- Supporting Information –

Characterization factors for water consumption and greenhouse gas emissions based on freshwater fish species extinction

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25 pages

1 figure

5 tables

Estimation of river volumes

Estimation of the river volume was based on data from Xenopoulos et al. (1), Alcamo et al. (2), Hugueny (3), Fekete et al. (4), Doll et al. (5), and EarthTrends Watersheds of the World (6). The water volume of a river can be calculated by:

$$V_i = Q_i \cdot \tau_i \quad \textbf{Equation S1}$$

where V_i is the water volume of river i (m^3), Q_i is the average discharge of river i ($m^3 \cdot s^{-1}$) and τ_i is the average residence time of the water in river i (s).

The average river discharge was calculated by:

$$Q_i = \frac{Q_{mouth,i}}{2} \quad \textbf{Equation S2}$$

where $Q_{mouth,i}$ is the discharge at the mouth of river i ($m^3 \cdot s^{-1}$) available from WaterGap (2). The average distance travelled by each raindrop will depend on the river network pattern. By dividing $Q_{mouth,i}$ by 2 to estimate the spatially averaged discharge, we assume that the average distance travelled is half of the river's total length.

The average residence time (in s) was obtained from the river's total length and the average river water velocity:

$$\tau_i = \frac{L_i/2}{v_i} \quad \textbf{Equation S3}$$

where L_i is the length of river i (m) and v_i is the average velocity of river i ($m \cdot s^{-1}$). Again, we assumed that the average distance travelled of the water is half of the river's total length.

Based on Allen et al. (7), a typical river velocity can be derived from river discharge data via:

$$v_i = 1.067 \cdot Q_i^{0.1035} \qquad \textbf{Equation S4}$$

where v_i is the river velocity ($m \cdot s^{-1}$) and Q_i is the average river discharge in river basin i ($m^3 \cdot s^{-1}$).

Feeding equation 4 into 3, and equations 2 and 3 into equation 1 reveals that:

$$V_i = \frac{Q_{mouth,i}}{2} \cdot \frac{L_i/2}{1.067 \cdot \left(\frac{Q_{mouth,i}}{2}\right)^{0.1035}} = 0.47 \cdot \left(\frac{Q_{mouth,i}}{2}\right)^{0.90} \cdot L_i \qquad \textbf{Equation S5}$$

Derivation of $dQ_{mouth,i}/dTEMP$

The derivation of $dQ_{mouth,i}/dTEMP$ for all the 214 river basins was taken as a starting point in the calculation of the effect factor for global warming, using year 2100 as a future reference year. The river basin-specific $dQ_{mouth,i}/dTEMP$ was calculated by dividing the discharge at the mouth of each river basin with the global mean temperature change in 2100. As reported in IPCC (8) and MA (9), global mean temperature changes are projected within the range of 1.9 to 4.4 by the year 2100, depending on the scenario chosen (see Table S1). The effect factors were calculated for five global climate scenarios to project freshwater fish species loss for the year 2100 by multiplying $dQ_{mouth,i}/dTEMP$ with $dPDF_i/dQ_{mouth,i}$ over all river basins included.

Table S1. Summary of the five global climate scenarios considered in the present study (8, 9).

Scenario	Summary	Global mean temperature change in 2100 (°C)
A2	A heterogeneous world with continuously increasing population growth rate. Regionalized and fragmented economic growth and slow technological change.	4.4
B2	A world with intermediate levels of economic and population growth, and emphasize on local solutions to economic, social, and environmental sustainability. Technological change is faster than A2.	3.2
FW	Regionalized and fragmented world. Reactive approach to the global environmental problems. High population growth with low economic development and technological change. The gap between rich and poor countries increases over time.	3.3
GO	Strong global action with emphasis on trade and economic growth. Offer an equal access on public goods and services. Reduce poverty by improving human well-being. Reactive approach to the global environmental problems.	3.5
TG	Strong global action, with emphasis on green technology. High economic growth. Proactive approach to the global environmental problems using technology and market-oriented institutional reform. Focusing on economic, education and human well-being. Symbiotic benefits for both the environment and economy.	1.9

Influence of including river basins located above 42°

Greenhouse gas emissions

Figure S1 shows the effect factors for greenhouse gases for five global scenarios in 214 and 297 river basins. The average effect factor for 214 river basins included is $2.04 \cdot 10^9$ PDF·.m^3·°C^{-1}. When including other river basins that located at the higher latitude (> 42°), the average effect factor increases to $2.07 \cdot 10^9$ PDF·m^3·°C^{-1}. A relatively high potential freshwater fish species loss is reported in B2 scenario per degree of temperature increase compared to the other future scenarios. This finding can be explained by the fact that in the B2 scenario the decrease in water discharge is predicted is due to the low water discharge in this scenario compared to other scenarios in rivers with the highest effect factors, i.e. the rivers below 42 degrees latitude with the highest river length. This results in a relatively high value for *dPDF/dQ* in the B2 scenario.

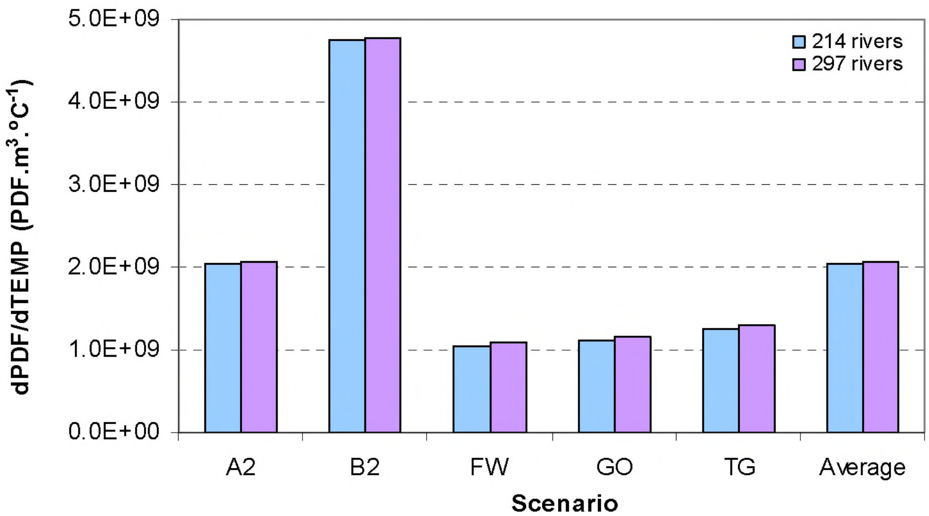

Figure S1. The effect factors for greenhouse gas emissions (PDF·m^3·°C^{-1}) based on IPCC and MA scenarios for 214 and 297 river basins, respectively.

Normalization factors

Characterization factors, water consumption in year 1995 and normalization factors for water consumption for 112 river basins were included. Due to lack of data, we were not able to derive normalization factors for all river basins considered in this study. To derive normalization factors for water consumption, we started with water withdrawal data for households, irrigation, industry, and livestock sectors representative for year 1995 from the WaterGap model (2, 10). We converted water withdrawal to water consumption by using continent-specific water withdrawal-consumption ratios derived from Shiklomanov (11), i.e. for Europe = 43%, North America = 34%, Africa = 72%, Asia = 62%, South America = 53% and Australia = 58%. The total population for the 112 river basins included is $2.65 \cdot 10^9$. Normalization factors were expressed in unit of the potentially disappeared fraction of fish species for river-specific water consumption (PDF·m^3/capita). The total normalization factor for direct water consumption (NF_{wc}) was calculated by:

$$NF_{wc} = \frac{\sum_i W_i \cdot CF_i}{\sum_i N_i}$$ **Equation S6**

where W_i is the water consumption in river basin i ($m^3 \cdot yr^{-1}$), CF_i is the characterization factor for river basin i ($PDF \cdot m^3 \cdot yr \cdot m^{-3}$) and N_i is the number of capita in river basin i (capita).

The normalization factors for global warming were based on the global greenhouse gas emissions for year 2000. The total population numbers in the world in 2000 is $6.1 \cdot 10^9$ (12). Normalization factors were expressed in unit of the potentially disappeared fraction of fish species over a certain river volume due to global greenhouse gas emissions in 2000 ($PDF \cdot m^3$/capita). The total normalization factor for greenhouse gas emissions (NF_{ghg}) was calculated by:

$$NF_{ghg} = \frac{\sum_x M_x \cdot CF_x}{N_{world}}$$ **Equation S7**

where M_x is the emitted quantity of a substance x (kg), CF_x is the characterization factor for substance x ($PDF \cdot m^3 \cdot yr \cdot kg^{-1}$) and N_{world} is the total number of capita in the world in year 2000 (capita).

Table S2. River characteristics for 214 river basins below 42 degrees latitude (1 – 6) and river-specific effect factor for global warming. Due to increased precipitation, the river discharge rate is predicted to increase in some areas (13). River basins with increased discharge were excluded in the calculation of the effect factor for global warming.

* - River basins with increased discharge.

River basins below 42 degrees latitude	River length (km)	Average river discharge at the mouth ($km^3 \cdot yr^{-1}$)	Calculated river volume (m^3)	Effect factor for global warming ($PDF \cdot m^3 \cdot {}^oC^{-1}$)
Nil (Af., int.)	5909	75.87	1.60E+09	*
Senegal (Guinée-Sénégal)	1680	9.94	7.34E+07	6.12E+06
Gambia (Guinée-Gambie)	745	6.76	2.31E+07	1.29E+06
Tominé ou Rio Corubal (Guinée-Guineé Bissau)	463	17.82	3.42E+07	9.67E+05
Konkouré (Guinée)	303	13.08	1.69E+07	2.70E+05
Kolenté (Guinée, Great Scarcies)	240	28.05	2.66E+07	4.07E+05
Jong (Sierra Leone)	249	17.85	1.84E+07	1.09E+05
Sewa (Sierra Leone)	240	17.41	1.73E+07	1.24E+05
Moa (Guinée-Sierra Leone)	425	26.14	4.42E+07	2.52E+05
Mano (Libéria)	276	10.79	1.30E+07	2.66E+04
Loffa (Guinée-Libéria)	349	15.81	2.31E+07	4.37E+04
St Paul (Libéria)	410	36.46	5.75E+07	2.26E+04
Nipoué (Cess, Libéria-RCI)	332	16.94	2.34E+07	*
Cavally (Libéria-RCI)	379	25.70	3.88E+07	*
Dodo (aka Déo) (RCI)	89	19.35	7.04E+06	*
San Pédro (RCI)	193	2.55	2.49E+06	*
Sassandra (RCI)	569	30.61	6.82E+07	*
N'Zo (a. Sassandra) (RCI)	243	3.25	3.91E+06	*
Boubo (RCI)	130	2.69	1.76E+06	*
Bandama (RCI)	692	23.26	6.48E+07	*
Yani (s.a. Bandama) (RCI)	167	23.26	1.56E+07	*

River basins below 42 degrees latitude
Marahoué (a. Bandama) (RCI)
N'Zi (a. Bandama) (RCI)
Kan (s.a. Bandama) (RCI)
Agnébi (RCI)
Comoé (RCI-Burkina)
Bia (RCI-Ghana)
Volta (Ghana-Burkina)
Black Volta (Burkina-Ghana) (a. Volta)
Nasia (a. White Volta) (Ghana)
Daka (a. Volta) (Ghana)
Mono (Togo)
Ouémé (Bénin)
Ogun (Nigéria)
Niger (Afr. Int.)
Niandan (Guinée) (a. Niger)
Bénoué (Nigéria-Cameroun) (a. Niger)
Sokoto (a. Niger) (Nigeria)
Cross (Nigéria-Cameroun)
Mungo (Cameroun)
Dibamba (Cameroun)
Wouri (Cameroun)
Sanaga (Cameroun)
Nyong (Cameroun)
Lokoundjé (Cameroun)
Kribi ou Kienké (Cameroun)
Lobé (Cameroun)
Ntem (Cameroun-Gabon-Guinée équat.)
Ogôoué (Gabon)
Niari-Kouilou (Congo)
Zaïre (Afr., Int.)
Cunene ou Kunene (Namibie-Angola)

River length (km)	Average river discharge at the mouth ($km^3 \cdot yr^{-1}$)	Calculated river volume (m^3)	Effect factor for global warming ($PDF \cdot m^3 \cdot {}^\circ C^{-1}$)
249	12.76	1.36E+07	*
472	6.86	1.48E+07	*
629	23.26	5.89E+07	*
281	2.76	3.89E+06	*
750	5.92	2.06E+07	*
260	4.32	5.38E+06	5.53E+03
1301	32.76	1.66E+08	*
1352	8.11	4.93E+07	*
219	8.52	8.33E+06	3.00E+04
106	21.45	9.23E+06	*
412	3.47	7.01E+06	*
480	6.22	1.38E+07	*
410	5.81	1.11E+07	*
4200	147.43	2.06E+09	*
344	18.69	2.65E+07	4.59E+05
1400	68.68	3.46E+08	*
275	29.01	3.14E+07	5.24E+04
480	59.93	1.05E+08	*
13	8.27	4.82E+05	3.29E+02
150	18.78	1.16E+07	1.48E+04
160	18.78	1.24E+07	1.58E+04
803	63.81	1.86E+08	3.69E+05
402	22.14	3.60E+07	8.34E+04
185	3.12	2.87E+06	2.85E+03
100	3.12	1.55E+06	1.54E+03
80	3.12	1.24E+06	1.23E+03
356	19.21	2.81E+07	1.50E+04
815	155.06	4.18E+08	9.00E+05
481	28.35	5.38E+07	6.76E+05
4339	1348.39	1.55E+10	5.11E+06
828	8.80	3.24E+07	6.18E+05

River basins below 42 degrees latitude
Kasaï (a. Zaïre) (Zaïre-Angola)
Chari (Lac Tchad)
Ubangi (a. Zaïre) (Congo-RCA)
Zambezi (Mozambique-Zambie-Angola)
Tana (Kénya)
Rufiji (Tanzanie)
Limpopo (Botswana-Mozamb.-Rhodésie-RSA)
Pongolo ou Maputo (RCA-Mozambique)
Shire (a.) (Malawi-Mozambique)
Kafue (a. Zambèze) (Zambie)
Ruaha (a. Rufiji) (Tanzanie)
Evros-Mariça (Grèce-Turquie-Bulgarie)
Nesta-Nestos (Grèce-Bulgarie)
Strymon-Strouma (Grèce-Bulgarie)
Agly (France)
Minho (Portugal-Espagne)
Lima (Portugal)
Cavado (Portugal)
Douro (Portugal-Esp.)
Vouga (Portugal)
Mondego (Portugal)
Sado (Portugal)
Mira (Portugal)
Guadiana (Portugal-Esp.)
Raisin (Canada)
Sydenham (Canada)
Grand river (Canada)
Thames (Canada)
Mississipi (USA)
Rio Grande (USA-Mexique)
Pecos (a. Rio Grande)

River length (km)	Average river discharge at the mouth ($km^3 \cdot yr^{-1}$)	Calculated river volume (m^3)	Effect factor for global warming ($PDF \cdot m^3 \cdot °C^{-1}$)
2153	573.15	3.57E+09	*
1733	25.45	1.76E+08	*
2300	177.98	1.34E+09	*
2693	120.36	1.10E+09	6.78E+07
671	7.31	2.23E+07	1.13E+05
809	30.49	9.66E+07	2.33E+05
1800	9.12	7.28E+07	3.45E+06
347	4.73	7.80E+06	1.42E+05
1200	119.70	4.88E+08	3.00E+07
960	17.84	7.09E+07	3.80E+06
475	30.49	5.67E+07	1.37E+05
415	11.01	1.99E+07	5.58E+05
230	1.91	2.29E+06	1.08E+05
389	3.40	6.50E+06	2.45E+05
82	1.38	6.12E+05	4.48E+03
350	11.20	1.70E+07	1.20E+04
108	3.23	1.72E+06	1.63E+03
135	3.23	2.15E+06	2.04E+03
555	23.10	5.17E+07	5.06E+05
148	1.67	1.31E+06	2.13E+03
234	2.78	3.27E+06	7.06E+03
175	1.28	1.22E+06	1.22E+04
145	0.33	3.01E+05	2.74E+03
766	7.86	2.71E+07	4.20E+05
217	178.89	1.27E+08	1.05E+05
165	162.07	8.81E+07	7.69E+04
280	196.50	1.78E+08	1.28E+05
270	4.90	6.26E+06	*
4185	530.64	6.47E+09	8.21E+06
2219	8.00	7.98E+07	2.10E+05
1490	6.55	4.48E+07	*

River basins below 42 degrees latitude
Canadian (s. a. Mississipi) (USA)
Colorado (USA-Mexique)
San Juan (a. Colorado) (USA)
Zuni (s. a. Colorado) (a. Little Colorado)
San Francisco (a. Gila) (USA)
Gila (a. Colorado)
Ohio river (a. Mississipi)
Scioto River (a. Ohio)
Big Darby Creek (s. a. Ohio) (a. Scioto)
Wabash River (a. Ohio)
Little Wabash River (a. Wabash)
Embarras River (a. Wabash)
St Joseph River (s.a. Wabash)
Elk river (s. a. Ohio) (a. Kanawha)
Cumberland river (a. Ohio)
Green river (a. Ohio)
Kanawha river (a. Ohio)
Tennessee River (a. Ohio)
Muskingum River (s.a. Ohio) (a. Allegheny)
Allegheny river (a. Ohio)
Little Miami river (a. Ohio)
Hocking river (a. Ohio)
Kinniconick river (a. Ohio)
Licking River (a. Ohio)
Little Scioto river (a. Ohio)
Ohio Brush Creek (a. Ohio)
Olentangy River (a. Little Scioto)
Paint Creek (a. Scioto river)
Scioto Brush Creek (a. Scioto)
Symmes River (a. Ohio)
Tygart Creek (a. Ohio)

River length (km)	**Average river discharge at the mouth ($km^3 \cdot yr^{-1}$)**	**Calculated river volume (m^3)**	**Effect factor for global warming ($PDF \cdot m^3 \cdot {}^oC^{-1}$)**
1223	4.59	2.67E+07	3.05E+05
1750	1.35	1.28E+07	3.03E+04
375	15.72	2.47E+07	7.52E+03
145	15.05	9.19E+06	3.42E+03
2212	0.04	7.17E+05	*
1044	0.68	4.13E+06	*
2102	240.85	1.60E+09	*
372	83.41	1.09E+08	*
135	3.89	2.55E+06	6.29E+02
764	147.34	3.75E+08	*
320	147.34	1.57E+08	*
298	12.70	1.62E+07	1.93E+04
160	2.84	2.27E+06	6.79E+03
277	9.56	1.17E+07	*
1106	93.04	3.59E+08	*
1175	118.14	4.73E+08	*
156	65.60	3.70E+07	*
1049	240.85	7.99E+08	*
179	36.46	2.51E+07	*
523	10.61	2.42E+07	*
170	93.83	5.56E+07	*
153	47.46	2.72E+07	*
159325	85.56	4.80E+10	*
65	93.83	2.13E+07	*
65	2.60	8.54E+05	8.11E+01
102	83.41	3.00E+07	*
98	1.91	9.78E+05	2.24E+02
153	6.97	4.85E+06	*
57936	83.41	1.71E+10	*
97	67.74	2.37E+07	*
257	2.72	3.52E+06	*

River basins below 42 degrees latitude
Bear Creek
Apalachicola (USA)
Klamath (USA)
Mobile (USA)
Potomac (USA)
Sabine (USA)
Sacramento (USA)
Savannah (USA)
Susquehanna (USA)
Connecticut river (USA)
Missouri (USA)
Arkansas river (USA)
Red river (USA)
Altamaha (USA)
Balsas (Mexico)
Panuco (Mexico)
Sucio (a. Lempa) (San Salvador)
Paz (San Salvador)
San Tiguel (ou Miguel) San Salvador)
Paraguay (Brésil-Arg.-Paraguay) (a. Parana)
Uruguay (Brésil-Arg.-Uruguay)
Magdalena (Colombie)
Rio Negro (a. Amazone) (Colomb.-Venez.-Brésil)
Parnaiba (Brésil)
Madeira (a. Amazone) (Brésil-Bolivie)
Orinoco (Vénézuela-Colombie)
Parana (Brésil-Paraguay-Argentine)
Tibagi (Bresil)
Amazon (Br. Mère Maranon) (Pérou-Brésil)
Maroni (Guyane-Surinam)
Oyapock (Guyane-Brésil)

River length (km)	Average river discharge at the mouth ($km^3 \cdot yr^{-1}$)	Calculated river volume (m^3)	Effect factor for global warming ($PDF \cdot m^3 \cdot {}^oC^{-1}$)
46	1.17	2.94E+05	*
180	24.24	1.75E+07	1.07E+04
318	19.77	2.57E+07	2.26E+05
72	60.65	1.59E+07	*
297	11.02	1.42E+07	*
564	12.92	3.12E+07	5.05E+05
927	36.79	1.31E+08	1.81E+06
457	11.18	2.22E+07	*
514	33.01	6.59E+07	*
497	17.64	3.63E+07	*
3767	192.83	2.35E+09	8.42E+06
2364	547.14	3.76E+09	3.28E+06
2188	522.08	3.33E+09	4.00E+06
449	13.33	2.55E+07	9.55E+03
706	24.85	7.02E+07	1.34E+06
490	17.15	3.49E+07	6.76E+05
25	13.42	1.43E+06	7.85E+04
134	4.47	2.86E+06	1.52E+05
145	1.30	1.02E+06	1.07E+05
2549	539.87	4.00E+09	*
1424	181.85	8.43E+08	*
1271	218.38	8.87E+08	9.30E+06
1112	4067.95	1.07E+10	8.24E+07
1192	26.62	1.26E+08	5.25E+06
3239	5010.21	3.75E+10	2.93E+08
1970	1096.40	5.84E+09	1.85E+08
2748	601.89	4.76E+09	*
550	11.51	2.74E+07	1.69E+04
4327	6394.15	6.23E+10	6.17E+08
445	57.17	9.34E+07	6.07E+06
291	40.17	4.45E+07	2.28E+06

River basins below 42 degrees latitude
Approuague
Sinnamary (Guyane)
Kourou (Guyane)
Vakhsh ou Vachs (fSU) (a. Amu Darya)
Surkhandarya ou Surchandarya (fSU)
Zeravshan (a. Syr Darya) (fSU)
Naryn (a. Syr Darya) (fSU)
Tarim (Chine)
Murgab ou Murghab ou Mourbab (fSU-Afghanistan) Endo
Kabul (a. Indus) (Afghanistan-Inde)
Salween (Tibet-Chine-Birmanie-Thaï)
Mae Khlong (Thaïlande)
Chao Phrya (Menam) (Thaïlande)
Mekong (Asie Sud-Est, Int.)
Kelani Ganga(Sri Lanka)
Kalu Ganga (Sri Lanka)
Gin Ganga (Sri Lanka)
Nilwala Ganga (Sri Lanka)
Mahaweli Ganga (Sri Lanka)
Brahmapoutre ou Tsangpo (Inde-Bengladesh-Tibet)
Indus (Tibet-Inde-Pakistan)
Gange (Inde)
Ob (fSU)
Yangzi Jiang (Tibet-Chine)
Gandaki river (a. Gange) (nepal)
Sakaria (Turkey)
Rakaïa river (New-Zealand)
Fly (Nlle-Guinée)
Sepik-Ramu (Nlle-Guinée)
Kapuas (Bornéo)
Murray-Darling (Australie)

River length (km)	Average river discharge at the mouth ($km^3 \cdot yr^{-1}$)	Calculated river volume (m^3)	Effect factor for global warming ($PDF \cdot m^3 \cdot {}^{o}C^{-1}$)
270	10.68	1.26E+07	5.98E+05
250	12.16	1.31E+07	6.78E+05
112	6.90	3.53E+06	1.75E+05
1976	51.29	3.76E+08	*
175	54.58	3.52E+07	*
1615	59.28	3.50E+08	*
807	16.27	5.49E+07	*
1227	2.23	1.40E+07	*
850	2.78	1.19E+07	3.62E+04
700	84.80	2.09E+08	*
2576	98.52	8.80E+08	*
145	21.06	1.24E+07	*
710	27.48	7.72E+07	*
3977	421.80	5.01E+09	*
145	3.85	2.71E+06	6.55E+03
129	3.85	2.41E+06	5.82E+03
116	2.38	1.41E+06	*
72	4.32	1.49E+06	3.10E+03
335	3.44	5.66E+06	7.77E+04
2897	1186.94	9.22E+09	1.06E+08
2382	121.17	9.80E+08	2.34E+06
2221	397.83	2.65E+09	9.78E+07
3977	413.18	4.91E+09	*
6380	955.40	1.67E+10	*
630	1186.94	2.00E+09	3.87E+07
506	7.78	1.78E+07	4.82E+05
150	4.74	3.38E+06	*
678	135.37	3.08E+08	4.34E+06
285	100.67	9.93E+07	1.76E+06
569	174.16	3.24E+08	*
1767	11.14	8.55E+07	2.83E+06

River basins below 42 degrees latitude
Yellow (Huang He, Huang Ho, China)
Yangtze (Chang Jiang, Yangtze Kiang, China)
Xi Jiang River (Pearl River, Chu Chiang, Zhu, Southeast China)
Tsengwen River (Southwestern Taiwan)
Tigris (Southeast Turkey and Iraq)
Tanshui (Northern Taiwan)
Tano (West Africa)
Saloum (West Africa)
Saint John (West Africa)
Rokel River (Seli River, West Africa)
Purus (Northwest central South America)
Pra River (West Africa)
Pilcomayo (South central South America)
Pará-Tocantins (Brazil)
Orange (South Africa)
Ombrone (Tuscany, Western Italy)
Okavango (Southwest central Africa)
Marañon (Peru)
Little Scarcies (West Africa)
Kwando River (Southwest Africa/Namibia)
Kura (Russia and Turkey)
Krishna (Karnataka, India)
Kogon (Guinea, West Africa)
Kaoping River (Southern Taiwan)
Irrawaddy River (Irawadi, Central Myanmar Burma)
Godavari (Central India)
Géba (Guinea Bissau, West Africa)
Ganges (Ganga, North and northeast Indian subcontinent)
Fatala (West Africa)
Euphrates (Firat Nehri, Al-Furat, Southwest Asia)
Erhjen River (Southern River)

River length (km)	Average river discharge at the mouth ($km^3 \cdot yr^{-1}$)	Calculated river volume (m^3)	Effect factor for global warming ($PDF \cdot m^3 \cdot {}^oC^{-1}$)
4168	56.53	8.66E+08	*
4734	955.94	1.24E+10	*
1696	270.52	1.43E+09	*
130	1.29	9.12E+05	1.42E+03
1950	34.43	2.60E+08	4.97E+06
328	2.47	4.12E+06	*
400	4.52	8.63E+06	1.77E+04
105	0.53	3.30E+05	2.48E+04
616	25.02	6.16E+07	*
386	13.16	2.17E+07	2.34E+05
3379	2888.58	2.39E+10	1.14E+08
245	7.14	7.96E+06	2.38E+04
2500	86.50	7.60E+08	1.14E+06
2234	376.40	2.54E+09	4.67E+07
1840	8.44	6.95E+07	3.40E+06
130	1.56	1.08E+06	5.20E+03
1600	23.78	1.53E+08	6.29E+06
1415	5.37	3.56E+07	1.09E+05
280	14.87	1.76E+07	2.53E+05
731	34.09	9.65E+07	8.25E+06
796	22.00	7.09E+07	4.63E+05
1091	107.26	4.02E+08	3.44E+06
256	10.75	1.22E+07	2.01E+05
171	4.29	3.52E+06	1.28E+04
1781	564.35	2.91E+09	*
950	107.26	3.50E+08	2.99E+06
547	3.95	1.04E+07	4.04E+05
2221	1045.01	6.30E+09	8.31E+07
205	13.09	1.15E+07	1.83E+05
2289	19.60	1.84E+08	4.42E+06
36	4.29	7.40E+05	5.34E+03

River basins below 42 degrees latitude	River length (km)	Average river discharge at the mouth ($km^3 \cdot yr^{-1}$)	Calculated river volume (m^3)	Effect factor for global warming ($PDF \cdot m^3 \cdot {}^oC^{-1}$)
Chobe River (Southwest Africa/Namibia)	1500	34.09	1.98E+08	1.69E+07
Chittar (Tamil Nadu, India)	80	0.00	2.13E+03	6.22E+01
Cauvery (Karnataka, India)	627	7.59	2.15E+07	1.31E+06
Casamance (West Africa)	320	3.49	5.47E+06	2.83E+05
Brahmaputra (Dyardanes, Oedanes, Tsangpo, Zangbo, Tibet, China, NE India and Bangladesh)	2948	1045.48	8.37E+09	1.10E+08
Araguaia (Araguaya, Central Brazil)	2627	183.47	1.57E+09	2.32E+07
Athi-Galana-Sabaki River Drainage System (Kenya, from Nairobi eastward to Mombasa)	962	3.99	1.85E+07	3.18E+04

Table S3. River characteristics for 83 river basins above 42 degrees latitude (1 - 6) and river-specific effect factor for global warming.

* - River basins with increased discharge.

River basin above 42 degrees latitude	River length (km)	Average river discharge at the mouth ($km^3 \cdot yr^{-1}$)	Calculated river volume (m^3)	Effect factor for global warming ($PDF \cdot m^3 \cdot {}^oC^{-1}$)
Scorff (a. Blavet) (France)	75	1.9098	7.47E+05	*
Seine (France)	451	17.124	3.21E+07	*
Lot (a. Garonne) (France)	481	19.359	3.82E+07	2.33E+05
Garonne (France-Espagne)	484	21.098	4.15E+07	2.72E+05
Dordogne (a. Garonne)	483	30.929	5.84E+07	3.26E+05
Po (Italie)	500	52.048	9.64E+07	3.71E+05
Rhin (Suisse-All.-Neth.)	1018	79.748	2.88E+08	1.97E+05
Meuse (France-Belg.-NL)	565	12.816	3.10E+07	*
Nida (a. Vistule) (Pol.)	151	35.927	2.09E+07	9.02E+03
Pilica (a. Vistule) (Pol.)	319	18.886	2.48E+07	6.36E+04
Warta (a. Oder) (Pol.)	808	19.755	6.54E+07	9.21E+04

River basin above 42 degrees latitude
Lyna ou Lava (Pol.)
Bzura (a. Vistule) (Pol.)
Raba (Pol.)
Vistula (Pol.)
Morava (a. Danube) (Tch.-Autriche)
Volga (fSU)
Danube (Int.)
Loire (France)
Yèrres (a. Seine)
Yonne (a. Seine) (France)
Touques (France)
Dives (France)
Vire (France)
Doubs (s.a. Rhône) (a. Saône) (France)
Gudena (Danemark)
Wye (Severn estuary) (Wales)
Tees (Britain)
Glama (Norvège)
Dunajec (a. Vistule) (Pologne-Slovaquie)
Hérault (France)
Orb (France)
Tarn (a. Garonne)
Allier (a. Loire) (France)
Ain (a. Rhône)
Isère (a. Rhône)
Sorgues (s. a. Rhône)
Ardèche (a. Rhône)
Cèze (a. Rhône)
Gard (a. Rhône)
Rhône (France-Suisse)
Saône (a. Rhône)

River length (km)	Average river discharge at the mouth ($km^3 \cdot yr^{-1}$)	Calculated river volume (m^3)	Effect factor for global warming ($PDF \cdot m^3 \cdot {}^oC^{-1}$)
264	4.599	5.78E+06	*
166	30.83229	2.00E+07	1.37E+04
137.4	7.484	4.66E+06	2.28E+04
1014	35.927	1.40E+08	6.06E+04
354	65.878	8.43E+07	2.13E+05
2785	234.33	2.07E+09	1.50E+06
2222	218.517	1.55E+09	1.65E+07
839	31.714	1.04E+08	*
6	8.385	2.25E+05	*
292	4.605	6.40E+06	*
104	1.4128	7.91E+05	*
105	2.02	1.10E+06	*
128	0.5467	4.16E+05	*
453	14.108	2.71E+07	1.17E+04
158	1.4956	1.26E+06	2.33E+04
297	5.679	7.86E+06	*
132	2.223	1.51E+06	*
490	21.935	4.36E+07	*
251	7.484	8.51E+06	4.17E+04
148	3.154	2.31E+06	5.76E+03
136	3.154	2.12E+06	5.29E+03
381	4.106	7.54E+06	2.18E+04
421	9.768	1.81E+07	7.43E+03
190	15.143	1.21E+07	3.21E+04
286	45.661	4.91E+07	9.82E+04
46.4	48.389	8.38E+06	1.56E+04
125	48.389	2.26E+07	4.21E+04
128	48.389	2.31E+07	4.31E+04
133	54.374	2.67E+07	5.50E+04
637	54.3377	1.28E+08	2.65E+05
473	32.608	6.00E+07	8.81E+04

River basin above 42 degrees latitude
Durance (a. Rhône)
Arve (a. Rhône)
Fier (a. Rhône)
Bourbre (a. Rhône)
Eyrieux (a. Rhône)
Drôme (a. Rhône)
Willamette (a. Columbia) (USA)
St Laurent (Canada)
Moisie river (Canada)
Ganaraska (Canada)
Humber (Canada)
Credit (Canada)
Au Sable (Canada)
Maitland (Canada)
Saugeen (Canada)
South Nation (Canada)
Mackenzie (Canada)
Yukon (Canada-U.S.A.)
Amu Darya (fSU)
Syr Darya (fSU)
Talas (fSU)
Chu ou Tchou (fSU)
Ili (Chine-fSU) (Lac Balkhach)
Léna (fSU)
Amour (fSU-Chine)
Dvina (ex-fSU)
Neva (ex-fSU)
Dniepr (ex-fSU)
Don (ex-fSU)
Anadir (ex-fSU)
Kamtchatka (ex-fSU)

River length (km)	Average river discharge at the mouth ($km^3 \cdot yr^{-1}$)	Calculated river volume (m^3)	Effect factor for global warming ($PDF \cdot m^3 \cdot {}^oC^{-1}$)
324	54.374	6.50E+07	1.34E+05
102	9.282	4.19E+06	2.08E+04
71.9	11.742	3.65E+06	1.24E+04
72.2	15.143	4.60E+06	1.22E+04
83	45.661	1.42E+07	2.85E+04
110	45.661	1.89E+07	3.78E+04
301	216.664	2.08E+08	*
3175	366.784	3.53E+09	*
343	14.071	2.05E+07	*
49.6740093	200.547	3.21E+07	2.60E+04
100	1.826	9.57E+05	*
1500	1.164	9.59E+06	*
240	0.8954	1.21E+06	*
150	2.083	1.62E+06	*
160	2.927	2.34E+06	*
175	53.092	3.44E+07	*
3679	267.295	3.08E+09	*
2716	187.187	1.65E+09	*
1976	50.257	3.69E+08	*
1615	21.326	1.40E+08	*
661	3.938	1.26E+07	*
1067	3.995	2.06E+07	*
1400	4.1855	2.82E+07	*
4387	540.007	6.89E+09	*
5061	330.454	5.12E+09	*
1441	101.23877	5.05E+08	*
911	3.38614	1.52E+07	*
1544	48.18512	2.78E+08	2.42E+06
1401	29.6661	1.63E+08	2.27E+05
1150	32.17743	1.44E+08	*
626	28.88501	7.12E+07	*

River basin above 42 degrees latitude
Yukon
Yenisei-Angara (Yenisey, Enisei, Russia)
Ural (Russia)
Ob-Irtysh
Nelson-Saskatchewan
Lena (East central Russia)
Kolyma (Russia)
Dneper (West and southwest Russia)
Amur (Hei-lung chiang, Northeast Asia
Amudar'ya (Oxus, Jayhun, Amy; Amyderya; Dar'yoi Amu; Jaihun, Central and west Asia)

River length (km)	Average river discharge at the mouth ($km^3 \cdot yr^{-1}$)	Calculated river volume (m^3)	Effect factor for global warming ($PDF \cdot m^3 \cdot {}^oC^{-1}$)
2716	187.20142	1.65E+09	*
4803	597.30829	8.26E+09	*
1411	9.509	5.93E+07	7.15E+04
3977	413.183	4.91E+09	*
2045	78.713	5.71E+08	*
4387	539.918	6.89E+09	*
2091	115.24	8.22E+08	*
1544	48.185	2.78E+08	2.42E+06
5061	330.454	5.12E+09	*
1976	50.257	3.69E+08	*

Table S4. Characterization factors, water consumption and normalization factors for water consumption. Characterization factors were calculated for 214 river basins. The data for water consumption, representative for the year 1995, were available for 112 river basins (2, 10, 11).

River basin	Characterization factor ($PDF{\cdot}m^3{\cdot}yr{\cdot}m^{-3}$)	Water consumption 1995 ($m^3{\cdot}yr^{-1}$)	Normalization factor ($PDF{\cdot}m^3$)
Nil (Af., int.)	8.42E-03	5.41E+09	4.56E+07
Senegal (Guinée-Sénégal)	2.96E-03	4.34E+08	1.28E+06
Gambia (Guinée-Gambie)	1.36E-03	1.46E+08	1.99E+05
Tominé ou Rio Corubal (Guinée-Guineé Bissau)	7.67E-04	7.75E+07	5.94E+04
Konkouré (Guinée)	5.18E-04	3.34E+07	1.73E+04
Kolenté (Guinée, Great Scarcies)	3.79E-04		
Jong (Sierra Leone)	4.12E-04		
Sewa (Sierra Leone)	3.98E-04	1.01E+07	4.04E+03
Moa (Guinée-Sierra Leone)	6.76E-04	2.80E+07	1.89E+04
Mano (Libéria)	4.82E-04	5.43E+06	2.61E+03
Loffa (Guinée-Libéria)	5.85E-04	3.47E+06	2.03E+03
St Paul (Libéria)	6.30E-04	3.52E+07	2.22E+04
Nipoué (Cess, Libéria-RCI)	5.53E-04		
Cavally (Libéria-RCI)	6.04E-04	1.24E+07	7.48E+03
Dodo (aka Déo) (RCI)	1.46E-04		
San Pédro (RCI)	3.91E-04	2.39E+06	9.33E+02
Sassandra (RCI)	8.91E-04	6.58E+07	5.86E+04
N'Zo (a. Sassandra) (RCI)	4.81E-04		
Boubo (RCI)	2.62E-04		
Bandama (RCI)	1.11E-03	8.88E+07	9.90E+04
Yani (s.a. Bandama) (RCI)	2.68E-04		
Marahoué (a. Bandama) (RCI)	4.27E-04		
N'Zi (a. Bandama) (RCI)	8.63E-04		
Kan (s.a. Bandama) (RCI)	1.01E-03		
Agnébi (RCI)	5.64E-04		
Comoé (RCI-Burkina)	1.39E-03	6.84E+07	9.53E+04
Bia (RCI-Ghana)	4.99E-04	1.76E+07	8.76E+03
Volta (Ghana-Burkina)	2.02E-03	4.34E+08	8.79E+05
Black Volta (Burkina-Ghana) (a. Volta)	2.43E-03		
Nasia (a. White Volta) (Ghana)	3.91E-04		
Daka (a. Volta) (Ghana)	1.72E-04		
Mono (Togo)	8.08E-04	2.75E+07	2.22E+04
Ouémé (Bénin)	8.86E-04	6.19E+07	5.48E+04
Ogun (Nigéria)	7.62E-04	1.17E+08	8.89E+04
Niger (Afr. Int.)	5.59E-03	7.84E+08	4.38E+06
Niandan (Guinée) (a. Niger)	5.66E-04		
Bénoué (Nigéria-Cameroun) (a. Niger)	2.02E-03		
Sokoto (a. Niger) (Nigeria)	4.33E-04		
Cross (Nigéria-Cameroun)	7.01E-04	1.73E+08	1.21E+05
Mungo (Cameroun)	2.33E-05	1.13E+07	2.63E+02
Dibamba (Cameroun)	2.47E-04		
Wouri (Cameroun)	2.64E-04	2.47E+07	6.52E+03
Sanaga (Cameroun)	1.17E-03	1.33E+08	1.55E+05
Nyong (Cameroun)	6.51E-04	2.66E+07	1.73E+04
Lokoundjé (Cameroun)	3.67E-04	4.34E+05	1.59E+02

River basin	Characterization factor ($PDF \cdot m^3 \cdot yr \cdot m^{-3}$)	Water consumption 1995 ($m^3 \cdot yr^{-1}$)	Normalization factor ($PDF \cdot m^3$)
Kribi ou Kienké (Cameroun)	1.98E-04		
Lobé (Cameroun)	1.59E-04		
Ntem (Cameroun-Gabon-Guinée équat.)	5.85E-04	9.48E+06	5.54E+03
Ogôoué (Gabon)	1.08E-03	4.33E+07	4.68E+04
Niari-Kouilou (Congo)	7.59E-04	4.20E+06	3.19E+03
Zaïre (Afr., Int.)	4.59E-03		
Cunene ou Kunene (Namibie-Angola)	1.48E-03	7.81E+07	1.15E+05
Kasaï (a. Zaïre) (Zaïre-Angola)	2.49E-03	5.55E+07	1.38E+05
Chari (Lac Tchad)	2.77E-03	5.09E+08	1.41E+06
Ubangi (a. Zaïre) (Congo-RCA)	3.00E-03		
Zambezi (Mozambique-Zambie-Angola)	3.66E-03	8.00E+08	2.93E+06
Tana (Kénya)	1.22E-03	2.46E+08	3.00E+05
Rufiji (Tanzanie)	1.27E-03	6.84E+07	8.67E+04
Limpopo (Botswana-Mozamb.-Rhodésie-RSA)	3.20E-03	2.82E+09	9.02E+06
Pongolo ou Maputo (RCA-Mozambique)	6.59E-04	1.77E+08	1.17E+05
Shire (a.) (Malawi-Mozambique)	1.63E-03		
Kafue (a. Zambèze) (Zambie)	1.59E-03		
Ruaha (a. Rufiji) (Tanzanie)	7.44E-04		
Evros-Mariça (Grèce-Turquie-Bulgarie)	7.22E-04	2.83E+09	2.04E+06
Nesta-Nestos (Grèce-Bulgarie)	4.80E-04	2.03E+08	9.72E+04
Strymon-Strouma (Grèce-Bulgarie)	7.65E-04	8.20E+08	6.27E+05
Agly (France)	1.77E-04		
Minho (Portugal-Espagne)	6.08E-04	2.86E+08	1.74E+05
Lima (Portugal)	2.13E-04		
Cavado (Portugal)	2.67E-04	8.89E+07	2.37E+04
Douro (Portugal-Esp.)	8.95E-04	3.47E+09	3.11E+06
Vouga (Portugal)	3.13E-04	6.10E+07	1.91E+04
Mondego (Portugal)	4.70E-04	1.45E+08	6.83E+04
Sado (Portugal)	3.81E-04	1.23E+08	4.70E+04
Mira (Portugal)	3.63E-04	9.74E+06	3.53E+03
Guadiana (Portugal-Esp.)	1.38E-03	1.97E+09	2.72E+06
Raisin (Canada)	2.83E-04		
Sydenham (Canada)	2.17E-04		
Grand river (Canada)	3.62E-04		
Thames (Canada)	5.11E-04		
Mississipi (USA)	4.88E-03	3.92E+09	1.91E+07
Rio Grande (USA-Mexique)	3.99E-03	5.28E+09	2.11E+07
Pecos (a. Rio Grande)	2.74E-03		
Canadian (s. a. Mississipi) (USA)	2.33E-03		
Colorado (USA-Mexique)	3.79E-03	4.08E+09	1.54E+07
San Juan (a. Colorado) (USA)	6.29E-04		
Zuni (s. a. Colorado) (a. Little Colorado)	2.44E-04		
San Francisco (a. Gila) (USA)	6.85E-03	1.68E+09	1.15E+07
Gila (a. Colorado)	2.42E-03		
Ohio river (a. Mississipi)	2.66E-03	9.77E+09	2.60E+07
Scioto River (a. Ohio)	5.25E-04		
Big Darby Creek (s. a. Ohio) (a. Scioto)	2.62E-04		
Wabash River (a. Ohio)	1.02E-03		
Little Wabash River (a. Wabash)	4.26E-04		
Embarras River (a. Wabash)	5.11E-04		
St Joseph River (s.a. Wabash)	3.20E-04		
Elk river (s. a. Ohio) (a. Kanawha)	4.89E-04		

River basin	Characterization factor (PDF·m^3·yr·m^{-3})	Water consumption 1995 (m^3·yr^{-1})	Normalization factor (PDF·m^3)
Cumberland river (a. Ohio)	1.54E-03		
Green river (a. Ohio)	1.60E-03		
Kanawha river (a. Ohio)	2.26E-04		
Tennessee River (a. Ohio)	1.33E-03		
Muskingum River (s.a. Ohio) (a. Allegheny)	2.75E-04		
Allegheny river (a. Ohio)	9.14E-04		
Little Miami river (a. Ohio)	2.37E-04		
Hocking river (a. Ohio)	2.29E-04		
Kinniconick river (a. Ohio)	2.24E-01		
Licking River (a. Ohio)	9.06E-05		
Little Scioto river (a. Ohio)	1.31E-04		
Ohio Brush Creek (a. Ohio)	1.44E-04		
Olentangy River (a. Little Scioto)	2.05E-04		
Paint Creek (a. Scioto river)	2.78E-04		
Scioto Brush Creek (a. Scioto)	8.18E-02		
Symmes River (a. Ohio)	1.40E-04		
Tygart Creek (a. Ohio)	5.17E-04		
Bear Creek	1.01E-04	1.43E+09	1.44E+05
Apalachicola (USA)	2.89E-04	1.48E+09	4.28E+05
Klamath (USA)	5.21E-04	3.18E+08	1.65E+05
Mobile (USA)	1.05E-04	1.18E+09	1.24E+05
Potomac (USA)	5.17E-04	1.56E+09	8.06E+05
Sabine (USA)	9.66E-04	3.24E+08	3.13E+05
Sacramento (USA)	1.42E-03	1.08E+10	1.54E+07
Savannah (USA)	7.94E-04	4.31E+08	3.42E+05
Susquehanna (USA)	7.99E-04	1.94E+09	1.55E+06
Connecticut river (USA)	8.24E-04	1.11E+09	9.11E+05
Missouri (USA)	4.88E-03	4.73E+09	2.31E+07
Arkansas river (USA)	2.75E-03		
Red river (USA)	2.55E-03		
Altamaha (USA)	7.66E-04	4.33E+08	3.32E+05
Balsas (Mexico)	1.13E-03	1.37E+09	1.55E+06
Panuco (Mexico)	8.15E-04	1.04E+09	8.51E+05
Sucio (a. Lempa) (San Salvador)	4.26E-05	4.51E+07	1.92E+03
Paz (San Salvador)	2.56E-04	6.20E+06	1.59E+03
San Tiguel (ou Miguel) San Salvador)	3.15E-04	9.00E+06	2.83E+03
Paraguay (Brésil-Arg.-Paraguay) (a. Parana)	2.97E-03	2.43E+09	7.22E+06
Uruguay (Brésil-Arg.-Uruguay)	1.85E-03	1.49E+09	2.77E+06
Magdalena (Colombie)	1.62E-03	1.84E+09	2.98E+06
Rio Negro (a. Amazone) (Colomb.-Venez.-Brésil)	1.05E-03	3.38E+06	3.54E+03
Parnaiba (Brésil)	1.89E-03		
Madeira (a. Amazone) (Brésil-Bolivie)	2.99E-03	3.84E+07	1.15E+05
Orinoco (Vénézuela-Colombie)	2.13E-03	1.12E+09	2.40E+06
Parana (Brésil-Paraguay-Argentine)	3.16E-03	2.05E+09	6.50E+06
Tibagi (Bresil)	9.53E-04	1.30E+08	1.23E+05
Amazon (Br. Mère Maranon) (Pérou-Brésil)	3.90E-03	5.43E+06	2.12E+04
Maroni (Guyane-Surinam)	6.53E-04	6.49E+06	4.24E+03
Oyapock (Guyane-Brésil)	4.43E-04	1.16E+06	5.14E+02
Approuague	4.71E-04	1.00E+06	4.72E+02
Sinnamary (Guyane)	4.31E-04	6.86E+05	2.95E+02
Kourou (Guyane)	2.05E-04	4.22E+05	8.63E+01
Vakhsh ou Vachs (fSU) (a. Amu Darya)	2.93E-03		

River basin	Characterization factor (PDF·m^3·yr·m^{-3})	Water consumption 1995 (m^3·yr^{-1})	Normalization factor (PDF·m^3)
Surkhandarya ou Surchandarya (fSU)	2.58E-04		
Zeravshan (a. Syr Darya) (fSU)	2.36E-03		
Naryn (a. Syr Darya) (fSU)	1.35E-03		
Tarim (Chine)	2.52E-03	1.33E+10	3.36E+07
Murgab ou Murghab ou Mourbab (fSU-Afghanistan) Endo	1.71E-03	1.06E+10	1.81E+07
Kabul (a. Indus) (Afghanistan-Inde)	9.86E-04		
Salween (Tibet-Chine-Birmanie-Thaï)	3.57E-03	1.63E+09	5.83E+06
Mae Khlong (Thaïlande)	2.36E-04	3.03E+08	7.16E+04
Chao Phrya (Menam) (Thaïlande)	1.12E-03	4.51E+09	5.07E+06
Mekong (Asie Sud-Est, Int.)	4.75E-03	8.70E+09	4.13E+07
Kelani Ganga(Sri Lanka)	2.81E-04		
Kalu Ganga (Sri Lanka)	2.50E-04		
Gin Ganga (Sri Lanka)	2.37E-04		
Nilwala Ganga (Sri Lanka)	1.38E-04		
Mahaweli Ganga (Sri Lanka)	6.58E-04	1.26E+09	8.31E+05
Brahmapoutre ou Tsangpo (Inde-Bengladesh-Tibet)	3.11E-03		
Indus (Tibet-Inde-Pakistan)	3.23E-03	4.95E+10	1.60E+08
Gange (Inde)	2.67E-03		
Ob (fSU)	4.76E-03	2.01E+09	9.57E+06
Yangzi Jiang (Tibet-Chine)	7.00E-03	3.38E+10	2.37E+08
Gandaki river (a. Gange) (nepal)	6.76E-04		
Sakaria (Turkey)	9.13E-04	1.90E+09	1.74E+06
Rakaïa river (New-Zealand)	2.85E-04	5.86E+07	1.67E+04
Fly (Nlle-Guinée)	9.10E-04	5.88E+06	5.35E+03
Sepik-Ramu (Nlle-Guinée)	3.95E-04	7.36E+06	2.90E+03
Kapuas (Bornéo)	7.44E-04	3.97E+07	2.96E+04
Murray-Darling (Australie)	3.07E-03	5.21E+09	1.60E+07
Yellow (Huang He, Huang Ho, China)	6.13E-03	3.25E+10	1.99E+08
Yangtze (Chang Jiang, Yangtze Kiang, China)	5.19E-03		
Xi Jiang River (Pearl River, Chu Chiang, Zhu, Southeast China)	2.12E-03		
Tsengwen River (Southwestern Taiwan)	2.82E-04		
Tigris (Southeast Turkey and Iraq)	3.02E-03	2.48E+10	7.47E+07
Tanshui (Northern Taiwan)	6.66E-04		
Tano (West Africa)	7.63E-04		
Saloum (West Africa)	2.50E-04		
Saint John (West Africa)	9.85E-04	1.24E+07	1.22E+04
Rokel River (Seli River, West Africa)	6.60E-04		
Purus (Northwest central South America)	3.30E-03		
Pra River (West Africa)	4.46E-04		
Pilcomayo (South central South America)	3.52E-03		
Pará-Tocantins (Brazil)	2.70E-03		
Orange (South Africa)	3.29E-03	2.24E+09	7.38E+06
Ombrone (Tuscany, Western Italy)	2.77E-04		
Okavango (Southwest central Africa)	2.57E-03	8.30E+07	2.14E+05
Marañon (Peru)	2.65E-03		
Little Scarcies (West Africa)	4.72E-04		
Kwando River (Southwest Africa/Namibia)	1.13E-03		
Kura (Russia and Turkey)	1.29E-03		
Krishna (Karnataka, India)	1.50E-03	3.50E+10	5.25E+07
Kogon (Guinea, West Africa)	4.53E-04		
Kaoping River (Southern Taiwan)	3.28E-04		

River basin	Characterization factor ($PDF \cdot m^3 \cdot yr \cdot m^{-3}$)	Water consumption 1995 ($m^3 \cdot yr^{-1}$)	Normalization factor ($PDF \cdot m^3$)
Irrawaddy River (Irawadi, Central Myanmar Burma)	2.06E-03	9.58E+08	1.98E+06
Godavari (Central India)	1.31E-03		
Géba (Guinea Bissau, West Africa)	1.06E-03		
Ganges (Ganga, North and northeast Indian subcontinent)	2.41E-03	1.29E+11	3.11E+08
Fatala (West Africa)	3.51E-04		
Euphrates (Firat Nehri, Al-Furat, Southwest Asia)	3.75E-03		
Erhjen River (Southern River)	6.90E-05		
Chobe River (Southwest Africa/Namibia)	2.32E-03		
Chittar (Tamil Nadu, India)	3.31E-04		
Cauvery (Karnataka, India)	1.13E-03		
Casamance (West Africa)	6.27E-04		
Brahmaputra (Dyardanes, Oedanes, Tsangpo, Zangbo, Tibet, China, NE India and Bangladesh)	3.20E-03	8.47E+09	2.71E+07
Araguaia (Araguaya, Central Brazil)	3.42E-03	1.83E+08	6.26E+05
Athi-Galana-Sabaki River Drainage System (Kenya, from Nairobi eastward to Mombasa)	1.86E-03		

Table S5. Characterization factors, emissions in year 2000 and normalization factors for 63 greenhouse gas emissions, based on 100-year time horizon. The emissions in year 2000 were taken from Sleeswijk et al. (14). Due to the data availability, we provide the normalization factors for 21 greenhouse gas emissions.

Substance	Characterization factor ($PDF \cdot m^3 \cdot yr \cdot kg^{-1}$)	Emission in year 2000 (kg)	Normalization factor ($PDF \cdot m^3$)
CO_2	8.53E-05	2.85E+13	2.43E+09
CH_4	1.69E-03	2.99E+11	5.04E+08
N_2O	2.78E-02	1.15E+10	3.19E+08
CFC-11	4.43E-01	4.06E+07	1.80E+07
CFC-12	1.02E+00	1.01E+08	1.02E+08
CFC-13	1.35E+00		
CFC-113	5.72E-01	3.86E+06	2.21E+06
CFC-114	9.37E-01	2.07E+06	1.94E+06
CFC-115	6.87E-01	8.73E+05	6.00E+05
Carbon tetrachloride	1.31E-01	4.17E+05	5.44E+04
Methyl bromide	4.48E-04		
Methyl chloroform	1.37E-02	3.57E+05	4.87E+03
HCFC-22	1.69E-01	3.00E+08	5.06E+07
HCFC-123	7.23E-03		
HCFC-124	5.68E-02	3.93E+06	2.23E+05
HCFC-141b	6.76E-02	1.66E+08	1.12E+07
HCFC-142b	2.16E-01	5.09E+07	1.10E+07
HCFC-225ca	1.14E-02		
HCFC-225cb	5.55E-02		
Halon-1211	1.76E-01	4.82E+06	8.48E+05
Halon-1301	6.66E-01	9.26E+05	6.17E+05
Halon-2402	1.53E-01	2.96E+05	4.54E+04
HFC-23	1.38E+00		
HFC-32	6.29E-02		
HFC-43-10mee	1.53E-01		
HFC-125	3.27E-01	7.40E+06	2.42E+06
HFC-134a	1.33E-01	1.30E+08	1.73E+07
HFC-143a	4.17E-01	5.40E+06	2.25E+06
HFC-227ea	3.01E-01		
HFC-245fa	9.65E-02		
HFC-152a	1.16E-02		
HFC-236fa	9.15E-01		
HFC-365mfc	7.41E-02		
Sulphur hexafluoride	2.13E+00	5.22E+06	1.11E+07
Nitrogen trifluoride	1.68E+00		
PFC-14	6.90E-01		

Substance	Characterization factor (PDF·m^3·yr·kg^{-1})	Emission in year 2000 (kg)	Normalization factor (PDF·m^3)
PFC-116	1.14E+00		
PFC-218	8.24E-01		
PFC-318	9.57E-01		
PFC-3-1-10	8.26E-01		
PFC-4-1-12	8.54E-01		
PFC-5-1-14	8.67E-01		
PFC-9-1-18	7.01E-01		
Trifluoromethyl sulphur pentafluoride	1.66E+00		
HFE-125	1.39E+00		
HFE-134	5.89E-01		
HFE-143a	7.05E-02		
HCFE-235da2	3.25E-02		
HFE-245cb2	7.51E-02		
HFE-245fa2	6.15E-02		
HFE-254cb2	3.68E-02		
HFE-347mcc3	5.37E-02		
HFE-347pcf2	5.39E-02		
HFE-356pcc3	1.02E-02		
HFE-449sl	2.86E-02		
HFE-569sf2	5.31E-03		
HFE-43-10pccc124	1.75E-01		
HFE-236ca12	2.64E-01		
HFE-338pcc13	1.40E-01		
PFPMIE	9.61E-01		
Dimethylether	3.96E-05		
Methylene chloride	8.15E-04		
Methyl chloride	1.20E-03		

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