at evaluation of the long-term variability of river runoff over Danube basin. Once detecting the relationships between the variability parameters of the climatic phenomena and those of the river runoff, the chance for development of the long-term runoff forecasting models becomes evident. In view of the man's induced warming up, and the expected general increase of the water demand, the project outputs would present a suitable tool for design and realization of the effective measures for coping with the actual demand for this precious resource.

2.2. Related studies

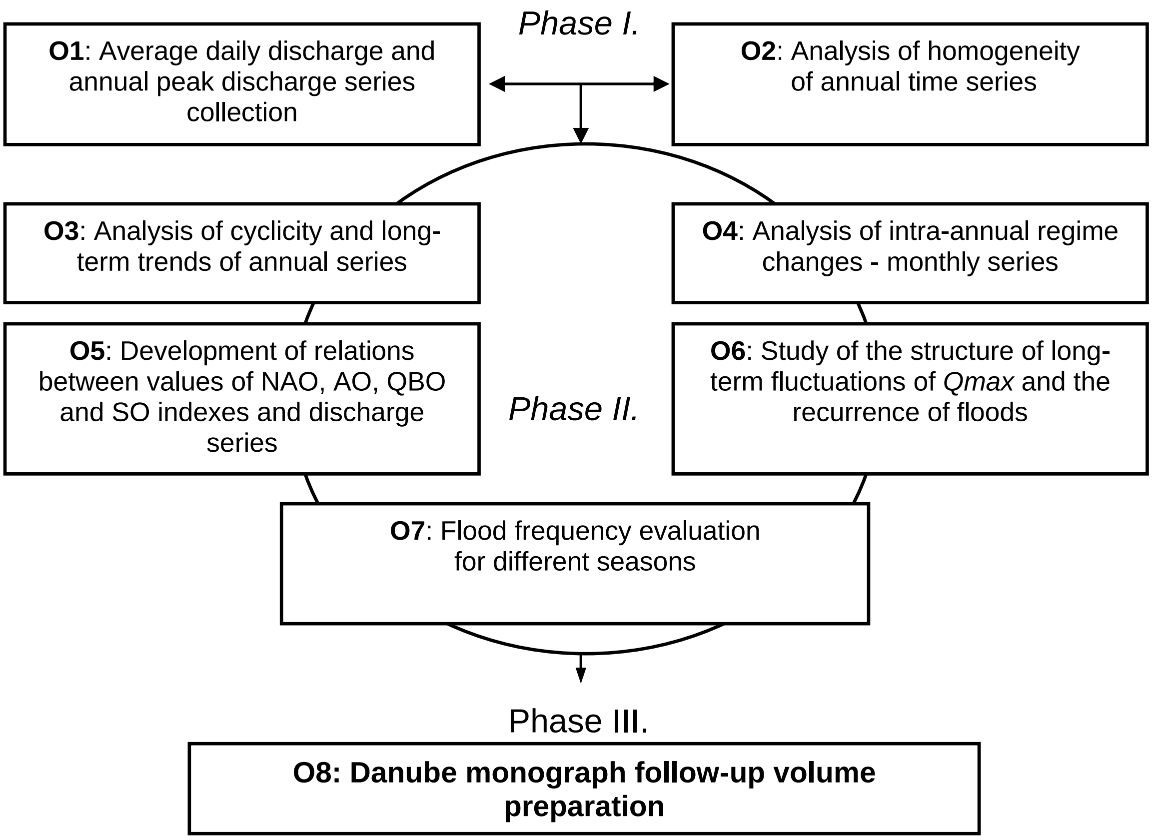
Preliminary study of long-term changes in river runoff in different parts of the Danube river basin indicates the presence of some regularity in a high and low river flow. It is shown that during the periods of high river runoff floods are the most active (Sosedko, 1992, 1997; Lukyanetz and Sosedko 1998, 2000; Svoboda et al., 2000). Thus, the investigations of the spatial and temporal variability of river runoff and frequency of floods ought to be of a great importance.

Charvatova and Strestik (2004); Esper et al. (2002), Pekarova et al. (2003), Pekarova and Pekar (2006), or Rao and Hamed (2003) found several different dry and wet periods (2.6, 3.5, 5, 20–21, 29–30 years) in the precipitation, temperature and discharge time series in the whole world. In world nowadays many scientists have studied relationships between some hydroclimatic characteristics - as total precipitation, air temperature, discharge, snow and ice cover, or flood risk and the global atmospheric phenomena - such as AO, ENSO, or NAO (Jevrejeva and Moore, 2001; Jevrejeva et al., 2003; Actil and Coulibaly, 2003; Turkes and Erlet, 2003; Uvo, 2003; Probst and Tardy, 1987; Labat et al., 2004; Kane, 1997).

The NAO refers to swings in the atmospheric sea-level pressure difference between the Artic and subtropical Atlantic that are associated with changes in the mean wind speed and direction (Hurrell et al., 2003). Whereas runoff in western and northern Europe increases with positive values of the NAO and AO indices during the period 1901–2000 (Arpe et al., 2000; Turkes and Erlat, 2003; Lindstrom and Bergstrom, 2004; Pekarova 2003; Pekarova and Pekar, 2004), in the middle and lower parts of the Danube basin the annual precipitation totals and runoff decrease with positive NAO values.

3. Project objectives for duration of the project and for its particular stages

The project will be elaborated in three phases. The individual phases are defined through 7 objectives. Main tasks of proposed project could be highlighted as following:



3.1. Main objectives of the project

O1. Assembling of the **database** of mean daily discharges from selected stations on the Danube river (about 23) with high quality and long data series. Collection of other data series (up to 50) of relatively large and anthropogenically uninfluenced rivers within the Danube basin. Data collected within project 5.2 “Update of the runoff regime” will be used and completed for the period till 2006.

O2. Statistical analysis of **homogeneity** (Alexandersson test).

O3. Statistical analysis of **cyclicity and long-term trends** of following time series:

1. the maximum mean daily flows ($Q_{max, d}$);
2. the 30-day flows (Q_{30}, flows exceeded 30 days in a year – indicator of higher flows);
3. the average annual flows (Q_a);
4. yearly runoff variability - Q30 – Q330;
5. the annual variation coefficients (C_v).

Autocorrelation and spectral analysis of long-term series, Filters – MA (moving averages), HP-filter, etc .

O4. Analysis of **intraannual discharge variability** based on mean monthly discharge series:

- 1. analysis of annual regime of the last 25-year period changes (1981–2005 versus periods 1906–1930, 1931–1955, 1956–1980);

- 2. comparison of 25-year periods with long-term regime – identification of changes in interannual regime;
- 3. estimation of mean discharges for the warm/dry and cold/wet periods of year.

O5. Development of relations between monthly values of **NAO, AO, QBO and SO indexes** and discharge series

- Analysis of possible teleconnection of QBO, SO, NAO, and AO phenomena with long-term streamflow fluctuation of Danube river at selected stations.

O6. Analysis of **floods recurrence in wet and dry periods**. Autocorrelation and spectral analyses of long-term series of maximum annual discharges

O7. **Flood frequency evaluation for different seasons**. Analysis of maximum annual discharges and assessment of frequency of their occurrence in individual months.
Analysis of maximum winter and summer season discharges from daily data series.

O8. Preparation of the Danube monograph **follow-up volume**.

4. Cooperation during the project implementation

Coordination of project will be taken by National Committee of Slovakia for IHP, particularly by the Institute of Hydrology SAS.

Institute of Hydrology SAS is the basic research institution in the field of hydrology in Slovakia with staff of 50 employees. The proposed project will be researched at the Department of Mountain Hydrology (staff 16 employees). The project team from IH SAS successfully managed and manages several scientific projects of UNESCO. In spite of their relatively young age the team members belong to accepted personalities in their field of competence. Some of them were members of the team that received the Award of the Slovak Academy of Sciences for *„Influence of climate change on runoff dynamics in Slovak river basins"* in 2004.

It is suggested:

- to nominate national experts for the project by IHP NC`s who will actively collaborate with the project co-ordinator on implementation of the project;
- to collaborate with scientists of the subproject 5.2 "Update of the runoff regime";
- to use results and data of studies in the area of the proposed subject obtained in Danube countries before.

5. Data collection

For project implementation it is supposed to collect following data through national hydrological services and/or public databases:

5.1. River runoff data

Data collected within project 5.2 "Update of the runoff regime" will be used as a basis (Annex 1). Public databases will be used as well (Annex 2).

Following river-runoff data series will be completed for the whole observation period as long as possible (including year 2006):

- daily discharge of the Danube river for stations in Annex 1;
- daily discharge of additional selected stations on the tributaries with long observations of high quality, preferably on large rivers (more than 15 000 km^2);
- the annual peak flows (Q_{max}) -values of highest floods during a year for all stations.

5.2. Hydrographic characteristics of rivers and river basins

Name of river and gauging stations, river's length, slope; area of watershed, average elevation, slope of river basin, the forestation, volume of water reservoirs.

5.3. Other data

Monthly time series of NAO, QBO, AO, and SO indexes will be collected from public databases.

6. Methods

The most up-to-date methods of statistical analysis will be applied within the project, such as time series analysis, spectral analysis, Fourier analysis, trend reversal point analysis, linear and non-linear regression analysis, cross-correlation analysis, etc. Special commercial software packages will be used (STATGRAPHICS, STATISTIKA, CTPA (Prochazka et al., 2001), AnClim (Stepanek, 2003), EViews3), as well as mathematical programmes developed by ourselves.
Time series analysis includes many useful methods that help us to identify periodicity in time series, e.g. Maximum Entropy Spectrum Analysis (MESA), Power Spectrum Analysis (PSA), Singular Spectrum Analysis (SSA), Empirical Orthogonal Functions Method (EOFs) / Fourier Analysis (FA), Autocorrelation Analysis (AC), Method of Main Components (MMC), etc. (Box and Jenkins 1976; Nobre and Shukla 1996; Jevrejeva and Moore 2001; Rao and Hamed 2003; Liritzis and Fairbridge 2003; Van Gelder et al. 2000; Prochazka et al. 2001).

7. Financial aspects. National contribution and required support

Nominated national experts and specialists from each Danubian country will collaborate using their national scientific and financial resources.

Slovak NC IHP and Institute of Hydrology SAS will provide office facilities, computers and related equipment and manpower costs of its staff.

External financial support is necessary for following activities:

- organization of workshops,
- co-ordination expenses, i.e. communications, editing of interim reports, etc.
- developing of project web-site
- editing and publication of the Final report.

8. Workshops and meetings

It is supposed to organize meetings during the project implementation at the occasion of the Danube countries conferences due to economic reasons.

9. Project work plan

The corrected project planned timeframe is **2007–2019**.

I. Phase		
Elaboration of detailed project proposal. After approval start of the project implementation.	June 2007	
Nominating of national experts. Collection of data series. Elaboration of the project's website.	December 2007	
Data processing, first statistical elaboration. First workshop at the occasion of the Danube countries conference. Presentation of preliminary results.	May 2008	
Elaboration of project objectives, analysis of cyclicity and long-term trends, development of relations between atmospheric indexes and discharge. Presentation of results at regular representatives and experts meeting.	June 2009	
Analysis of intra-annual regime, fluctuations of Qmax, and flood frequencies.	December 2009	
Second workshop at the occasion of the Danube countries conference. Presentation of main project results. Discussion on Final databaze structure.	June 2010	
II. Phase		
Presentation of Final database.	October 2015	
Third workshop at the occasion of the Danube countries conference. Presentation of main project results. Discussion on Final report structure		
III. Phase	June 2017	
4th workshop at the occasion of the Danube countries conference. Presentation of main project results. Discussion on Final monograph		
Monograph preparation	June 2019	

10. Project outputs

1. Website of the project.
2. Summary of obtained characteristics and parameters in textual, tabular, graphical and cartographic form.
3. Follow-up volume of the Danube monograph.

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Pavol Miklanek, chairman
Pavla Pekárová, expert.

List of selected rivers in Danube basin, 2017

Daily discharge Qd, monthly discharge Qm, yearly peak Qmax, Qa - annual discharge (1931-2005), V - annual volume, R - runoff depth

REGION	RIVER	STATION	COUNTRY	AREA	River km	ALTITUDE	Q_a	DAILY DATA (Q_d)		MONTHLY (Q_m) AND YEARLY (Q_y) DATA		EXTREME DATA (Q_{max})		V	R	LAT	LONG
		new/old						from	to	from	to	from	to				
				[km^2]		[m.s.l.]	[m^3/s]	[year]	[year]	[year]	[year]	[year]	[year]	10^9 [m^3/y]	[mm/y]		
D1	Danube	Berg	GE	4047	2613	489,9	38,0	1931	2007	1929	2007	1930	2007	1,20	296	48,27	9,73
D2	Danube	Ingolstadt	GE	20001	2457	360,4	313,0	1924	2013	1924	2013	1947	2007	9,87	494	48,75	11,42
D3	Danube	Schwabelweis/Regensb	GE	35399	2376	324,5	444,0	1923	2013	1924	2013	1924	2007	14,00	396	49,02	12,14
D4	Danube	Pfelling	GE	37757	2306	308,2	468,8	1926	2013	1925	2013	1926	2007	14,78	392	48,88	12,75
D5	Danube	Hofkirchen	GE	47496	2257	299,6	640,0	1901	2013	1901	2013	1901	2007	20,18	425	48,68	13,12
D6	Danube	Achleiten	GE	76653	2223	288,0	1428,0	1901	2007	1901	2007	1901	2007	45,03	587	48,58	13,50
D7	Danube	Linz/Aschach	AT	79490	2135	248,2	1464,0	1931	2007	1893	2007	1821	2007	46,17	581	48,31	14,30
D8	Danube	Kienstock/Stein-Krems	AT	96045	2003	189,5	1892,0	1900	2006	1893	2003	1828	2006	59,67	621	48,38	15,46
D9	Danube	Wien-Nussdorf	AT	101731	1934	157,0	1920,4	1900	2006	1893	2006	1828	2006	60,56	595	48,25	16,30
D10	Danube	Devin/Bratislava	SK	131338	1869	129,3	2050,0	1876	2015	1876	2008	1876	2010	64,65	492	48,14	17,11
D11	Danube	Nagymaros	HU	183534	1695	99,8	2336,0	1893	2007	1893	2007	1893	2007	73,67	401	47,78	18,95
D12	Danube	Mohács	HU	209064	1447	79,4	2354,0	1930	2007	1930	2007	1930	2007	74,24	355	46,00	18,67
D13	Danube	Bezdan	SR	210250	1426	81,1	2357,0	1931	2007	1931	2007	1950	2007	74,33	354	45,85	18,87
D14	Danube	Bogojevo	SR	251593	1367	78,0	2893,0	1931	2007	1931	2007	1950	2007	91,23	363	45,53	19,08
D15	Danube	Pancevo	SR	525009	1153	67,8	5320,0	1931	2007	1931	2007	1946	2007	167,77	320	44,87	20,64
D16	Danube	Veliko Gradiste	SR	570375	1060	62,7	5560,0	1931	2007	1931	2007	1931	2007	175,34	307	44,80	21,40
D17	Danube	Orsova/Turnu Severin	RO	576232	955	44,4	5602,0	1840	2005	1840	2005	1840	2006	176,66	307	44,70	22,42
D18	Danube	Zimnicea	RO	658400	554	16,2	6001,0	1931	2009	1931	2009	1931	2010	189,25	287	43,63	25,36
D19	Danube	Reni	UKR	805700	132	4,0	6563,0	1921	2010	1921	2010	1921	2010	206,97	257	45,28	28,13
D20	Danube	Ceatal Izmail	RO	807000	72	0,6	6415,0	1931	2008	1921	2008	1931	2010	202,30	251	45,22	28,73
1	Inn	Oberaudorf	GE	9712		464,0	354,0	1901	2007	1901	2007	1901	2007	11,16	1150	47,65	12,20
2	Inn	Passau-Ingling	GE	26084	3	289,2	740,0	1921	2007	1921	2007	1921	2007	23,34	895	48,56	13,45
3	Lech	Landsberg	GE	2295	85	582,3	83,0	1901	2007	1901	2007	1901	2007	2,62	1141	48,04	10,88
4	Regen	Marienthal/Regenstauf	GE	2613	30	337,0	38,0	1901	2007	1901	2007	1901	2007	1,20	459	49,22	12,17
5	Salzach	Burghausen	GE	6649		352,0	259,5	1901	2007	1901	2007	1901	2007	8,18	1231	48,16	12,83
6	Issar	Plattling	GE	8839	9	316,0	175,0	1926	2007	1926	2007	1926	2007	5,52	624	48,77	12,88
7	Enns	Steyr	AT	5915	31	284,0	200,2	1951	2010	1951	2010	1895	2007	6,31	1067	48,04	14,43
8	Traun	Ebensee	AT	1223		422,2	64,0	1951	2010	1951	2010	1951	2010	2,02	1650	47,80	13,76
9	Morava	Kromeriz	CZ	7014		184,2	51,3	1916	2013	1916	2013	1915	2007	1,62	231	49,3	17,4
10	Morava	Straznice	CZ	9147		163,3	59,6	1921	2013	1921	2013	1921	2007	1,88	205	48,93	17,3
11	Jihlava	Ivancice	CZ	2681		194,0	11,5	1924	2013	1924	2013	1924	2007	0,36	135	49,08	16,41
12	Svratka	Zidlochovice	CZ	3939		178,0	15,4	1916	2013	1916	2013	1921	2007	0,49	123	49,04	16,62
13	Morava	Mor.Sv.Jan	SK	24129		146,0	107,6	1921	2014	1895	2014	1895	2007	3,39	141	48,60	16,94
14	Bela	Podbanske	SK	93		922,7	3,0	1928	2013	1901	2013	1928	2008	0,09	1017	49,14	19,19
15	Vah	L. Mikulas	SK	1107		568,0	20,6	1921	2015	1921	2015	1921	2007	0,65	586	49,09	19,61
16	Vah	Sala	SK	11218		109,0	145,7	1921	2012	1921	2012	1901	2007	4,60	410	48,16	17,88
17	Hron	B. Bystrica	SK	1766		334,0	24,5	1931	2015	1931	2015	1931	2006	0,77	437	48,73	19,13
18	Hron	Brehy	SK	3821		195,0	47,2	1931	2015	1931	2015	1924	2007	1,49	390	48,41	18,65
19	Kysuca	Kysucke N. Mesto	SK	955		346,0	16,4	1931	2015	1931	2015	1931	2007	0,52	542	49,30	18,79
20	Topla	Hanusovce	SK	1050		160,4	8,0	1931	2015	1931	2015	1931	2007	0,25	239	49,03	21,50
21	Krupinica	Plastovce	SK	303		139,5	2,0	1931	2014	1931	2014	1931	2007	0,06	208	48,16	18,96
22	Ipel	Holisa	SK	686		172,0	3,1	1931	2015	1931	2015	1931	2007	0,10	144	48,30	19,74
23	Nitra	Nitrianska Streda	SK	2094		158,3	14,7	1931	2015	1931	2015	1931	2007	0,46	221	48,30	18,10
24	Raba	Arpas	HU	6610	29,00	113,3	34,0	1955	2007	1955	2007	1954	2007	1,07	162	47,51	17,40
25	Tisza	Vasarosnameny	HU	25100	684,45	102,0	361,0	1883	2007	1883	2007	1882	2007	11,38	454	48,12	22,34
26	Tisza	Szolnok	HU	73113	334,60	78,8	539,0	1921	2007	1921	2007	n	n	17,00	232	47,17	20,19
27	Tisza	Szeged	HU	138408	173,60	74,0	828,3	1921	2007	1921	2007	1921	2007	26,12	189	46,25	20,17
28	Szamos	Csenger	HU	15283		113,0	127,3	1930	2007	1930	2007	1930	2007	4,01	263	47,83	22,68
29	Maros	Mako	HU	30149		80,0	173,1	1930	2007	1930	2007	1930	2007	5,46	181	46,22	20,48
30	Sajo	Felsoezsolca	HU	6440		107,0	30,6	1891	2007	1891	2007	1891	2007	0,96	150	48,11	20,84
31	Iskar	Orahovica	BG			8370,0										43,6	24,4
32	Vit	Iasen	BG														
33	Jantra	Radanova	BG														
34																	
35	Tisza	Senta	SR	141715		73,0	798,0	1931	2007	1931	2007	1946	2006	25,17	178	45,56	20,06
36	Lim	Prijepolje	SR	3160		442,0	78,0	1926	2007	1926	2007	1946	2006	2,46	778	43,23	19,38
37	Drina	Bajina Basta	SR	14797		211,0	340,0	1926	2007	1926	2007	1946	2006	10,72	725	43,58	19,33
38	Sava	Sremska Mitrovica	SR	87966		72,0	1560,0	1926	2007	1926	2007	1946	2006	49,20	559	44,98	19,62
39	Moravica	Arilje	SR	832		322,0	11,0	1963	2007	1963	2007	1950	2007	0,35	417	43,45	20,07
40	Ibar	Lopatnica Lakat	SR	7818		225,0	57,0	1948	2007	1948	2007	1948	2007	1,80	230	43,38	20,34
41	Zapadna Mo	Jasika	SR	14721		139,0	104,0	1959	2007	1959	2007	n	n	3,28	223	43,37	21,18
42	Juzna Morav	Mojsinje	SR	15390		136,0	93,0	1948	2007	1848	2007	1950	2006	2,93	191	43,38	21,29
43	Velika Morav	Ljubicevski most	SR	37320		73,0	230,0	1931	2007	1931	2007	1948	2006	7,25	194	44,35	21,07
44	Drava	Donji Miholjac	HR	37142	80,50	88,0	538,0	1926	2007	1926	2007	1926	2008	16,97	457	45,77	18,17
45	Kupa	Jamnicka Kiselica	HR	6895	93,00	100,8	175,0	1948	2007	1948	2007	1948	2006	5,52	800	45,55	15,86
46	Sava	Zagreb (incl. Catez)	HR	12450	664,20	112,3	311,0	1926	2008	1926	2008	1926	2008	9,81	788	45,79	15,96
47	Orljava	Pleternica Most	HR	745		113,8	5,2	1946	2008	1946	2008	1946	2008	0,16	221	45,29	17,81
48	Una	Kostajnica	HR	8876	42,10	103,2	232,0	1926	2008	1926	2008	1926	2007	7,32	824	45,22	16,55
49	Sava	Čatež	SI	10186,45	736,7	137,3	279,0	1926	2013	1926	2013	1956	2007	8,80	864	45,89	15,61
50	Krka	Podbočje	SI	2238,12	16,05	146,3	55,0	1926	2013	1926	2013	1926	2013	1,73	775	45,87	15,47
51	Savinja	Laško	SI	1663,60	14,34	215,0	41,5	1907	2013	1907	2013	1907	2013	1,31	787	46,15	15,23
52	Sava	Litija	SI	4821,43	818,65	230,4	167,0	1895	2013	1895	2013	1895	2013	5,27	1092	46,06	14,82
57	Szamos	Satu Mare	RO	15388		127,0	126,1	1950	2008	1950	2008	1925	2010	3,98	259	47,80	22,88
60	Crisul Negru	Zerind	RO	3702		1872,0	29,4	1951	2008	1951	2008	n	n	0,93	250	46,63	21,52
62	Maros	Arad	RO	27280		618,0	169,5	1952	2008	1877	2002	1939	2010	5,34	196	46,18	21,32
64	Siret	Storozhinec	UKR	672		356,0	6,0	1953	2012	1953	2012	1953	2005	0,19	282	48,09	25,43
65	Prut	Chernivcy	UKR	6890		165,0	74,0	1895	2012	1895	2012	1895	2005	2,33	339	48,19	25,55
66	Tisza	Rakhiv	UKR	1070		435,0	25,0	1947	2005	1947	2005	1947	2005	0,79	737	48,04	24,13
67	Tisza	Vylok	UKR	9140		118,0	210,0	1954	2005	1954	2005	1954	2005	6,62	725	48,06	22,50
68	Teresva	Ust-Chorna	UKR	572		524,0	19,0	1947	2005	1947	2005	1947	2005	0,60	1048	48,20	23,56
69	Rika	Mizhhirya	UKR	550		439,0	14,0	1946	2005	1946	2005	1946	2005	0,44	803	48,32	23,30
70	Latorycya	Mucacheve	UKR	1360		123,0	26,0	1947	2012	1947	2012	1947	2005	0,82	603	48,27	22,43
71	Latorycya	Chop	UKR	2870		105,0	36,0	1956	2012	1956	2012	1956	2005	1,14	396	48,27	22,12
72	Uzh	Uzhhorod	UKR	1970		114,0	29,0	1947	2012	1947	2012	1947	2005	0,91	464	48,37	22,18
73	Prut	Jaremcha	UKR	597		507,0	12,0	1950	2012	1950	2012	1950	2005	0,38	634	48,27	24,33
74	Una	Kralje	BA	-		208,9	98,0	1969	2005	1969	2005	1969	2005	3,09	-	44,84	15,85
75	Sana	Sanski Most	BA	2008		156,2	68,0	1964	2005	1964	2005	1964	2005	2,14	1068	44,77	16,68
76	Vrbas	Kozluk Jajce	BA	3161		342,4	29,0	1971	2005	1971	2005	1971	2005	0,91	289	44,37	17,29
77	Bosna	Maglaj	BA	6619		150,0	130,0	1964	2005	1964	2005	1964	2005	4,10	619	44,54	18,09