

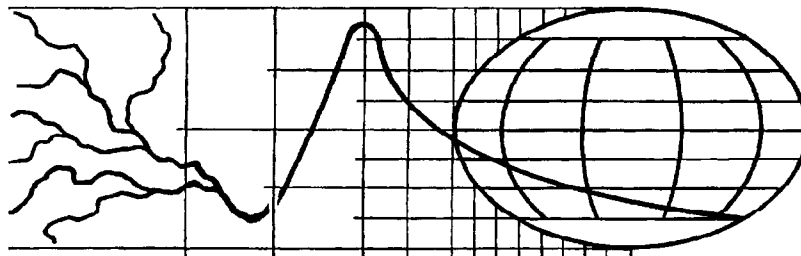
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**Report No. 10**

**Freshwater Fluxes from Continents into the  
World Oceans  
based on Data of the Global Runoff Data  
Base**

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**GRDC**



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In this way the runoff contribution of the area not gauged by regular stations could be assessed and statistically correlated to the gauge height - discharge relationship at the nearest regular gauging station.

For several rivers however, e.g. the Niger river, the station in the GRDC database is not the nearest station to the mouth of the river: A large part of the drainage basin of the Niger could not be considered because the station available nearest to the mouth of the Niger is at Gaya, well in the upper middle course of the river. In these cases, it must be tried to obtain the data for the station which actually is closest to the mouth of the river. In the database are also rivers which receive a substantial increase in runoff from tributaries below the station nearest to the mouth of the river. In these cases, the tributary river discharging below that station into the main stem of a river has also to be taken into account for the flux computations: The Obidos station is the closest station to the mouth of the Amazone; however, below that station the Xingu river discharges into the Amazone and thus is included in the computations.

To indicate the number of necessary rivers and gauging stations globally and for each continent which are necessary to monitor global/continental runoff, the following method was used: From the information presently available in the GRDC database, the size of drainage basins of rivers draining into the oceans has been ranked in decreasing order on a global scale and for each continent. Following a suggestion of M. MEYBECK (personal communication), for all stations close to the mouth of the rivers, the runoff was computed and then cumulated. The results have been plotted into the graphs of figures 9-16. The common characteristic of all figures is, that the curve reaches a near-asymptotical stage with increasing numbers of rivers. This indicates, that once the curve is asymptotic, an increase in the number of rivers does not significantly increase the information content with regard to runoff from continents into the oceans.

The validity of the continental and global runoff obtained from GRDC data has been checked against runoff estimates from other authors and indicated in the graphs. Except for the data from BAUMGARTNER and REICHEL, cited in PEIXOTO (1993)) all other authors are cited in LEGATES and MATHER (1992)). On a global scale, the 10 largest rivers overestimate global runoff, whereas for the 25 largest rivers the GRDC-runoff is at the upper limit of estimates of the other authors (fig.9). For Africa, the computed runoff is in general higher than the estimated runoff of most other authors. This is explained by the fact that the GRDC database for Africa is perhaps the most complete database of all and therefore contains more valid information (fig.10).















## **Note**

**Maps produced by the GRDC are not to be taken as necessarily representing the view of the GRDC on boundaries or the political status.**









GLOBAL RUNOFF DATA CENTRE (GRDC)

Fresh Water Fluxes into the Oceans  
based on Mean Annual Values

	River Discharge from Land Surfaces	Surface of Basin Areas draining into the Oceans	Precipitation	P-E	Surface of Oceans
	GRDC km <sup>3</sup> /a	GRDC 10 <sup>6</sup> km <sup>2</sup>	Baumg./Reichel km <sup>3</sup> /a	Baumg./Reichel km <sup>3</sup> /a	Baumg./Reichel 10 <sup>6</sup> km <sup>2</sup>
Arctic Ocean	110	11.21	825	374	8.50
Atlantic Ocean	151	20.44	74578	-36456	98.00
Indian Ocean	79	6.18	81041	-19503	77.70
Pacific Ocean	59	8.45	228555	15921	176.90

Table 4























































## GLOBAL RUNOFF DATA (CENTRE)

### NORTH AND CENTRAL AMERICA Representative Gauging Stations for Continental Runoff Monitoring

Rivers sorted according to size of drainage basins

No.	River	Station	Country Code	Latitude	Longitude	Basin Area
26	San Juan	el Castillo	NK	1102N	8442W	32819
27	Coppermine River	Point Lake Outlet	CN	6541N	11400W	19300
28	Lempa	San Marcos	ES	1343N	8870W	18176
29	Ellice	near the Mouth	CN	6771N	10414W	16900
30	Burnside River	near The Mouth	CN	6674N	10882W	16800







AFRICA									
No.	River	Station	Latitude	Longitude	Aerea(km2)	First rec.	last rec.	day/mont	Remark
1	Sebou	Azib Soltane	3428N	54W	17250	9 1959	1 1989	M	
2	Senegal	Dagana	1652N	155W	268000	5 1903	10 1974	M	*
3	Gambie	Gouloumbou	1347N	137W	42000	5 1979	12 1989	D	*
4	Moa	Moa Bridge	782N	111W	17150	4 1976	5 1977	M	
5	Lofa	Dougomai	820N	97W	246	4 1973	11 1977	M	
6	St Paul	Walker Bridge	733N	95W	9760	1 1973	12 1975	M	
7	Cestos	Sawolo	643N	86W	683	1 1976	12 1979	M	
8	Cavally	Tate	438N	75W	28800	1 1979	12 1982	D	
9	Bandama	Tiassale	588N	47W	95500	1 1979	12 1982	D	
10	Sassandra	Soubre	576N	66W	62000	1 1979	12 1982	D	
11	Comoe	Mbasso	629N	34W	69900	1 1979	12 1982	D	
12	Tano	Alanda	512N	27W	15800	1 1965	7 1978	M	
13	Oueme	Bonou	690N	24E	46990	7 1948	12 1992	D	
14	Niger	Gaya	1188N	34E	1000000	7 1952	9 1990	M	*
15	Cross	Mamfe	575N	93E	6810	4 1967	12 1979	M	
16	Sanaga	Edea	377N	100E	131520	9 1943	3 1980	M	*
17	Nyong	Dehane	357N	101E	26400	2 1951	3 1977	M	
18	Ogooue	Lambarene	068S	102E	205000	1 1930	12 1975	M	
19	Kouilou	Sounda	410S	120E	55010	1 1969	12 1982	M	
20	Zaire	Kinshasa	430S	153E	3475000	1 1903	12 1983	D	*
21	Oranje	Vioolsdrif	2876S	177E	850530	10 1964	9 1986	M	
22	Groot-Vis	Outspan	3324S	269E	29745	7 1969	9 1986	M	
23	Nile	el Ekhsase	2970N	312E		1 1973	12 1984	M	
24	Juba	Lugh Ganana	356N	423E	179520	1 1951	1 1979	M	*
25	Rufiji	Stigler	780S	379E	158200	10 1954	12 1978	D	
26	Mangoky	Bevoay	2183S	438E	53225	11 1964	10 1983	M	
27	Zambeze	Matundo-Cais	1615S	335E	940000	1 1976	12 1979	M	*
28	Save	Villafranca do Save	2110S	346E	100885	1 1976	11 1979	M	*
29	Limpopo	Chokwe	2450S	330E	342000	1 1976	9 1979	M	

Table 1.1

Remark: \* Selected Stations for general characteristics































GLOBAL RUNOFF DATA CENTRE (GRDC)

Australia

Stations close to the mouth of Rivers

River	mean annual discharge (m <sup>3</sup> /s)	mean annual runoff (mm)	Minimum annual discharge (m <sup>3</sup> /s)	Minimum annual runoff (mm)	Maximum annual discharge (m <sup>3</sup> /s)	Maximum annual runoff (mm)	Mean volume of discharge per year (km <sup>3</sup> /a)	Year of occurrence (Mean/Min/Max) annual discharge
Fitzroy	69	16	24	6	184	43	2	1967/1965/1968
Murray	257	8	36	1	1107	35	8	1984/1982/1974
Sepik	4208	3242	4208	3242	4208	3242	133	1983/1983/1983
Burdekin	360	88	40	10	1639	399	11	1975/1982/1974

Table 1.13





















GLOBAL RUNOFF DATA CENTRE (GRDC)

NORTH AND CENTRAL AMERICA

Overview of overlapping timeseries of stations close to the mouth of Rivers

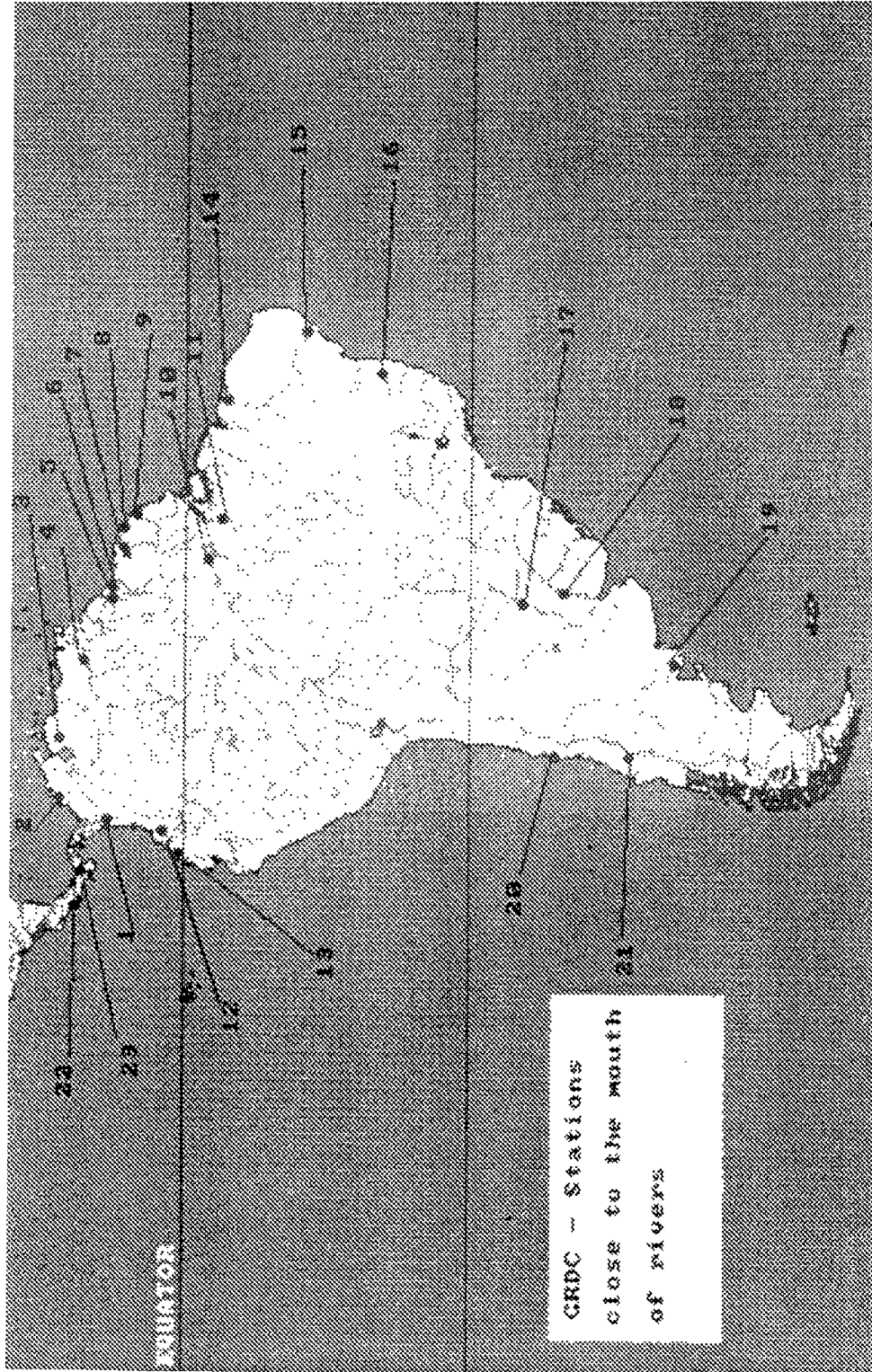
River	Station	Time series	1880	1885	1890	1895	1900	1905	1910	1915	1920	1925	1930	1935	1940	1945	1950	1955	1960	1965	1970	1975	1980	1985	1990	1995
Kuskokwim	Crooked Creek, Alias	1965 1984																								
Yukon River	Pilot Station	1975 1993																								
Sitkine	above Butterfly Creek	1971 1984																								
Taku	near Tulsequah	1953 1984																								
Skeena	USK	1928 1984																								
Fraser River	Hope	1912 1990																								
Mackenzie River	Arctic Red River	1972 1992																								
Back	below Deep Rose Lake	1966 1984																								
Churchill River	above Granville Falls	1946 1990																								
Columbia	The Dalles, Oreg	1878 1988																								
Mississippi	Tarbert Landing, Miss	1965 1984																								
Saint John River	below Macataquac	1973 1984																								
St Lawrence	Cornwall(Ontario), near Massena	1973 1984																								
Churchill River	above Upper Muskkrat Falls	1966 1984																								
Sacramento	Sacramento, Calif	1948 1984																								
Susquehanna	Harrisburg, Pa	1890 1987																								
Alabama	Claiborne, Ala	1930 1984																								
Brazos	Richmond, Tex	1965 1984																								
Colorado	Limite Internacional Norte	1976 1979																								
Yaqui	el Novillo	1976 1979																								
Fuerte	San Miguel Zapotitan	1976 1981																								
Santiago	el Capomal	1965 1981																								
Panuco	Las Adjuntas	1965 1979																								
Usumacinta	Boca del Cerro	1965 1983																								
Lempa	San Marcos	1969 1978																								
Motaqua	Morales	1976 1977																								
Coco	Corriente Lira	1978 1980																								
Grande	San Pedro del Norte	1976 1979																								
San Juan	el Castillo	1969 1978																								
Yaque del Norte	Palo Verde	1976 1979																								
Milk River	Rest	1968 1970																								
Rio Culebrinas	Highway 404 near Moca	1978 1990																								
Bravo	Matamoros	1976 1979																								
Nelson River	above Bladder Rapids	1958 1990																								
Trail Valley Creek	near Inuvik	1977 1992																								
Coppermine River	Point Lake Outlet	1965 1992																								
Tree River	near the mouth	1968 1992																								
Burnside River	near the mouth	1976 1992																								
Gordon River	near the mouth	1977 1992																								
Elice River	near the mouth	1971 1992																								
Big River	above Egg River	1975 1988																								
Freshwater Creek	near Cambridge Bay	1970 1992																								

Table 1.21









Map 7











































