2001

Estimating global river runoff from observed river flow data

George David Perry
San Jose State University

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DOI: <https://doi.org/10.31979/etd.qn7j-g87q>
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**ESTIMATING GLOBAL RIVER RUNOFF FROM
OBSERVED RIVER FLOW DATA**

**A Thesis Presented to
The Faculty of the Department of Meteorology
San Jose State University**

**In Partial Fulfillment
of the Requirements for the Degree
Master of Science**

**by
George David Perry
December 2001**

UMI Number: 1407311

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APPROVED FOR THE DEPARTMENT OF
METEOROLOGY

Dr. Jerry Steffens

Dr. Douglas Sinton

Dr. Philip Duffy, Lawrence Livermore National Laboratory

APPROVED FOR THE UNIVERSITY

ABSTRACT

ESTIMATING GLOBAL RIVER RUNOFF FROM OBSERVED RIVER FLOW DATA

by George D. Perry

This thesis develops a new dataset of 981 observed river discharges to the ocean with a total discharge of 824,503 m³/s. The characteristics of this dataset are examined and a power law size distribution is developed for rivers between 250 m³/s and 20,000 m³/s. Using the observed data and the power law distribution to estimate missing data, a total global land surface runoff estimate is obtained that is in good agreement with previous estimates.

Past efforts and the methods used to estimate global land surface runoff are reviewed. The new global land surface runoff estimate of 1,256,640 m³/s is within 2% of the mean value of 1,274,950 m³/s derived from 12 previous estimates. Similar estimates created for each continent differ from earlier continental estimates by up to 20%. The sum of the continental estimates is 1,124,940 m³/s, which is about 6% lower than the global estimate.

Acknowledgments

The author would like to express his sincere gratitude to Drs. Philip Duffy, Jerry Steffens, and Douglas Sinton for their patience guidance and encouragement during every phase of this research. Dr. Norm Miller provided many useful insights during this research and was helpful in the preparation of figures. Dr. Ken Caldeira also provided useful suggestions during this research.

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1. Introduction

This thesis is an outgrowth of a project undertaken at Lawrence Livermore National Laboratory (LLNL) to improve its General Circulation Model (GCM). The idea was to add a component to the model to trace the flow of surface and subsurface water from the land into the oceans. The hydrologic cycle was not closed in their existing model.

Precipitation was falling to the land surface and was no longer being considered after that point. At the same time, the ocean portion of the model depicted ocean conditions and currents, as well as precipitation and evaporation, but did not take into account the influx of fresh water from the continents. This influx influences the salinity and density of sea water in those regions and probably affects the thermohaline circulation of the ocean. To study changes to the thermohaline circulation and the impact on climate, the inclusion of surface water and an accurate river routing system are necessary. For these reasons, the project that led to this thesis was initiated.

In order to test the accuracy of the hydrologic cycle in the improved GCM, observational data for fresh water discharge to the oceans is needed. With a sufficiently large and complete dataset of riverflow data could be assembled, then a comparison can be done between the fresh water discharge values generated at each coastline grid location of the GCM and the observed data. This allows for an accuracy assessment and the fine-tuning of the new surface fresh water component to best reflect the observed data.

2. River discharge dataset

The data acquisition process began by investigating the datasets that had been used by other researchers. It was thought that these datasets would be sufficient to study GCM performance. However, soon it became apparent that available datasets omitted many rivers for which measurements existed. By compiling these additional data, it became apparent a much larger dataset could be created.

a. Acquisition

The new dataset evolved and grew over a period of time. Initially, the project began by studying two river discharge datasets from the Max Planck Institute (MPI) GCM and the National Aeronautics and Space Administration - Goddard Institute of Space Sciences (NASA-GISS) GCM. These datasets were limited in size and some geographical regions were underrepresented. This was a significant shortcoming since tuning a model to match the streamflow in Europe did not necessarily help it to match the streamflow in Africa or other areas where streamflow data were sparse. It would be better to have extensive data for all areas, enabling one to choose which rivers to use for verification. This condition was alleviated somewhat by combining the two datasets since the overlap between them was minimal. Further research documented that data for other rivers were readily available and could be used to expand the dataset to give it more

geographical diversity. The project then became a search to compile as much data as possible about the rivers of the world and apply quality control to that data.

Research focused on finding as many sources of data as possible. Data were acquired online from the National Center for Atmospheric Research (NCAR), the World Meteorological Organization (WMO), the United Nations Education Scientific and Cultural Organization (UNESCO), and the United States Geological Survey (USGS). Inquiries were made to the USGS and written reports were obtained. Extensive research was conducted at the University of California, Berkeley. Its Doe Library Map Room has a large collection of maps and atlases. The UC Berkeley Water Resources Library has a large amount of information pertaining to global water resources and water resource development. In a few cases where data were difficult to obtain for a particular country, attempts were made to find these data through the country's governmental sources, such as local embassies or national bureaus of statistics or physical resources. While this was occasionally successful, many of these requests were ignored.

Existing river discharge inventories fall into three distinct categories. The first type of dataset is specifically designed for the validation of GCM streamflow estimates. Two datasets of this type were found, one from the Max Planck Institute for the MPI climate model and the dataset compiled by Miller and Russell for the NASA-GISS GCM. Both of these datasets are useful for directly validating GCM river discharge data, but are limited in scope and are geographically biased. The MPI dataset has 46 rivers, the bulk of

which are in Europe or the Americas. Rivers in the Arctic are underrepresented.

Additionally, it includes ten rivers that flow to internal basins or are tributaries of larger rivers. The NASA-GISS river discharge dataset is even smaller, with only 33 rivers, although it has a higher total volume than the MPI dataset, $557\,000\text{ m}^3\text{ s}^{-1}$ compared to $462\,000\text{ m}^3\text{ s}^{-1}$. These datasets include only rivers with reliable measurements and a lengthy time series. They represent data of the best available quality.

The second type of dataset has been compiled for other purposes, such as water resource management, ecological or biogeochemistry studies. Much of the data in these datasets are related to topics other than streamflow, such as water chemistry or irrigation.

The streamflow is included as a fundamental characteristic of the river and thus it is useful for this study. These datasets are often more regional in scope, concentrating on rivers in a small area or of a particular type. Two such examples are the river channel fragmentation and regulation dataset for the northern third of the world (Bergstrom and Carlsson 1994) and the carbon transport dataset for Himalayan rivers (Subramanian and Ittekkot 1991).

The third type of dataset is compiled by national governments to inventory the natural resources of their country, with the goal of planning the economic development of these resources. Often they have a title such as “The National Atlas of Country X”.

While only a small portion of the information deals with streamflow data, national atlases are an important source of information since they are generally more complete than other

sources. They usually have all the major rivers and many of the smaller ones that are not reported elsewhere. Governmental agencies are normally the ones to measure streamflow and therefore have access to all of the data, which they include in their water resource inventory. Most of the datasets mentioned elsewhere do not have this level of detail and completeness. They are more likely to have data for monthly mean streamflow as well as annual mean streamflow and often give a detailed description of the location where the measurements are being made.

The *Discharge of Selected Rivers of the World* dataset from UNESCO is the most comprehensive global streamflow dataset available. It also requires the most effort to be utilized for climate model validation. It consists of monthly mean streamflow data that have been reported to UNESCO for over 1000 rivers worldwide. Some rivers have only a year or two of monthly values; others have well over 100 years. For example, the Nile River has 178 years of data. Annual values must be computed from the monthly values. Since the purpose of this project was to compile a dataset of river discharges to the oceans, each river in the UNESCO dataset had to be examined to determine if it flowed to an ocean. Most of the included rivers were tributaries of larger rivers and thus were not used. A number of rivers could not be identified either because the name was misspelled, changed or because the latitude and longitude were incorrect. Others had large quantities of missing data at certain times of the year, skewing the average flow. A few rivers had obvious unexplained errors, such as a sudden large permanent increase in flow. There

could have been a number of reasons for a large change in flow, such as a change in the gauge location or incorrect unit conversion. Since there was no way to know why the changes occurred, the data were not used. Much of the effort in the compilation of this project involved the validation and processing of the data in the UNESCO dataset.

Two sources that were especially valuable due to the amount of useful data they contained are *Water Resources of the World* (van der Leeden 1975) and *World Facts and Figures* (Showers 1979). *Water Resources of the World* is a compendium of data about water resources, municipal water supplies, hydroelectric development, and more for over 130 countries around the world. Most of the major rivers in those countries are covered. *World Facts and Figures* is a fact book about the geographical and sociological data of each continent and country. It has such varied data as the oldest cities, tallest buildings, largest dams, birth and death rates, highest mountains, as well as longest and largest rivers.

The annual water supply reports for each state issued by the United States Geological Survey (USGS) are another comprehensive source of river discharge data for the United States. These reports are massive and contain data for nearly all rivers, including those so small as to be barely measurable. As with the UNESCO dataset, each river had to be examined to see if it belonged in the new dataset. Additionally, most rivers have several measurement locations and the one closest to the ocean had to be determined. Ultimately, this resource was not heavily utilized because it was discovered late in the data acquisition process and would have required an extensive effort to extract the useful

portion of the data. While this effort might have added a few hundred more rivers to the dataset, nearly all of these rivers would be very small and the additional streamflow in the dataset would be insignificant. These data may be more easily handled in the near future because the USGS has begun to make some of the data available online in digital format (in the form of daily measurements as opposed to monthly mean or annual mean values). That should make the processing of this data much simpler.

Another source of river discharge information is found in journal articles about aspects of certain rivers that have sparsely reported data. Often these researchers have found riverflow data that has not been reported elsewhere or they have measured the flow as a part of their investigations. This type of information was used for a number of rivers in remote areas, such as New Guinea. While this information may have been based on only a few measurements at one time of year, it was preferable to having no data at all.

b. Evaluation

Each river adequately identified enough to be located on a map was examined to see if it flowed to an ocean. Those that did were added to the dataset. In many cases, the location of the river gauging station was unknown, but when the location was available, the distance of the gauging station to the river mouth was considered. If the gauging station was upstream from other gauging stations, the data were not included. If the gauging station was so close to the headwaters that the streamflow was unrealistically

low, the data were only incorporated if no better data were available. Table 1 gives the estimated distances from gauging stations to the ocean for a number of prominent rivers, and illustrates that the gauging stations are often located well upstream from the river mouth.

The data were also analyzed for quality. Some sources listed data as a time series of monthly mean values. Many of these sources had months for which the data were missing. When the pattern appeared to be random, the data were accepted. Often, the missing data were concentrated in one part of the year. This was considered grounds for removing that data, as seasonal changes in the streamflow would not be adequately reflected and the resulting mean value would be in error. Most often, the missing data occurred only in certain years of the time series and the bias could be avoided by eliminating the incomplete years and keeping the complete ones. In a few cases, the data for a given river appeared to be inconsistent or obviously in error. In these cases, the data were rejected to prevent the inclusion of inaccurate data.

After the data were verified, the result was a dataset containing numerous quoted values for average annual streamflow for most large rivers. Figure 1 is a matrix that shows the sources that were found for the 52 largest rivers in the dataset. The numbered sources correspond to the sources listed in Appendix A. Table 2 gives the range of values that were found for three large rivers. As can be seen, the discrepancies between different reported discharges can be significant. These discrepancies arise because of measurement

errors, seasonal and interannual variability of river discharges, human activities (such as dam construction) that change river flow rates, and the fact that measurements may have been taken at different points on the river. In some extreme cases, measurements differed by an order of magnitude. It was not readily apparent which value was the most accurate one. It seemed unreasonable to merely select one of the values and use it, so the following procedure was developed. The values for each river were examined. In many cases, the same value was present in several of the references. It was decided that these identical values were likely referenced from the same original source. Rather than give one source more weight by including it more than once, duplicate entries were removed from the dataset. The remaining entries for each river were then used to find the mean and the standard deviation. The entries were then evaluated again. All outlying values that were more than two standard deviations from the mean were eliminated. The remaining values were then used to find the final mean flow and standard deviation reported in Appendix B.

This process resulted in a dataset that included 981 rivers with a total streamflow of $824\,503\text{ m}^3\text{ s}^{-1}$. The new dataset of streamflows for rivers that discharge into the oceans is an order of magnitude larger than any of the other datasets that were examined for this project. It has approximately 17.9 percent more total streamflow than any similar dataset. The location and magnitude of these rivers can be seen on fig. 2.

3. A new global land surface runoff estimate

a. *The power-law size distribution of rivers*

An interesting pattern is apparent if the rivers in the dataset are ranked by size and then size versus rank is plotted on a log-log graph (fig. 3). The plot of the size distribution is linear over a wide range of river sizes. The eight or nine largest rivers are do not have enough volume to be linear with the rest of the rivers, but from about $15\,000\text{ m}^3\text{ s}^{-1}$ down to about $250\text{ m}^3\text{ s}^{-1}$ (287 rivers), the plot is almost perfectly linear ($R^2 = 0.997$). Below $250\text{ m}^3\text{ s}^{-1}$, the plot deviates from the linear shape. This suggests that rivers follow a power-law size distribution. This is clearly true for the linear portion of the plot. It is probable that for rivers above $250\text{ m}^3\text{ s}^{-1}$, the new dataset should be virtually complete. Rivers in this size range are usually important economically to the countries in which they flow. They provide drinking water, transportation, irrigation, food, and other benefits. For these reasons, nearly every country has made some effort to monitor the streamflow conditions occurring in these rivers as well as selected other smaller rivers. A few rivers may be missing from Indonesia and Malaysia, where records were unavailable, and others may be missing from remote areas of the arctic or the tropics. Therefore, since the data are nearly complete and the size distribution displays a power-law pattern, it is probably accurate that a power-law distribution holds for all rivers above $250\text{ m}^3\text{ s}^{-1}$.

For rivers smaller than $250\text{ m}^3\text{ s}^{-1}$, the situation is different. As rivers become smaller, it is progressively more likely that they will be unmeasured. They have a smaller

economic value and if a country has limited resources for monitoring river conditions, it will naturally concentrate on the larger, more important rivers. Therefore, at some point (which appears to be about $250 \text{ m}^3 \text{ s}^{-1}$), the dataset begins to become seriously incomplete and the size distribution below this range is probably inaccurate. If one assumes that the size distribution for these smaller rivers follows the same pattern as for the larger rivers, the linear portion of the plot could be extended downward to estimate the number and size of the missing small rivers. An estimated volume from small rivers and the observed volume from larger rivers could be summed to give an overall global total river runoff to the oceans.

In fig. 3, the observed rivers were plotted on a log-log graph. Using a curve-fitting program, a line was fitted to the portion of the data between $250 \text{ m}^3 \text{ s}^{-1}$ and $15\,000 \text{ m}^3 \text{ s}^{-1}$ using the least-squares method. This line obeys the equation

$$\log N = 4.5143 - 0.84193 \log Q, \quad (1)$$

where N is the rank of the river by size and Q is the discharge of that river.

Equation (1) has the implication that there are an infinite number of rivers if one attempts to determine the rank of a river with a flow of $0 \text{ m}^3 \text{ s}^{-1}$. If Eq. (1) is integrated to find a sum of river discharges, the integral converges to a finite value. Alternately, it could be assumed that there is a lower bound to the size of a river, so that a river must have a certain threshold flow rate in order to exist. Making this assumption at $0.01 \text{ m}^3 \text{ s}^{-1}$ would reduce the total river runoff by about 2 percent. This study did not make this assumption. The

integration was extended down to $0 \text{ m}^3 \text{ s}^{-1}$ since this would reflect the contribution of small intermittent streamlets that only flow briefly after rainfall.

b. Global estimate

As stated earlier, the global total river runoff can be estimated by summing the observations of all rivers above $250 \text{ m}^3 \text{ s}^{-1}$ and integrating to get the sum of the rivers below $250 \text{ m}^3 \text{ s}^{-1}$. This approach yielded the following equation:

$$Q_{total} = \sum_{i=1}^N Q_{i_{obs}} + \int_0^{Q_{max}} Q \frac{dN}{dQ} dQ, \quad (2)$$

where Q_{total} is the total river runoff, $Q_{i_{obs}}$ is the individual observed streamflow, Q_{max} is the streamflow value used as the cutoff point from observed data to the integrated values and N is the river rank by size.

Substituting (1) into the integral in (2) gives an estimated total flux of $416\,648 \text{ m}^3 \text{ s}^{-1}$ from rivers smaller than $250 \text{ m}^3 \text{ s}^{-1}$. Combining this with the dataset observed discharge summation of $780\,154 \text{ m}^3 \text{ s}^{-1}$ for rivers larger than or equal to $250 \text{ m}^3 \text{ s}^{-1}$ gives an estimated global land surface runoff of $1\,196\,802 \text{ m}^3 \text{ s}^{-1}$ for all rivers.

c. *Ground water discharge*

There are a number of factors contributing to the runoff missing from observed streamflow datasets. These factors include ground water that enters the ocean directly along the shoreline without coming to the surface, rivers that were omitted from the dataset, and streamflow discharge values that are systematically low since many measurements are made significantly upstream from the ocean. While the integration used to develop the new runoff estimate has addressed the latter two factors, so far the issue of ground water discharge has not been addressed.

Accounting for groundwater flowing directly into the ocean from underground is difficult. Until recently, data on ground water discharge have been so deficient as to make an accurate estimate nearly impossible. Direct measurement is impractical and most estimates have been inferred from poorly understood and unreliable data. Baumgartner and Reichel (1975) used a value of 5 percent for their calculations, based on previous estimates. Nace (1970) did some crude calculations based on the assumption that there is no runoff in Arctic and Antarctic regions, as well as an assumption about the average discharge rate per km of shoreline. He found an average total runoff of $7000 \text{ m}^3 \text{ s}^{-1}$ or about 0.55 percent of the mean total surface runoff. Church (1996) stated that previous estimates ranged from 0.1 to 10 percent of surface water runoff, although he gave no details about the specific studies.

A study by Moore (1996) indicates that these estimates may be too low. Moore analyzed concentrations of ^{226}Ra in seawater samples taken at a number of locations off the

coast of South Carolina and from the open waters of the Atlantic Ocean. The concentration of ^{226}Ra near the coastline was several times higher than the background values of the ocean due to river water transport of ^{226}Ra , ^{226}Ra desorption from riverine sediments, erosion of terrestrial sediments, and ^{226}Ra transport by ground water. Moore found that the first three sources were relatively minor contributors and that by process of elimination, the primary source of ^{226}Ra enrichment is from ground water discharge. The ^{226}Ra concentration that was found in ground water near Winyah Bay, a centrally located point on the shoreline, was used as a typical value. Using this value, the ground water flux to the ocean was estimated to be 40 percent of the river water flux. This surprising value does not appear to be a localized aberration, as measurements were taken over 320 km of coastline. However, it may be that ^{226}Ra concentrations in ground water near shorelines are not well understood. Moore gives measurements taken at eight wells in the coastal survey area. Samples from any of these wells vary widely, as much as an order of magnitude for samples taken from one well. Comparing mean values from each of the wells shows a variance of over two orders of magnitude.

These changes in concentration from site to site yield discharge values significantly higher than Moore's 40 percent value at some locations. Given that the ^{226}Ra concentration can vary greatly over distances as small as 50m, Moore's value may not be typical. It is also possible that Moore's assessment of the contribution of other ^{226}Ra sources is too low or that there is an undiscovered additional source of ^{226}Ra . Until similar analyses at other

locations have been completed, Moore's analyses must be considered provisional. Moore has presented a good argument for ground water discharges being greater than previously thought, but a value of 40 percent of the surface river discharge seems excessive. This study will use the classical estimate of 5 percent of surface runoff as the estimate for ground water runoff. This is the value that was used by Baumgartner and Reichel (1975) and in the midrange of the values found by Church (1996).

Using this assumption, a final value for land surface runoff can be made. The estimated 5 percent value for ground water discharge yields a value of $59\,840\text{ m}^3\text{ s}^{-1}$ for the ground water runoff estimate. Adding this value to the previous river discharge estimate of $1\,196\,802\text{ m}^3\text{ s}^{-1}$ gives a total land surface runoff estimate of $1\,256\,642\text{ m}^3\text{ s}^{-1}$.

4. Past global land surface runoff estimates

Since this thesis has estimated global land surface runoff, a review is in order of past estimates of global land surface runoff. The purpose of this review is to explore the methodologies and the likely errors in previous estimates and to compare their results with the results this study has obtained. Early investigators of the global water balance used the global water balance equation

$$P = E + D + R + U \quad , \quad (3)$$

where P is precipitation, E is evaporation, D is discharge and the exchange of water between soil and surface, R is temporary soil storage of water, and U is consumption (chemically or

physically bound water). For long-term (multi-year) cases of the most interest, it is assumed that long-term averages of R and U are zero, allowing (3) to be simplified to

$$P = E + D \quad (4)$$

Using this simplified equation, early researchers computed the magnitude of land surface runoff by altering (4) to get

$$D = P - E \quad (5)$$

Maps of precipitation and evaporation were prepared from observations. From these, distribution maps of runoff were created using the differences between the two maps. Unfortunately, details of many of the earliest efforts are hard to come by or unavailable altogether since they were published in obscure Russian or German texts. Generally, one must depend on the assessments of their work by later researchers for some idea as to what their work entailed.

a. *The approach of Baumgartner and Reichel (1975)*

One of the most referenced (e.g., Peixoto and Oort 1992) modern quantitative assessments of global water balance is that of Baumgartner and Reichel (1975).

Baumgartner and Reichel began by assembling all available hydrologic data. This data was used to prepare maps of precipitation, evaporation, and runoff.

Baumgartner and Reichel used an iterative process to create their precipitation map. Several versions were created as they attempted to reconcile the precipitation data with the

evaporation and river runoff data. The problem locations that needed to be adjusted were confined to certain areas on each continent and were not excessively widespread. There were also interpolations made to areas where data were sparse. This was done with attention paid to how orography would affect precipitation.

Baumgartner and Reichel used several methods to create their evaporation map due to the lack of sufficient observational data. Attempts to create maps of continental evaporation have been handicapped by the paucity of evaporation observations. Evaporation has been traditionally measured by building large shallow tanks of water and measuring the rate that water is evaporated from the tank. These tanks are rather costly to build and require frequent maintenance. Thus, very few long-term studies of evaporation have been carried out and these have been done at relatively few locations. There are short-term studies that have been carried out at other locations, but this does not give the seasonal variation of evaporation. Many of these observations are quite old. Given the expense of building and operating evaporation measuring equipment, this is unlikely to change in the future.

Past researchers have looked for a surrogate measurement that might be used as an alternative to estimate evaporation. Evapotranspiration, moisture transport to and from vegetation, while not the same as evaporation and not directly comparable, was considered a good candidate. The actual evapotranspiration values are usually larger than the evaporation values and adjustments must be made. Evapotranspiration rates have been measured from

numerous plant species. These data can be matched to the prevalent vegetation in given locations to estimate evapotranspiration. Thornthwaite and others (1962-65) used this method to develop distribution maps of evapotranspiration.

Another method of estimating evaporation used by Baumgartner and Reichel is called the hydrographic method. In this method, both river flow values and precipitation are known and evaporation can be determined from Eq. (3). This approach yields relatively accurate evaporation values, but only as a mean value for the entire watershed. To determine alterations to the distribution of evaporation over each watershed, a subjective analysis of the most probable evaporation distribution was used. The pattern of the local orography is used as a variable to determine the evaporation patterns, as is vegetation, i. e. mountain peaks would have lower evaporation than low-lying swamps and forests would have more than sandy dunes.

Baumgartner and Reichel created maps using direct measurements, evapotranspiration values, and the hydrographic method results and merged the results to develop their new evaporation map. They took the maps of evapotranspiration and used adjustments to the given values to estimate evaporation at numerous locations. They also used the evaporation data derived from river basin data and generated a similar and large database of evaporation values. Applying the hydrographic regional values and the general continental values allowed Baumgartner and Reichel to construct their own global evaporation map. In many places, the data were inconsistent and neighboring stations

disagreed. The data had to be analyzed point by point to reconcile the differences.

Baumgartner and Reichel describe this as a difficult process that required a number of iterations before a physically consistent map could be created.

There are some significant errors involved in such an estimation process. The data field they used was necessarily coarse and there can be significant variations between points.

Evapotranspiration values can also vary depending on the density of the vegetation in a given area. This could not be known with a great degree of certainty. In addition, the adjustments made when converting evapotranspiration data to evaporation were subject to some error. Unfortunately, Baumgartner and Reichel did not give an error estimate, so the magnitude of the error is unknown.

It should be noted that Eq. (3) has one term that is not explicitly stated. That term is for the modifications of the water balance due to the activities of man. Irrigation is one of the major factors of this term and results in a reduction of the runoff to the ocean.

Baumgartner and Reichel do not address irrigation specifically, but include it in a general sense in the evaporation term. In addition, where the observed runoff data were used to find the evaporation rate, the effects of irrigation may be reflected in the decreased runoff values.

Using their global maps of precipitation and evaporation, Baumgartner and Reichel were able to plot the difference between the two to create a global map of runoff. (It should be noted that the precipitation and evaporation maps compiled by Baumgartner and Reichel are not entirely independent of runoff, as runoff data was used in their preparation.) As

with the earlier maps, they attempted to reconcile their runoff map with observed river flow data. They used the river basin runoff values of Marcinek (1964, 1965) and some values for individual rivers from UNESCO (1969), a precursor to the dataset from UNESCO that was used in this survey. Other unspecified sources of river basin runoff data were used as well. Mean runoff values were computed for individual river basins. In some cases, data were available for several river gauges, which allowed runoff values to be computed for sub-basins of the larger river basin. This yielded runoff estimates for a sizable portion of the earth's surface. Unfortunately, Baumgartner and Reichel's map showing runoff as a remainder from precipitation minus evaporation was not in close agreement with the observed streamflow data. Thus, they had to adjust their maps to attempt to reconcile these differences and in some cases, further adjustments to the evaporation maps were made. In the final adjustment process for the development of their maps, Baumgartner and Reichel ended up increasing global runoff by 9 percent from the value that Marcinek (1965) estimated with his river basin dataset. They did so because since they had higher runoff for Antarctica, higher precipitation for some areas, such as southern Chile, and higher discharge values for the Amazon and Orinoco rivers. Their final result was $1\,267\,500\text{ m}^3\text{ s}^{-1}$ on an annual average.

b. Other runoff studies

A number of other researchers have used methods similar to Baumgartner and Reichel to estimate of the magnitude of global land surface runoff. Table 3 lists the values

that have been arrived at by these investigators. They varied considerably, even when the same researcher compiled two or more studies. For example, L'vovitch (1964, 1973) had compiled world maps of runoff that varied as much as 10 percent from each other. The earliest estimates by Brikner and Frizche are 30 percent to 50 percent lower than most recent estimates. This is most likely because they had less data than later researchers. The data availability problem (especially for evaporation) casts doubt upon most of the early estimates. It seems reasonable to restrict this study to those done more recently. It would be prudent to begin with Budyko's 1956 estimate. Before Budyko's 1956 estimate, the previous estimate was done by L'vovitch in 1945, but L'vovitch also issued three other estimates in the 1960s and 1970s. Going back further, there are estimates from the 1930s and these studies should be given less weight due to the even greater lack of observational data at that time. Therefore, this study of runoff estimates shall be confined to those after 1950. Of the estimates made since 1956, Albrecht's 1961 estimate of $1\,063\,300\text{ m}^3\text{ s}^{-1}$ was the lowest and the highest was Budyko's 1963 estimate of $1\,521\,000\text{ m}^3\text{ s}^{-1}$. Budyko's 1963 estimate has two values because he used two different sets of assumptions and therefore produced two different results. It was not possible to obtain a copy of Budyko's 1963 study and Baumgartner and Reichel did not describe his assumptions, so the nature of the two sets of assumptions is unknown. The decision was made to include both values since it was not clear which value should be preferred. The fact that both values were quoted by Baumgartner and Reichel (1975) suggests that both values were considered reasonable. The

mean of all of the estimates made since 1956 is $1\,274\,950\text{ m}^3\text{ s}^{-1}$. The standard deviation is $140\,593\text{ m}^3\text{ s}^{-1}$. This mean value is within 10 percent of nine of the thirteen estimates used, so it seems to be a reasonable benchmark to use for global mean annual runoff. This will be the value used in this study for comparison.

Nace (1970) used some ideas similar to those employed in this study. He plotted rank versus cumulative streamflow, but only noted that the streamflow was approaching a limit about 30 percent lower than expected. He also compared cumulative discharge to the cumulative river basin area. Nace concluded that it was unlikely that the remaining land area could generate enough runoff to supply the missing streamflow unless small rivers have extremely high discharge volumes per km^2 of land area and/or the small rivers in his dataset have surprisingly low discharge rates per km^2 . This is possible, but Nace did not attempt to investigate the issue further. In addition, Nace ignored the possibility that river discharges are higher at the ocean than at the point where the measurements were made and that groundwater runoff should be included in the global land surface runoff.

5. Dataset and estimate features

a. Dataset

The new dataset streamflow total of $824\,503\text{ m}^3\text{ s}^{-1}$ is about 65 percent of the mean estimated land surface discharge from previous researchers as shown in Table 3. It is also

about 66 percent of the new total land surface runoff estimate that has been developed here, as can be seen in fig. 4. As can be seen in fig. 5, this shortfall is quite consistent over all continents except for Oceania, where there is a problem with missing data for some areas.

Figure 6 plots both the new discharge dataset and the land area as a function of latitude. The large dominant peak occurs at 0° - 5° S due to the discharge of the Amazon and Tocantins rivers. The relatively low values from 0° - 5° N and 10° - 25° S can be explained by noting that these regions drain into rivers that discharge in other latitude zones, mainly 0° - 5° S. In South America, this would be into the Amazon, Orinoco, and Tocantins rivers. In Africa, this would be into the Zaire and Niger rivers. There is a sharp peak of river discharge in the Arctic and a relative low for several bands below that since many rivers in Europe, Asia, and North America flow north to empty in the Arctic. There are relatively low discharge values at 35° - 45° N since these regions drain into the Mississippi and Chang Jiang rivers, which appear in the 25° - 35° N bands. There is a relatively high discharge value in the 20° - 25° N band that reflects the drainage (especially from the Himalayas) into Asian rivers, such as the Ganges, Brahmaputra, Xi, Indus, and Meghna rivers. There is another relative peak in the 5° - 10° N band due to the Orinoco and Mekong rivers draining adjacent regions. From 25° - 35° S, the low values occur because drainage is primarily into the Parana and Uruguay rivers in South America, while in Africa, the aridness of the climate limits runoff.

b. Runoff estimate

The new land surface runoff estimate of $1\,256\,642\text{ m}^3\text{ s}^{-1}$ derived using the power-law size distribution is 98.6 percent of the mean P-E estimate and 103.5 percent of the estimate of Baumgartner and Reichel, as seen in Table 3. This value is in remarkably close agreement and well within the uncertainty of the data. If the Moore (1996) estimate of 40 percent for ground water discharge is used, ground water discharge is $478\,720\text{ m}^3\text{ s}^{-1}$, giving the estimate an overall total of $1\,675\,522\text{ m}^3\text{ s}^{-1}$. That would be about 10 percent higher than the highest of the previous estimates using the 5 percent value for ground water discharge.

In making this estimate of total land surface runoff, it was assumed that the log-linear size law was valid. This law is an empirical relationship based on analysis of the observed data. There is no a priori reason for expecting to find this sort of a distribution. No known physical law can be used to demonstrate that such a pattern exists. The new estimate agrees with previous estimates derived using the P-E method to within a few percent. Since this is well within the uncertainty of the data, the log-linear profile of the size distribution might in fact be correct. Indeed, the fact that two different methods give similar results lends further credibility to the estimates and validity of the two methods.

c. *Individual continents*

The same methods that were employed to estimate the global land surface runoff could also be used to estimate land surface runoff on a continent-by-continent basis. First, rivers must be categorized by continent and ranked in size order. The rivers can be plotted on a log-log plot, a curve fitted to the data to get the relationship between size and rank, and then integrated to estimate the missing data.

Figures 7 and 8 compare the plotted observed data for each continent with the global data. While each continent displays a linear size distribution, none is as strikingly smooth as the global data. Oceania is probably the least linear of the continents, which is not surprising since a significant amount of data are missing from the Oceania portion of the dataset. Four of the six continental groupings have a similar slope to the global data with the exceptions being Europe and North America. Both Europe and North America have a slope steeper than the other plots. This is a problem, since the steeper slope suggests that there are more rivers on these two continents than is likely to be the case. This in turn leads to higher discharge values than expected, when compared to the previous continental discharge estimate of Baumgartner and Reichel (1975).

Both Asia and South America have shallower slopes than the other plots. This suggests that there are fewer rivers than might be expected and less discharge than was estimated by Baumgartner and Reichel (1975). The results of these continental estimates are summarized in Table 4.

Figure 9 is analogous to fig. 3, creating a log-log plot for African rivers and extrapolating to find the total runoff for that continent, adjusted for ground water discharge. Africa was estimated to have a discharge of $126\,110\text{ m}^3\text{ s}^{-1}$. This is 16.7 percent greater than Baumgartner and Reichel's (1975) estimate of $108\,025\text{ m}^3\text{ s}^{-1}$.

Asia's estimated discharge, as displayed in fig. 10, was $322\,470\text{ m}^3\text{ s}^{-1}$ versus the Baumgartner and Reichel (1975) estimate of $395\,055\text{ m}^3\text{ s}^{-1}$. The new estimate is 18.4 percent lower than Baumgartner and Reichel's.

Figure 11 shows the curve plot for Europe. Europe was estimated to have a discharge of $100\,630\text{ m}^3\text{ s}^{-1}$. This is 23.9 percent higher than Baumgartner and Reichel's (1975) estimate of $81\,250\text{ m}^3\text{ s}^{-1}$. This is the greatest percentage difference of any continent except Oceania, the cause of which is probably missing data. This difference is surprising Europe is the continent with the most thorough streamflow monitoring. In general, the records are the most extensive and cover the longest period. It would seem to be the likeliest continent to have close agreement with Baumgartner and Reichel's (1975) since the continent that has the most complete data is Europe. It may well be that the higher values of the current study are accurate and that the estimate of Baumgartner and Reichel (1975) is too low due to local small scale effects that cannot be adequately resolved on their large-scale maps. Orography can greatly increase precipitation over small areas and topography and vegetation can greatly effect evaporation. Each of these could alter runoff and be difficult to detect using the P-E method.

Figure 12 shows the curve fit for North American rivers. The new estimate for North America was $226\,440\text{ m}^3\text{ s}^{-1}$. This value was 18.3 percent higher than Baumgartner and Reichel's (1975) estimate of $185\,060\text{ m}^3\text{ s}^{-1}$. This result is similar to that of Europe in that the data available from North America are probably the most complete after that of Europe. Like Europe, North America is one of the continents furthest out of agreement with Baumgartner and Reichel's (1975) estimate. It should be noted that Europe and North America appear to be the continents with the highest percentage of mountainous terrain and this would enhance the localized terrain effects on precipitation and evaporation. This would tend to decrease the accuracy of the P-E method for these continents.

Oceania rivers were plotted and curve fitting was done in fig. 13. Oceania was estimated to have a discharge of $42\,920\text{ m}^3\text{ s}^{-1}$. This is 43.3 percent lower than Baumgartner and Reichel's (1975) estimate of $75\,860\text{ m}^3\text{ s}^{-1}$. This disagreement is no doubt mainly due to the missing streamflow data from Indonesia, Malaysia, and New Guinea. It may also be the case that the small land area compared to the relatively large coastlines of most islands makes the presence of large rivers unlikely. The power-law relationship between river size distribution and total runoff for islands may thus be different than for continents. In addition, the extreme aridity of Australia and the extent of the large internal drainage may not have been captured accurately by Baumgartner and Reichel.

The results of the plotting and curve fitting for South America are shown in fig. 14. South America's estimated discharge was $306\,370\text{ m}^3\text{ s}^{-1}$ versus Baumgartner and Reichel's

(1975) estimate of $349\,805\text{ m}^3\text{ s}^{-1}$. The new estimate is 12.4 percent lower than Baumgartner and Reichel's (1975). The new estimate may be low due to incomplete data from the tropical northern areas or from the remote areas of southern Chile. It seems likely that the dominance of the Amazon River on the surface discharge of South America may also skew the new estimate in some way. If some of the flow from the Amazon was instead a part of additional smaller rivers or existing smaller rivers, the slope of the South American plot would change and lead to a larger estimated discharge for South America.

Overall, when the continent totals are summed together, the global land surface runoff is $1\,124\,940\text{ m}^3\text{ s}^{-1}$. This compares to the earlier global estimate of $1\,196\,800\text{ m}^3\text{ s}^{-1}$. The continental values are 6.0 percent lower than the global estimate. This suggests that the uncertainty of these values is at least this large. Given the uncertainty of the streamflow data, this difference is acceptable. The uncertainty affects the estimate to an unknown extent, but it is probably at least plus or minus 10 percent. When 5 percent for ground water discharge is added to the sum of the continental estimates, the final total is $1\,181\,190\text{ m}^3\text{ s}^{-1}$. This is once again 6.0 percent lower than the global estimate. It is also 7.4 percent below the mean P-E estimate from other researchers and 1.2 percent below the estimate of Baumgartner and Reichel. This is well within the uncertainty of the data, so it is in acceptable agreement with the other estimates.

6. Conclusion

A dataset of observed annual mean river outflows to the ocean has been compiled which includes 981 rivers. This appears to be the largest such dataset that has ever been compiled, being larger by an order of magnitude than any other similar dataset that could be found. The dataset was constructed by selectively combining previously published measurements. Care was taken to select the streamflow measurements located closest to the river's ocean outlet. For rivers with more than one published streamflow measurement, the dataset contains the mean and standard deviation of the selected measurements. Multiple listings of the same flow rate and outlying values were eliminated.

It was found during an analysis of the streamflow data that rivers have a log-linear size profile, at least for rivers between $250 \text{ m}^3 \text{ s}^{-1}$ and $20\,000 \text{ m}^3 \text{ s}^{-1}$. Below $250 \text{ m}^3 \text{ s}^{-1}$, it can be assumed that the data are highly incomplete. If it is assumed that the log-linear profile holds for these smaller rivers as well, then the observed profile for larger rivers can be used to estimate the magnitude of the missing data. A curve can be fit to the log-linear portion of the data, then extended to the smaller rivers. Integrating the resultant equation will give an estimate of the missing data. Combining this estimate with the observed data for the large rivers yields an estimate of $1\,256\,642 \text{ m}^3 \text{ s}^{-1}$ for the total global land surface runoff which is in close agreement with previous estimates computed using other methods.

Using a method similar to the one used for the global data, estimates can be made for surface runoff for each of the continents. Curves were fitted to the linear portion of the

plots for each continent. The equation for each fitted curve was then integrated, as before, to yield an estimate of the missing data. By summing the observed data and the estimate, an estimate of the surface runoff was calculated for each continent.

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Appendix A: Sources Used to Compile Dataset

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Table 1. Gauging Station Distances to River Mouths for Selected Large Rivers, Where Distance D was Estimated from Maps

River	Gauging Station Location	D (km)
Amazon	Obidos, Brazil	750
Zaire	Kinshasa, Zaire	425
Orinoco	Ciudad Bolivar, Venezuela	325
Ganges	Paksey, Bangladesh	325
Brahmaputra	Bahadurabad, Bangladesh	375
Chang Jiang	Datong, China	525
Yenisei	Igarka, Russia	700
Mississippi	Tarbert Landing, MS, USA	400
Lena	Kusur, Russia	300
Parana	Posadas, Argentina	1250
St. Lawrence	Cornwall, Ont., Canada	775
Ob	Salekhard, Russia	300
Amur	Komsomolsk, Russia	525
Tocantins	Itupiranga, Brazil	600
Xi	Wuzhou 3, China	375
MacKenzie	Norman Wells, N. W. T., Canada	700
Magdalena	Calamar, Colombia	100
Yukon	Kaltag, Alaska, USA	675
Niger	Jebba, Nigeria	700
Uruguay	Salto, Uruguay	425

(Distances estimated from maps)

Table 2. River Flow Values from All Sources for Selected Rivers

River	Flow (m ³ s ⁻¹)	Source
Amazon	212 400	(van der Leeden et al. 1991)
	212 000	(Szestay 1982)
	200 000	(Kammerer 1989b)
	199 800	(Milliman and Meade 1983)
	198 600	(Probst and Sigha 1989)
	196 600	(Meybeck 1993)
	190 000	(Baumgartner and Reichel 1975)
	183 300	(Degens et al. 1991)
	180 000	(Czaya 1981)
	175 000	(Spitzzy and Leenheer 1991)
	175 000	(Meybeck 1988)
	175 000	(Showers 1979)
	174 400	(Depetris and Paolini 1991)
	174 400	(Degens et al. 1991)
River	Flow (m ³ s ⁻¹)	Source
Zaire	46 000	(Esser and Kohlmaier 1992)
	44 000	(Kammerer 1989b)
	42 000	(Baumgartner and Reichel 1975)
	42 000	(Czaya 1981)
	41 200	(Degens et al. 1992)
	41 100	(Nkounkou and Probst 1987)
	41 100	(Probst and Tardy 1987)
	41 100	(UNESCO 1985)
	40 700	(Probst and Sigha 1989)
	40 000	(Szestay 1982)
	39 600	(van der Leeden et al. 1991)
	39 600	(Milliman and Meade 1983)
	39 600	(Leopold 1962)
	39 200	(Spitzzy and Leenheer 1991)
	39 200	(Meybeck 1988)
	39 200	(van der Leeden 1975)
	39 000	(Showers 1979)

Table 2. River Flow Values from All Sources for Selected Rivers (continued)

River	Flow (m ³ s ⁻¹)	Source
Irrawaddy	14 000	(Kammerer 1989b)
	14 000	(Baumgartner and Reichel 1975)
	14 000	(Czaya 1981)
	13 600	(Subramanian and Ittekkot 1991)
	13 600	(Leopold 1962)
	13 600	(van der Leeden et al. 1991)
	13 600	(Szestay 1982)
	13 600	(Milliman and Meade 1983)
	13 600	(Degens et al. 1992)
	13 400	(Meybeck 1988)
	12 700	(Showers 1979)

Table 3. Dataset Discharge Estimates

Source	Global Land Surface Runoff, m ³ s ⁻¹
Brikner (1905)*	807 000
Frizche (1906)*	973 100
Wust (1920)*	1 182 000
Meinardus (1934)*	1 186 800
Wust (1936)*	1 177 300
L'vovitch (1945)*	1 158 300
Budyko (1956)*	1 205 700
Albrecht (1961)*	1 063 300
Budyko (1963)**	1 457 700/1 521 000
L'vovitch (1964)*	1 182 000
Mira Atlas (1964)***	1 140 800
Marcinek (1965)***	1 156 600
Sellers (1965)	1 463 700
Nace (1967b)****	1 205 000
L'vovitch (1970)	1 273 900
Mather (1970)***	1 172 500
L'vovitch (1973)****	1 185 900
Baumgartner and Reichel (1975)	1 267 500
Mean of entries published after 1945	1 274 950

* from L'vovitch (1970)

** from Baumgartner and Reichel (1975), two sets of assumptions used giving two results.

*** from Baumgartner and Reichel (1975)

**** as cited by van der Leeden (1975)

Table 4. Global and Continental Land Surface Discharge Estimates

	Mean P-E Estimate	Baumgartner and Reichel P-E Estimate	New Estimate
Global	1 274 950	1 195 050	1 196 800
Africa		108 025	126 110
Asia		395 055	322 470
Europe		81 250	100 630
North America		185 058	226 440
Oceania		75 860	42 940
South America		349 805	306 370
Continental Sum	1 274 950	1 195 050	1 124 940

Appendix B: Streamflow Data Ranked by Size

Rank	River	Country (at mouth)	River Flow Volume (m ³ /s)	Standard Deviation (m ³ /s)	Global Sum (m ³ /s)
1	Amazon	Brazil	192918.2	12859.0	192918.2
2	Zaire	Zaire	40755.6	1483.3	233673.8
3	Ganges/ Brahmaputra	Bangladesh	34000.0	3498.1	267673.8
4	Orinoco	Venezuela	30950.0	3810.5	298623.8
5	Chang Jiang (Yangtze)	China	28863.3	3576.8	327487.1
6	Yenisei	Russia	18350.0	1001.2	345837.1
7	Parana (Plata)	Argentina	16387.5	1511.2	362224.6
8	Mississippi	USA	16287.5	2082.9	378512.1
9	Lena	Russia	16287.5	398.2	394799.6
10	Mekong	Vietnam	14850.0	1880.8	409649.6
11	Irrawaddy	Burma	13425.0	471.0	423074.6
12	Ob	Russia	12738.9	557.7	435813.5
13	Saint Lawrence	Canada	11458.9	1483.1	447272.4
14	Tocantins	Brazil	10400.0	1186.6	457672.4
15	Amur	Russia	10185.7	527.6	467858.1
16	Xi (Zhu Jiang) (Pearl)	China	9611.3	1882.0	477469.4
17	MacKenzie	Canada	9013.8	1076.3	486483.3
18	Columbia	USA	7460.0	455.9	493943.3
19	Magdalena	Colombia	7325.0	465.7	501268.3
20	Yukon	USA	6412.0	552.4	507680.3
21	Danube	Romania	6365.0	141.6	514045.3
22	Indus	Pakistan	6092.9	1122.3	520138.2
23	Salween	Burma	5750.0	4250.0	525888.1
24	Niger	Nigeria	5533.3	575.7	531421.4
25	Sepik	Papua New Guinea	5150.0	1350.0	536571.4
26	Fly	Papua New Guinea	4960.0	2752.6	541531.4
27	Ogooue	Gabon	4686.7	12.5	546218.1
28	Uruguay	Argentina	4618.6	529.1	550836.8
29	Bengawan Sala	Indonesia	4240.0	3360.0	555076.8
30	Zambezi	Mozambique	4121.7	2093.1	559198.4
31	Pechora	Russia	4052.5	35.6	563250.9
32	Red (Hungbo) (Sankai)	Vietnam	3750.0	150.0	567000.9

33	Fraser	Canada	3590.0	210.9	570590.9
34	Meghna	Bangladesh	3515.0	0.0	574105.9
35	Severnaya Dvina	Russia	3418.9	87.6	577524.8
36	Godavari	India	3250.0	447.8	580774.8
37	Khatanga-Popigay	Russia	3240.0	40.0	584014.8
38	Sao Francisco	Brazil	3087.7	364.1	587102.5
39	Kolyma	Russia	2985.0	740.5	590087.5
40	Neva	Russia	2524.3	41.0	592611.8
41	Pyasina	Russia	2512.0	135.6	595123.8
42	Nelson	Canada	2495.0	200.3	597618.8
43	Koksoak	Canada	2460.0	63.8	600078.8
44	Tarum	Indonesia	2400.0	0.0	602478.8
45	Purari	Papua New Guinea	2376.7	63.4	604855.5
46	Usumacinta	Mexico	2339.0	791.6	607194.5
47	Atrato	Colombia	2275.0	0.0	609469.5
48	Rhine (Rhein)	Netherlands	2246.7	53.7	611716.2
49	Essequibo	Guyana	2198.3	19.3	613914.5
50	Sanaga	Cameroon	2087.5	71.5	616002.0
51	San Juan	Colombia	2010.0	0.0	618012.0
52	Mahanadi	India	2008.3	158.8	620020.3
53	Corantijn	Surinam	2000.0	0.0	622020.3
54	Min	China	1905.0	55.0	623925.3
55	Krishna (Kistna)	India	1894.0	185.1	625819.3
56	Maroni (Marowijne)	Surinam	1877.5	82.9	627696.8
57	Nile	Egypt	1829.5	787.8	629526.3
58	Mobile	USA	1752.5	93.6	631278.8
59	La Grande	Canada	1720.0	24.5	632998.8
60	Saguenay	Canada	1701.0	116.1	634699.8
61	Churchill l	Canada	1686.7	123.6	636386.5
62	Indigirka	Russia	1631.4	111.5	638017.9
63	Dnieper	Ukraine	1630.8	69.4	639648.7
64	Rhone	France	1630.0	71.4	641278.7
65	Tanduj	Indonesia	1595.0	0.0	642873.7
66	Taz	Russia	1540.0	0.0	644413.7
67	Kuskokwim	USA	1503.0	323.4	645916.7
68	Guayas	Ecuador	1490.0	0.0	647406.7
69	Tsientang	China	1490.0	0.0	648896.7
70	Po	Italy	1476.7	38.6	650373.4
71	Shatt-al-Arab	Iraq	1445.0	284.2	651818.4
72	Narmada	India	1401.7	232.9	653220.1
73	Huang He (Yellow)	China	1361.4	155.2	654581.4

74	Copper	USA	1344.0	286.8	655925.4
75	Skeena	Canada	1331.3	413.9	657256.8
76	Manuk	Indonesia	1300.0	0.0	658556.8
77	Cuyuni	Guyana	1280.0	0.0	659836.8
78	Stikine	USA	1257.5	360.7	661094.3
79	Albany	Canada	1255.0	219.4	662349.3
80	Anadyr	Russia	1247.5	772.5	663596.8
81	Abitibi (Moose)	Canada	1218.8	248.6	664815.6
82	Volta	Ghana	1186.7	57.3	666002.3
83	Mazaruni	Guyana	1150.0	0.0	667152.3
84	Nottaway	Canada	1142.5	66.1	668294.8
85	Thelon	Canada	1105.5	264.5	669400.3
86	Susitna	USA	1097.5	476.1	670497.8
87	Churchill 2	Canada	1090.0	158.9	671587.8
88	Punagara	Indonesia	1070.0	0.0	672657.8
89	Wisla (Vistula)	Poland	1040.0	47.7	673697.8
90	Yalu	North Korea	1040.0	0.0	674737.8
91	Susquehanna	USA	1005.8	43.7	675743.6
92	Tsiribihina	Madagascar	1000.0	0.0	676743.6
93	Bei	China	1000.0	0.0	677743.6
94	Udjung	Indonesia	1000.0	0.0	678743.6
95	Taymyra	Russia	990.0	0.0	679733.6
96	Olenek	Russia	989.6	151.1	680723.2
97	Manicouagan	Canada	979.0	91.7	681702.2
98	Doce	Brazil	970.0	0.0	682672.2
99	Saint John	Canada	969.0	158.8	683641.2
100	Yana	Russia	935.0	43.7	684576.2
101	Papaloapan	Mexico	930.0	310.0	685506.2
102	Pur	Russia	928.0	71.1	686434.2
103	Kouilou	Congo	926.7	53.9	687360.9
104	Han	China	922.0	0.0	688282.9
105	Eastmain	Canada	918.0	17.3	689200.9
106	Nass	Canada	896.3	47.9	690097.2
107	Nushagak	USA	886.7	174.6	690983.9
108	Rupert	Canada	885.8	15.1	691869.7
109	Negro	Argentina	881.0	128.5	692750.7
110	Willamette	USA	875.0	185.0	693625.7
111	George	Canada	874.3	63.4	694500.0
112	Kamchatka	Russia	872.8	116.2	695372.8
113	Loire	France	855.4	29.0	696228.2
114	Don	Russia	850.7	46.9	697078.9
115	Alsek	USA	850.0	0.0	697928.9
116	Chao Phraya	Thailand	848.0	50.9	698776.9
117	Parnaiba	Brazil	843.0	0.0	699619.9
118	Cuanza	Angola	836.0	0.0	700455.9
119	Baker	Chile	828.3	168.1	701284.2

120	Brantas	Indonesia	810.0	0.0	702094.2
121	Esmeraldas	Ecuador	803.0	19.0	702897.2
122	Uda	Russia	800.0	0.0	703697.2
123	Kaveri (Cauvery)	India	799.0	135.0	704496.2
124	Mesen	Russia	789.3	101.3	705285.5
125	Dong	China	762.0	0.0	706047.5
126	Oyapock	French Guiana	761.7	174.8	706809.2
127	Ebro	Spain	753.5	419.8	707562.7
128	Elbe	Germany	745.3	35.3	708308.0
129	Saint Maurice	Canada	744.5	11.5	709052.5
130	Bio-Bio	Chile	729.0	268.6	709781.5
131	Mindanao	Philippines	725.6	0.0	710507.1
132	Penzhina	Russia	710.3	10.3	711217.4
133	Sacramento	USA	700.7	51.4	711918.1
134	Glamma (Gloma)	Norway	696.6	19.3	712614.8
135	Paraiba	Brazil	695.7	259.2	713310.4
136	Grande de la Baleine	Canada	675.7	7.7	713986.1
137	Santa Cruz	Argentina	675.0	0.0	714661.1
138	Puelo	Chile	670.0	0.0	715331.1
139	Arnaud	Canada	662.5	8.5	715993.6
140	Apalachicola	USA	655.5	55.3	716649.1
141	Nyanga	Gabon	650.0	0.0	717299.1
142	Hayes	Canada	641.5	52.5	717940.6
143	Murray I	Australia	641.0	141.5	718581.6
144	Rufiji	Tanzania	630.0	345.0	719211.6
145	Brahmani	India	627.5	46.5	719839.1
146	Garonne	France	622.4	32.0	720461.5
147	Nadym	Russia	610.0	0.0	721071.5
148	Ou (Wu)	China	608.0	0.0	721679.5
149	Clutha	New Zealand	604.0	119.4	722283.5
150	Taku	USA	600.0	0.0	722883.5
151	Colville	USA	600.0	0.0	723483.5
152	Senegal	Senegal	594.3	214.0	724077.8
153	Neman	Lithuania	594.0	57.1	724671.8
154	Rompido de Samaria	Mexico	592.0	0.0	725263.8
155	Kvichak	USA	590.0	0.0	725853.8
156	Daugava	Latvia	586.0	98.9	726439.8
157	Vuoksi	Russia	582.0	12.0	727021.8
158	Riviere aux Feuilles	Canada	581.3	24.2	727603.1
159	Kelantan	Malaysia	578.5	18.5	728181.6
160	Agusan	Philippines	572.0	33.0	728753.6
161	San Juan	Nicaragua	572.0	8.0	729325.6

162	Riviere a la Baleine	Canada	565.0	19.9	729890.6
163	Gota-Vanern	Sweden	554.0	19.7	730444.6
164	Pahang	Malaysia	550.0	0.0	730994.6
165	Cross	Nigeria	548.0	0.0	731542.6
166	Kemijoki	Finland	545.3	21.1	732087.9
167	Odra (Oder)	Poland	544.5	23.9	732632.4
168	Moa	Sierra Leone	533.0	0.0	733165.4
169	Back	Canada	530.8	52.3	733696.3
170	Mangoky	Madagascar	529.5	70.5	734225.8
171	Severn	Canada	529.0	152.9	734754.8
172	Winisk	Canada	522.7	121.8	735277.4
173	Shinano	Japan	522.0	19.0	735799.4
174	Petit Mecatina	Canada	514.3	8.8	736313.8
175	Klamath	USA	509.3	18.6	736823.1
176	Han	South Korea	507.5	22.5	737330.6
177	Onega	Russia	507.2	34.9	737837.8
178	Thaanne-Thlewiatza	Canada	507.0	0.0	738344.8
179	Kivchak	USA	502.0	0.0	738846.8
180	Douro	Portugal	500.5	122.3	739347.3
181	Grande	Nicaragua	491.0	0.0	739838.3
182	Kazan	Canada	489.0	55.0	740327.3
183	Lulealven	Sweden	484.7	23.1	740811.9
184	Connecticut	USA	482.8	34.0	741294.8
185	Ishikari	Japan	480.0	11.0	741774.8
186	Buller	New Zealand	476.0	25.0	742250.8
187	Angermanalven	Sweden	475.9	15.7	742726.6
188	Skagit	USA	475.0	0.0	743201.6
189	Moisie	Canada	474.5	15.5	743676.1
190	Tapi	India	469.3	138.1	744145.4
191	Jiulong	China	466.0	0.0	744611.4
192	Jequitinhonha	Brazil	465.0	65.6	745076.4
193	Hudson	USA	458.8	106.0	745535.3
194	Karun	Iran	455.0	130.0	745990.3
195	Panuco	Mexico	454.7	88.9	746444.9
196	Attawapiskat	Canada	453.3	131.0	746898.3
197	Ikopa	Madagascar	451.0	11.0	747349.3
198	Indalsalven	Sweden	450.3	7.1	747799.6
199	Valdivia	Chile	450.0	0.0	748249.6
200	Umealven	Sweden	442.5	7.5	748692.1
201	Balsas	Mexico	439.0	0.0	749131.1
202	Narva	Estonia	433.0	17.0	749564.1
203	Harricana	Canada	431.3	130.3	749995.4
204	Anabar	Russia	422.5	48.8	750417.9
205	Delaware	USA	421.6	86.8	750839.5

206	Saint Paul	Liberia	416.5	203.5	751256.0
207	Cortzacoalcos	Mexico	413.0	0.0	751669.0
208	Rioni	Georgia	409.7	8.2	752078.7
209	Mae Klong	Thailand	408.0	0.0	752486.7
210	Natashquan	Canada	405.0	14.8	752891.7
211	Aux Outardes	Canada	399.5	0.5	753291.2
212	Coppename	Suriname	398.5	71.5	753689.7
213	Olfusa	Iceland	395.0	32.3	754084.7
214	Kobuk	USA	394.3	108.6	754479.0
215	Altamaha	USA	386.3	15.9	754865.3
216	Seine	France	385.0	115.0	755250.3
217	Tortuguero	Costa Rica	385.0	0.0	755635.3
218	Mahi	India	378.5	4.5	756013.8
219	Thjorsa	Iceland	378.5	14.8	756392.3
220	Neretva	Croatia	378.0	0.0	756770.3
221	Betsiamites	Canada	375.0	0.0	757145.3
222	Tornealven	Sweden	373.0	0.0	757518.3
223	Lempa	El Salvador	367.7	12.6	757886.0
224	Bandama	Ivory Coast	365.0	40.0	758251.0
225	Bueno	Chile	365.0	0.0	758616.0
226	Seal	Canada	365.0	0.0	758981.0
227	Dalalven	Sweden	364.7	8.3	759345.7
228	Penobscot	USA	364.0	49.9	759709.7
229	Waiau	New Zealand	363.0	28.0	760072.7
230	Tauy	Russia	362.0	0.0	760434.7
231	Muonio	Finland	361.2	10.3	760795.9
232	Tineg	Philippines	358.7	0.0	761154.6
233	Catarman	Philippines	357.1	0.0	761511.7
234	Sassandra	Ivory Coast	354.0	50.5	761865.7
235	Tagus	Portugal	350.8	129.8	762216.5
236	Kuban	Russia	350.8	67.1	762567.3
237	Esquinas	Costa Rica	350.0	0.0	762917.3
238	Polangui	Philippines	350.0	0.0	763267.3
239	Noatak	USA	350.0	0.0	763617.3
240	Kanairiktok	Canada	350.0	0.0	763967.3
241	Naskaupi	Canada	350.0	0.0	764317.3
242	Povungnituk	Canada	350.0	0.0	764667.3
243	Progo	Indonesia	345.0	0.0	765012.3
244	Savannah	USA	341.8	17.7	765354.1
245	Oranje	South Africa	340.8	21.0	765694.9
246	Romaine	Canada	340.0	0.0	766034.9
247	Pee Dee	USA	339.0	123.4	766373.9
248	Nagdong	South Korea	334.0	41.0	766707.9
249	Tolten	Chile	334.0	0.0	767041.9
250	Grande de Terraba	Costa Rica	327.0	14.9	767368.9

251	Kiso	Japan	327.0	0.0	767695.9
252	Dniestr	Ukraine	326.3	29.3	768022.3
253	Drammensvassdraget	Norway	326.0	0.0	768348.3
254	Drin	Albania	324.5	23.0	768672.8
255	Wouri	Cameroon	319.0	10.0	768991.8
256	Potomac	USA	318.0	19.7	769309.8
257	Weser	Germany	317.8	29.0	769627.6
258	Ntem	Cameroon	315.3	54.9	769942.9
259	Minho	Portugal	313.0	0.0	770255.9
260	Pascagoula	USA	311.8	68.7	770567.7
261	Damodar	India	307.0	10.0	770874.7
262	Amguema	Russia	307.0	27.0	771181.7
263	Burdekin	Australia	305.3	38.7	771487.0
264	Peninsula Osa	Costa Rica	304.0	0.0	771791.0
265	Maas (Meuse)	Netherlands	302.0	35.1	772093.0
266	Saint John	Liberia	301.0	168.0	772394.0
267	Mana	French Guiana	300.0	0.0	772694.0
268	Guadalquivir	Spain	299.4	142.1	772993.4
269	Dordogne	France	297.5	19.5	773290.9
270	Kitakami	Japan	297.0	0.0	773587.9
271	Save	Mozambique	296.5	137.5	773884.4
272	Santiago	Mexico	296.0	52.8	774180.4
273	Yodo	Japan	294.5	12.5	774474.9
274	Maule	Chile	293.3	79.6	774768.2
275	Nyong	Cameroon	290.5	150.5	775058.7
276	Kalixalven (Kaitum)	Sweden	287.0	3.6	775345.7
277	Skien svassdraget	Norway	287.0	0.0	775632.7
278	Kaoping	Taiwan	285.0	0.0	775917.7
279	Subarnarekha	India	282.5	30.5	776200.2
280	Coco	Honduras	276.0	224.0	776476.2
281	Petrohue	Chile	275.0	0.0	776751.2
282	Comoe	Ivory Coast	274.0	0.0	777025.2
283	Daule	Ecuador	270.0	0.0	777295.2
284	Namsen	Norway	270.0	0.0	777565.2
285	Konkoure	Guinea	267.0	0.0	777832.2
286	Musa	Papua New Guinea	263.0	0.0	778095.2
287	Santiago	Mexico	262.5	28.5	778357.7
288	Cagayan l	Philippines	260.5	2.5	778618.2
289	Pearl	USA	260.3	15.3	778878.5
290	Cavally	Ivory Coast	258.4	151.3	779136.9
291	Waikato	New Zealand	258.0	91.7	779394.9
292	Mahaweli	Sri Lanka	255.8	67.6	779650.7
293	Chirripo	Costa Rica	252.0	0.0	779902.7
294	Oulujoki	Finland	251.0	3.0	780153.7

295	Limpopo	Mozambique	250.0	120.3	780403.7
296	Cisnes	Chile	250.0	0.0	780653.7
297	Colorado	Mexico	243.5	202.9	780897.2
298	Mananara	Madagascar	242.0	0.0	781139.2
299	Abulug	Philippines	240.5	0.0	781379.7
300	Pra	Ghana	240.0	43.0	781619.7
301	Pemali	Indonesia	240.0	0.0	781859.7
302	Oueme	Benin	240.0	0.0	782099.7
303	Bolgoda	Sri Lanka	238.0	0.0	782337.7
304	Adige	Italy	237.0	17.7	782574.7
305	Coppermine	Canada	236.5	120.5	782811.2
306	Tone	Japan	236.0	37.3	783047.2
307	Waitaki	New Zealand	235.0	0.0	783282.2
308	Hai	China	234.0	0.0	783516.2
309	Lurio	Mozambique	232.0	0.0	783748.2
310	Sabine	USA	231.7	17.9	783979.9
311	Approuague	French Guiana	230.0	0.0	784209.9
312	Sinnamary	French Guiana	230.0	0.0	784439.9
313	Motagua	Guatemala	229.8	80.8	784669.7
314	Tiber	Italy	229.2	8.0	784898.9
315	Roanoke	USA	228.3	3.9	785127.2
316	Kem	Russia	228.0	29.0	785355.2
317	Perak	Malaysia	228.0	19.0	785583.2
318	Ljusnan	Sweden	226.7	5.4	785809.9
319	Pampanga	Philippines	225.4	2.6	786035.3
320	Kymijoki	Finland	224.3	100.8	786259.6
321	Kalu	Sri Lanka	221.1	28.2	786480.7
322	Kokemaenjoki	Finland	220.5	5.5	786701.2
323	Ranavassdraget	Norway	220.0	0.0	786921.2
324	Merrimack	USA	218.5	13.5	787139.7
325	Adour	France	217.5	142.5	787357.2
326	Sakarya	Turkey	217.3	28.3	787574.5
327	Eel	USA	215.1	24.8	787789.6
328	Mambare	Papua New Guinea	215.0	0.0	788004.6
329	Umpqua	USA	215.0	3.0	788219.6
330	Daly	Australia	211.0	0.0	788430.6
331	Ceyhan	Turkey	210.0	11.0	788640.6
332	Patuca	Honduras	209.0	0.0	788849.6
333	Kalkkinen	Finland	209.0	0.0	789058.6
334	Fitzroy-Dawson	Australia	206.5	40.5	789265.1
335	Buzi	Mozambique	206.0	160.0	789471.1
336	Tym	Russia	206.0	0.0	789677.1
337	Trinity	USA	205.7	2.9	789882.8
338	Changuinola	Panama	204.0	0.0	790086.8
339	Kunene	Angola	202.5	12.5	790289.3

340	Chico	Philippines	201.8	6.3	790491.1
341	Suwanee	USA	201.3	11.9	790692.4
342	Juba	Somalia	200.0	0.0	790892.4
343	James	USA	199.7	12.0	791092.1
344	Reventazon	Costa Rica	198.8	82.6	791290.9
345	Wanganui	New Zealand	198.0	0.0	791488.9
346	Anderson	Canada	198.0	0.0	791686.9
347	Tecolutla	Mexico	198.0	0.0	791884.9
348	Ulua	Honduras	196.0	0.0	792080.9
349	Laoag	Philippines	195.3	0.0	792276.3
350	Brazos	USA	194.3	26.5	792470.6
351	Sixaola	Costa Rica	194.0	49.0	792664.6
352	Haast	New Zealand	190.0	0.0	792854.6
353	Liaohe	China	190.0	0.0	793044.6
354	Santee	USA	189.6	213.9	793234.2
355	Itata	Chile	188.0	0.0	793422.2
356	Mira	Ecuador	187.3	70.6	793609.5
357	Tana/Tenojoki	Norway	187.0	0.0	793796.5
358	Bayano	Panama	186.5	4.5	793983.0
359	Patia	Colombia	184.5	102.5	794167.5
360	Rogue	USA	184.5	2.5	794352.0
361	Shannon	Ireland	183.7	10.5	794535.7
362	Escambia	USA	182.0	9.0	794717.7
363	Kizil	Turkey	180.5	21.5	794898.2
364	Jokulsa	Iceland	180.5	5.5	795078.7
365	Malselvvassdraget	Norway	180.0	0.0	795258.7
366	Androscoggin	USA	173.3	6.2	795432.0
367	Iijoki	Finland	171.5	0.5	795603.5
368	Kelani	Sri Lanka	171.2	6.0	795774.7
369	Fuerte	Mexico	171.0	0.0	795945.7
370	Pasvikelva/ Paatsjoki	Norway	170.0	0.0	796115.7
371	Yoshino	Japan	170.0	0.0	796285.7
372	Verde	Mexico	169.0	0.0	796454.7
373	Neches	USA	168.0	15.7	796622.7
374	Tay	United Kingdom	168.0	12.0	796790.7
375	Malaren- Norrstrom	Sweden	167.0	1.0	796957.7
376	Seraju	Indonesia	166.0	0.0	797123.7
377	Pitealven	Sweden	165.3	7.3	797289.0
378	Vijose	Albania	165.0	18.0	797454.0
379	Periyar	India	162.0	0.0	797616.0
380	Vetsna	Norway	161.0	0.0	797777.0
381	Karkkeh	Iran	161.0	5.0	797938.0
382	Skelleftealven	Sweden	158.0	2.2	798096.0
383	Pasig	Philippines	157.5	0.0	798253.5

384	Scheldt	Netherlands	155.0	0.0	798408.5
385	Chosui	Taiwan	149.7	29.6	798558.2
386	Kum	South Korea	149.0	0.0	798707.2
387	Gambia	Gambia	149.0	5.0	798856.2
388	Severn	United Kingdom	148.5	119.2	799004.7
389	Otra	Norway	148.0	0.0	799152.7
390	Tauri	Papua New Guinea	147.5	11.5	799300.2
391	Tana	Kenya	147.3	9.0	799447.5
392	Matina	Costa Rica	147.0	0.0	799594.5
393	Isonzo	Italy	147.0	0.0	799741.5
394	Ord	Australia	146.5	21.5	799888.0
395	Farmington	Liberia	146.1	0.0	800034.1
396	Rapel	Chile	146.0	24.9	800180.1
397	Trengganu	Malaysia	145.5	55.5	800325.6
398	Nickerie	Surinam	144.5	55.5	800470.1
399	Guadiana	Portugal	144.0	39.9	800614.1
400	Grijalva	Mexico	144.0	0.0	800758.1
401	Tano	Ghana	144.0	0.0	800902.1
402	Axios	Greece	140.5	5.5	801042.6
403	Luan	China	140.0	0.0	801182.6
404	Peninsula Nicoya	Costa Rica	140.0	0.0	801322.6
405	Vanapa	Papua New Guinea	139.0	0.0	801461.6
406	San Joaquin	USA	138.3	14.4	801599.9
407	Ljungan	Sweden	138.0	2.0	801737.9
408	Achelooos	Greece	137.5	27.5	801875.4
409	Agno	Philippines	137.4	16.7	802012.8
410	Colorado	Argentina	135.0	3.6	802147.8
411	Chiriqui	Panama	133.5	9.5	802281.3
412	Tempisque	Costa Rica	133.0	109.8	802414.3
413	Puyango-Tumbes	Ecuador	132.5	7.5	802546.8
414	Pampana	Sierra Leone	132.0	0.0	802678.8
415	Taedongang	North Korea	129.0	49.0	802807.8
416	Kalinadi	India	128.0	0.0	802935.8
417	Clarence	Australia	127.0	9.0	803062.8
418	Hualien	Taiwan	127.0	0.0	803189.8
419	Peinan	Taiwan	127.0	0.0	803316.8
420	Hsiukuluan	Taiwan	127.0	0.0	803443.8
421	Cetina	Croatia	127.0	0.0	803570.8
422	Nera	Russia	127.0	0.0	803697.8
423	Tagum	Philippines	126.7	0.0	803824.5
424	Kennebec	USA	126.5	5.5	803951.0
425	Aklan	Philippines	126.0	0.0	804077.0
426	Sebou	Morocco	125.8	48.5	804202.8
427	Lagarfljot	Iceland	125.5	15.5	804328.3

428	Ta Pi	Thailand	124.0	0.0	804452.3
429	Santa	Peru	123.7	17.9	804576.0
430	Agus	Philippines	123.3	1.3	804699.3
431	Tugela	South Africa	122.5	26.5	804821.8
432	Sehnkwehn	Liberia	121.7	1.7	804943.5
433	Chehalis	USA	120.0	1.0	805063.5
434	Shebelle	Somalia	120.0	0.0	805183.5
435	Arendalsvassdraget	Norway	119.0	0.0	805302.5
436	Numedalslagan	Norway	119.0	0.0	805421.5
437	Mananjary	Madagascar	118.0	0.0	805539.5
438	Cagayan 2	Philippines	117.8	0.0	805657.3
439	Pungoe	Mozambique	117.5	19.5	805774.8
440	Nidelvvassdraget	Norway	117.0	0.0	805891.8
441	Naranjal	Ecuador	117.0	0.0	806008.8
442	Chikugo	Japan	116.5	0.5	806125.3
443	Chira	Peru	116.3	32.3	806241.6
444	Sira	Norway	116.0	0.0	806357.6
445	Sambirano	Madagascar	116.0	0.0	806473.6
446	Trent	United Kingdom	113.3	49.0	806586.9
447	Victoria	Australia	112.5	20.5	806699.4
448	Oum er Rbia	Morocco	112.0	12.8	806811.4
449	Demerara	Guyana	112.0	0.0	806923.4
450	Mkomazi	South Africa	110.1	0.0	807033.6
(Durban Region)					
451	Strymon	Greece	110.0	0.0	807143.6
452	Southern Bug	Ukraine	110.0	0.0	807253.6
453	Maipo	Chile	109.6	7.5	807363.2
454	Muda	Malaysia	109.0	0.0	807472.2
455	Papagayo	Mexico	107.8	0.0	807580.0
456	Lobe	Cameroon	107.0	0.0	807687.0
457	Ivondro	Madagascar	106.6	0.0	807793.6
458	Smith	USA	106.1	0.0	807899.8
459	Seli	Sierra Leone	106.0	0.0	808005.8
460	Mondego	Portugal	104.0	22.0	808109.8
461	Vossovassdraget	Norway	104.0	0.0	808213.8
462	Arno	Italy	103.0	37.0	808316.8
463	Suldalsvassdraget	Norway	103.0	0.0	808419.8
464	Rio Grande	USA	102.8	18.1	808522.6
465	San Pedro	Mexico	102.5	7.5	808625.1
466	Cebollati	Uruguay	102.0	0.0	808727.1
467	Incomati	Mozambique	100.7	20.3	808827.8
468	Gaula	Norway	98.0	0.0	808925.8
469	Cape Fear	USA	97.6	1.7	809023.4
470	Yuna	Dominican Rep.	96.0	0.0	809119.4
471	Rossaga	Norway	96.0	0.0	809215.4
472	Nestos	Greece	96.0	0.0	809311.4

473	Buyuk Menderes	Turkey	94.5	4.5	809405.9
474	Camana	Peru	94.0	0.0	809499.9
475	Yaqui	Mexico	93.5	14.5	809593.4
476	Maputo	Mozambique	93.2	4.2	809686.6
477	Saint Johns	USA	93.0	1.0	809779.6
478	Luga	Russia	92.0	0.0	809871.6
479	Corrib	Ireland	91.0	0.0	809962.6
480	Escalante	Venezuela	91.0	0.0	810053.6
481	Pennar (Penneru)	India	90.7	12.2	810144.3
482	Jubones	Ecuador	90.0	38.0	810234.3
483	Atoyac	Mexico	90.0	0.0	810324.3
484	Motalastrom	Sweden	90.0	0.8	810414.3
485	Artibonite	Haiti	89.5	0.0	810503.8
486	Anchicaya	Colombia	88.8	0.0	810592.6
487	Mandrare	Madagascar	88.0	0.0	810680.6
488	Sewa	Sierra Leone	87.0	0.0	810767.6
489	Kvina	Norway	87.0	0.0	810854.6
490	Ve	Vietnam	86.6	0.0	810941.2
491	Mono	Benin	86.0	20.8	811027.2
492	Grande de Tarcoles	Costa Rica	86.0	7.1	811113.2
493	Erne	Ireland	85.5	0.0	811198.7
494	Mandalselva	Norway	85.0	0.0	811283.7
495	Santa Maria	Panama	84.2	3.2	811367.9
496	Tabasara	Panama	84.0	11.0	811451.9
497	Altavassdraget	Norway	84.0	0.0	811535.9
498	Stjordalsvassdraget	Norway	82.0	0.0	811617.9
499	Neuse	USA	82.0	0.0	811699.9
500	Suchiate	Mexico	80.7	0.0	811780.6
501	Ems	Germany	80.2	5.2	811860.8
502	Maritza	Bulgaria	79.5	4.5	811940.3
503	Wye	United Kingdom	78.0	0.0	812018.3
504	Lagan	Sweden	77.0	5.0	812095.3
505	Thames	United Kingdom	75.9	5.4	812171.1
506	Santa Catalina	Mexico	75.3	0.0	812246.4
507	Snasavassdraget	Norway	75.0	0.0	812321.4
508	Ota	Japan	74.0	0.0	812395.4
509	Colorado	USA	73.7	5.7	812469.1
510	Jucar	Spain	72.5	0.0	812614.5
512	Ruvu	Tanzania	72.0	0.0	812686.5
513	Orkla	Norway	70.0	0.0	812756.5
514	Mandulog	Philippines	69.5	0.0	812826.0
515	Driva	Norway	69.0	0.0	812895.0
516	South Esk	Australia	69.0	0.0	812964.0
517	Bucayao	Philippines	68.8	0.0	813032.8
518	Aliakmon	Greece	68.0	19.0	813100.8

519	Spey	United Kingdom	67.6	3.6	813168.4
520	Tweed	United Kingdom	66.4	23.7	813234.8
521	Berg	South Africa	66.3	0.0	813301.1
	(Capetown Region)				
522	Hawkesbury	Australia	66.0	0.0	813367.1
523	Snowy	Australia	66.0	0.0	813433.1
524	Angat	Philippines	66.0	0.0	813499.1
525	Bebedero	Costa Rica	66.0	0.0	813565.1
526	Verdalsvassdraget	Norway	65.0	0.0	813630.1
527	Breedde	South Africa	64.2	0.0	813694.3
528	Guasare	Venezuela	64.0	0.0	813758.3
529	Tovdalsvassdraget	Norway	64.0	0.0	813822.3
530	Sabarmati	India	64.0	40.0	813886.3
531	Tsengwen	Taiwan	63.0	0.0	813949.3
532	Haiho	China	63.0	0.0	814012.3
533	Russian	USA	62.9	0.0	814075.2
534	Ilog	Philippines	62.8	11.7	814138.0
535	Selangor	Malaysia	62.8	6.5	814200.8
536	Bernam	Malaysia	62.0	0.0	814262.8
537	Wami	Brazil	62.0	0.0	814386.8
539	Ogeechee	USA	62.0	0.0	814448.8
540	Tumen	Russia	62.0	0.0	814510.8
541	Orontes (Asi)	Turkey	62.0	0.0	814572.8
542	Gin Ganga	Sri Lanka	61.6	0.0	814634.4
543	Meluli	Mozambique	61.0	0.0	814695.4
544	Fonseca	Panama	60.8	0.0	814756.3
545	Jostedola	Norway	60.0	0.0	814816.3
546	Pacuare	Costa Rica	60.0	4.5	814876.3
547	Guadalupe	USA	59.0	0.0	814935.3
548	Surna	Norway	59.0	0.0	814994.3
549	Cestos	Liberia	58.8	5.8	815053.1
550	Chiriqui Viejo	Panama	58.2	5.2	815111.3
551	Charente	France	58.0	0.0	815169.3
552	Blackwater	Ireland	57.5	0.0	815226.8
553	Bjerkreimsvassdraget	Norway	57.0	0.0	815283.8
554	Yaque del Norte	Dominican Rep.	56.8	7.8	815340.6
555	Walawe	Sri Lanka	56.8	11.8	815397.4
556	Bobos	Mexico	56.5	0.0	815453.9
557	Seom Jin	South Korea	56.0	0.0	815509.9
558	Majes	Peru	55.8	0.0	815565.7
559	Gaularvassdraget	Norway	55.0	0.0	815620.7
560	Canete	Peru	55.0	0.0	815675.7
561	Zulia	Colombia	55.0	0.0	815730.7
562	La Antigua	Mexico	54.7	0.0	815785.4
563	Naranjo	Guatemala	54.7	0.0	815840.1
564	Salado	Argentina	54.5	0.0	815894.6

565	Jolstra	Norway	54.0	0.0	815948.6
566	Abangares	Costa Rica	54.0	0.0	816002.6
567	Panay	Philippines	53.8	0.0	816056.4
568	Sibalom	Philippines	53.8	0.0	816110.2
569	Foulakari	Congo	53.5	3.5	816163.7
570	Sipocot	Philippines	53.4	0.0	816217.1
571	Tusubres	Costa Rica	53.0	0.0	816270.1
572	San Pablo	Panama	52.9	0.1	816322.9
573	Aconcagua	Chile	51.7	19.8	816374.6
574	San Lorenzo	Mexico	51.7	0.0	816426.3
575	Jalaud (Jalaur)	Philippines	51.0	10.5	816477.3
576	Moy	Ireland	51.0	0.0	816528.3
577	Deduru Oya	Sri Lanka	51.0	0.0	816579.3
578	Maha Oya	Sri Lanka	51.0	0.0	816630.3
579	Chone	Ecuador	51.0	0.0	816681.3
580	Burnett	Australia	51.0	0.0	816732.3
581	Lofa	Liberia	50.4	0.2	816782.7
582	Saltdalsvassdraget	Norway	50.0	0.0	816832.7
583	Eidfjordvassdraget	Norway	50.0	0.0	816882.7
584	Ozama	Dominican Rep.	50.0	0.0	816932.7
585	Attanagalu Oya	Sri Lanka	49.8	0.0	816982.5
586	Bentota Ganga	Sri Lanka	48.8	0.0	817031.3
587	Bicol	Philippines	48.8	2.0	817080.1
588	Helgean	Sweden	48.5	4.5	817128.6
589	Atran	Sweden	48.5	1.5	817177.1
590	Chubut	Argentina	48.5	0.5	817225.6
591	Beiarelva	Norway	48.0	0.0	817273.6
592	Cocle del Norte	Panama	48.0	0.0	817321.6
593	Tyne	United Kingdom	47.0	0.0	817368.6
594	Simojoki	Finland	46.5	2.5	817415.1
595	Mad	USA	46.4	0.0	817461.5
596	Piarnu	Estonia	46.2	0.0	817507.7
597	Caracan	Philippines	46.1	0.0	817553.8
598	Pativilca	Peru	46.0	0.0	817599.8
599	Savegre	Costa Rica	46.0	0.0	817645.8
600	Piaxtla	Mexico	45.5	0.0	817691.3
601	Catubig	Philippines	45.2	0.0	817736.5
602	Cazones	Mexico	45.0	0.0	817781.5
603	Aisen	Chile	45.0	0.0	817826.5
604	Ardalselva	Norway	45.0	0.0	817871.5
605	Bonga	Philippines	44.9	0.0	817916.4
606	Kola	Russia	44.8	2.8	817961.2
607	Bago	Philippines	44.2	0.0	818005.4
608	Muar	Malaysia	44.0	0.0	818049.4
609	Chamelecon	Honduras	44.0	0.0	818093.4
610	Kyronjoki	Finland	44.0	0.0	818137.4

611	Kiiminkijoki	Finland	44.0	0.0	818181.4
612	Ardalsvassdraget	Norway	44.0	0.0	818225.4
613	Lokoundje	Cameroon	43.1	0.0	818268.5
614	Parrita	Costa Rica	43.0	13.0	818311.5
615	La Estrella	Costa Rica	43.0	1.0	818354.5
616	Reisavassdraget	Norway	43.0	0.0	818397.5
617	Breimsvassdraget	Norway	43.0	0.0	818440.5
618	Yeong San	South Korea	43.0	0.0	818483.5
619	Tuxpan	Mexico	42.0	0.0	818525.5
620	Lika	Croatia	42.0	0.0	818567.5
621	Loukkos	Morocco	42.0	0.0	818609.5
622	Candelaria	Mexico	41.6	0.0	818651.1
623	Jarrahi	Iran	41.6	0.0	818692.8
624	Tuy	Venezuela	41.5	20.5	818734.3
625	Vouga	Portugal	41.2	0.0	818775.4
626	Portoviejo	Ecuador	41.0	0.0	818816.4
627	Rauma	Norway	41.0	0.0	818857.4
628	Nissan	Sweden	40.5	0.5	818897.9
629	Langat	Malaysia	40.4	8.8	818938.3
630	Sulitjelmavassdraget	Norway	40.0	0.0	818978.3
631	Berbice	Guyana	40.0	0.0	819018.3
632	Krian	Malaysia	40.0	0.0	819058.3
633	Var	France	40.0	0.0	819098.3
634	Gal Oya	Sri Lanka	39.6	0.0	819137.9
635	Ranealven	Sweden	39.5	2.5	819177.4
636	Trang	Thailand	39.3	0.0	819216.8
637	Clyde	United Kingdom	39.0	0.0	819255.8
638	Santa Lucia	Uruguay	39.0	0.0	819294.8
639	Thu-Bon	Vietnam	39.0	0.0	819333.8
640	Kuparuk	United States	38.9	0.0	819372.6
641	Great Kei	South Africa	38.7	0.0	819411.3
642	Broadback	Canada	38.3	0.0	819449.6
643	Moulouya	Morocco	38.2	12.7	819487.8
644	Coahuayana	Mexico	38.1	0.0	819525.9
645	Licungo	Mozambique	38.0	0.0	819563.9
646	Bengo	Angola	38.0	0.0	819601.9
647	Mattole	USA	37.9	0.0	819639.8
648	Johore	Malaysia	37.8	0.0	819677.6
649	Yaque del Sur	Dominican Rep.	37.7	14.3	819715.3
650	Zohreh	Iran	37.3	0.0	819752.6
651	Sinaloa	Mexico	37.2	0.0	819789.8
652	Hunter	Australia	37.0	9.0	819826.8
653	Ocosito	Guatemala	36.9	0.0	819863.7
654	Nahualate	Guatemala	36.6	34.6	819900.3
655	Aricuaisa	Venezuela	36.4	0.0	819936.7
656	Ameca	Mexico	36.0	0.0	819972.7

657	Lune	United Kingdom	36.0	0.0	820008.7
658	Tra Khuc	Vietnam	36.0	0.0	820044.7
659	Busuanga	Philippines	35.6	0.0	820080.3
660	Ican	Guatemala	35.6	0.0	820115.9
661	Gidealven	Sweden	35.5	0.5	820151.4
662	Nilwala Ganga	Sri Lanka	35.0	0.0	820186.4
663	Ore	Sweden	35.0	0.0	820221.4
664	Kala	Finland	35.0	0.0	820256.4
665	San Jose	Uruguay	35.0	0.0	820291.4
666	Acaponeta	Mexico	34.7	0.0	820326.1
667	Motatan	Venezuela	34.0	0.0	820360.1
668	Choluteca	Honduras	34.0	0.0	820394.1
669	Goascaran	El Salvador	34.0	0.0	820428.1
670	Siika	Finland	34.0	0.0	820462.1
671	Osumi	Albania	33.9	0.0	820496.0
672	Tambo	Peru	33.0	0.0	820529.0
673	Messalo	Mozambique	33.0	0.0	820562.0
674	Viskan	Sweden	33.0	0.0	820595.0
675	Neveri	Venezuela	33.0	0.0	820628.0
676	Mico	Nicaragua	32.9	0.0	820660.9
677	Tamiraparni	India	32.1	0.0	820693.0
678	Dee	United Kingdom	32.0	2.0	820725.0
679	Monapo	Mozambique	32.0	0.0	820757.0
680	Daling	China	32.0	0.0	820789.0
681	Ramu	Papua New Guinea	32.0	0.0	820821.0
682	Pyha	Finland	32.0	0.0	820853.0
683	Orb	France	32.0	0.0	820885.0
684	Cleddau	New Zealand	31.9	0.0	820916.9
685	Sagavanirktok	United States	31.6	0.0	820948.5
686	Grande-Anse	Haiti	31.5	0.0	820980.0
687	Boyne	Ireland	31.1	0.0	821011.1
688	Lapuan	Finland	31.0	0.0	821042.1
689	Marikina	Philippines	30.9	0.0	821073.0
690	Assi	Syria	30.4	0.0	821103.4
691	Magasauang Tubig	Philippines	30.2	0.0	821133.6
692	Chagres	Panama	30.2	0.0	821163.8
693	Chicama	Peru	30.0	0.0	821193.8
694	Chongchongang	North Korea	30.0	0.0	821223.8
695	Eman	Sweden	30.0	0.0	821253.8
696	Usk	United Kingdom	30.0	0.0	821283.8
697	Redwood Creek	USA	29.8	0.0	821313.6
698	Padang Terap	Malaysia	29.0	0.0	821342.6
699	Jequetepeque	Peru	29.0	0.0	821371.6
700	Rimac	Peru	29.0	0.0	821400.6

701	Damas	Costa Rica	29.0	0.0	821429.6
702	Tensift	Morocco	29.0	0.0	821458.6
703	Vaigai	India	28.9	0.0	821487.4
704	Huaura	Peru	28.0	0.0	821515.4
705	Byskealven	Sweden	27.5	13.5	821542.9
706	Morrumsan	Sweden	27.5	0.5	821570.4
707	Banano	Costa Rica	27.3	10.8	821597.8
708	Mundeni Aru	Sri Lanka	27.2	0.0	821624.9
709	Pisco	Peru	27.0	0.0	821651.9
710	Coyolate	Guatemala	27.0	0.0	821678.9
711	Molocue	Mozambique	27.0	0.0	821705.9
712	Aude	France	27.0	0.0	821732.9
713	Somme	France	27.0	0.0	821759.9
714	Mamburao	Philippines	26.8	0.0	821786.8
715	Bundoya	Sierra Leone	26.7	0.0	821813.4
716	Devolli	Albania	26.4	0.0	821839.8
717	Armeria	Mexico	26.3	0.0	821866.1
718	Tenane	Philippines	26.1	0.0	821892.3
719	Piura	Peru	26.0	0.0	821918.3
720	Ligonha	Mozambique	26.0	0.0	821944.3
721	Gatun	Panama	26.0	0.0	821970.3
722	Naguilian	Philippines	25.6	0.0	821995.9
723	Maduru Oya	Sri Lanka	25.5	0.0	822021.4
724	Ankobra	Ghana	25.3	0.0	822046.7
725	Mati	Albania	25.1	0.0	822071.8
726	Jesus Maria	Costa Rica	25.0	0.0	822096.8
727	Van Duzen	USA	24.7	0.0	822121.5
728	Kumbukkan Oya	Sri Lanka	24.5	0.0	822146.0
729	Grande de San Miquel	El Salvador	24.2	0.0	822170.2
730	Rio Grande	Jamaica	24.1	0.0	822194.3
731	Cahabon	Guatemala	24.0	0.0	822218.3
732	Moalven	Sweden	24.0	0.0	822242.3
733	Naranjo	Costa Rica	24.0	0.0	822266.3
734	Nueces	USA	23.7	1.2	822290.0
735	Paz	El Salvador	23.6	3.4	822313.6
736	Nykopingsan	Sweden	23.0	0.0	822336.6
737	Zrmanja	Croatia	23.0	0.0	822359.6
738	La Villa	Panama	22.8	5.8	822382.4
739	Kamtehiya	Bulgaria	22.4	0.0	822404.8
740	Klang	Malaysia	22.2	5.0	822427.0
741	Moin	Costa Rica	22.0	0.0	822449.0
742	Perhon	Finland	22.0	0.0	822471.0
743	Tuma	Nicaragua	21.8	0.8	822492.8
744	Cheliff	Algeria	21.7	4.2	822514.5
745	Outeniqua Region	South Africa	21.5	0.0	822536.0

746	Indio	Panama	21.0	0.0	822557.0
747	Glenelg	Australia	21.0	0.0	822578.0
748	Mersey	United Kingdom	21.0	0.0	822599.0
749	Gavlean	Sweden	21.0	0.0	822620.0
750	Humaya	Mexico	20.9	0.0	822640.9
751	Tehuantepec	Mexico	20.7	0.0	822661.6
752	Ponnaiyar	India	20.6	0.0	822682.2
753	Gouritz	South Africa	20.6	0.0	822702.8
754	Taw	United Kingdom	20.5	0.0	822723.3
755	Salung-Daca	Philippines	20.3	0.0	822743.6
756	Laloki	Papua New Guinea	20.0	0.0	822763.6
757	Baru	Costa Rica	20.0	0.0	822783.6
758	Bou Regreg	Morocco	20.0	0.0	822803.6
759	Iponan	Philippines	19.7	0.0	822823.3
760	Delangersan	Sweden	19.0	0.0	822842.3
761	Karjaan	Finland	19.0	0.0	822861.3
762	Grande	Panama	18.9	0.1	822880.2
763	Wharfe	United Kingdom	18.8	0.0	822899.0
764	Medjerda	Tunisia	18.6	0.0	822917.6
765	Kala Oya	Sri Lanka	18.6	0.0	822936.3
766	Toa	Cuba	18.5	13.2	822954.8
767	Barranca	Costa Rica	18.1	7.0	822972.9
768	Avon	England	18.1	0.0	822991.0
769	Sebaou	Algeria	18.1	0.0	823009.1
770	Grande	Peru	18.0	0.0	823027.1
771	Mala	Peru	18.0	0.0	823045.1
772	Gamtoos	South Africa	18.0	0.0	823063.1
773	Umbeluzi	Mozambique	17.9	7.9	823081.0
774	Itapicuru	Brazil	17.0	0.0	823098.0
775	Humuya	Honduras	17.0	0.0	823115.0
776	East London Region	South Africa	17.0	0.0	823132.0
777	Sembrong	Malaysia	16.8	0.0	823148.8
778	Maria Linda	Guatemala	16.3	0.0	823165.1
779	Villanueva	Nicaragua	16.2	0.0	823181.3
780	San Juan	Peru	16.0	0.0	823197.3
781	Flinders	Australia	16.0	0.0	823213.3
782	Exe	United Kingdom	16.0	0.0	823229.3
783	Ahtavan	Finland	16.0	0.0	823245.3
784	Mirna	Croatia	16.0	0.0	823261.3
785	Nizao	Dominican Rep.	15.8	0.0	823277.1
786	Kirindi Oya	Sri Lanka	15.1	0.0	823292.3
787	Lambayeque	Peru	15.0	0.0	823307.3
788	Chancay	Peru	15.0	0.0	823322.3
789	Mecuburi	Mozambique	15.0	0.0	823337.3

790	Macoris	Dominican Rep.	14.7	0.0	823351.9
791	Martha Brae	Jamaica	14.5	0.0	823366.4
792	Skjern	Denmark	14.4	0.0	823380.8
793	Navarro	USA	14.4	0.0	823395.2
794	Sout	South Africa	14.2	0.0	823409.4
795	Aruvi Aru (Malwatu Oya)	Sri Lanka	14.2	3.0	823423.6
796	Elqui	Chile	14.0	0.0	823437.6
797	Boac	Philippines	13.9	0.0	823451.4
798	Erzeni	Albania	13.7	0.0	823465.1
799	Dra	Morocco	13.5	0.0	823478.6
800	Los Esclavos	Guatemala	13.4	2.4	823492.0
801	Zaza	Cuba	13.2	0.0	823505.2
802	Mamoni	Panama	13.0	0.0	823518.2
803	Great	Jamaica	13.0	0.0	823531.2
804	Acari	Peru	13.0	0.0	823544.2
805	Chili	Peru	13.0	0.0	823557.2
806	Tavignano	Sardinia	13.0	0.0	823570.2
807	Caroni	Trinidad&Tobago	13.0	0.0	823583.2
808	Lau	Tahiti	12.9	0.0	823609.1
810	Soco	Dominican Rep.	12.7	0.0	823621.8
811	Great Fish	South Africa	12.6	5.8	823634.4
812	Heda Oya	Sri Lanka	12.5	0.0	823646.9
813	Great Ouse	United Kingdom	12.3	0.0	823659.2
814	Bananito	Costa Rica	12.0	0.0	823671.2
815	Agneby	Ivory Coast	12.0	0.0	823683.2
816	Gualala	USA	11.8	0.0	823695.0
817	Dajabon	Dominican Rep.	11.8	0.0	823706.8
818	Cuyaguateje	Cuba	11.1	0.0	823717.9
819	Ica	Peru	11.0	0.0	823728.9
820	Choapa	Chile	11.0	0.0	823739.9
821	Tocuyo	Venezuela	10.9	1.1	823750.8
822	Salinas	USA	10.9	0.0	823761.7
823	Mi Oya	Sri Lanka	10.7	0.0	823772.4
824	Ciri	Panama	10.3	0.0	823782.7
825	Nene	United Kingdom	10.1	1.1	823792.8
826	Moche	Peru	10.0	0.0	823802.8
827	Samala	Guatemala	10.0	0.0	823812.8
828	Madre Vieja	Guatemala	10.0	0.0	823822.8
829	Warren	Australia	10.0	0.0	823832.8
830	San Juan	Chile	10.0	0.0	823842.8
831	Limari	Chile	9.8	1.8	823852.6
832	Jaina	Dominican Rep.	9.6	0.0	823862.3
833	Sio	Togo	9.5	0.0	823871.8
834	Rio Cobre	Jamaica	9.4	0.0	823881.1
835	Sundays	South Africa	9.4	0.0	823890.5

836	Riviere du Mat	Reunion	9.4	0.0	823899.9
837	North Oropuche	Trinidad&Tobago	9.4	0.0	823909.3
838	Gudena	Denmark	9.3	6.8	823918.6
839	Damuji	Cuba	9.1	0.0	823927.7
840	Yauca	Peru	9.0	0.0	823936.7
841	Yaracuy	Venezuela	9.0	0.0	823945.7
842	Chillon	Peru	9.0	0.0	823954.7
843	Minab	Iran	9.0	0.0	823963.7
844	Murray 2	Australia	9.0	0.0	823972.7
845	Madre de Dios	Costa Rica	9.0	0.0	823981.7
846	Garcia	USA	9.0	0.0	823990.7
847	Neckor	Morocco	9.0	0.0	823999.7
848	Sana	Peru	8.3	0.0	824008.0
849	Hutt	New Zealand	8.3	0.0	824016.3
850	Boqueron	Panama	8.0	0.0	824024.3
851	Kerte	Morocco	8.0	0.0	824032.3
852	Carron	United Kingdom	7.9	0.0	824040.2
853	Chavon	Dominican Rep.	7.9	0.0	824048.1
854	Tontouna	New Caledonia	7.9	5.2	824055.9
855	Grande Riviere du Nord	Haiti	7.8	0.0	824063.8
856	Jiboa	El Salvador	7.6	0.0	824071.4
857	Isser	Algeria	7.6	0.0	824079.0
858	Rhis	Morocco	7.5	0.0	824086.5
859	Paiva	Portugal	7.2	0.0	824093.7
860	Les Trois Rivieres	Haiti	7.2	0.0	824100.9
861	Russell Creek	United States	7.2	0.0	824108.1
862	Liffey	Ireland	7.2	0.0	824115.3
863	Io Grande	Sao Tome	7.1	0.0	824122.4
864	Souss	Morocco	7.0	0.0	824129.4
865	Quinne	New Caledonia	7.0	0.0	824136.4
866	Manganui	New Zealand	7.0	0.0	824143.4
867	Sado	Portugal	6.8	0.0	824150.2
868	Caimito	Panama	6.8	0.0	824157.0
869	Hilabangan	Philippines	6.7	0.0	824163.7
870	Tchamba	New Caledonia	6.6	0.0	824170.3
871	Mazafran	Algeria	6.5	0.0	824176.8
872	Doring	South Africa	6.5	0.0	824183.3
873	Grand River South East	Mauritius	6.3	0.0	824189.6
874	Momance	Haiti	6.2	0.0	824195.8
875	Sosonate	El Salvador	6.1	0.0	824201.9
876	Bras de la Plaine	Reunion	6.1	0.0	824208.1
877	Casma	Peru	6.0	0.0	824214.1
878	Montepuez	Mozambique	6.0	0.0	824220.1
879	Noyo	USA	6.0	0.0	824226.1

880	Treene	Germany	6.0	0.0	824232.1
881	Ouaieme	New Caledonia	6.0	0.0	824238.1
882	Grand Goyave	Guadeloupe	5.8	1.3	824243.9
883	Tafna	Algeria	5.5	0.0	824249.4
884	Dumbea Nord	New Caledonia	5.4	0.0	824254.8
885	Jacmel	Haiti	5.3	0.0	824260.1
886	Riviere des Marsouins	Reunion	5.3	0.0	824265.4
887	Bouselam	Algeria	5.0	0.0	824275.5
889	Massacre	Haiti	5.0	0.0	824280.5
890	Golo	Sardinia	5.0	0.0	824285.5
891	Taravo	Sardinia	5.0	0.0	824290.5
892	Dumbea Est	New Caledonia	4.9	0.0	824295.4
893	Algoa (Port Elizabeth)	South Africa	4.8	0.0	824300.2
894	Mkomasi	Tanzania	4.7	0.0	824304.9
895	Huasco	Chile	4.7	0.0	824309.6
896	Salado	Cuba	4.6	0.0	824314.2
897	Tiwaka	New Caledonia	4.6	0.0	824318.8
898	Ponerihoven	New Caledonia	4.6	0.0	824323.4
899	Riviere des Roches	Reunion	4.2	0.0	824327.6
900	Tipindje	New Caledonia	4.2	0.0	824331.8
901	Maboa	Sierra Leone	4.1	0.0	824335.9
902	Odelouca	Portugal	4.0	0.0	824339.9
903	Viru	Peru	4.0	0.0	824343.9
904	Huarmey	Peru	4.0	0.0	824347.9
905	Lurin	Peru	4.0	0.0	824351.9
906	Bravo	Colombia	3.9	0.0	824355.8
907	Ozat	India	3.8	0.0	824359.6
908	Segura	Spain	3.8	0.0	824363.4
909	Little	USA	3.8	0.0	824367.3
910	Riviere Des Creoles	Mauritius	3.8	0.0	824371.1
911	Boghen	New Caledonia	3.7	0.0	824374.8
912	Houaliou	New Caledonia	3.7	0.0	824378.4
913	Selwyn	New Zealand	3.6	0.0	824382.1
914	Ayensu	Ghana	3.5	0.0	824385.6
915	South Oropuche	Trinidad&Tobago	3.5	0.0	824389.1
916	Ouenghi	New Caledonia	3.5	0.0	824392.6
917	Fatenaoue	New Caledonia	3.4	0.0	824395.9
918	San Cristobal	Cuba	3.2	0.2	824399.1
919	Melah	Algeria	3.1	0.0	824402.3
920	Ortoire	Trinidad&Tobago	3.1	0.0	824405.4
921	San Diego	Cuba	3.1	0.0	824408.5
922	Pangani	Tanzania	3.0	0.0	824411.5
923	Cunapo	Trinidad&Tobago	2.9	0.0	824414.4

924	Tamarindo	Nicaragua	2.9	0.3	824417.3
925	Five Rivers Combined	Guam	2.8	0.0	824420.1
926	Deep	Mauritius	2.8	0.0	824422.9
927	Riviere des Lacs	New Caledonia	2.8	0.0	824425.7
928	Casamance	Senegal	2.6	0.0	824428.3
929	Great Bushmans	South Africa	2.6	0.0	824430.9
930	Big Sur	USA	2.5	0.0	824433.4
931	Langevin	Reunion	2.5	0.0	824435.9
932	Brito	Nicaragua	2.5	0.0	824438.4
933	Nepena	Peru	2.4	0.0	824440.8
934	Elk	USA	2.4	0.0	824443.2
935	Lemba	Sao Tome	2.4	0.0	824445.6
936	Aragua	Venezuela	2.3	0.0	824447.9
937	Guantanamo	Cuba	2.2	0.0	824450.1
938	La Chaux	Mauritius	2.2	0.0	824452.3
939	Navet	Trinidad&Tobago	2.2	0.0	824454.4
940	Papageio	Sao Tome	2.1	0.0	824456.6
941	Lorrain	Martinique	2.1	0.0	824458.7
942	Carmel	USA	2.1	0.0	824460.8
943	Buffels Region	South Africa	2.1	0.0	824462.9
944	Diahot	New Caledonia	2.1	0.0	824465.1
945	Osmore	Peru	2.0	0.0	824467.1
946	Copiapo	Chile	2.0	0.0	824469.1
947	Tanninim	Israel	2.0	0.0	824471.1
948	Joumine	Tunisia	2.0	0.0	824473.1
949	Grand Carbet	Guadeloupe	1.9	0.0	824474.9
950	Ocoa	Dominican Rep.	1.9	0.0	824476.8
951	Le Lezarde	Martinique	1.8	1.0	824478.6
952	Waveney	United Kingdom	1.8	0.0	824480.4
953	Seche	Mauritius	1.8	0.0	824482.3
954	Santa Cruz	Cuba	1.7	0.0	824483.9
955	Couva	Trinidad&Tobago	1.5	0.0	824485.4
956	Abade	Sao Tome	1.4	0.0	824486.8
957	Caplina	Peru	1.2	0.0	824488.0
958	Yuma	Dominican Rep.	1.2	0.0	824489.2
959	Loa	Chile	1.1	0.5	824490.3
960	Omakere	New Zealand	1.1	0.3	824491.4
961	Tryggevaelde	Denmark	1.0	0.0	824492.4
962	Gibara	Cuba	0.9	0.0	824493.3
963	Pedernales	Dominican Rep.	0.9	0.0	824494.2
964	Kouris	Cyprus	0.7	0.0	824494.9
965	Moutere	New Zealand	0.7	0.0	824495.6
966	Boudouaou	Algeria	0.6	0.0	824496.2
967	Agua Grande	Sao Tome	0.6	0.0	824496.8
968	La Rioja	Cuba	0.6	0.0	824497.4

969	Qishon	Israel	0.5	0.0	824497.9
970	Yarqon	Israel	0.5	0.0	824498.4
971	Pudding Creek	USA	0.5	0.0	824498.9
972	Saint Joseph	Trinidad&Tobago	0.5	0.0	824499.4
973	Rhumel	Algeria	0.4	0.0	824499.8
974	Manuel Jorge	Sao Tome	0.4	0.0	824500.2
975	Ouro	Sao Tome	0.4	0.0	824500.6
976	Limnitis	Cyprus	0.4	0.0	824500.9
977	Uchusuma	Peru	0.4	0.0	824501.3
978	Alexander	Israel	0.3	0.0	824501.6
979	Soreq	Israel	0.3	0.0	824501.9
980	Bukit Timah	Singapore	0.3	0.0	824502.3
981	Caura	Trinidad&Tobago	0.3	0.0	824502.6

Appendix C: Additional Streamflow Data Ranked by Size

Rank	River	Country	River Mouth Latitude	River Mouth Longitude	No. of Data Sources	River Volume (m ³ /s)
1	Amazon	Brazil	0.0	310.0	11	192918.2
2	Zaire	Zaire	-6.0	12.5	9	40755.6
3	Ganges/ Brahmaputra	Bangladesh	22.0	91.0	11	34000.0
4	Orinoco (Yangtze)	Venezuela	31.5	122.0	15	28863.3
6	Yenisei	Russia	72.0	82.0	10	18350.0
7	Parana (Plata)	Argentina	-35.0	303.0	8	16387.5
8	Mississippi	USA	29.0	271.0	12	16287.5
9	Lena	Russia	73.0	127.0	8	16287.5
10	Mekong	Vietnam	10.0	106.0	8	14850.0
11	Irrawaddy	Burma	16.0	95.0	4	13425.0
12	Ob	Russia	72.0	73.0	9	12738.9
13	Saint Lawrence	Canada	49.5	295.5	9	11458.9
14	Tocantins	Brazil	-0.5	311.5	5	10400.0
15	Amur	Russia	53.0	141.0	7	10185.7
16	Xi (Zhu Jiang) (Pearl)	China	22.2	113.4	8	9611.3
17	MacKenzie	Canada	69.0	225.0	8	9013.8
18	Columbia	USA	46.3	236.0	6	7460.0
19	Magdalena	Colombia	11.0	285.0	4	7325.0
20	Yukon	USA	63.0	195.0	10	6412.0
21	Danube	Romania	45.2	29.7	7	6365.0
22	Indus	Pakistan	24.0	67.5	7	6092.9
23	Salween	Burma	16.5	97.0	2	5750.0
24	Niger	Nigeria	-4.0	6.0	6	5533.3
25	Sepik	Papua New Guinea	-3.8	144.5	2	5150.0
26	Fly	Papua New Guinea	-9.0	143.0	4	4960.0
27	Ogooue	Gabon	-1.0	9.0	3	4686.7
28	Uruguay	Argentina	-35.0	303.8	7	4618.6
29	Bengawan Sala	Indonesia	-6.8	112.6	2	4240.0
30	Zambezi	Mozambique	-18.7	36.5	6	4121.7
31	Pechora	Russia	68.0	54.0	4	4052.5
32	Red (Hungo) (Sankai)	Vietnam	20.5	106.5	2	3750.0
33	Fraser	Canada	49.5	236.5	6	3590.0
34	Meghna	Bangladesh	22.5	91.0	1	3515.0

35	Severnaya Dvina	Russia	64.5	41.0	9	3418.9
36	Godavari	India	16.5	82.0	8	3250.0
37	Khatanga-Popigay	Russia	73.0	107.0	2	3240.0
38	Sao Francisco	Brazil	-10.5	323.5	11	3087.7
39	Kolyma	Russia	69.0	161.0	6	2985.0
40	Neva	Russia	59.9	30.3	7	2524.3
41	Pyasina	Russia	73.5	87.0	5	2512.0
42	Nelson	Canada	57.0	268.0	7	2495.0
43	Koksoak	Canada	58.0	292.0	3	2460.0
44	Tarum	Indonesia	-6.0	107.0	1	2400.0
45	Purari	Papua New Guinea	-8.0	145.0	3	2376.7
46	Usumacinta	Mexico	18.0	267.0	5	2339.0
47	Atrato	Colombia	8.4	283.0	1	2275.0
48	Rhine (Rhein)	Netherlands	52.0	4.0	6	2246.7
49	Essequibo	Guyana	7.0	301.5	3	2198.3
50	Sanaga	Cameroon	4.0	10.0	4	2087.5
51	San Juan	Colombia	4.2	283.4	1	2010.0
52	Mahanadi	India	20.0	87.0	6	2008.3
53	Corantijn	Surinam	6.0	302.8	1	2000.0
54	Min	China	26.1	119.7	2	1905.0
55	Krishna (Kistna)	India	16.0	81.0	5	1894.0
56	Maroni (Marowijne)	Surinam	5.8	306.0	4	1877.5
57	Nile	Egypt	31.5	31.0	10	1829.5
58	Mobile	USA	30.2	272.0	4	1752.5
59	La Grande	Canada	53.8	281.0	3	1720.0
60	Saguenay	Canada	48.1	290.2	5	1701.0
61	Churchill l	Canada	54.4	302.5	3	1686.7
62	Indigirka	Russia	71.0	150.0	7	1631.4
63	Dnieper	Ukraine	46.5	32.3	6	1630.8
64	Rhone	France	43.5	4.5	8	1630.0
65	Tanduj	Indonesia	-7.7	108.8	1	1595.0
66	Taz	Russia	67.7	78.7	1	1540.0
67	Kuskokwim	USA	60.0	162.5	5	1503.0
68	Guayas	Ecuador	-2.5	280.0	1	1490.0
69	Tsientang	China	30.2	120.3	1	1490.0
70	Po	Italy	45.0	12.5	9	1476.7
71	Shatt-al-Arab	Iraq	30.0	49.0	6	1445.0
72	Narmada	India	21.5	72.5	3	1401.7
73	Huang He (Yellow)	China	38.0	119.0	11	1361.4
74	Copper	USA	60.5	215.0	5	1344.0
75	Skeena	Canada	54.1	230.0	4	1331.3
76	Manuk	Indonesia	-6.2	108.2	1	1300.0
77	Cuyuni	Guyana	7.0	301.7	1	1280.0
78	Stikine	USA	56.5	227.8	4	1257.5
79	Albany	Canada	52.5	278.0	3	1255.0

80	Anadyr	Russia	64.7	177.0	2	1247.5
81	Abitibi (Moose)	Canada	51.5	279.0	4	1218.8
82	Volta	Ghana	5.8	0.3	3	1186.7
83	Mazaruni	Guyana	7.0	301.4	1	1150.0
84	Nottaway	Canada	51.3	281.4	4	1142.5
85	Thelon	Canada	63.5	269.0	2	1105.5
86	Susitna	USA	60.0	208.0	4	1097.5
87	Churchill 2	Canada	58.5	265.9	4	1090.0
88	Punagara	Indonesia	-6.2	107.8	1	1070.0
89	Wisla (Vistula)	Poland	54.5	19.0	7	1040.0
90	Yalu	North Korea	39.9	124.3	1	1040.0
91	Susquehanna	USA	39.5	284.0	6	1005.8
92	Tsiribihina	Madagascar	-19.7	44.3	1	1000.0
93	Bei	China	22.2	113.2	1	1000.0
94	Udjung	Indonesia	-5.9	106.3	1	1000.0
95	Taymyra	Russia	75.4	99.2	1	990.0
96	Olenek	Russia	73.0	120.0	5	989.6
97	Manicouagan	Canada	49.5	299.5	3	979.0
98	Doce	Brazil	-19.5	320.2	1	970.0
99	Saint John	Canada	49.5	299.5	4	969.0
100	Yana	Russia	71.0	136.0	5	935.0
101	Papaloapan	Mexico	18.7	264.4	2	930.0
102	Pur	Russia	67.5	78.0	4	928.0
103	Kouilou	Congo	-4.5	11.5	3	926.7
104	Han	China	23.5	116.8	1	922.0
105	Eastmain	Canada	52.2	281.7	4	918.0
106	Nass	Canada	54.7	229.7	3	896.3
107	Nushagak	USA	59.0	201.0	3	886.7
108	Rupert	Canada	51.3	281.5	4	885.8
109	Negro	Argentina	-41.0	297.0	5	881.0
110	Willamette	USA	46.3	236.0	2	875.0
111	George	Canada	58.5	294.0	4	874.3
112	Kamchatka	Russia	56.2	162.3	5	872.8
113	Loire	France	47.5	357.5	5	855.4
114	Don	Russia	47.1	39.3	7	850.7
115	Alsek	USA	59.1	221.5	1	850.0
116	Chao Phraya	Thailand	13.6	100.6	3	848.0
117	Parnaiba	Brazil	-2.8	318.2	1	843.0
118	Cuanza	Angola	-9.2	13.0	1	836.0
119	Baker	Chile	-47.8	285.0	3	828.3
120	Brantas	Indonesia	-7.2	112.7	1	810.0
121	Esmeraldas	Ecuador	1.0	280.4	2	803.0
122	Uda	Russia	54.4	135.3	1	800.0
123	Kaveri (Cauvery)	India	11.3	79.8	2	799.0
124	Mesen	Russia	66.5	43.9	3	789.3
125	Dong	China	22.3	113.8	1	762.0

126	Oyapock	French Guiana	4.2	308.3	3	761.7
127	Ebro	Spain	40.5	0.5	6	753.5
128	Elbe	Germany	54.0	9.0	3	745.3
129	Saint Maurice	Canada	49.5	299.5	2	744.5
130	Bio-Bio	Chile	-36.8	286.9	5	729.0
131	Mindanao	Philippines	7.2	124.2	1	725.6
132	Penzhina	Russia	62.5	165.0	3	710.3
133	Sacramento	USA	37.8	237.4	3	700.7
134	Glamma (Gloma)	Norway	59.1	10.8	5	696.6
135	Paraiba	Brazil	-21.5	319.0	3	695.7
136	Grande de la Baleine	Canada	55.2	282.5	3	675.7
137	Santa Cruz	Argentina	-50.2	291.5	1	675.0
138	Puelo	Chile	-41.8	287.0	1	670.0
139	Arnaud	Canada	60.0	290.0	2	662.5
140	Apalachicola	USA	29.7	275.0	4	655.5
141	Nyanga	Gabon	5.2	357.0	1	650.0
142	Hayes	Canada	57.0	268.0	2	641.5
143	Murray I	Australia	-35.5	139.0	5	641.0
144	Rufiji	Tanzania	-8.0	39.5	2	630.0
145	Brahmani	India	20.7	86.9	2	627.5
146	Garonne	France	45.5	359.0	5	622.4
147	Nadym	Russia	66.1	72.5	1	610.0
148	Ou (Wu)	China	28.0	120.8	1	608.0
149	Clutha	New Zealand	-46.4	169.8	3	604.0
150	Taku	USA	58.2	223.3	1	600.0
151	Colville	USA	70.3	209.0	1	600.0
152	Senegal	Senegal	16.5	343.5	8	594.3
153	Neman	Lithuania	55.0	21.0	6	594.0
154	Rompido de Samaria	Mexico	18.6	267.5	1	592.0
155	Kvichak	USA	58.5	202.5	1	590.0
156	Daugava	Latvia	57.1	24.1	5	586.0
157	Vuoksi	Russia	60.0	29.0	3	582.0
158	Riviere aux Feuilles	Canada	58.8	290.0	4	581.3
159	Kelantan	Malaysia	6.2	102.2	2	578.5
160	Agusan	Philippines	9.0	125.5	2	572.0
161	San Juan	Nicaragua	10.9	276.3	2	572.0
162	Riviere a la Baleine	Canada	58.0	292.0	3	565.0
163	Gota-Vanern	Sweden	58.0	12.0	6	554.0
164	Pahang	Malaysia	3.5	103.6	1	550.0
165	Cross	Nigeria	4.3	8.5	1	548.0
166	Kemijoki	Finland	65.7	24.5	6	545.3
167	Odra (Oder)	Poland	54.0	14.5	6	544.5
168	Moa	Sierra Leone	6.9	348.5	1	533.0
169	Back	Canada	68.0	264.0	4	530.8
170	Mangoky	Madagascar	-21.3	43.5	2	529.5

171	Severn	Canada	56.0	272.6	5	529.0
172	Winisk	Canada	55.5	275.0	3	522.7
173	Shinano	Japan	37.9	139.0	2	522.0
174	Petit Mecatina	Canada	50.4	300.5	4	514.3
175	Klamath	USA	41.6	235.9	5	509.3
176	Han	South Korea	37.8	126.4	2	507.5
177	Onega	Russia	63.8	38.0	5	507.2
178	Thaanne-Thlewiatza	Canada	60.4	265.3	1	507.0
179	Kivchak	United States	58.7	202.5	1	502.0
180	Douro	Portugal	41.1	351.3	4	500.5
181	Grande	Nicaragua	12.6	276.5	1	491.0
182	Kazan	Canada	63.5	269.0	2	489.0
183	Lulealven	Sweden	65.4	22.0	6	484.7
184	Connecticut	USA	41.3	287.6	4	482.8
185	Ishikari	Japan	43.3	141.4	2	480.0
186	Buller	New Zealand	-44.4	171.4	2	476.0
187	Angermanalven	Sweden	62.8	18.0	7	475.9
188	Skagit	USA	48.3	237.6	1	475.0
189	Moisie	Canada	50.1	293.5	2	474.5
190	Tapi	India	21.4	72.6	3	469.3
191	Jiulong	China	24.4	118.0	1	466.0
192	Jequitinhonha	Brazil	-15.8	321.0	3	465.0
193	Hudson	USA	40.6	286.0	5	458.8
194	Karun	Iran	30.0	48.8	2	455.0
195	Panuco	Mexico	22.2	262.2	3	454.7
196	Attawapiskat	Canada	52.6	277.8	3	453.3
197	Ikopa	Madagascar	-15.5	46.5	2	451.0
198	Indalsalven	Sweden	62.5	17.4	3	450.3
199	Valdivia	Chile	-39.8	286.4	1	450.0
200	Umealven	Sweden	63.7	20.3	2	442.5
201	Balsas	Mexico	17.9	257.9	1	439.0
202	Narva	Estonia	59.4	28.0	2	433.0
203	Harricana	Canada	51.5	280.5	3	431.3
204	Anabar	Russia	73.1	113.4	4	422.5
205	Delaware	USA	39.2	284.8	5	421.6
206	Saint Paul	Liberia	6.3	349.2	2	416.5
207	Cortzacoalcos	Mexico	18.1	265.5	1	413.0
208	Rioni	Georgia	42.2	41.6	3	409.7
209	Mae Klong	Thailand	13.2	100.0	1	408.0
210	Natashquan	Canada	50.3	298.0	3	405.0
211	Aux Outardes	Canada	49.5	299.5	3	399.5
212	Coppename	Suriname	5.8	304.0	2	398.5
213	Olfusa	Iceland	63.8	339.2	3	395.0
214	Kobuk	USA	67.0	198.0	3	394.3
215	Altamaha	USA	31.3	278.7	4	386.3
216	Seine	France	49.5	0.5	2	385.0

217	Tortuguero	Costa Rica	10.6	276.5	1	385.0
218	Mahi	India	21.5	72.5	2	378.5
219	Thjorsa	Iceland	63.8	339.2	4	378.5
220	Neretva	Croatia	43.1	17.5	1	378.0
221	Betsiamites	Canada	48.6	291.6	1	375.0
222	Tornealven	Sweden	65.8	24.1	1	373.0
223	Lempa	El Salvador	13.8	271.2	3	367.7
224	Bandama	Ivory Coast	5.1	355.0	2	365.0
225	Bueno	Chile	-40.2	286.2	1	365.0
226	Seal	Canada	59.0	265.5	1	365.0
227	Dalalven	Sweden	60.7	17.3	3	364.7
228	Penobscot	USA	44.5	291.2	4	364.0
229	Waiau	New Zealand	-45.7	166.7	2	363.0
230	Tauy	Russia	59.5	149.0	1	362.0
231	Muonio	Finland	65.8	24.3	5	361.2
232	Tineg	Philippines	17.6	120.3	1	358.7
233	Catarman	Philippines	12.6	124.6	1	357.1
234	Sassandra	Ivory Coast	5.0	353.8	3	354.0
235	Tagus	Portugal	38.6	350.8	5	350.8
236	Kuban	Russia	45.3	37.2	5	350.8
237	Esquinas	Costa Rica	8.5	276.8	1	350.0
238	Polangui	Philippines	7.4	124.2	1	350.0
239	Noatak	USA	67.0	197.5	1	350.0
240	Kanairiktok	Canada	55.1	299.9	1	350.0
241	Naskaupi	Canada	54.0	301.0	1	350.0
242	Povungnituk	Canada	62.3	285.5	1	350.0
243	Progo	Indonesia	-8.0	110.2	1	345.0
244	Savannah	USA	32.0	279.1	4	341.8
245	Oranje	South Africa	-28.5	17.5	5	340.8
246	Romaine	Canada	50.0	296.5	1	340.0
247	Pee Dee	USA	33.3	280.8	4	339.0
248	Nagdong	South Korea	35.1	128.9	2	334.0
249	Tolten	Chile	-39.3	286.6	1	334.0
250	Grande de Terraba	Costa Rica	9.0	276.3	3	327.0
251	Kiso	Japan	34.9	136.7	1	327.0
252	Dniestr	Ukraine	46.2	30.1	4	326.3
253	Drammensvassdraget	Norway	59.3	10.5	1	326.0
254	Drin	Albania	41.8	19.5	4	324.5
255	Wouri	Cameroon	4.1	9.6	2	319.0
256	Potomac	USA	38.1	283.4	4	318.0
257	Weser	Germany	53.5	8.5	5	317.8
258	Ntem	Cameroon	2.3	9.8	3	315.3
259	Minho	Portugal	41.9	351.2	1	313.0
260	Pascagoula	USA	30.2	271.4	4	311.8
261	Damodar	India	22.0	88.0	2	307.0
262	Amguema	Russia	68.0	182.0	2	307.0

263	Burdekin	Australia	-19.7	147.6	3	305.3
264	Peninsula Osa	Costa Rica	8.8	276.7	1	304.0
265	Maas (Meuse)	Netherlands	51.8	4.0	5	302.0
266	Saint John	Liberia	5.9	349.9	2	301.0
267	Mana	French Guiana	5.8	306.1	1	300.0
268	Guadalquivir	Spain	36.8	353.5	5	299.4
269	Dordogne	France	45.7	359.0	2	297.5
270	Kitakami	Japan	38.4	141.4	1	297.0
271	Save	Mozambique	-21.0	35.0	2	296.5
272	Santiago	Mexico	21.7	254.5	3	296.0
273	Yodo	Japan	34.7	135.4	2	294.5
274	Maule	Chile	-35.2	287.3	3	293.3
275	Nyong	Cameroon	3.1	9.9	2	290.5
276	Kalixalven (Kaitum)	Sweden	65.8	23.2	3	287.0
277	Skien svassdraget	Norway	59.1	9.7	1	287.0
278	Kaoping	Taiwan	22.5	120.6	1	285.0
279	Subarnarekha	India	21.7	87.3	2	282.5
280	Coco	Honduras	15.0	276.9	2	276.0
281	Petrohue	Chile	-41.7	286.2	1	275.0
282	Comoe	Ivory Coast	5.2	356.2	1	274.0
283	Daule	Ecuador	-3.7	279.3	1	270.0
284	Namsen	Norway	64.4	11.2	1	270.0
285	Konkoure	Guinea	9.8	346.3	1	267.0
286	Musa	Papua New Guinea	-9.0	149.0	1	263.0
287	Santiago	Mexico	21.7	254.5	2	262.5
288	Cagayan I	Philippines	18.4	121.7	2	260.5
289	Pearl	USA	30.1	270.5	3	260.3
290	Cavally	Ivory Coast	4.3	352.6	2	258.4
291	Waikato	New Zealand	-37.4	174.7	3	258.0
292	Mahaweli	Sri Lanka	8.5	81.3	3	255.8
293	Chirripo	Costa Rica	10.8	276.4	1	252.0
294	Oulujoki	Finland	65.0	25.4	2	251.0
295	Limpopo	Mozambique	-25.0	33.5	3	250.0
296	Cisnes	Chile	-44.8	286.5	1	250.0
297	Colorado	Mexico	31.5	245.3	6	243.5
298	Mananara	Madagascar	-23.3	47.7	1	242.0
299	Abulug	Philippines	16.1	120.2	1	240.5
300	Pra	Ghana	4.7	358.5	2	240.0
301	Pemali	Indonesia	-6.8	109.0	1	240.0
302	Oueme	Benin	6.5	2.5	1	240.0
303	Bolgoda	Sri Lanka	6.8	79.9	1	238.0
304	Adige	Italy	45.2	12.3	3	237.0
305	Coppermine	Canada	67.5	245.0	2	236.5
306	Tone	Japan	35.7	140.7	3	236.0
307	Waitaki	New Zealand	-44.9	171.2	1	235.0

308	Hai	China	39.0	117.8	1	234.0
309	Lurio	Mozambique	-13.5	40.6	1	232.0
310	Sabine	USA	29.8	266.2	3	231.7
311	Approuague	French Guiana	4.7	308.0	1	230.0
312	Sinnamary	French Guiana	5.6	306.8	1	230.0
313	Motagua	Guatemala	15.8	271.7	2	229.8
314	Tiber	Italy	41.7	12.3	5	229.2
315	Roanoke	USA	36.0	283.9	3	228.3
316	Kem	Russia	65.0	34.7	2	228.0
317	Perak	Malaysia	4.0	100.7	2	228.0
318	Ljusnan	Sweden	61.3	17.2	3	226.7
319	Pampanga	Philippines	14.9	120.5	2	225.4
320	Kymijoki	Finland	60.4	26.5	3	224.3
321	Kalu	Sri Lanka	6.6	80.0	2	221.1
322	Kokemaenjoki	Finland	61.5	21.6	2	220.5
323	Ranavassdraget	Norway	66.2	14.0	1	220.0
324	Merrimack	USA	41.3	287.6	2	218.5
325	Adour	France	43.5	358.4	2	217.5
326	Sakarya	Turkey	41.1	30.7	3	217.3
327	Eel	USA	40.6	235.6	3	215.1
328	Mambare	Papua New Guinea	-8.0	148.0	1	215.0
329	Umpqua	USA	43.7	235.9	2	215.0
330	Daly	Australia	-13.3	130.3	1	211.0
331	Ceyhan	Turkey	36.6	35.6	2	210.0
332	Patuca	Honduras	15.8	275.7	1	209.0
333	Kalkkinen	Finland	61.8	25.7	1	209.0
334	Fitzroy-Dawson	Australia	-23.5	151.0	2	206.5
335	Buzi	Mozambique	-19.9	34.7	2	206.0
336	Tym	Russia	51.8	143.3	1	206.0
337	Trinity	USA	29.6	265.2	3	205.7
338	Changuinola	Panama	9.6	277.5	1	204.0
339	Kunene	Angola	-17.2	11.7	2	202.5
340	Chico	Philippines	18.4	121.7	2	201.8
341	Suwanee	USA	29.2	276.9	3	201.3
342	Juba	Somalia	-0.2	42.6	1	200.0
343	James	USA	37.0	283.7	3	199.7
344	Reventazon	Costa Rica	10.4	276.6	4	198.8
345	Wanganui	New Zealand	-40.0	175.0	1	198.0
346	Anderson	Canada	69.4	231.0	1	198.0
347	Tecolutla	Mexico	20.5	263.2	1	198.0
348	Ulua	Honduras	15.9	272.2	1	196.0
349	Laoag	Philippines	18.3	120.5	1	195.3
350	Brazos	USA	29.0	263.4	4	194.3
351	Sixaola	Costa Rica	9.6	277.4	2	194.0
352	Haast	New Zealand	-44.0	169.0	1	190.0

353	Liaohe	China	41.0	122.3	1	190.0
354	Santee	USA	33.1	280.8	4	189.6
355	Itata	Chile	-36.4	287.0	1	188.0
356	Mira	Ecuador	1.7	281.0	3	187.3
357	Tana/Tenojoki	Norway	70.2	28.2	1	187.0
358	Bayano	Panama	9.1	280.8	2	186.5
359	Patia	Colombia	2.3	281.2	2	184.5
360	Rogue	USA	42.4	235.6	2	184.5
361	Shannon	Ireland	52.6	350.3	3	183.7
362	Escambia	USA	30.5	272.9	2	182.0
363	Kizil	Turkey	41.7	36.0	2	180.5
364	Jokulsa	Iceland	66.3	343.3	2	180.5
365	Malselvassdraget	Norway	69.5	18.7	1	180.0
366	Androscoggin	USA	43.8	290.0	3	173.3
367	Iijoki	Finland	65.4	25.3	2	171.5
368	Kelani	Sri Lanka	7.0	79.9	3	171.2
369	Fuerte	Mexico	25.8	250.5	1	171.0
370	Pasvikelva/Paatsjoki	Norway	69.8	30.1	1	170.0
371	Yoshino	Japan	34.2	135.1	1	170.0
372	Verde	Mexico	16.0	262.2	1	169.0
373	Neches	USA	29.8	266.2	3	168.0
374	Tay	United Kingdom	56.5	357.2	2	168.0
375	Malaren-Norrstrom	Sweden	59.3	18.2	2	167.0
376	Seraju	Indonesia	-7.8	109.1	1	166.0
377	Pitealven	Sweden	65.3	21.6	3	165.3
378	Vijose	Albania	40.7	19.3	2	165.0
379	Periyar	India	10.2	76.2	1	162.0
380	Vetsna	Norway	65.8	12.6	1	161.0
381	Karkkeh	Iran	30.0	48.5	2	161.0
382	Skelleftealven	Sweden	64.6	21.1	3	158.0
383	Pasig	Philippines	14.5	121.0	1	157.5
384	Scheldt	Netherlands	51.4	4.3	1	155.0
385	Chosui	Taiwan	24.0	120.5	3	149.7
386	Kum	South Korea	36.0	126.6	1	149.0
387	Gambia	Gambia	13.3	283.6	3	149.0
388	Severn	United Kingdom	51.4	357.0	3	148.5
389	Otra	Norway	58.2	8.0	1	148.0
390	Tauri	Papua New Guinea	-8.2	146.2	2	147.5
391	Tana	Kenya	-2.3	40.3	3	147.3
392	Matina	Costa Rica	10.1	276.8	1	147.0
393	Isonzo	Italy	45.7	13.6	1	147.0
394	Ord	Australia	-15.0	128.3	2	146.5
395	Farmington	Liberia	7.1	349.6	1	146.1
396	Rapel	Chile	-33.9	288.1	3	146.0
397	Trengganu	Malaysia	4.3	103.3	2	145.5

398	Nickerie	Surinam	6.0	303.0	2	144.5
399	Guadiana	Portugal	37.2	352.6	4	144.0
400	Grijalva	Mexico	18.6	267.5	1	144.0
401	Tano	Ghana	5.0	357.0	1	144.0
402	Axios	Greece	40.5	22.7	2	140.5
403	Luan	China	39.3	119.1	1	140.0
404	Peninsula Nicoya	Costa Rica	9.9	274.3	1	140.0
405	Vanapa	Papua New Guinea	-9.3	146.8	1	139.0
406	San Joaquin	USA	37.8	237.4	3	138.3
407	Ljungan	Sweden	62.3	17.3	2	138.0
408	Acheloos	Greece	38.4	21.1	2	137.5
409	Agno	Philippines	16.1	120.2	3	137.4
410	Colorado	Argentina	-39.7	297.9	3	135.0
411	Chiriqui	Panama	8.3	277.5	2	133.5
412	Tempisque	Costa Rica	10.2	274.8	3	133.0
413	Puyango-Tumbes	Ecuador	-3.5	279.2	2	132.5
414	Pampana	Sierra Leone	7.5	347.5	1	132.0
415	Taedongang	North Korea	38.7	125.2	2	129.0
416	Kalinadi	India	15.0	74.1	1	128.0
417	Clarence	Australia	-29.3	153.4	2	127.0
418	Hualien	Taiwan	24.0	121.7	1	127.0
419	Peinan	Taiwan	22.7	121.2	1	127.0
420	Hsiukuluan	Taiwan	23.4	121.5	1	127.0
421	Cetina	Croatia	43.5	16.4	1	127.0
422	Nera	Russia	59.3	144.5	1	127.0
423	Tagum	Philippines	7.4	125.7	1	126.7
424	Kennebec	USA	43.8	290.0	2	126.5
425	Aklan	Philippines	11.8	122.3	1	126.0
426	Sebou	Morocco	34.2	353.1	4	125.8
427	Lagarfljot	Iceland	65.0	341.0	2	125.5
428	Ta Pi	Thailand	9.3	99.3	1	124.0
429	Santa	Peru	-9.1	281.3	3	123.7
430	Agus	Philippines	14.8	121.7	2	123.3
431	Tugela	South Africa	-29.3	31.5	2	122.5
432	Sehmkwehn	Liberia	5.5	350.5	2	121.7
433	Chehalis	USA	46.9	235.8	2	120.0
434	Shebelle	Somalia	-0.4	42.6	1	120.0
435	Arendalsvassdraget	Norway	58.4	8.8	1	119.0
436	Numedalslagan	Norway	59.0	10.1	1	119.0
437	Mananjary	Madagascar	-21.1	48.2	1	118.0
438	Cagayan 2	Philippines	8.6	124.7	1	117.8
439	Pungoe	Mozambique	-19.8	34.8	2	117.5
440	Nidelvvassdraget	Norway	58.3	8.6	1	117.0
441	Naranjal	Ecuador	-2.7	279.5	1	117.0
442	Chikugo	Japan	33.1	130.2	2	116.5

443	Chira	Peru	-4.5	278.8	3	116.3
444	Sira	Norway	58.3	6.6	1	116.0
445	Sambirano	Madagascar	-13.4	48.2	1	116.0
446	Trent	United Kingdom	53.6	0.1	4	113.3
447	Victoria	Australia	-14.9	129.5	2	112.5
448	Oum er Rbia	Morocco	33.6	351.4	3	112.0
449	Demerara	Guyana	6.8	301.8	1	112.0
450	Mkomazi	South Africa	-30.0	30.4	1	110.1
	(Durban Region)					
451	Strymon	Greece	40.8	23.8	1	110.0
452	Southern Bug	Ukraine	46.5	31.9	1	110.0
453	Maipo	Chile	-33.5	288.2	4	109.6
454	Muda	Malaysia	5.5	100.5	1	109.0
455	Papagayo	Mexico	16.7	260.4	1	107.8
456	Lobe	Cameroon	2.8	9.9	1	107.0
457	Ivondro	Madagascar	-17.7	48.8	1	106.6
458	Smith	USA	41.9	235.8	1	106.1
459	Seli	Sierra Leone	8.6	347.0	1	106.0
460	Mondego	Portugal	40.1	351.1	2	104.0
461	Vossoassdraget	Norway	60.2	6.0	1	104.0
462	Arno	Italy	43.7	10.3	2	103.0
463	Suldalsvassdraget	Norway	59.5	5.8	1	103.0
464	Rio Grande	USA	26.0	262.9	6	102.8
465	San Pedro	Mexico	21.8	254.4	2	102.5
466	Cebollati	Uruguay	-32.0	308.0	1	102.0
467	Incomati	Mozambique	-25.8	32.7	3	100.7
468	Gaula	Norway	63.6	10.0	1	98.0
469	Cape Fear	USA	34.0	282.0	2	97.6
470	Yuna	Dominican Rep.	19.2	290.3	1	96.0
471	Rossaga	Norway	66.1	13.8	1	96.0
472	Nestos	Greece	40.8	24.7	1	96.0
473	Buyuk Menderes	Turkey	37.5	27.3	2	94.5
474	Camana	Peru	-16.7	287.2	1	94.0
475	Yaqui	Mexico	27.6	249.5	2	93.5
476	Maputo	Mozambique	-26.2	32.7	2	93.2
477	Saint Johns	USA	30.4	278.4	2	93.0
478	Luga	Russia	59.7	28.3	1	92.0
479	Corrib	Ireland	53.2	350.9	1	91.0
480	Escalante	Venezuela	11.0	289.0	1	91.0
481	Pennar (Penneru)	India	14.7	80.5	3	90.7
482	Jubones	Ecuador	-3.3	280.0	2	90.0
483	Atoyac	Mexico	16.0	262.2	1	90.0
484	Motalastrom	Sweden	58.7	17.0	3	90.0
485	Artibonite	Haiti	19.2	287.2	1	89.5
486	Anchicaya	Colombia	3.8	282.8	1	88.8
487	Mandrare	Madagascar	-25.1	46.4	1	88.0

488	Sewa	Sierra Leone	7.2	349.2	1	87.0
489	Kvina	Norway	58.2	6.7	1	87.0
490	Ve	Vietnam	15.0	109.0	1	86.6
491	Mono	Benin	6.2	1.8	3	86.0
492	Grande de Tarcoles	Costa Rica	9.7	275.3	4	86.0
493	Erne	Ireland	54.5	351.7	1	85.5
494	Mandalselva	Norway	58.0	7.6	1	85.0
495	Santa Maria	Panama	8.1	279.5	2	84.2
496	Tabasara	Panama	8.0	278.3	2	84.0
497	Altavassdraget	Norway	70.2	23.0	1	84.0
498	Stjordalsvassdraget	Norway	63.6	11.0	1	82.0
499	Neuse	USA	35.1	283.3	1	82.0
500	Suchiate	Mexico	14.5	267.7	1	80.7
501	Ems	Germany	53.7	7.0	3	80.2
502	Maritza	Bulgaria	40.7	26.0	2	79.5
503	Wye	United Kingdom	51.6	357.3	1	78.0
504	Lagan	Sweden	56.5	12.9	2	77.0
505	Thames	United Kingdom	51.5	0.7	4	75.9
506	Santa Catalina	Mexico	16.5	261.3	1	75.3
507	Snasavassdraget	Norway	64.0	13.0	1	75.0
508	Ota	Japan	34.4	132.4	1	74.0
509	Colorado	USA	28.7	264.0	3	73.7
510	Jucar	Spain	39.1	359.8	4	72.9
511	Tamega	Portugal	38.7	350.7	1	72.5
512	Ruvu	Tanzania	-6.3	39.0	1	72.0
513	Orkla	Norway	63.5	10.0	1	70.0
514	Mandulog	Philippines	8.6	124.7	1	69.5
515	Driva	Norway	63.0	8.2	1	69.0
516	South Esk	Australia	-41.2	146.8	1	69.0
517	Bucayao	Philippines	13.5	121.4	1	68.8
518	Aliakmon	Greece	40.5	22.7	2	68.0
519	Spey	United Kingdom	57.7	356.9	2	67.6
520	Tweed	United Kingdom	55.8	358.0	3	66.4
521	Berg (Capetown Region)	South Africa	-32.8	18.2	1	66.3
522	Hawkesbury	Australia	-33.5	151.3	1	66.0
523	Snowy	Australia	-37.8	148.7	1	66.0
524	Angat	Philippines	14.8	120.6	1	66.0
525	Bebedero	Costa Rica	10.2	274.8	1	66.0
526	Verdalsvassdraget	Norway	63.8	11.3	1	65.0
527	Breede	South Africa	-34.3	20.8	1	64.2
528	Guasare	Venezuela	11.0	289.0	1	64.0
529	Tovdalsvassdraget	Norway	58.3	8.1	1	64.0
530	Sabarmati	India	22.2	72.2	3	64.0
531	Tsengwen	Taiwan	23.1	120.1	1	63.0
532	Haiho	China	39.0	117.7	1	63.0

533	Russian	USA	38.5	236.9	1	62.9
534	Ilog	Philippines	9.9	122.7	2	62.8
535	Selangor	Malaysia	3.3	101.2	2	62.8
536	Bernam	Malaysia	3.7	100.8	1	62.0
537	Wami	Tanzania	-6.1	39.0	1	62.0
538	Pardo	Brazil	-15.6	321.1	1	62.0
539	Ogeechee	USA	31.9	278.9	1	62.0
540	Tumen	Russia	42.2	130.7	1	62.0
541	Orontes (Asi)	Turkey	36.1	36.0	1	62.0
542	Gin Ganga	Sri Lanka	6.1	80.2	1	61.6
543	Meluli	Mozambique	-16.4	39.7	1	61.0
544	Fonseca	Panama	8.2	278.1	1	60.8
545	Jostedola	Norway	61.2	5.0	1	60.0
546	Pacuare	Costa Rica	10.3	276.7	3	60.0
547	Guadalupe	USA	28.3	263.5	1	59.0
548	Surna	Norway	63.2	8.2	1	59.0
549	Cestos	Liberia	5.5	350.3	2	58.8
550	Chiriqui Viejo	Panama	8.3	277.3	2	58.2
551	Charente	France	46.0	359.0	1	58.0
552	Blackwater	Ireland	51.9	352.2	1	57.5
553	Bjerkreimsvassdraget	Norway	58.4	6.0	1	57.0
554	Yaque del Norte	Dominican Rep.	19.8	288.3	2	56.8
555	Walawe	Sri Lanka	6.1	81.1	2	56.8
556	Bobos	Mexico	20.7	262.7	1	56.5
557	Seom Jin	South Korea	34.9	127.7	1	56.0
558	Majes	Peru	-16.7	287.3	1	55.8
559	Gaularvassdraget	Norway	61.2	5.0	1	55.0
560	Canete	Peru	-13.2	283.6	1	55.0
561	Zulia	Colombia	11.0	288.5	1	55.0
562	La Antigua	Mexico	19.4	263.6	1	54.7
563	Naranjo	Guatemala	14.6	267.8	1	54.7
564	Salado	Argentina	-36.0	303.0	1	54.5
565	Jolstra	Norway	61.2	5.0	1	54.0
566	Abangares	Costa Rica	10.1	275.1	1	54.0
567	Panay	Philippines	11.6	122.8	1	53.8
568	Sibalom	Philippines	10.8	121.9	1	53.8
569	Foulakari	Congo	-6.0	12.3	2	53.5
570	Sipocot	Philippines	13.7	123.1	1	53.4
571	Tusubres	Costa Rica	9.6	275.4	1	53.0
572	San Pablo	Panama	7.6	278.1	2	52.9
573	Aconcagua	Chile	-33.0	289.2	3	51.7
574	San Lorenzo	Mexico	24.3	252.7	1	51.7
575	Jalaud (Jalaur)	Philippines	10.8	122.7	3	51.0
576	Moy	Ireland	54.3	350.8	1	51.0
577	Deduru Oya	Sri Lanka	7.6	79.7	1	51.0
578	Maha Oya	Sri Lanka	7.3	79.9	1	51.0

579	Chone	Ecuador	-0.5	279.3	1	51.0
580	Burnett	Australia	-24.8	152.5	1	51.0
581	Lofa	Liberia	6.7	349.7	2	50.4
582	Saltdalsvassdraget	Norway	67.3	14.5	1	50.0
583	Eidfjordvassdraget	Norway	60.0	5.9	1	50.0
584	Ozama	Dominican Rep.	18.4	290.2	1	50.0
585	Attanagalu Oya	Sri Lanka	7.2	79.9	1	49.8
586	Bentota Ganga	Sri Lanka	6.5	80.0	1	48.8
587	Bicol	Philippines	14.0	123.2	2	48.8
588	Helgean	Sweden	55.9	14.3	2	48.5
589	Atran	Sweden	56.9	12.4	2	48.5
590	Chubut	Argentina	-43.2	295.0	2	48.5
591	Beiarelva	Norway	67.2	14.3	1	48.0
592	Cocle del Norte	Panama	9.1	279.3	1	48.0
593	Tyne	United Kingdom	56.0	357.4	1	47.0
594	Simojoki	Finland	65.6	25.1	2	46.5
595	Mad	USA	40.9	235.9	1	46.4
596	Piarnu	Estonia	58.4	24.5	1	46.2
597	Caracan	Philippines	9.3	126.0	1	46.1
598	Pativilca	Peru	-10.7	282.2	1	46.0
599	Savegre	Costa Rica	9.4	275.9	1	46.0
600	Piaxtla	Mexico	23.6	253.2	1	45.5
601	Catubig	Philippines	12.7	125.0	1	45.2
602	Cazones	Mexico	20.7	262.8	1	45.0
603	Aisen	Chile	-45.3	287.0	1	45.0
604	Ardalselva	Norway	59.2	6.0	1	45.0
605	Bonga	Philippines	17.9	120.4	1	44.9
606	Kola	Russia	69.3	32.8	2	44.8
607	Bago	Philippines	10.6	122.7	1	44.2
608	Muar	Malaysia	2.0	102.7	1	44.0
609	Chamelecon	Honduras	15.9	271.2	1	44.0
610	Kyronjoki	Finland	63.2	21.8	1	44.0
611	Kiiminkijoki	Finland	65.2	25.3	1	44.0
612	Ardalsvassdraget	Norway	61.2	5.0	1	44.0
613	Lokoundje	Cameroon	3.0	10.0	1	43.1
614	Parrita	Costa Rica	9.5	275.6	2	43.0
615	La Estrella	Costa Rica	9.8	277.1	2	43.0
616	Reisavassdraget	Norway	69.8	21.0	1	43.0
617	Breimsvassdraget	Norway	61.2	5.0	1	43.0
618	Yeong San	South Korea	34.8	126.3	1	43.0
619	Tuxpan	Mexico	21.0	262.6	1	42.0
620	Lika	Croatia	44.5	15.2	1	42.0
621	Loukkos	Morocco	35.2	353.8	1	42.0
622	Candelaria	Mexico	18.8	268.5	1	41.6
623	Jarrahi	Iran	30.0	48.5	1	41.6
624	Tuy	Venezuela	10.5	294.0	2	41.5

625	Vouga	Portugal	40.7	351.2	1	41.2
626	Portoviejo	Ecuador	-0.7	279.5	1	41.0
627	Rauma	Norway	62.7	7.0	1	41.0
628	Nissan	Sweden	56.7	12.8	2	40.5
629	Langat	Malaysia	2.7	101.3	2	40.4
630	Sulitjelmavassdraget	Norway	67.2	14.4	1	40.0
631	Berbice	Guyana	6.5	302.5	1	40.0
632	Krian	Malaysia	5.2	100.3	1	40.0
633	Var	France	43.7	7.2	1	40.0
634	Gal Oya	Sri Lanka	7.3	81.8	1	39.6
635	Ranealven	Sweden	65.8	22.4	2	39.5
636	Trang	Thailand	7.3	99.5	1	39.3
637	Clyde	United Kingdom	55.9	355.1	1	39.0
638	Santa Lucia	Uruguay	-33.2	303.5	1	39.0
639	Thu-Bon	Vietnam	15.8	108.4	1	39.0
640	Kuparuk	United States	70.4	211.2	1	38.9
641	Great Kei	South Africa	-32.7	28.4	1	38.7
642	Broadback	Canada	5.1	280.0	1	38.3
643	Moulouya	Morocco	35.2	357.7	3	38.2
644	Coahuayana	Mexico	18.7	256.2	1	38.1
645	Licungo	Mozambique	-17.5	37.5	1	38.0
646	Bengo	Angola	-8.6	13.2	1	38.0
647	Mattole	USA	40.3	235.6	1	37.9
648	Johore	Malaysia	1.4	104.0	1	37.8
649	Yaque del Sur	Dominican Rep.	18.3	288.8	2	37.7
650	Zohreh	Iran	30.1	49.5	1	37.3
651	Sinaloa	Mexico	25.2	251.4	1	37.2
652	Hunter	Australia	-32.9	151.8	2	37.0
653	Ocosito	Guatemala	14.4	268.0	1	36.9
654	Nahualate	Guatemala	14.0	268.4	2	36.6
655	Aricuaisa	Venezuela	11.0	287.5	1	36.4
656	Ameca	Mexico	20.6	254.5	1	36.0
657	Lune	United Kingdom	54.1	357.1	1	36.0
658	Tra Khuc	Vietnam	15.2	109.0	1	36.0
659	Busuanga	Philippines	12.3	119.9	1	35.6
660	Ican	Guatemala	14.1	268.4	1	35.6
661	Gidealven	Sweden	63.3	19.2	2	35.5
662	Nilwala Ganga	Sri Lanka	6.0	80.5	1	35.0
663	Ore	Sweden	63.5	19.7	1	35.0
664	Kala	Finland	64.3	23.9	1	35.0
665	San Jose	Uruguay	-33.2	303.5	1	35.0
666	Acaponeta	Mexico	22.7	254.2	1	34.7
667	Motatan	Venezuela	11.0	288.5	1	34.0
668	Choluteca	Honduras	13.2	272.2	1	34.0
669	Goascaran	El Salvador	13.2	272.3	1	34.0
670	Siika	Finland	64.8	24.7	1	34.0

671	Osumi	Albania	40.9	19.4	1	33.9
672	Tambo	Peru	-17.3	288.1	1	33.0
673	Messalo	Mozambique	-11.5	40.5	1	33.0
674	Viskan	Sweden	57.2	12.2	1	33.0
675	Neveri	Venezuela	10.2	295.3	1	33.0
676	Mico	Nicaragua	12.0	276.0	1	32.9
677	Tamiraparni	India	8.6	78.1	1	32.1
678	Dee	United Kingdom	54.8	355.8	2	32.0
679	Monapo	Mozambique	-15.2	40.8	1	32.0
680	Daling	China	41.0	121.5	1	32.0
681	Ramu	Papua New Guinea	-4.0	144.7	1	32.0
682	Pyha	Finland	64.5	24.2	1	32.0
683	Orb	France	43.2	3.2	1	32.0
684	Cleddau	New Zealand	-44.6	167.8	1	31.9
685	Sagavanirktok	United States	70.3	212.0	1	31.6
686	Grande-Anse	Haiti	18.7	286.0	1	31.5
687	Boyne	Ireland	53.7	353.7	1	31.1
688	Lapuan	Finland	63.6	22.6	1	31.0
689	Marikina	Philippines	14.5	121.0	1	30.9
690	Assi	Syria	36.0	36.0	1	30.4
691	Magasauang Tubig	Philippines	13.3	121.4	1	30.2
692	Chagres	Panama	9.3	279.9	1	30.2
693	Chicama	Peru	-8.0	280.6	1	30.0
694	Chongchongang	North Korea	39.6	125.5	1	30.0
695	Eman	Sweden	57.2	16.5	1	30.0
696	Usk	United Kingdom	51.6	357.9	1	30.0
697	Redwood Creek	USA	41.3	235.9	1	29.8
698	Padang Terap	Malaysia	6.4	100.2	1	29.0
699	Jequetepeque	Peru	-7.4	280.5	1	29.0
700	Rimac	Peru	-12.1	282.9	1	29.0
701	Damas	Costa Rica	9.5	275.5	1	29.0
702	Tensift	Morocco	32.0	350.5	1	29.0
703	Vaigai	India	9.2	79.0	1	28.9
704	Huaura	Peru	-11.2	282.5	1	28.0
705	Byskealven	Sweden	64.9	21.2	2	27.5
706	Morrumsan	Sweden	56.2	14.8	2	27.5
707	Banano	Costa Rica	9.9	277.0	2	27.3
708	Mundeni Aru	Sri Lanka	7.8	81.4	1	27.2
709	Pisco	Peru	-13.2	283.4	1	27.0
710	Coyolate	Guatemala	13.9	268.6	1	27.0
711	Molocue	Mozambique	-17.0	39.0	1	27.0
712	Aude	France	43.0	3.0	1	27.0
713	Somme	France	50.2	1.5	1	27.0
714	Mamburao	Philippines	13.3	120.6	1	26.8
715	Bundoya	Sierra Leone	7.8	347.6	1	26.7

716	Devolli	Albania	40.9	19.4	1	26.4
717	Armeria	Mexico	19.0	256.0	1	26.3
718	Tenane	Philippines	11.2	125.0	1	26.1
719	Piura	Peru	-5.5	279.3	1	26.0
720	Ligonha	Mozambique	-16.8	39.2	1	26.0
721	Gatun	Panama	9.4	280.0	1	26.0
722	Naguilian	Philippines	16.2	119.8	1	25.6
723	Maduru Oya	Sri Lanka	7.9	81.5	1	25.5
724	Ankobra	Ghana	4.8	357.7	1	25.3
725	Mati	Albania	41.6	19.5	1	25.1
726	Jesus Maria	Costa Rica	9.9	275.3	1	25.0
727	Van Duzen	USA	40.6	235.8	1	24.7
728	Kumbukkan Oya	Sri Lanka	6.5	81.7	1	24.5
729	Grande de San Miquel	El Salvador	13.2	271.5	1	24.2
730	Rio Grande	Jamaica	18.2	283.5	1	24.1
731	Cahabon	Guatemala	15.8	271.2	1	24.0
732	Moalven	Sweden	63.3	18.9	1	24.0
733	Naranjo	Costa Rica	9.4	275.7	1	24.0
734	Nueces	USA	27.8	262.7	3	23.7
735	Paz	El Salvador	13.8	269.9	2	23.6
736	Nykopingsan	Sweden	58.7	17.1	1	23.0
737	Zrmanja	Croatia	44.5	15.0	1	23.0
738	La Villa	Panama	8.0	279.7	2	22.8
739	Kamtehiya	Bulgaria	43.0	27.9	1	22.4
740	Klang	Malaysia	3.0	101.3	2	22.2
741	Moin	Costa Rica	10.0	276.9	1	22.0
742	Perhon	Finland	63.9	23.1	1	22.0
743	Tuma	Nicaragua	12.9	276.5	2	21.8
744	Cheliff	Algeria	36.0	0.1	2	21.7
745	Outeniqua Region	South Africa	-23.4	34.0	1	21.5
746	Indio	Panama	9.2	279.7	1	21.0
747	Glenelg	Australia	-38.0	141.0	1	21.0
748	Mersey	United Kingdom	53.4	356.8	1	21.0
749	Gavlean	Sweden	60.5	17.3	1	21.0
750	Humaya	Mexico	24.5	252.4	1	20.9
751	Tehuantepec	Mexico	16.1	264.7	1	20.7
752	Ponnaiyar	India	11.8	79.8	1	20.6
753	Gouritz	South Africa	-34.3	21.9	1	20.6
754	Taw	United Kingdom	51.1	355.8	1	20.5
755	Salung-Daca	Philippines	9.8	123.5	1	20.3
756	Laloki	Papua New Guinea	-9.5	147.0	1	20.0
757	Baru	Costa Rica	9.3	276.1	1	20.0
758	Bou Regreg	Morocco	34.0	353.0	1	20.0
759	Iponan	Philippines	9.0	125.4	1	19.7

760	Delangersan	Sweden	61.7	17.2	1	19.0
761	Karjaan	Finland	60.0	23.5	1	19.0
762	Grande	Panama	8.4	279.6	2	18.9
763	Wharfe	United Kingdom	53.6	0.1	1	18.8
764	Medjerda	Tunisia	37.2	10.2	1	18.6
765	Kala Oya	Sri Lanka	8.3	79.7	1	18.6
766	Toa	Cuba	20.4	285.5	2	18.5
767	Barranca	Costa Rica	9.9	275.2	3	18.1
768	Avon	England	51.5	357.3	1	18.1
769	Sebaou	Algeria	37.0	3.7	1	18.1
770	Grande	Peru	-15.2	284.5	1	18.0
771	Mala	Peru	-12.7	283.3	1	18.0
772	Gamtoos	South Africa	-34.0	25.0	1	18.0
773	Umbeluzi	Mozambique	-26.0	32.5	2	17.9
774	Itapicuru	Brazil	-11.5	322.4	1	17.0
775	Humuya	Honduras	15.9	272.2	1	17.0
776	East London Region	South Africa	-33.0	27.9	1	17.0
777	Sembrong	Malaysia	2.8	103.6	1	16.8
778	Maria Linda	Guatemala	13.9	269.3	1	16.3
779	Villanueva	Nicaragua	13.0	273.0	1	16.2
780	San Juan	Peru	-13.4	283.3	1	16.0
781	Flinders	Australia	-17.6	140.6	1	16.0
782	Exe	United Kingdom	50.6	356.6	1	16.0
783	Ahtavan	Finland	63.7	22.7	1	16.0
784	Mima	Croatia	45.3	13.6	1	16.0
785	Nizao	Dominican Rep.	18.2	289.8	1	15.8
786	Kirindi Oya	Sri Lanka	6.2	81.3	1	15.1
787	Lambayeque	Peru	-7.0	280.1	1	15.0
788	Chancay	Peru	-11.5	282.7	1	15.0
789	Mecuburi	Mozambique	-14.2	40.6	1	15.0
790	Macoris	Dominican Rep.	18.4	290.8	1	14.7
791	Martha Brae	Jamaica	18.5	282.7	1	14.5
792	Skjern	Denmark	56.0	8.1	1	14.4
793	Navarro	USA	39.2	236.2	1	14.4
794	Sout	South Africa	-31.6	18.2	1	14.2
795	Aruvi Aru (Malwatu Oya)	Sri Lanka	8.6	79.8	3	14.2
796	Elqui	Chile	-30.0	289.5	1	14.0
797	Boac	Philippines	13.5	121.8	1	13.9
798	Erzeni	Albania	41.4	19.4	1	13.7
799	Dra	Morocco	28.7	348.3	1	13.5
800	Los Esclavos	Guatemala	13.8	269.4	2	13.4
801	Zaza	Cuba	21.7	280.5	1	13.2
802	Mamoni	Panama	9.0	281.0	1	13.0
803	Great	Jamaica	18.4	282.0	1	13.0
804	Acari	Peru	-15.8	285.3	1	13.0

805	Chili	Peru	-16.8	287.6	1	13.0
806	Tavignano	Sardinia	42.6	9.5	1	13.0
807	Caroni	Trinidad& Tobago	10.6	299.0	1	13.0
808	Lau	Morocco	35.4	354.9	1	13.0
809	Papenoo	Tahiti	-17.5	210.6	1	12.9
810	Soco	Dominican Rep.	18.4	290.9	1	12.7
811	Great Fish	South Africa	-33.6	27.1	2	12.6
812	Heda Oya	Sri Lanka	6.9	81.7	1	12.5
813	Great Ouse	United Kingdom	52.8	0.4	1	12.3
814	Bananito	Costa Rica	9.9	277.1	1	12.0
815	Agneby	Ivory Coast	5.3	355.7	1	12.0
816	Gualala	USA	38.7	236.4	1	11.8
817	Dajabon	Dominican Rep.	19.7	288.3	1	11.8
818	Cuyaguateje	Cuba	22.0	276.0	1	11.1
819	Ica	Peru	-15.0	284.5	1	11.0
820	Choapa	Chile	-31.5	288.4	1	11.0
821	Tocuyo	Venezuela	11.2	291.7	2	10.9
822	Salinas	USA	36.7	238.2	1	10.9
823	Mi Oya	Sri Lanka	8.1	79.8	1	10.7
824	Ciri	Panama	9.3	280.1	1	10.3
825	Nene	United Kingdom	52.8	0.3	2	10.1
826	Moche	Peru	-8.2	281.0	1	10.0
827	Samala	Guatemala	14.2	268.2	1	10.0
828	Madre Vieja	Guatemala	14.0	268.5	1	10.0
829	Warren	Australia	-34.7	115.8	1	10.0
830	San Juan	Chile	-53.7	289.9	1	10.0
831	Limari	Chile	-30.7	288.2	2	9.8
832	Jaina	Dominican Rep.	18.3	289.3	1	9.6
833	Sio	Togo	6.1	1.3	1	9.5
834	Rio Cobre	Jamaica	17.9	282.9	1	9.4
835	Sundays	South Africa	-33.7	25.8	1	9.4
836	Riviere du Mat	Reunion	-21.0	55.5	1	9.4
837	North Oropuche	Trinidad&Tobago	10.6	299.0	1	9.4
838	Gudena	Denmark	56.3	10.1	2	9.3
839	Damuji	Cuba	22.0	279.5	1	9.1
840	Yauca	Peru	-15.9	285.5	1	9.0
841	Yaracuy	Venezuela	10.7	291.7	1	9.0
842	Chillon	Peru	-11.9	282.8	1	9.0
843	Minab	Iran	27.0	57.0	1	9.0
844	Murray 2	Australia	-32.7	115.7	1	9.0
845	Madre de Dios	Costa Rica	10.2	276.7	1	9.0
846	Garcia	USA	38.9	236.3	1	9.0
847	Neckor	Morocco	35.2	356.2	1	9.0
848	Sana	Peru	-7.2	280.4	1	8.3
849	Hutt	New Zealand	-41.3	174.8	1	8.3

850	Boqueron	Panama	8.3	277.5	1	8.0
851	Kerte	Morocco	35.3	356.7	1	8.0
852	Carron	United Kingdom	57.8	355.8	2	7.9
853	Chavon	Dominican Rep.	18.4	291.2	1	7.9
854	Tontouna	New Caledonia	-21.9	166.1	2	7.9
855	Grande Riviere du Nord	Haiti	19.7	287.6	1	7.8
856	Jiboa	El Salvador	13.4	270.9	1	7.6
857	Isser	Algeria	36.7	3.6	1	7.6
858	Rhis	Morocco	35.2	356.1	1	7.5
859	Paiva	Portugal	41.1	351.9	1	7.2
860	Les Trois Rivières	Haiti	19.9	287.1	1	7.2
861	Russell Creek	USA	55.2	197.3	1	7.2
862	Liffey	Ireland	53.3	353.8	1	7.2
863	Io Grande	Sao Tome	0.2	6.7	1	7.1
864	Souss	Morocco	30.5	350.3	1	7.0
865	Quinne	New Caledonia	-22.0	166.7	1	7.0
866	Manganui	New Zealand	-39.0	174.2	1	7.0
867	Sado	Portugal	38.5	351.1	1	6.8
868	Caimito	Panama	8.7	280.3	1	6.8
869	Hilabangan	Philippines	10.1	122.7	1	6.7
870	Tchamba	New Caledonia	-21.1	165.5	1	6.6
871	Mazafran	Algeria	36.8	2.8	1	6.5
872	Doring	South Africa	-31.7	18.2	1	6.5
873	Grand River South East	Mauritius	-20.2	57.7	1	6.3
874	Momance	Haiti	18.7	287.3	1	6.2
875	Sosonate	El Salvador	13.6	270.3	1	6.1
876	Bras de la Plaine	Reunion	-21.0	55.5	1	6.1
877	Casma	Peru	-9.5	281.7	1	6.0
878	Montepuez	Mozambique	-12.5	40.5	1	6.0
879	Noyo	USA	39.3	236.2	1	6.0
880	Treene	Germany	54.4	9.0	1	6.0
881	Ouaieme	New Caledonia	-20.6	164.9	1	6.0
882	Grand Goyave	Guadeloupe	16.3	298.4	2	5.8
883	Tafna	Algeria	35.3	358.4	1	5.5
884	Dumbea Nord	New Caledonia	-22.2	166.4	1	5.4
885	Jacmel	Haiti	18.2	287.4	1	5.3
886	Riviere des Marsouins	Reunion	-21.0	55.5	1	5.3
887	Bouselam	Algeria	36.8	5.0	1	5.1
888	Hienghene	New Caledonia	-20.7	165.0	1	5.0
889	Massacre	Haiti	19.7	288.0	1	5.0
890	Golo	Sardinia	42.6	9.5	1	5.0
891	Taravo	Sardinia	41.6	8.8	1	5.0
892	Dumbea Est	New Caledonia	-22.2	166.4	1	4.9

893	Algoa (Port Elizabeth)	South Africa	-33.9	25.7	1	4.8
894	Mkomasi	Tanzania	-5.5	39.2	1	4.7
895	Huasco	Chile	-28.0	288.7	1	4.7
896	Salado	Cuba	20.6	282.5	1	4.6
897	Tiwaka	New Caledonia	-20.9	165.3	1	4.6
898	Ponerihoven	New Caledonia	-21.2	165.4	1	4.6
899	Riviere des Roches	Reunion	-21.0	55.5	1	4.2
900	Tipindje	New Caledonia	-20.8	165.1	1	4.2
901	Maboa	Sierra Leone	7.6	347.9	1	4.1
902	Odelouca	Portugal	37.1	351.4	1	4.0
903	Viru	Peru	-8.5	281.3	1	4.0
904	Huarmey	Peru	-10.1	281.9	1	4.0
905	Lurin	Peru	-12.3	283.1	1	4.0
906	Bravo	Colombia	4.1	77.5	1	3.9
907	Ozat	India	20.7	86.8	1	3.8
908	Segura	Spain	38.1	359.3	1	3.8
909	Little	USA	41.0	235.9	1	3.8
910	Riviere Des Creoles	Mauritius	-20.2	57.7	1	3.8
911	Boghen	New Caledonia	-21.8	165.2	1	3.7
912	Houaliou	New Caledonia	-21.3	165.7	1	3.7
913	Selwyn	New Zealand	-43.9	172.4	1	3.6
914	Ayensu	Ghana	5.3	359.5	1	3.5
915	South Oropuche	Trinidad&Tobago	10.1	298.5	1	3.5
916	Ouenghi	New Caledonia	-22.0	166.0	1	3.5
917	Fatenaoue	New Caledonia	-21.0	164.8	1	3.4
918	San Cristobal	Cuba	23.0	277.7	2	3.2
919	Melah	Algeria	36.7	7.8	1	3.1
920	Ortoire	Trinidad&Tobago	10.3	299.0	1	3.1
921	San Diego	Cuba	22.4	276.7	1	3.1
922	Pangani	Tanzania	-0.5	39.0	1	3.0
923	Cunapo	Trinidad&Tobago	10.6	299.0	1	2.9
924	Tamarindo	Nicaragua	12.0	273.3	3	2.9
925	Five Rivers Combined	Guam	13.5	144.8	1	2.8
926	Deep	Mauritius	-20.2	57.7	1	2.8
927	Riviere des Lacs	New Caledonia	-22.1	167.0	1	2.8
928	Casamance	Senegal	12.5	343.6	1	2.6
929	Great Bushmans	South Africa	-33.7	26.7	1	2.6
930	Big Sur	USA	36.2	238.2	1	2.5
931	Riviere Langevin	Reunion	-21.0	55.5	1	2.5
932	Brito	Nicaragua	11.4	274.0	1	2.5
933	Nepena	Peru	-9.3	281.5	1	2.4
934	Elk	USA	40.7	235.8	1	2.4
935	Lemba	Sao Tome	0.2	6.7	1	2.4
936	Aragua	Venezuela	10.2	295.3	1	2.3

937	Guantanamo	Cuba	19.9	284.4	1	2.2
938	Riviere La Chaux	Mauritius	-20.2	57.7	1	2.2
939	Navet	Trinidad&Tobago	10.4	299.0	1	2.2
940	Papageio	Sao Tome	0.2	6.7	1	2.1
941	Lorrain	Martinique	14.8	298.9	1	2.1
942	Carmel	USA	36.5	238.1	1	2.1
943	Buffels (Region)	South Africa	-29.6	16.9	1	2.1
944	Diahot	New Caledonia	-20.4	164.3	1	2.1
945	Osmore	Peru	-17.7	288.5	1	2.0
946	Copiapo	Chile	-27.3	289.0	1	2.0
947	Tanninim	Israel	32.6	34.9	1	2.0
948	Joumine	Tunisia	37.3	9.9	1	2.0
949	Grand Carbet	Guadeloupe	16.0	298.5	1	1.9
950	Ocoa	Dominican Rep.	18.3	290.0	1	1.9
951	Le Lezarde	Martinique	14.6	299.0	2	1.8
952	Waveney	United Kingdom	52.5	1.7	1	1.8
953	Seche	Mauritius	-20.2	57.7	1	1.8
954	Santa Cruz	Cuba	23.0	277.7	1	1.7
955	Couva	Trinidad&Tobago	10.2	298.5	1	1.5
956	Abade	Sao Tome	0.2	6.7	1	1.4
957	Caplina	Peru	-18.2	289.3	1	1.2
958	Yuma	Dominican Rep.	18.4	291.4	1	1.2
959	Loa	Chile	-21.3	290.0	2	1.1
960	Omakere	New Zealand	-39.5	176.9	2	1.1
961	Tryggevaelde	Denmark	55.3	12.2	1	1.0
962	Gibara	Cuba	21.1	283.8	1	0.9
963	Pedernales	Dominican Rep.	18.0	288.3	1	0.9
964	Kouris	Cyprus	35.0	33.0	1	0.7
965	Moutere	New Zealand	-41.2	173.0	1	0.7
966	Boudouaou	Algeria	36.8	3.0	1	0.6
967	Agua Grande	Sao Tome	0.2	6.7	1	0.6
968	La Rioja	Cuba	20.5	282.8	1	0.6
969	Qishon	Israel	32.8	35.0	1	0.5
970	Yarqon	Israel	32.2	34.8	1	0.5
971	Pudding Creek	USA	39.5	236.3	1	0.5
972	Saint Joseph	Trinidad&Tobago	10.6	298.5	1	0.5
973	Rhumel	Algeria	36.8	6.1	1	0.4
974	Manuel Jorge	Sao Tome	0.2	6.7	1	0.4
975	Ouro	Sao Tome	0.2	6.7	1	0.4
976	Limnitis	Cyprus	35.0	33.2	1	0.4
977	Uchusuma	Peru	-18.3	289.6	1	0.4
978	Alexander	Israel	32.4	34.8	1	0.3
979	Soreq	Israel	31.9	34.7	1	0.3
980	Bukit Timah	Singapore	13.3	103.8	1	0.3
981	Caura	Trinidad&Tobago	10.6	298.5	1	0.3

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Observed River Discharges

Fig. 2

OBSERVED AND EXTRAPOLATED CONTINENTAL DISCHARGE

Linear Extrapolation: $Q > 250 \text{ m}^3/\text{s}$

Fig. 3

Dataset vs. River Discharge Estimates

Fig. 4

Dataset vs. Estimated Total Discharge

Fig. 5

Discharge vs. Land Area in Latitude Bands

Fig. 6

Global and Continental River Size Distribution

Fig. 7

Global and Continental River Discharge

Fig. 8

Extrapolated Africa Runoff

Estimate = 126,110 m³/s

Fig. 9

Estimate = 322,470 m³/s

Fig. 10

Extrapolated Europe Runoff

Estimate = 100,630 m³/s

Fig. 11

Extrapolated North America Runoff

Estimate = 226,440 m³/s

Fig. 12

Extrapolated Oceania Runoff

Estimate = 42, 920 m³/s

Fig. 13

Extrapolated South America Runoff

Estimate = 306,370 m³/s

Fig. 14