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Sediment Yield in Africa

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Abstract

Several studies have compiled and analyzed measured contemporary catchment sediment yield (SY, [t km^{-2} y^{-1}]) values for various regions of the world. Although this has significantly contributed to our understanding of SY, Africa remains severely underrepresented in these studies. The objective of this article is therefore: i) to review and compile available SY data for Africa; ii) to explore the spatial variability of these SY data; and iii) to examine which environmental factors explain this spatial variability.

A literature review resulted in a dataset of SY measurements for 682 African catchments from 84 publications and reports, representing more than 8,340 catchment-years of observations. These catchments span eight orders of magnitude in size and are relatively well spread across the continent. A description of this dataset and comparison with other SY datasets in terms of spatial and temporal distribution and measurement quality is provided.

SY values vary between 0.2 and 15,699 t km^{-2} y^{-1} (median: 160 t km^{-2} y^{-1}, average: 634 t km^{-2} y^{-1}). The highest SY values occur in the Atlas region with SY values frequently exceeding 1,000 t km^{-2} y^{-1}. Also the Rift Region is generally characterized by relatively high SY values, while rivers in Western and Central Africa have generally low SY values.

Spatial variation in SY at the continental scale is mainly explained by differences in seismic activity, topography, vegetation cover and annual runoff depth. Other factors such as lithology, catchment area or reservoir impacts showed less clear correlations. The results of these analyses are discussed and compared with the findings from other studies. Based on our results, we propose a simple regression model to simulate SY in Africa. Although this model has a relatively low predictive accuracy (40%), it simulates the overall patterns of the observed SY values well. Potential explanations for the unexplained variance are discussed and suggestions for further research that may contribute to a better understanding of SY in Africa are made.

Keywords: data compilation; reservoir sedimentation; seismic activity; land use; climate; topography

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1. Introduction

Understanding the factors and processes controlling contemporary catchment sediment yield (SY, [t km^{-2} y^{-1}]; i.e. the mass of sediment annually leaving a catchment per unit of catchment area) is crucial for our comprehension of global denudation rates, biogeochemical cycles, fluvial sedimentary archives and human impacts on sediment fluxes (e.g. Meybeck, 2003; Walling, 2006; Syvitski and Milliman, 2007). Several studies therefore compiled and analyzed worldwide SY observations (e.g. Jansen and Painter, 1974; Walling and Kleo, 1979; Dedkov and Mozzherin, 1984; Jansson, 1988; Milliman et al., 1995; FAO, 2008; Milliman and Farnsworth, 2011). Despite its size and physiographic variability (Goudie et al., 1996), Africa is clearly underrepresented in these compilations (table 1). So far, the FAO (2008) conducted the largest SY data compilation for Africa (table 1). However, almost half of the 205 African SY observations in this dataset are located in Algeria, Morocco or Lesotho while most other African countries are not or poorly represented (FAO, 2008). Moreover, the few African SY data included in these compilations are mainly for larger river systems (> 10,000 km²). Smaller catchments (< 100 km²) are even more underrepresented (table 1).

The main reason for this under representation is the limited number of African SY observations available. This was already highlighted by Walling (1984). Nonetheless, a large number of SY measurements have been conducted in Africa but were often only published in internal reports, theses, conference proceedings or local research journals. This is illustrated by a few regional or country-wide SY compilations in Africa (e.g. Dunne, 1979; Rooseboom, 1978, Nyssen et al., 2004; Liénou et al., 2005; Balthazar et al., 2012). Whereas these compilation studies are an important step forward, a comprehensive continent-wide compilation of African SY data is currently lacking. As a result, our insight into the spatial patterns of SY in Africa is limited (e.g. Walling and Webb, 1983; Walling, 1984; Milliman and Farnsworth, 2011).

Also our ability to predict SY of African rivers is hampered by this lack of data. Some models have been proposed to predict SY for specific African regions, but they are mostly based on a relatively limited number of catchments and involve large uncertainties when applied to catchments in other regions (e.g. Picouet et al., 2001; Ning Ma, 2006; Haregeweyn et al., 2008; Meshesha et al., 2011; Schmengler, 2011; Balthazar et al., 2012). Furthermore, these studies focus on only a few specific African regions (e.g. the Ethiopian Highlands; Haregeweyn et al., 2008; Meshesha et al., 2011; Balthazar et al., 2012). Also earlier developed SY models remain poorly tested for African conditions, while studies aiming to apply existing SY models to African catchments often report poor model performances and/or high data requirements (e.g. Bouraoui et al., 2005; Syvitski and Milliman, 2007; Balthazar et al., 2012; Bossa et al., 2012; Pelletier, 2012; de Vente et al., 2013).

It is generally accepted that SY is influenced by catchment area, lithology, topography, land use, reservoir impacts and climatic conditions (e.g. de Vente and Poesen, 2005; Syvitski and Milliman, 2007; Pelletier, 2012). However, the relative importance of these factors in explaining spatial variation in SY is not fully understood as this also depends on the catchments considered. This issue has been raised before and is evident from the fact that different studies often report different factors controlling SY (e.g. Jansen and Painter, 1974; Walling, 1983; Lane et al., 1997; de Vente et al., 2005; de Vente et al., 2006; Syvitski and Milliman, 2007; Haregeweyn et al. 2008; de Vente et al., 2013). Most studies dealing with factors controlling SY focus either on large river basins worldwide (e.g. Syvitski and Milliman, 2007; Pelletier, 2012) or on smaller catchments in a specific region (e.g. Dunne, 1979; Liénou et al., 2005; Haregeweyn et al., 2008). Very few studies consider a wide range of catchment sizes or on regional differences at a continental scale.

Furthermore, tectonic activity is generally not considered as a potential controlling factor of SY (e.g. Milliman and Syvitski, 1992; de Vente and Poesen, 2005; Syvitski and Milliman, 2007; Pelletier, 2012; de Vente et al., 2013) with the exception of some studies in highly tectonically active regions (e.g. Dadson et al., 2003; Hovius et al., 2011). Mostly, it is implicitly assumed that the effects of tectonic activity are either irrelevant or reflected in the catchment topography (e.g. Syvitski and Milliman, 2007). However, recent studies indicate that this is not always the case: spatial variation in soil erosion rates and SY can partly be attributed to spatial differences in seismic activity, even in regions where this activity is relatively limited (e.g. Cox et al., 2010; Portenga and Bierman, 2011; Vanmaercke et al., 2014a; 2014b). Nonetheless, the importance of seismic activity as an explaining factor of SY remains poorly understood. The large variation in land use and climatic conditions in combination with the overall low degree of seismic activity (e.g. Shedlock et al., 2000; ANSS, 2013) make the African continent an interesting case to further investigate the potential role of seismic activity as a controlling factor of SY.

However, understanding the factors controlling SY in Africa is not only of interest from a merely scientific point of view. The rapidly growing population (UN-ESA, 2011) and the projected climate changes (e.g. de Wit and Stankiewicz, 2006) will result in a larger need for dams and reservoirs to respond to the increasing energy and water demands in Africa (e.g. Bartle, 2002; Karekezi & Kithyoma, 2002; Alhassan, 2009; Vanmaercke et al., 2011a; Wisser et al., 2013). Moreover, population growth and climatic changes have important impacts on the land cover changes of various African regions (e.g. Barnes, 1990; Nyssen et al., 2004; Zhang et al., 2006; Odada et al., 2009). These changes often pose significant threats to the sustainable use of available water resources (e.g. Ogutu-Ohwayo et al., 1997; Lewis, 2000; Bruijnzeel, 2004; Nyssen et al., 2004; Odada et al., 2004; Reichenstein et al., 2013). For example, numerous constructed or planned water reservoirs in Africa face important capacity losses due to high siltation rates (e.g. Kabell, 1984; Liebe et al., 2005; Haregeweyn et al., 2006; Adwubi et al., 2009; Amegashie et al., 2011; Baade et al., 2012). Also many of the Great African Lakes face important ecological problems, related to the input of sediments and sediment-fixed nutrients (e.g. Ogutu-Ohwayo et al., 1997; Odada et al., 2004). Reliable information on the expected SY and its sensitivity to land use or climate changes is therefore crucial for sustainable catchment management and water harvesting projects. However, the lack of SY measurements and our inability to make reliable predictions often impede the design of such projects (e.g. Haregeweyn et al., 2006).

A continent-wide compilation and analysis of SY measurements in Africa could strongly improve our understanding of the factors controlling SY and help addressing these challenges. The objectives of this study are therefore: i) to present and discuss a compilation of measured SY data in Africa, based on an extensive literature review (section 2); ii) to explore the spatial variability of SY (section 3); and iii) to examine which factors best explain the variability in observed SY (section 4).

2. A database of African sediment yield observations

2.1 Data collection and quality assessment

Based on an extensive literature review of scientific publications, conference proceedings, MSc. and PhD. theses and reports from hydrological and environmental institutes, a database was constructed with measured catchment SY data for African rivers. Only SY data that were derived from measurements at a gauging station or from reservoir siltation rates over a measuring period of at least one year were considered. Each entry in the database corresponds to one catchment for which SY has been measured and contains the original source of the data, the catchment and/or location name, the location of the catchment outlet, the measured SY value, the type of measurement (observation at a gauging station ('GS') or derived from a reservoir sedimentation rate ('R')), the originally reported catchment area, and if available the measuring period. For several entries, the measuring period was not reported but known to be longer than one year. In these cases, the measuring period was indicated as unknown. If available, the coordinates of the catchment outlets were based on the originally reported coordinates. If not, an assessment was made based on information provided in the publication and Google™ Earth. SY observations for which the measuring location could not be estimated were not included in the database.

The compiled SY data was measured and calculated using various techniques and procedures. This has important implications for the analyses of these data. Especially the difference between SY values derived from reservoir siltation and those obtained from gauging station measurements impedes the comparability of SY observations. Earlier studies have shown that SY-estimates based on low-frequency sampling (e.g. Phillips et al., 1999; Moatar et al., 2006) or short (< 5 yr) measuring periods (Vanmaercke et al., 2012) are more likely to underestimate the true sediment yield because they have a higher probability of excluding low-frequency but high-magnitude events. Especially short-term SY values derived from gauging station measurements are susceptible to such underestimations, while SY estimates based on long-term sedimentation rates in reservoirs with high trapping efficiencies often provide more reliable estimates of the average SY (Verstraeten and Poesen, 2002). Moreover, SY estimates derived from reservoir sedimentation rates include both the suspended and bedload, while almost all SY values measured at gauging stations only consider the suspended load. It is therefore likely that observed differences in SY can, for an important part, be attributed to methodological differences.

To account for this, we explicitly considered this difference in measuring method (GS or R) in our analyses. In addition, we assessed the reliability of each SY observation. Based on the (often limited) available information about the applied measuring procedure, the quality of each SY observation was labelled as ‘good’, ‘acceptable’, ‘poor’ or ‘unknown’. GS entries classified as ‘good’ are typically observations for which runoff discharge and sediment concentrations (SC) were measured at least daily (e.g. Walling et al., 2001). ‘Acceptable’ entries mainly consist of SY values based on daily runoff measurements while SC was measured at least weekly. Also SY observations for which SC values were estimated based on rating curves with at least 50 observations are included in this category (e.g. Carré, 1972). GS-entries based on a lower sampling frequency or based on rating curves with less than 50 observations were classified as having a ‘poor’ data quality (e.g. Sichingabula, 2000). SY estimates based on sediment deposition rates in reservoirs with a high estimated trapping efficiency (> 90%) for which the sediment dry bulk density was measured and for which a correction for the trapping efficiency was applied were classified as having a ‘good’ data quality (e.g. Haregeweyn et al., 2012). Trapping Efficiencies values were estimated using an empirical equation proposed by Brown (1943). SY estimates derived from sedimentation rates in reservoirs with a high trapping efficiency that were corrected for trapping efficiency but for which the dry bulk density was not measured were classified as 'acceptable' (e.g. Rooseboom et al., 1992). R-entries that did not meet these criteria or for which it was suspected that the estimated annual sedimentation volume was susceptible to considerable uncertainties were classified as having a 'poor' data quality (e.g. Ndomba, 2011). For 245 entries, no or insufficient information on the measuring method could be found in their source to allow a quality assessment. These entries were labelled as having an unknown data quality (e.g. Milliman and Farnsworth, 2011).

Evidently, also these quality assessments are subject to uncertainties, since also other sources or error can affect the reliability of the SY observations. Nonetheless, earlier studies clearly indicate that the reliability of sediment yield estimates based on measurements at gauging stations is mainly determined by the sediment concentration sampling frequency and/or the number of sediment concentration samples used to establish rating curves (e.g. Phillips et al., 1999; Moatar et al., 2006; Vanmaercke et al., 2010; Delmas et al., 2011). Likewise, the reliability of SY estimates based on reservoir sedimentation rates strongly depends on the trapping efficiency and the (often estimated) dry bulk density of the sediments (e.g. Verstraeten and Poesen, 2002). The criteria used in this study to assess data quality can therefore be expected to consider the most important sources of uncertainty on SY-measurements.

For many catchments multiple alternative SY estimates exist. Therefore, the database was thoroughly checked for duplicate entries. Two entries were considered as duplicates if they had the same outlet and (hence) the same catchment area. In such case only the SY measurement that was deemed to be the most reliable was selected. When the estimated quality of both entries was equal or unknown, the entry with the longest measuring period was selected. This was done because average SY values based on a short (< 5 years) measuring period may be susceptible to large (> 100%) uncertainties (e.g. Olive and Rieger, 1992; Vanmaercke et al., 2012). If also the measuring periods were equal or unknown, the source that provided the most detailed information on the catchment outlet and measuring technique was selected.

2.2. Data Availability

An overview of all collected sediment yield data per country and the original sources of the data is given in table 2. In total SY data for 682 catchments in Africa were collected. For 377 of these catchments, SY was measured at gauging stations. For the other 305 catchments, SY was derived from reservoir sedimentation rates. Several African countries have no or only few

SY data (table 2). For some of these countries, more SY data most likely exists but could not be included because they were reported in documents that could not be retrieved (e.g. SY data for Kenya, reported by Dunne, 1979). The overview of SY data presented in this study therefore remains to some extent incomplete. Nevertheless, it is hitherto the largest SY compilation for Africa (table 1).

Dividing the area of African continent by the number of SY measurements (682) results roughly in one SY observation per 44,300 km². This remains a relatively low density compared to other regions. A recent compilation of SY data using a similar approach as this study yielded SY measurements for 1,794 catchments in Europe, corresponding to about one observation per 5,700 km² (Vanmaercke et al., 2011b). Likewise, the USA has at least 1,026 gauging stations where SY was monitored for at least one year (USGS, 2008) and 1,823 reservoirs with sedimentation rate data available (Ackerman et al., 2009). Assuming that a SY value can be calculated for each of these reservoirs, this yields a total of ca. one SY observation per 3,400 km².

Figure 1 displays the outlet locations of all African catchments for which SY data were collected. This map illustrates clear regional differences in SY data availability. North-western, southern and large parts of eastern Africa are densely covered by SY observations, while no or only very few data are available for Central Africa and the Southwest of the continent. To a large extent, the lack of data in some regions can be easily explained by the presence of deserts (i.e. Sahara, Kalahari) or rainforest. Furthermore the availability of SY data (figure 1) closely corresponds to the availability of runoff discharge data (e.g. Hannah et al., 2011) and with the location of large dams and reservoirs in Africa (Lehner et al. 2011; Wisser et al., 2013). The spatial pattern shown in figure 1 therefore most likely reflects the true SY data availability in Africa.

2.3 Measuring periods, length of records and data quality

Assuming that SY values with an unknown measuring period are based on only one year of observations, the sum of all measuring periods for all compiled SY data yields a total of minimum 8,340 catchment-years of observations (table 2). A majority of the SY measurements at gauging stations has an unknown or relatively short (≤ 5 years) measuring period (Figure 2). Excluding SY observations with an unknown measuring period, SY measurements at gauging station stations were on average conducted for 6.0 years (minimum: 1 year, median: 4 years, maximum: 54 years). This is considerably shorter than e.g. in Europe where SY at gauging stations were recorded for on average 13.2 years (Vanmaercke et al., 2011b). SY observations derived from reservoir sedimentation rates generally cover longer periods (figure 2; average: 24.8 years, minimum: 1 year, median: 17 years, maximum: 98 years).

Figure 3 shows that SY measurements at gauging stations started around the 1930s but were mainly made between 1970 and 1990. After the 1990s, the number of GS observations dropped. The number of SY observations derived from reservoir sedimentation rates increases from the 1900s until the first half of the 1970s but then decreases over the next ten years. This sharp decrease can be partly attributed to two publications discussing reservoir sedimentation rates in South-Africa (table 2; Rooseboom, 1978; Rooseboom et al., 1992). Nonetheless, the overall pattern of figure 3 illustrates a strong decrease in SY data availability after the 1990s. Similar trends were observed for SY data in Europe (Vanmaercke et al., 2011b), the number of reservoir sedimentation surveys in the USA (Ackerman et al., 2009) and the number of runoff discharge data worldwide (Vörösmarty, 2002; Hannah et al., 2011) and have been attributed to a worldwide decreased interest in hydrological measurements (e.g. Hannah et al., 2011; Vanmaercke et al., 2011b).

Based on the criteria discussed in section 2.1, about half of the SY observations were evaluated to have a 'good' or 'acceptable' data quality (Figure 4). For 91 of the SY observations, the reliability was expected to be 'poor'. Especially the reliability of GS entries was mostly low or unknown (Figure 4). As discussed in section 2.1, uncertainties on these SY observations are often further increased by the corresponding short measuring period (e.g. Walling, 1984; Olive and Rieger, 1992; Vanmaercke et al., 2012; figure 2).

2.4 Catchment areas

Catchment areas for the collected SY data range between 0.02 and 3.8 x 10^6 km² (median: 998 km², average: 53,128 km²; Figure 5). Less than 22% of the catchments are smaller than 100 km², while only 12% is smaller than 10 km². Most of these SY observations for smaller catchments were derived from reservoir sedimentation rates (Figure 5). Also SY data compilations for other regions in the world show that smaller catchments are clearly less well represented (e.g. Dedkov and Mozzherin, 1984; Jansson, 1988; USGS, 2008; de Aráujo and Knight, 2005; Vanmaercke et al., 2011b). This is most likely explained by the fact that larger catchments (> 100 km²) are more relevant for planning water management at national scales and are therefore better represented in gauging station networks.

Nonetheless, SY data from small catchments are also highly relevant for various purposes. For example, large numbers of micro-dams have been constructed throughout Africa in order to increase water availability (e.g. Rockström, 2000; Liebe et al., 2005; Haregeweyn et al., 2006; Adwubi et al., 2009). Reliable estimates of the expected sediment input into reservoirs are crucial when designing and implementing such projects. Smaller catchments are generally also more suitable than larger catchments to study impacts of various environmental conditions on sediment export, since larger catchments often have more heterogeneous characteristics and are commonly less sensitive to land use changes or specific climatic events (e.g. Walling, 1983; Trimble, 1999; Walling, 1999; Parkin et al., 1996; Phillips, 2003; Dearing et al., 2006).

3. Observed sediment yields in Africa

The compiled SY observations for African catchments range between 0.2 and 15,700 t km^{-2} y^{-1} (median: 160 t km^{-2} y^{-1}, average: 634 t km^{-2} y^{-1}). However, SY values derived from reservoir sedimentation rates (median: 256 t km^{-2} y^{-1}, average 808 t km^{-2} y^{-1}) are generally higher than those obtained from gauging station observations (median: 114 t km^{-2} y^{-1}, average 493 t km^{-2} y^{-1}; figure 6). As discussed in section 2.1, SY measurements from gauging stations generally do not include bedload and have a higher probability of underestimating the true SY, which may partly explain this difference.

Nonetheless, this difference may also be attributed to specific catchment characteristics and environmental conditions. For example, SY observations derived from reservoirs are mainly for catchments < 10,000 km², while most SY data for larger catchments (> 10,000 km²) are based on gauging station measurements (Figure 5; Figure 6). In addition, figure 1 indicates important spatial differences in measuring method: most of the SY values derived from reservoir surveys were made in mountainous regions (i.e. the Rift Valley, Southern Africa and the Atlas region), while a majority of the gauging station observations were made in 'lowlands' (e.g. Western Africa). This pattern corresponds well with observed patterns in SY. When we classify all SY observations into three classes that contain each about one third of the SY observations, one can clearly notice that many of the lowest SY observations are located in Western Africa, while Southern and Eastern Africa are generally characterized by higher SY values (Figure 7). The largest SY values were mainly recorded in the Atlas region and in Ethiopia. It is therefore likely that the difference between SY values derived from gauging station observations and those derived from reservoir sedimentation rates (figure 6) to some extent reflect regional differences of SY in Africa. This will be further investigated in section 4.

4. Explaining the spatial variability of sediment yield in Africa

4.1 Methodology

4.1.1 Delineating catchment boundaries

For each of the catchments included in the database an attempt was made to delineate the catchment boundaries. This step was necessary to allow the extraction of various catchment properties that potentially explain the spatial variability of SY in Africa. Depending on the size of the catchment and local terrain conditions, catchment boundaries were (in order of preference) delineated from either SRTM 90m DEMs (CGIAR, 2008), the 30 arc-second HydroSHEDS dataset (Lehner et al., 2006) or the 0.5° STN dataset (Vörösmarty et al., 2000). Catchment areas resulting from this delineation procedure did not always correspond to the catchment area reported in the original data source. These deviations can be attributed to several reasons: uncertainties on the estimated outlet location, errors and inaccuracies in the datasets used to delineate the watershed boundaries, and wrongly reported catchment areas in the original data source. Estimating the reliability of the obtained watershed boundaries therefore involved some expert judgement. However, as a general criterion, only catchments for which the delineated area deviated less than 20% from the originally reported catchment area and for which we were certain about the outlet location were considered for further analyses.

In total, catchment boundaries could be delineated for 507 of the 682 catchments (figure 8). The median deviation of the delineated area from the originally reported catchment area was 2.6%. The spatial distribution of the catchments for which the catchment boundaries could be delineated corresponds closely to the overall availability of SY data in Africa (compare figure 8 and figure 1). The 175 catchments for which the boundaries could not be accurately delineated were not considered in our further analyses.

4.1.2 Parameter selection

Several catchment characteristics were derived for each catchment for which the catchment boundaries could be delineated (section 4.1.1). These characteristics describe the area, topography, lithology, seismic activity, climatic conditions and land use of the catchments (table 3). Most of these variables or similar ones have also been used in previous studies on spatial variation in SY or long-term erosion rates at the catchment scale (e.g. Montgomery and Brandon, 2002; Syvitski and Milliman, 2007; de Vente et al., 2011; Portenga and Bierman, 2011). In addition, we included variables to indicate whether a catchment is potentially influenced by large reservoirs (i.e. reservoirs included in the earlier published

GranD database; Lehner et al., 2011) and whether the SY measurement corresponding to the catchment was derived from gauging station measurements or reservoir sedimentation rates (table 3). Although more variables can be included, the variables listed in table 3 were considered to be the most meaningful in the framework of this study. Several other variables (e.g. average height of the catchment, different measures to quantify land use) were initially included but yielded no different results.

A comparison of environmental characteristics between the 507 selected catchments (section 4.1.1) and the African continent shows that, although some differences in distribution exist, both cover the same range for most of the considered characteristics (figure 9). This indicates that the SY data used in this study are representative for the African continent.

4.1.3 Statistical analyses

The relevance of these variables in explaining differences in SY was explored by means of Pearson (partial) correlation coefficients. Partial correlation measures the degree of association between two variables, with the effect of other controlling variables removed (Fisher, 1924; Steel and Torrie, 1960). These (partial) correlation coefficients were calculated based on the log-transformed SY values. Where relevant, also log-transformed versions of the selected parameters (section 4.1.2) were considered in the analyses. A similar approach was followed in earlier studies aiming to identify the factors controlling SY or erosion rates (e.g. Aalto et al., 2006; de Vente et al., 2011; Portenga and Bierman, 2011).

In addition, the potential importance of the considered parameters (table 3) in explaining SY was explored by stepwise regressions, a commonly applied method where the selection of predictive variables is carried out by an automated procedure (Draper and Smith, 1998; Verstraeten and Poesen, 2001). The procedure works by generating an initial model and then evaluating (based on an F-statistic) if adding any of the potential variables would significantly increase the explanatory power of the model. If so, the variable is added. Likewise, it is checked if removing any of the included variables would result in a significant decrease of explanatory power. If not, the variable is removed again. The procedure ends when no single step further improves the model (Mathworks, 2013).

To obtain sufficiently robust results, this stepwise regression procedure was not applied to the entire dataset but to 10,000 randomly selected subsets containing between 30 and 70% of the original 507 catchments. This resulted in 10,000 different stepwise regression models. Evaluating the frequency with which variables were included in these models, allowed assessing the overall importance of these variables for explaining spatial differences in SY.

4.2. Factors controlling sediment yield

4.2.1 Main results

Of all variables considered (table 3), PGA shows the strongest correlation with the natural logarithm (ln) of SY (table 4). PGA (i.e. the expected Peak Ground Acceleration with an exceedance probability of 10% in 50 years; Shedlock et al., 2000) relates to the probability that an earthquake causes ground movement in the catchment and is a proxy for the degree of seismic activity in a catchment. Based on figure 10a, one can argue that this correlation is mainly attributable to one observation with a high SY and a PGA-value of 3.1 m s^{-2} (i.e. the SY of the Allalah river near Sidi Akacha, Algeria; FAO, 2008). However, this catchment has very little influence on the regression (removing this observation from the regression yields the following equation: $SY=54.4e^{1.67PGA}$; $R^2 = 0.16$; $p < 0.0001$; $n = 506$). Overall, the distribution of PGA values for the considered catchments agrees well with the distribution of PGA in Africa (figure 9; Shedlock et al., 2000).

Also the variables used to characterise topography generally show significantly positive correlations with ln(SY) (table 4). Of all topographic measures, the natural logarithm of MLR (Mean Local Relief, i.e. a robust proxy for catchment slope, see table 3) shows the strongest correlation with ln(SY) (figure 10b). Likewise, lithology (quantified by the scoring variable L; see table 3) show a significant and positive correlation with ln(SY) (table 4; figure 10c).

Land use, expressed as the areal fraction of tree cover (TreeCover; Defries et al., 2000) shows a significantly negative correlation with the natural logarithm of SY (table 4; figure 10d). Since TreeCover represents a fraction and not an absolute value, this variable was not logarithmically transformed. Also catchment area correlates negatively with SY (figure 6), as do most of the considered climatic parameters (table 4; figure 10e and 10f). Variables that express the intra-annual variability in rainfall and runoff (i.e. VarP and VarRo) did not show significant correlations with ln(SY).

Evidently, all these correlations should be interpreted with care, since several of the considered catchment characteristics are also inter-correlated (table 4). For example, PGA shows significant correlations with L, MLR and several other topographic parameters. Likewise, rainfall and rainfall erosivity correlate negatively with many of the topographic measures. As earlier studies demonstrated, disentangling the importance of individual variables in explaining SY is often difficult (e.g. Verstraeten and Poesen, 2001; de Vente et al., 2011; Portenga and Bierman, 2011; Vanmaercke et al., 2014a and 2014b). Nonetheless, some insight can be obtained from the partial correlation coefficients, i.e. the correlation between two variables that remains after correcting for one or more controlling variables (see section 4.1.3). Table 5 lists the partial correlation coefficients of the considered variables after removing the effect of all other variables that relate to other factors (see table 3). These partial correlation coefficients show that seismic activity (expressed as PGA or ln(PGA)) remains clearly correlated with ln(SY) after controlling for all variables that relate to factors other than tectonics (i.e. area, topography, lithology, climate, land use, reservoir impacts and measuring procedure). This strongly indicates that the observed correlations between SY and seismicity (figure 10a) are not merely a result of inter-correlations with other factors. Likewise, most of the topographic variables and tree cover show significant partial correlations with ln(SY) (table 5). Contrary to the normal Pearson correlations (table 4, figure 10f), ln (Ro) shows a highly significant positive partial correlation with ln(SY) after controlling for all variables related to non-climatic factors (table 5). This suggests that also the average annual runoff depth explains some of the observed variation in SY after the effect of other factors is taken into account. On the other hand, other climatic variables and variables related to lithology, catchment size, reservoir impact, measuring procedure and variability in land use only show a weak (often insignificant) partial correlation with ln(SY) (table 5).

These findings were confirmed by the stepwise regression models applied to 10,000 randomly selected subsets of catchments (see section 4.1.3). Of all considered variables, TreeCover and PGA were selected in more than 98% of all cases as an explanatory of SY (figure 11). ln(MLR) was selected in 87% of the cases, followed by the natural logarithm of the annual runoff depth (68%) and the measuring method (64%). All other variables were only selected for less than half of the models (figure 11).

4.2.2 Comparison with other studies

Most of these results concur with findings from other studies exploring the factors controlling SY and erosion rates. For example, the strong topographic control on SY has been identified in several studies (e.g. Milliman and Syvitski, 1992; Montgomery and Brandon, 2002; Aalto et al., 2006; Portenga and Bierman, 2011). Likewise, negative relationships between vegetation cover and SY or erosion rates have been reported before (e.g. Bednarczyk et al., 1996; Vanacker et al., 2007; Nadal-Romero et al., 2011; Portenga and Bierman, 2011).

While it is often expected that SY decreases with catchment area due to an increased probability of sediment deposition, previous studies pointed out that such relationships need to be interpreted with care as they are often, at least partly, spurious and a result of inter-correlations between A and other catchment properties (e.g. Walling, 1983; Verstraeten and

Poesen, 2001; de Vente et al., 2007; Vanmaercke et al., 2011b). Also in this case, SY shows a significant negative correlation with A (figure 6), which becomes insignificant after controlling for the effects of other factors (table 5). Likewise, ln(A) was chosen as an explanatory variable of ln(SY) in less than half of the stepwise regression models (figure 11). This indicates that the negative trend between SY and A for African catchments can be mainly attributed to the overall lower topography and degree of seismic activity in larger catchments compared to smaller catchments (table 4) and that catchment area itself is of relatively limited importance for explaining spatial variability in SY.

Also the poor correlations between ln(SY) and the considered climatic variables concurs with findings of earlier studies. Although it can be expected that higher rainfall depth and erosivity would result in higher SY values, such trends are often not apparent for large datasets at the global or continental scale, due to the overriding effect of other parameters or interactions between rainfall and vegetation cover (e.g. Walling and Kleo, 1979; Jansson, 1988). Also Syvitski and Milliman (2007) did not detect any meaningful correlation between rainfall measures and the sediment load of rivers at a global scale and indicated that average air temperature might be a more meaningful measure of climatic impacts on SY. However, we observed no such effect (table 5). The fairly limited range of temperatures for our African dataset might explain this.

Also catchment runoff was found to have a significant but fairly limited impact on the spatial variability of SY (table 5; figure 11). Likewise, this is in line with other studies reporting that runoff has only a relatively limited impact on average SY at regional or global scales (e.g. Aalto et al., 2006; Syvitski and Milliman, 2007; Vanmaercke et al., 2014a). It has been argued that temporal variability in rainfall, runoff and (linked to this) seasonal changes in vegetation cover can have an important impact on the sediment load of rivers (Walling and Webb, 1982; Hudson, 2003; Morehead et al., 2003; Moliere et al., 2004; Markus and Demissie 2006; Alexandrov et al., 2007; Vanmaercke et al., 2010). However, none of the three considered variables expected to reflect seasonal changes in rainfall (VarP), runoff (VarRo) or vegetation cover (VarNDVI) showed a convincing correlation with SY (table 4 and 5; figure 11). This may be attributed to the large uncertainties associated with these measures, as these provide only a rudimentary estimate of the seasonal fluctuations and not necessarily of the occurrence of flood events. These measures might be insufficient to reflect the often complex feedbacks between changes in climate, vegetation cover and sediment dynamics (Morehead et al., 2003; Vanmaercke et al., 2012). It could also indicate that, while very relevant for understanding sediment dynamics at local scales, temporal variability in rainfall, runoff or vegetation is less important for understanding spatial patterns of average SY values at the continental scale.

The fact that we did not detect an impact of upstream reservoirs on the spatial variability of SY (table 4 and 5; figure 11) may be explained by the similar reasons. It is well known that upstream reservoirs can significantly reduce SY (e.g. Vörösmarty et al., 2003; Syvitski et al., 2005; Walling, 2006). The lack of a clear correlation in our study may therefore be a result of the oversimplified manner with which the influence of reservoirs was evaluated (table 3). Due to limitations in the available data, we only considered large reservoirs (Lehner et al., 2011) while also smaller ponds and reservoirs may have a significant impact on SY (e.g. Smith et al., 2002). Furthermore, our approach does not take into account the location of the reservoirs within the catchment, their trapping efficiency or the fact that some reservoirs were constructed after the SY measuring period. Nevertheless, it is also possible that the effects of reservoirs on SY is rather limited compared to other factors. Reservoir construction can easily lead to reductions in SY of a factor five (e.g. Walling, 2006). Nonetheless, such decreases remain relatively limited compared to the six orders of magnitude variation in SY for Africa (figure 6). Moreover, such reduction due to reservoir construction is often compensated for by a (re)activation of sediment sources, resulting in a quickly decreasing impact on SY downstream of the reservoir (e.g. Phillips, 2003).

Likewise, lithology explained little of the variation in SY (table 5; figure 10c; figure 11). This too might be attributed to the fact that the lithology scoring variable used provides only a rough estimate of the erodibility (table 3). Furthermore, the erodibility of rocks is also strongly controlled by the occurrence of fractures (e.g. Selby, 1980; Molnar et al., 2007; Koons et al., 2012), which are not considered by the scoring variable used. More detailed lithological descriptions and their degree of fracturing, as well as information on soil types and textures in the different catchments can be expected to explain more of the observed variability in SY. However, earlier studies also indicated that, compared to other factors such as topography and land use, lithology has often only a secondary control on SY (e.g. Bruijnzeel, 2004; Aalto et al., 2006; Syvitski and Milliman, 2007; Vanmaercke et al., 2014a).

Finally, the strong control of seismic activity on seismic activity is noteworthy. PGA showed one of the strongest observed correlations with SY (table 4, Figure 10a) and remained one of the most important explanatory variables after controlling for other factors (table 5, figure 11). As discussed in the introduction, a growing number of studies shows that seismicity can have a hitherto often neglected control on SY (e.g. Dadson et al., 2003; Cox et al., 2010; Hovius et al., 2011; Portenga and Bierman, 2011; Vanmaercke et al., 2014). Nonetheless, Africa is one of the most stable continents in terms of seismic activity (e.g. Shedlock et al., 2000), while the variability in other factors (e.g. topography, climate, land use) is very large. The fact that regional differences in seismicity have such a clear impact on observed SY can therefore be considered surprising.

Seismic impacts on SY are often attributed to earthquake-triggered landslides (e.g. Dadson et al., 2004; Hovius et al., 2011; Vanmaercke et al., 2014b). However, co-seismic landsliding mostly occurs only for earthquakes with a magnitude ≥ 4.3 (Malamud et al., 2004). Since high-magnitude earthquakes are relatively rare in Africa (ANSS, 2013), other explanations, such as the seismic weakening of rocks due to fracturing (e.g. Molnar et al., 2007; Koons et al., 2012) or an increased rate of river incision as a response to catchment uplift (e.g. Whittaker et al., 2010) are perhaps of greater importance. Overall, the linkages between seismicity and SY as well as the underlying erosion processes remain poorly understood. This is also illustrated by Cox et al. (2010) who noted that, due to unknown reasons, the spatial distribution of Lavakas (i.e. large gullies) on Madagascar mainly correlates with the occurrence of low-magnitude earthquakes.

4.3 Simulating spatial patterns of sediment yield in Africa

4.3.1 An African sediment yield model

Building on the results of our statistical analyses (see section 4.2), a multiple regression model was constructed that simulates spatial variation in SY. The selection of variables and the type of relationship (exponential or power law) was based on the results of the normal and partial correlation analyses (table 4 and 5), the individual regression analyses (figure 10) and the stepwise regression analyses (figure 11), showing that variability in SY is mainly controlled by seismicity, topography, vegetation cover and runoff ($n = 507$, $R^2 = 0.40$):

$$SY_{Pred} = 1.49 \text{ x } e^{1.24PGA} \text{ x } MLR^{0.66} \text{ x } e^{-0.05TreeCover} \text{ x } Ro^{0.24} \qquad \text{(Eq. 1)}$$

With SY_{Pred} the predicted sediment yield in t km^{-2} y^{-1}, PGA the average expected Peak Ground Acceleration with an exceedance probability of 10% in 50 years, MLR the average height difference within a radius of 5 km, TreeCover the estimated percentage of the catchment covered by trees and Ro the estimated average annual runoff depth (see table 3).

The model explains 40% of the observed variability of ln(SY) (figure 12). 74% of the predicted values deviate less than a factor five from their corresponding observed SY, while 88% deviate less than a factor ten. Hence, the unexplained variance remains relatively large. Apart from the parameters included in Eq.1, several other variables showed a significant partial correlation with SY (table 5). However, adding these to the model lead to only very small increases in explained variance. Moreover, 'Method' is the most frequently selected variable in stepwise regressions after runoff depth (figure 11). This indicates that the type of SY measurement (derived from gauging station measurements or reservoir sedimentation rates) is more important for explaining variation in SY than catchment size, lithology, air temperature, climatic variability or other considered factors. Including these other significant variables would therefore involve the risk of overfitting the model. Also 'Method' was not included in the model since it does not reflect a catchment characteristic and added little to the explained variance (figure 12).

4.3.2 Unexplained variance

The relatively low fraction of variance explained by our model (Eq. 1; R^2=0.40) can be attributed to several reasons. Firstly, the observed SY data used are characterized by important uncertainties. A large fraction of the collected SY data has a poor or unknown quality, leading to potentially large deviations between the observed and true SY value (section 2.3; figure 4). We tested if only using SY observations of 'good' or 'acceptable' quality resulted in better results. However, this would strongly compromise the representativeness of our model, since these data are mainly clustered in northern and southern Africa and very scarcely available for other parts of Africa (figure 8).

Secondly, also the variables included in the model (Eq. 1) involve important uncertainties. Although MLR provides a robust proxy of topographic steepness on global or continental scales (e.g. Montgomery and Brandon, 2002), more refined measures based on more detailed DEMs may increase the explained variance (e.g. de Vente et al., 2009). Likewise, the fractions of tree cover in each catchment are only coarse-scale estimates based on satellite imagery obtained between 1992 and 1993 (Defries et al., 2000). These estimates may deviate significantly from the actual vegetation cover in the catchment during the SY measuring period. Also the PGA-values are subject to important uncertainties, associated with the earthquake inventories and extrapolation methods they are based on (Grünthal et al., 1999; Shedlock et al., 2000). Furthermore, the Ro-values used are only crude estimates of the long-term average runoff depth (table 3; Fekete et al., 1999). Replacing these estimates by runoff measurements corresponding to the SY measuring period would most likely increase the explained variance. However, such observations were mostly unavailable.

Thirdly, also factors that are not considered by our model most likely influence SY. As discussed in section 4.2.2, the lack of clear correlations between SY and catchment area, upstream reservoirs, lithology, temporal variations in climate or other factors may be attributed to the fact that they are only of limited importance compared to other factors, but also to the errors on the parameters used to quantify these effects. More accurate measures to express these factors may better explain some of the observed variability in SY.

These issues of uncertainty relate to a more fundamental problem that affects all empirical models aiming to predict SY or erosion rates. Namely, that spatially and/or temporary lumped parameters are often inadequate to describe the complex nature of erosion and sediment transport processes that not only depend on specific factors but also on their spatial patterns, their temporal changes and their interactions (e.g. Walling, 1983; Govers, 2011; Pelletier, 2012; de Vente et al., 2013). It can therefore be expected that more advanced models that take this spatial and temporal variability and interactions into account would result in higher prediction accuracies. However, this will only be true to some extent. Model errors are determined by a trade-off between errors in model concepts (i.e. simplifications of the actual situation) and errors in the input data used (de Vente et al., 2008; Govers, 2011; de Vente et al. 2013). Furthermore, the true unexplained variance of a model not only depends on model errors but also on errors on the observed SY values (Li, 1991; Van Rompaey et al., 2001). This is also indicated by the fact that more complex, spatially distributed and process-oriented models do not necessarily perform better in predicting SY than empirical models based on spatially and temporally aggregated parameters (e.g. de Vente et al., 2008; Govers, 2011; de Vente et al., 2013).

It should also be noted that the relatively low predictive power of our model ($R^2 = 0.40$; Figure 12) is certainly not exceptional for a SY model (e.g. Merrit et al., 2003; de Vente and Poesen, 2005; Balthazar et al., 2012; de Vente et al., 2013). Since our model was based on very similar model concepts and input data as used in other empirical SY models, its somewhat lower model performance is most likely mainly due to the large uncertainties on many of the SY observations (section 2.3).

4.3.3 Spatial patterns of sediment yield in Africa

Various studies have presented maps of expected SY values in Africa (e.g. Fournier, 1960; Strakhov, 1967; Walling and Webb, 1983; Walling, 1984; Pelletier, 2012). As discussed in the introduction and already pointed out by Walling (1984), many of these maps rely on very few SY observations and/or were often based on expert judgement without a thorough analysis of the factors controlling SY.

Despite its uncertainties, our model allows for a better insight into the spatial patterns of SY in Africa. Eq. 1 was applied to the gridded datasets of PGA, MLR, TreeCover and Ro and aggregated the result to a 50x50 km² resolution (roughly corresponding to the resolution Ro, i.e. the coarsest data layer; table 3). A comparison of the resulting simulated SY map with all available SY measurements indicates very similar patterns (figure 13).

Based on seismicity, topography, land cover and runoff (see section 4.3.1) our model predicts relatively high SY values along the Rift Valley and Madagascar, while central and South-western Africa and the Sahara are generally characterized by low SY values. The highest predicted SY values occur in the Atlas mountains and the northern part of the East African Rift Valley. This corresponds well with the observed SY values (figure 13).

While the average of all available SY observations for Africa equals 634 t km^{-2} y^{-1} (section 3), the average simulated SY for the entire African continent is only 42 t km^{-2} y^{-1} (figure 13). The latter value closely corresponds to the estimated area-specific sediment flux of African rivers to the oceans before the impact of large dams (43±8.3 t km^{-2} y^{-1}; Syvitski et al., 2005) and further indicates that our model (Eq. 1) provides realistic estimates of the overall magnitude and spatial variability of SY in Africa (figure 13). The large difference between the average observed SY and the average expected SY of the African continent indicates that SY observations in Africa are biased towards erosion-prone conditions and areas. This is also evident from figure 9, showing that regions with high MLR, high PGA, significant Ro and low TreeCover values are somewhat overrepresented, compared to the rest of Africa. Nonetheless, most of these over-represented regions with high SY-values are also characterized by high population densities and face important population increases during the next decades (e.g. North-western Africa, the Ethiopian highlands, the Lake Victoria region; UN-ESA, 2011). Therefore, the overall low average SY-value for Africa certainly not implies that problems related to SY are unimportant in Africa.

5. Conclusions

Africa has been largely underrepresented in previous studies aiming to understand the factors controlling SY at regional and continental scales (e.g. table 1). By means of an extensive literature review on SY observations in Africa, we addressed this research gap. We compiled and georeferenced SY measurements for 682 African catchments (comprising more than 8340 catchment years of observations). With the exception of some countries, SY measurements are available for most of the populated regions of Africa (figure 1). Nonetheless, data availability remains relatively low compared to other continents (see section 2.2). Furthermore, SY observations derived from gauging stations measurements are often based on short (< 5 years) measuring periods and subjected to important uncertainties (figure 2 and

4). SY values derived from reservoir sedimentation rates are generally more reliable, but unavailable for large parts of Africa (figure 1).

The available SY observations display clear regional patterns: the Atlas mountains and the Rift region are generally characterized by relatively high SY values, while rivers in western and central Africa have generally lower SY values (figures 7). Extensive (partial) correlation analyses showed that these spatial patterns are best explained by differences in seismic activity, topography, vegetation cover and runoff. Combining these four factors resulted in a model that explains about 40% of the observed variation in SY (Eq. 1; figure 12). The large fraction of unexplained variance is probably attributable to the large uncertainties on many of the SY measurements, errors on the used predictive variables and the fact that other potentially relevant factors are not considered by our model. Nonetheless, this model was capable to simulate the spatial patterns of observed SY in Africa fairly well (figure 13).

These results have important implications. During the coming decades, Africa faces large population increases and important climatic changes. The fact that differences in SY at the continental scale are significantly correlated to tree cover and runoff indicates that that these changes and their impact on land cover may have significant impacts on the sediment load of African rivers. Since high sediment loads form a potential threat to many existing or planned reservoirs, such changes may also threaten the future water availability in Africa. Likewise, they may affect the ecology of various aquatic systems in Africa.

Also the fact that seismicity explains a significant part of the observed variation in SY is important. A growing number of studies shows that seismic activity can have important but hitherto often neglected impacts on contemporary erosion rates and SY. Nonetheless, most of these studies focus on regions that are seismically very active or on regions with strongly contrasting degrees of seismic activity. In Africa, however, both the differences and overall degree of seismicity are limited. It is therefore noteworthy that seismic activity still has such a clear impact on the spatial variation of SY in Africa, despite the large variability in climate, land cover and other factors. The mechanisms explaining this impact are currently poorly understood, but may be related to the seismic weakening of surface lithologies, tectonically induced changes in river base levels or (to a limited extent) earthquake-triggered landsliding. Nevertheless, this result indicates that seismic activity should not be neglected in studies focussing on SY at regional scales.

Further research is needed to quantify and understand the processes through which tectonic activity affects SY. Likewise, more detailed analyses that take into account the effects of lithology, soil characteristics, upstream reservoirs, weather conditions and land use in a spatially (and temporally) explicit way may contribute to the development of more accurate SY models. Such models will be an important tool for addressing the hydrological challenges which Africa is facing. The dataset collected in the framework of this study may be an important aid in developing such models.

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TABLES

Table 1: Overview of global sediment yield (SY) inventories, their total number of catchments for which SY was observed, the number of SY observations in Africa, the relative share of SY observations that was measured in Africa and the range of catchment areas (A) for the included African SY observations. 'N.A.' means not available.

Reference	Total # SY-observations	# African SY-observations	% of observations African	A-range Africa (km²)
Holeman (1968)	110	5	4.5	2.1×10^4 - 4.0×10^6
Fournier (1969)	139	0	0.0	N.A.
Jansen and Painter (1974)	79	3	3.8	1.1×10^6 - 4.0×10^6
Walling and Kleo (1979)	1246	13	1.0	N.A.
Dedkov & Mozzherin (1984)	3763	45	1.2	1.9×10^1 - 3.7×10^6
Jansson (1988)	1358	117	8.6	> 300[a]
de Araújo and Knight (2005)	364	23	6.3	2.9×10^{-1} - 3.6×10^6
Meybeck and Ragu (1995)	219	24	11.0	9.0×10^3 - 3.6×10^6
Milliman et al. (1995)	401	43	10.7	3.0×10^2 - 3.8×10^6
FAO (2008)	869	205	23.6	1.9×10^1 - 4.0×10^6
Milliman and Farnsworth (2011)	776	66	8.5	1.8×10^1 - 3.8×10^6

[a] 300 km² is the minimum A for the global dataset. The A-range for African catchments could not be retrieved

Table 2: Overview of all collected Sediment Yield (SY) data. For each country, the number of catchments (#), the corresponding number of catchment-years (catch. yr), the minimum and maximum catchment area (A) of the entries, the minimum and maximum reported SY values, and the sources of the data are indicated. For the number of catchments and catchment-years, a distinction is made between SY data derived from gauging station measurements (GS) or from reservoir sedimentation rates (R). 'N.A.' indicates that no data are available.

Country	# GS (catch. yr)	# R (catch. yr)	Total # (catch. yr)	min A - max A (km²)	min SY - max SY (t km^{-2}y^{-1})	Sources
Algeria	45 (307)	32 (836)	77 (1143)	93 - 44,000	63 - 7273	Achite et al. (2007); Bengueddach and Chabouni (1997); FAO (2008); Ghenim et al. (2008); Hooke (2006); Kanchoul et al. (2009); Lahlou (1996); Milliman and Farnsworth (2011); Terfous et al. (2003); Touaibia (2010)
Benin	1 (1)	N.A.	1 (1)	50,000 - 50,000	48 - 48	Milliman and Farnsworth (2011)
Botswana	1 (1)	N.A.	1 (1)	530,000 - 530,000	0.4 - 0.4	McCarthy and Metcalfe (1990)
Burkina Faso	N.A.	3 (39)	3 (39)	7.9 - 24	30 - 441	Schmengler (2010)
Cameroon	20 (60)	1 (1)	21 (61)	0.58 - 130,000	2.9 - 330	Dedkov and Mozzherin (1984); Liénou et al. (2005); Liénou (2007); Liénou et al. (2009); Milliman and Farnsworth (2011); Ndam Ngoupayou et al. (2007); Nouvelot (1969); Olivry (1977)
Cape Verde	5 (30)	N.A.	5 (30)	1.9 - 11	10 - 4300	Olivry (1989); Tavares (2010)
Central African Rep.	7 (14)	N.A.	7 (14)	2590 - 553,900	3.1 - 9.3	Coynel et al. (2005); Laraque et al. (2009); Liénou et al. (2005); Walling (1984)
Chad	10 (31)	N.A.	10 (31)	14,300 - 515,000	1.2 - 65	Carré (1972); Dedkov and Mozzherin (1984); Liénou et al. (2005)
Congo D.R.	7 (11)	N.A.	7 (11)	8.5 - 3,800,000	2.4 - 70.6	Bombi et al. (2000); Laraque et al. (2009); Lootens and Kishimbi (1986); Lootens and Lumbu (1986); Milliman and Farnsworth (2011)
Congo Republic	6 (18)	N.A.	6 (18)	13,500 - 3,500,000	4.2 - 9.4	Laraque et al. (2009); Liénou et al. (2005)
Egypt	N.A.	1 (1)	1 (1)	2,960,000 - 2,960,000	41 - 41	Shahin (1993)
Eritrea	N.A.	1 (17)	1 (17)	174 - 174	2241 - 2241	Nyssen et al. (2004)
Ethiopia	58 (323)	20 (124)	78 (447)	0.72 - 172,254	0.2 - 8387	Balthazar et al. (2012); BCEOM (1997); FAO (2008); Guzman et al. (2012); Haregeweyn et al. (2008); Haregeweyn et al. (2012); Kissi et al. (2011); Meshesha et al. (2011); Nyssen et al. (2004); Nyssen et al. (2009); SCRP (2000a); SCRP (2000b); SCRP (2000c); SCRP (2000d); SCRP (2000e); Shahin (1993); Tamene et al. (2006); Vanmaercke et al. (2010); Van Opstal (2011); Zenebe et al. (2013)
Gambia	1 (1)	N.A.	1 (1)	77,000 - 77,000	2.6 - 2.6	Milliman and Farnsworth (2011)
Ghana	21 (33)	5 (50)	26 (83)	0.35 - 400,000	9.1 - 15,699	Adwubi et al. (2009); Akrasi (2005); Akrasi and Ansa-Asare (2008); Amegashie et al. (2011); Milliman and Farnsworth (2011)
Guinea	2 (2)	N.A.	2 (2)	9600 - 16,000	21 - 24	Liénou et al. (2005); Milliman and Farnsworth (2011)
Ivory Coast	7 (10)	N.A.	7 (10)	0.02 - 97,000	6.1 - 169	Mathieu (1971); Milliman and Farnsworth (2011)
Kenya	20 (161)	4 (26)	24 (187)	24 - 42,000	8.2 - 6330	Brown et al. (1996); FAO (2008); Kithiia (1997); Milliman and Farnsworth (2011); Ning Ma (2006); Ongweny (1978); Ongweny et al. (1993); UN-WATER (2006)
Lesotho	16 (98)	N.A.	16 (98)	212 - 19,875	3 - 2050	FAO (2008)
Liberia	1 (1)	N.A.	1 (1)	28,000 - 28,000	189 - 189	Milliman and Farnsworth (2011)
Madagascar	6 (9)	N.A.	6 (9)	575 - 59,000	169 - 3130	FAO (2008); Milliman and Farnsworth (2011)
Malawi	17 (19)	N.A.	17 (19)	0.05 - 12,110	7.2 - 1605	Amphlett (1984); Hecky et al. (2003)
Mali	8 (37)	N.A.	8 (37)	17.5 - 141,000	3.9 - 31	Droux et al. (2003); Liénou et al. (2005); Picouet (1999); Picouet et al. (2001)
Morocco	19 (19)	19 (314)	38 (333)	7.66 - 114,000	100 - 4620	Abdellaoui et al. (2002); FAO (2008); Hooke (2006); Jansson (1982); Milliman and Farnsworth (2011); Walling (1984)
Mozambique	2 (2)	1 (1)	3 (3)	410,000 - 1,300,000	37 - 135	Bolton (1984); Milliman and Farnsworth (2011)
Niger	10 (29)	N.A.	10 (29)	7500 - 757,640	4.8 - 25	Amogu (2009); Gallaire (1986)
Nigeria	13 (35)	N.A.	13 (35)	2653 - 2,200,000	7 - 344	Dedkov and Mozzherin (1984); FAO (2008); Milliman and Farnsworth (2011)
Senegal	5 (16)	N.A.	5 (16)	7500 - 270,000	2.1 - 11	Liénou et al. (2005); Milliman and Farnsworth (2011)
South Africa	38 (333)	136 (4318)	174 (4651)	0.18 - 1,000,000	1 - 890	Baade et al. (2012); Dedkov and Mozzherin (1984); FAO (2008); Foster et al. (2012); Milliman and Farnsworth (2011); Rooseboom (1978); Rooseboom et al. (1992); Scott et al. (1998)
Sudan	9 (71)	1 (13)	10 (84)	16,000 - 2,600,000	38 - 3422	Billi and el Badri Ali (2010); Dedkov and Mozzherin (1984); FAO (2008); Nyssen et al. (2004)
Tanzania	6 (24)	11 (221)	17 (245)	1.2 - 180,000	3.8 - 3132	Dedkov and Mozzherin (1984); FAO (2008); Milliman and Farnsworth (2011); Ndomba (2011); Nkotagu and Mbwano (2000); Rapp et al. (1972); Sichingabula (2000)
Togo	1 (1)	N.A.	1 (1)	29,000 - 29,000	55 - 55	Milliman and Farnsworth (2011)
Tunesia	2 (2)	41 (286)	43 (288)	0.85 - 22,000	149 - 5070	Boufaroua et al. (2006); Ghorbel and Claude (1977); Lahlou (1996); Milliman and Farnsworth (2011)
Uganda	8 (8)	N.A.	8 (8)	99 - 2121	23 - 164	Ryken (2011); Ryken et al. (2013)
Zambia	4 (6)	N.A.	4 (6)	54 - 686	1.2 - 21	Sichingabula (2000); Walling et al. (2001)
Zimbabwe	1 (1)	29 (379)	30 (380)	2.4 - 514,892	10 - 704	Bolton (1984); Dedkov and Mozzherin (1984); FAO (2008); Kabell (1984); Van den wall Bake (1986)
All data	377 (1714)	305 (6626)	682 (8340)	0.02 - 3,800,000	0.2 - 15,699	

Table 3: Catchment characteristics calculated for each catchment for which the catchment boundaries could be determined (n = 507). Resolution indicates the original spatial resolution of the data layer from which the parameter was derived. 'N.A.' indicates not applicable.

Variable	Factor	Description	Derived from	Resolution	Units
A	Size	Orignially reported catchment area.	Original source of the SY-data	N.A.	km²
R	Topography	Relief, i.e. the maximum altitude difference within the catchment.	ERSDAC (2009)	30" x 30"	m
MLR	Topography	Mean Local Relief, where local relief is the maximum altitude difference within a radius of 5000m.	ERSDAC (2009)	30" x 30"	m
Hstd	Topography	Standard deviation of the altitude within the catchment.	ERSDAC (2009)	30" x 30"	m
L	Lithology	Catchment lithology erodibility factor, defined by Syvitski and Milliman (2007). Based on a global lithology map (Dürr et al., 2005), a score was assigned to each lithology, depending on their erodibility. Scores ranged between 0.5 for erosion-resistant rock types (e.g. acidic plutonic or metamorphic rocks) and 3 for very erodible lithologies (e.g. loess).	Dürr et al. (2005)	30' x 30'	N.A.
PGA	Tectonics	Peak Ground Acceleration with an exceedance probability of 10% in 50 years.	Giardini et al. (1999); Shedlock et al. (2000)	6' x 6'	$m\ s^{-2}$
T	Climate	Average (1961-1990) annual air temperature.	New et al. (2002)	10' x 10'	° C
P	Climate	Average (1961-1990) annual rainfall.	New et al. (2002)	10' x 10'	mm
VarP	Climate	Relative monthly rainfall variability. VarP was calculated as the difference between the wettest and driest month of the year, divided by the mean monthly rainfall. Minimum, maximum and mean monthly rainfall values, were derived from average rainfall statistics for the period 1961-1990.	New et al. (2002)	10' x 10'	%
RE	Climate	Average Rainfall Erosivity. RE-values were based on the Modified Fournier Index, calculated from monthly rainfall data for the period 1998-2008 and data from literature.	Vrieling et al. (2010)	15' x 15'	$MJ\ mm\ ha^{-1}h^{-1}y^{-1}$
Ro	Climate	Estimated annual runoff depth, based on observed river discharges and simulated water balances.	Fekete et al. (1999)	30' x 30'	$mm\ y^{-1}$
VarRo	Climate	Relative monthly runoff variability. VarRo was calculated as the difference between the highest and lowest estimated monthly runoff, divided by the average monthly runoff.	Fekete et al. (1999)	30' x 30'	%
TreeCover	Land use	Estimated percentage of the catchment that is covered by trees, as derived from 1992-1993 satellite data.	Defries et al. (2000)	30" x 30"	%
VarNDVI	Land use	Estimated intra-annual changes in vegetation cover, derived from average monthly NDVI-values for the period 1982-2000 (except 1994). VarNDVI was calculated as the difference between the maximum and minimum monthly NDVI, divided by the mean monthly NDVI value.	EDIT-CSIC (2007)	6' x 6'	%
Reservoirs	Reservoir impacts	Boolean variable indicating if the catchment is potentially affected by large reservoirs (1) or not (0). Values were calculated by making an overlay between the catchment boundaries and the locations of reservoirs included in the GranD reservoir database.	Lehner et al. (2011)	N.A.	N.A.
Method	Measuring Procedure	Dummy variable to indicate if the SY-value was derived from measurements at gauging stations (0) or from bathymetric surveys of a reservoir (1)	Original source of the SY-data	N.A.	N.A.

Table 4: Pearson correlation coefficients between all considered variables (table 3) and with catchment sediment yield (SY) for the 507 catchment selected for detailed analyses. Values in bold are highly significant ($p < 0.0001$). Values in normal font are significant ($p < 0.05$). Correlations in italic are insignificant ($p > 0.05$). 'ln' indicates that the variable was logarithmically transformed.

	ln (A)	R	ln (R)	MLR	ln (MLR)	Hstd	ln (Hstd)	L	ln (L)	PGA	ln (PGA)	T	P	ln (P)	VarP	RE	ln (RE)	Ro	ln (Ro)	VarRo	TreeCover	VarNDVI	Reservoirs	Method	ln (SY)
ln (A)	1																								
R	**0.58**	1																							
ln (R)	**0.66**	**0.83**	1																						
MLR	**-0.26**	**0.30**	**0.42**	1																					
ln (MLR)	**-0.27**	**0.34**	**0.48**	**0.90**	1																				
Hstd	**0.33**	**0.88**	**0.78**	**0.59**	**0.59**	1																			
ln (Hstd)	**0.38**	**0.78**	**0.91**	**0.63**	**0.71**	**0.88**	1																		
L	*-0.03*	*0.06*	*0.08*	*0.08*	0.15	*0.03*	0.09	1																	
ln (L)	*0.02*	0.13	0.16	0.14	**0.21**	0.10	0.17	**0.97**	1																
PGA	**-0.26**	*0.02*	*0.05*	**0.31**	**0.35**	0.10	0.16	**0.20**	**0.19**	1															
ln (PGA)	**-0.19**	0.16	**0.20**	**0.35**	**0.43**	**0.26**	**0.34**	**0.22**	**0.21**	**0.84**	1														
T	**0.29**	-0.16	**-0.26**	**-0.64**	**-0.75**	**-0.35**	**-0.43**	**-0.36**	**-0.43**	**-0.24**	**-0.39**	1													
P	0.13	*0.03*	*0.01*	**-0.18**	**-0.24**	*0.02*	*0.02*	**-0.41**	**-0.45**	-0.12	*-0.08*	**0.37**	1												
ln (P)	*0.08*	*0.00*	*-0.03*	-0.16	**-0.22**	*0.00*	*-0.01*	**-0.42**	**-0.46**	-0.11	-0.09	**0.36**	**0.96**	1											
VarP	0.14	*-0.05*	-0.14	**-0.38**	**-0.42**	-0.17	**-0.24**	**-0.26**	**-0.25**	**-0.19**	**-0.33**	**0.57**	0.11	0.15	1										
RE	**0.22**	*-0.05*	-0.11	**-0.41**	**-0.48**	-0.13	**-0.18**	**-0.49**	**-0.52**	**-0.25**	**-0.29**	**0.63**	**0.79**	**0.78**	**0.52**	1									
ln (RE)	0.09	-0.10	-0.14	**-0.30**	**-0.35**	-0.15	**-0.19**	**-0.42**	**-0.44**	-0.16	**-0.24**	**0.47**	**0.63**	**0.76**	**0.48**	**0.78**	1								
Ro	0.14	0.10	0.13	*-0.04*	*-0.06*	0.13	0.14	**-0.23**	**-0.23**	-0.09	*-0.04*	0.16	**0.76**	**0.66**	*0.06*	**0.60**	**0.41**	1							
ln (Ro)	0.11	*0.09*	0.10	*0.00*	*-0.06*	0.11	0.11	**-0.25**	**-0.25**	-0.09	*-0.07*	0.14	**0.68**	**0.70**	0.11	**0.57**	**0.54**	**0.81**	1						
VarRo	*-0.01*	*-0.05*	*-0.08*	*-0.03*	*-0.04*	*-0.07*	-0.10	*0.08*	0.10	*0.04*	*-0.06*	*0.08*	**-0.38**	**-0.36**	**0.31**	**-0.19**	-0.14	**-0.34**	**-0.34**	1					
TreeCover	*-0.02*	*0.02*	*0.06*	0.13	*0.03*	0.09	0.12	**-0.39**	**-0.42**	*-0.02*	*0.07*	0.12	**0.52**	**0.52**	**-0.22**	**0.34**	**0.31**	**0.30**	**0.34**	**-0.30**	1				
VarNDVI	0.10	-0.13	**-0.21**	**-0.47**	**-0.40**	**-0.25**	**-0.31**	*-0.06*	*-0.07*	-0.13	**-0.23**	**0.38**	0.17	**0.26**	**0.51**	**0.45**	**0.48**	*0.05*	0.15	0.09	**-0.25**	1			
Reservoirs	**0.39**	**0.28**	**0.30**	*0.02*	*0.04*	**0.18**	**0.18**	*0.08*	0.14	**-0.19**	**-0.20**	-0.10	**-0.28**	**-0.27**	-0.11	**-0.25**	**-0.20**	**-0.19**	-0.14	0.16	-0.09	-0.14	1		
Method	**-0.37**	**-0.28**	**-0.28**	*0.02*	0.11	**-0.24**	**-0.24**	**0.20**	**0.20**	*-0.04*	*-0.02*	**-0.29**	**-0.49**	**-0.48**	**-0.23**	**-0.47**	**-0.39**	**-0.33**	**-0.32**	**0.22**	**-0.19**	-0.09	**0.19**	1	
ln (SY)	**-0.26**	0.11	*0.06*	**0.28**	**0.40**	**0.19**	0.16	**0.31**	**0.31**	**0.41**	**0.34**	**-0.36**	**-0.30**	**-0.26**	*-0.03*	**-0.32**	**-0.19**	-0.10	*-0.07*	*0.07*	**-0.39**	*0.03*	*-0.02*	**0.20**	1

Table 5: Partial correlation coefficient (partial r) and corresponding p-value for each considered variable with ln(SY) (i.e. the natural logarithm of the catchment sediment yield). Each partial correlation was calculated by controlling for all variables that relate to different factors than the considered variable (see table 3). For example: the partial r for PGA was calculated by controlling for all other variables except 'ln(PGA)'. Variables in bold show a very significant partial correlation ($p < 0.0001$). Variables in normal font show a significant partial correlation ($p < 0.05$). Variables in italic are insignificantly partially correlated ($p > 0.05$).

Variable	Factor	partial r	p-value
PGA	Tectonics	0.34	< 0.0001
ln (PGA)	Tectonics	0.28	< 0.0001
Hstd	Topography	0.28	< 0.0001
R	Topography	0.27	< 0.0001
TreeCover	Land use	-0.27	< 0.0001
ln (R)	Topography	0.23	< 0.0001
ln (Hstd)	Topography	0.23	< 0.0001
ln (MLR)	Topography	0.22	< 0.0001
ln (Ro)	Climate	0.19	< 0.0001
ln (RE)	Climate	0.14	0.0017
Ro	Climate	0.14	0.0026
MLR	Topography	0.13	0.0029
L	Lithology	0.12	0.0060
Method	Measuring Procedure	0.12	0.0100
VarP	Climate	0.11	0.0136
RE	Climate	0.09	0.0467
ln L	Lithology	0.09	0.0539
ln P	Climate	0.08	0.0612
VarRo	Climate	-0.08	0.0672
VarNDVI	Land use	0.08	0.0854
ln A	Size	-0.07	0.1291
P	Climate	0.04	0.3751
Reservoirs	Reservoir impacts	0.03	0.5257
T	Climate	-0.02	0.5957

FIGURES

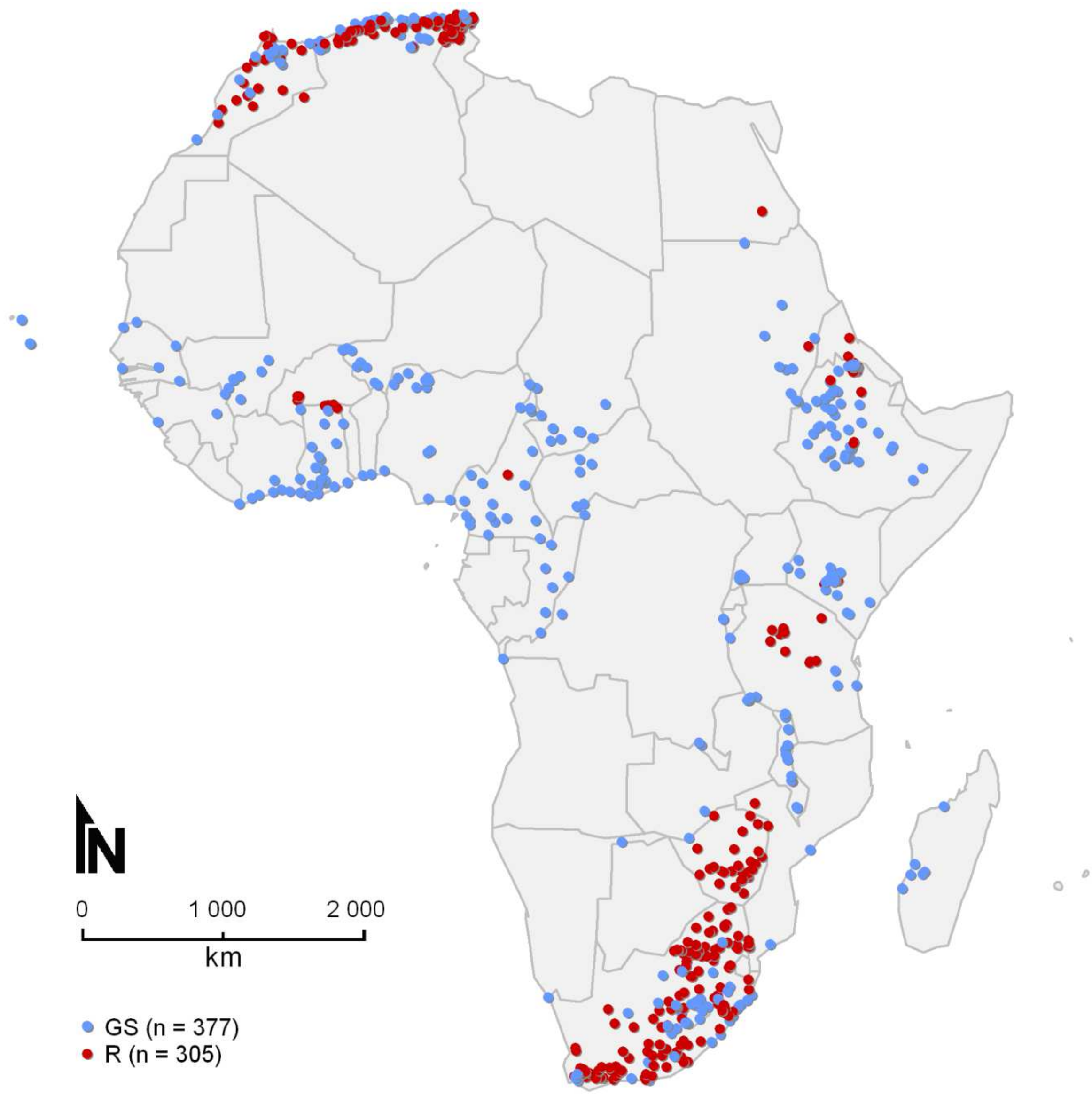

Figure 1: Location of the outlets of all African catchments for which a sediment yield measurement (SY) is available and included in this study. ‘GS’ = SY was derived from gauging station measurements, ‘R’ = SY was derived from sedimentation rates in a reservoir. ‘n’ = number of catchments.

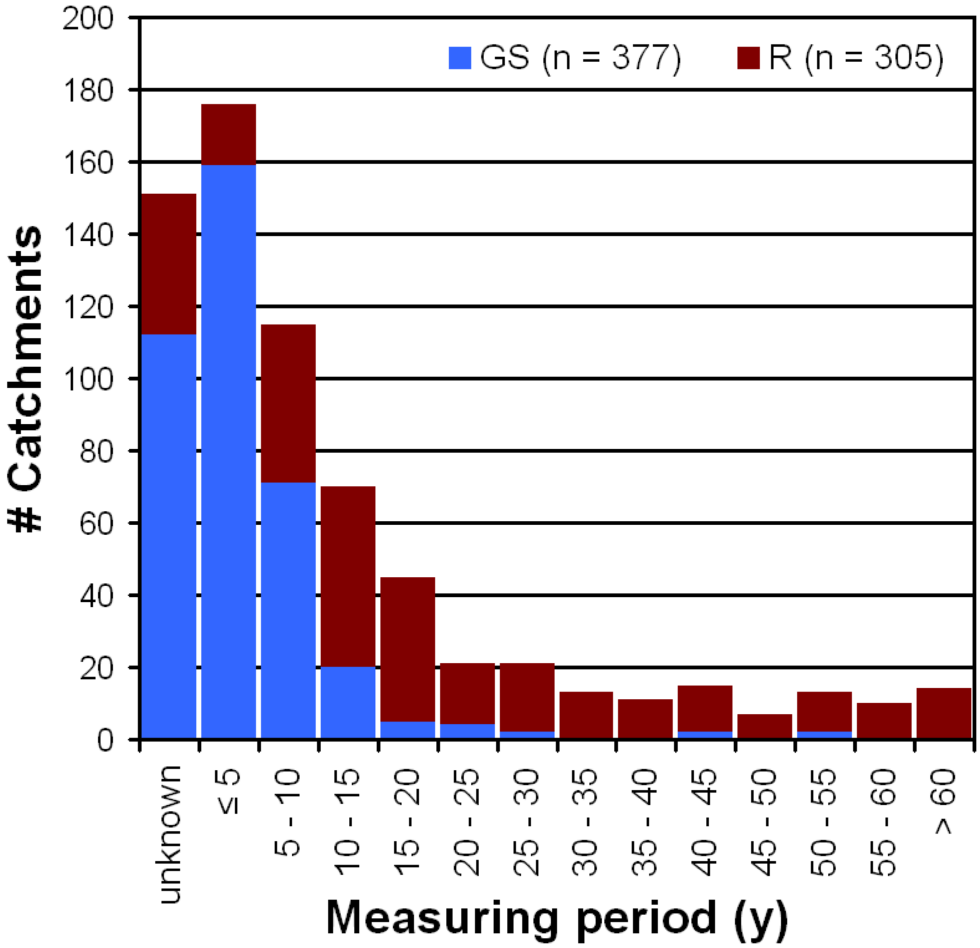

Figure 2: Number of African catchments for which sediment yield (SY) data are available, according to the measuring period of the SY observation. A subdivision is made according to the measuring method: ‘GS’ = SY was derived from gauging station measurements (377 catchments); ‘R’ = SY was derived from sedimentation rates in a reservoir (305 catchments).

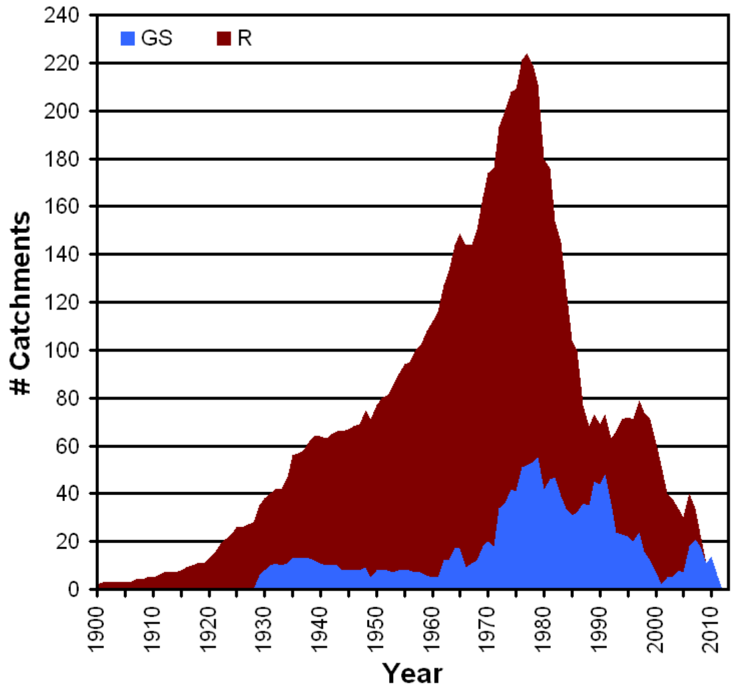

Figure 3: Temporal coverage of the catchments with a sediment yield (SY) observation for which the start and end date of the SY measurement was known (n = 495). A subdivision is made according to the measuring method: GS = SY was derived from measurements at a gauging station (250 catchments); R = SY was derived from reservoir sedimentation rates (245 catchments).

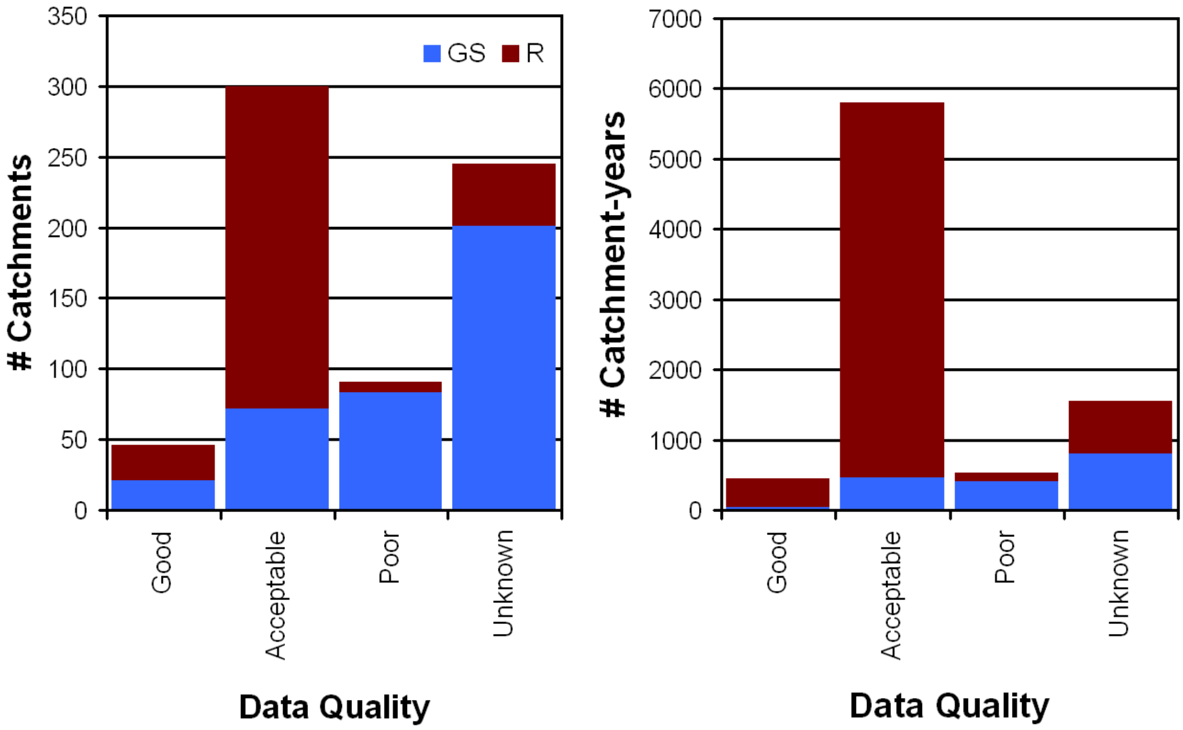

Figure 4: Number (#) of catchments (left) and the corresponding number of catchment-years (right) according to the estimated quality of their sediment yield (SY) measurement. A subdivision is made according to the measuring method: 'GS' = SY was derived from gauging station measurements (377 catchments); 'R' = SY was derived from sedimentation rates in a reservoir (305 catchments). A measuring period of 1 year was assumed for SY observations with an unknown measuring period.

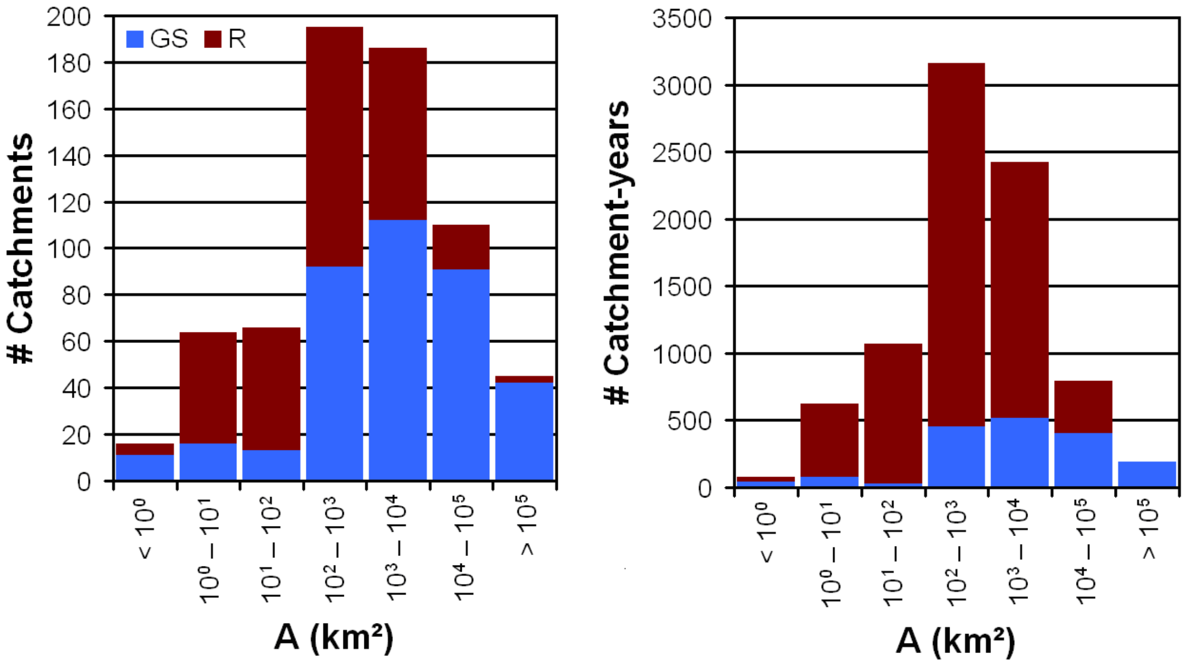

Figure 5: Number (#) of catchments (left) for which sediment yield (SY) data are available and the corresponding number of catchment-years (right) according to the area (A) of the catchment. A subdivision is made according to the measuring method: 'GS' = SY was derived from gauging station measurements (377 catchments); 'R' = SY was derived from sedimentation rates in a reservoir (305 catchments). A measuring period of 1 year was assumed for SY observations with an unknown measuring period.

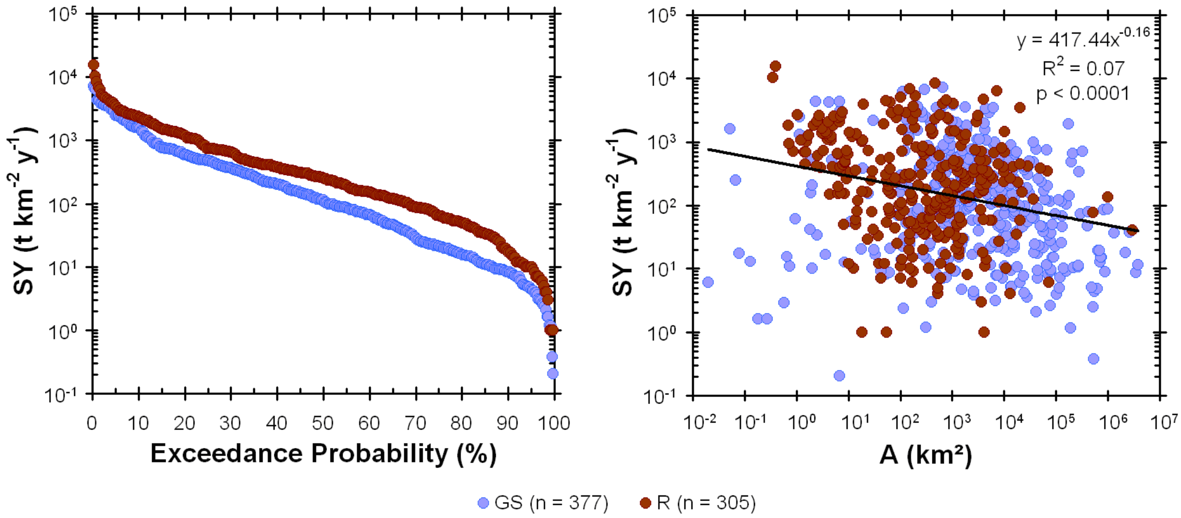

Figure 6: Left: Exceedance Probability of all observed African catchment yields (SY) reported in this study. Right: scatter plot of these SY data and their corresponding catchment area (A). In both graphs, SY observations are subdivided according to their measuring method (GS = gauging station, R = reservoir). The regression (right) is based on all data (n = 682).

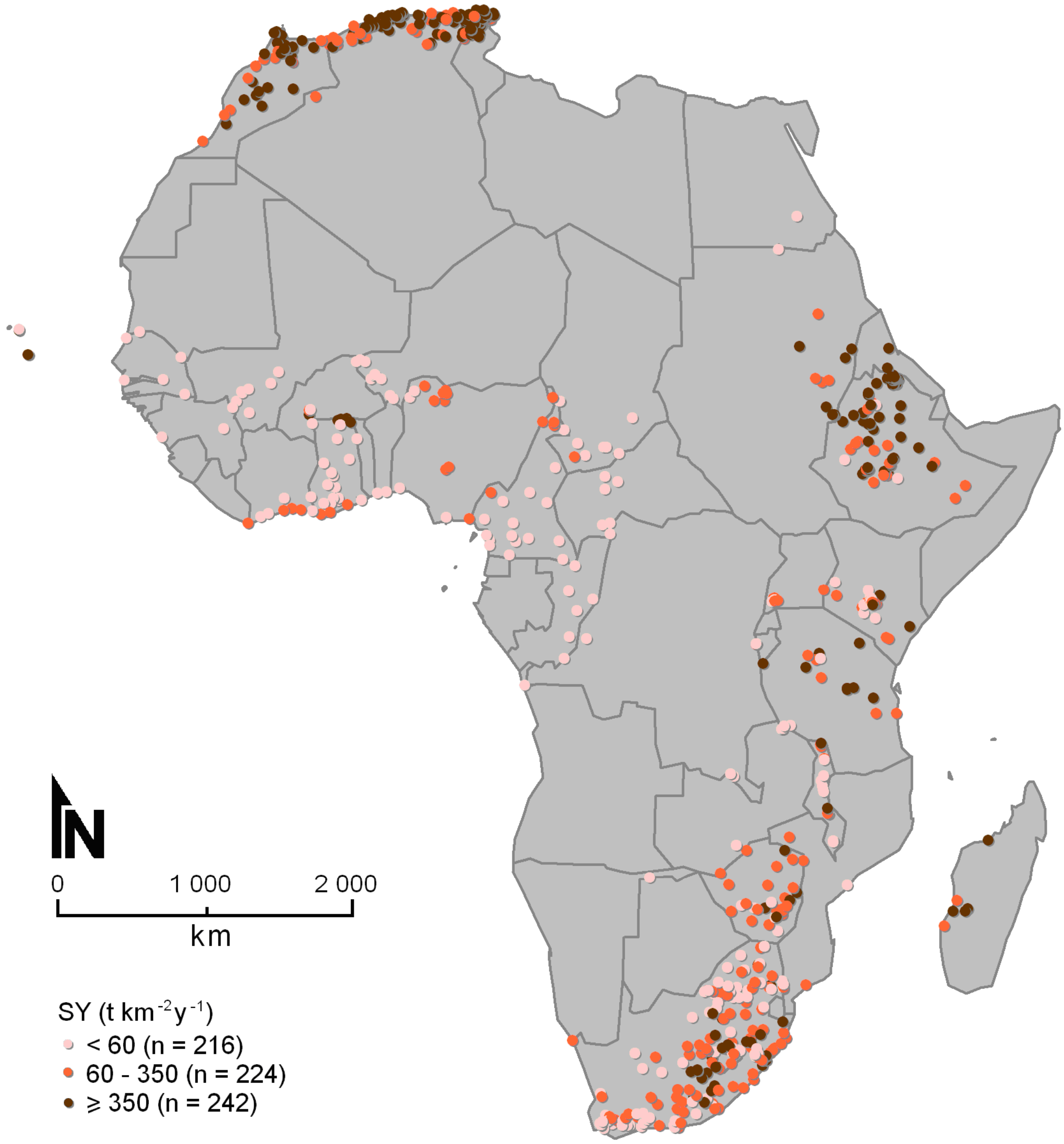

Figure 7: Catchment sediment Yield (SY) in Africa, based on all SY observations reported in this study. The subdivision in SY classes was made so that each class contains ca. one third of all the observations. Each dot corresponds to the outlet of a catchment for which SY was measured. 'n' = number of catchments.

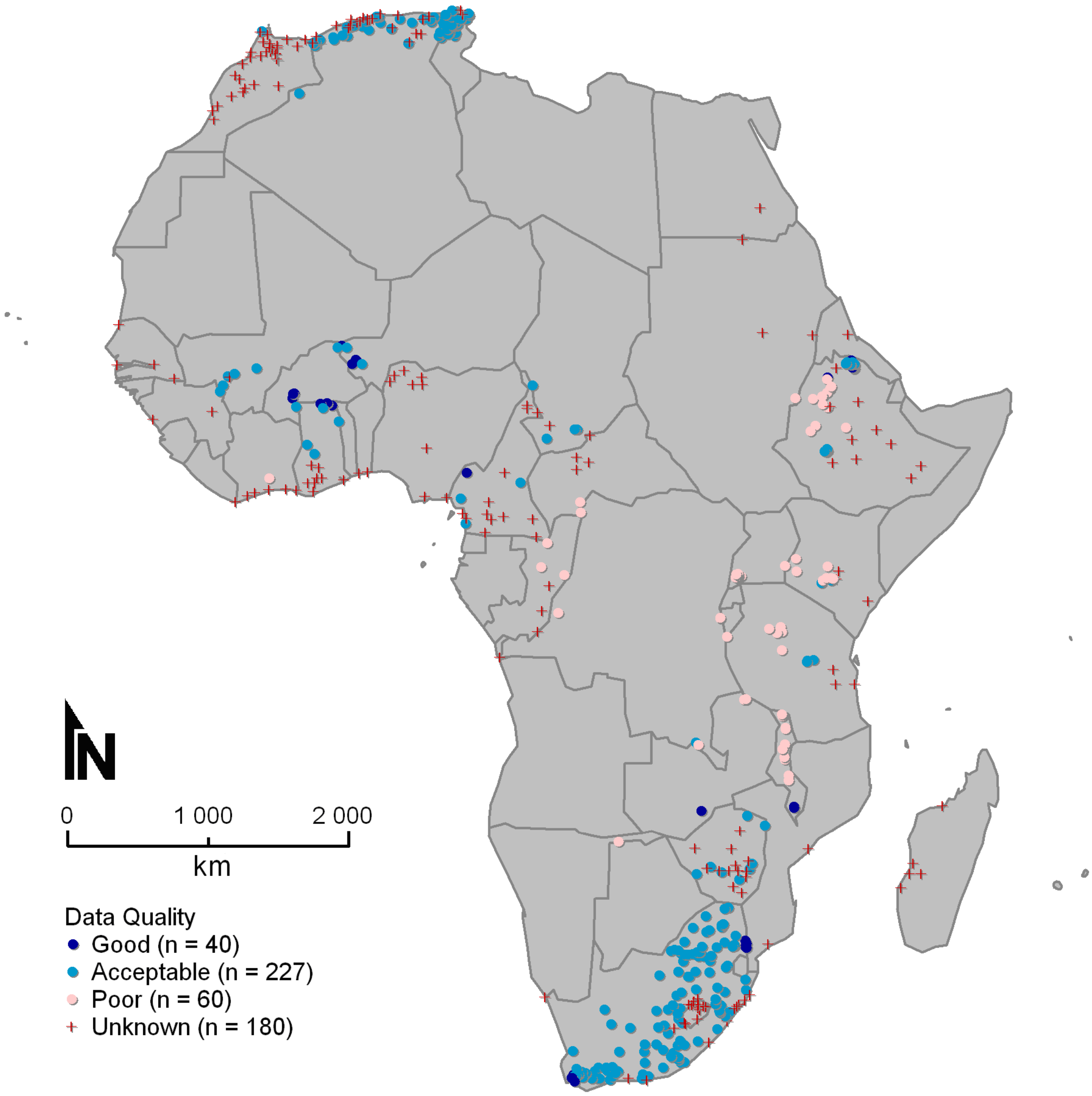

Figure 8: Location of the outlets of the 507 catchments with available sediment yield (SY) observations for which the catchment boundaries could be delineated. Symbols indicate the estimated data quality of the SY observation. 'n' = number of catchments.

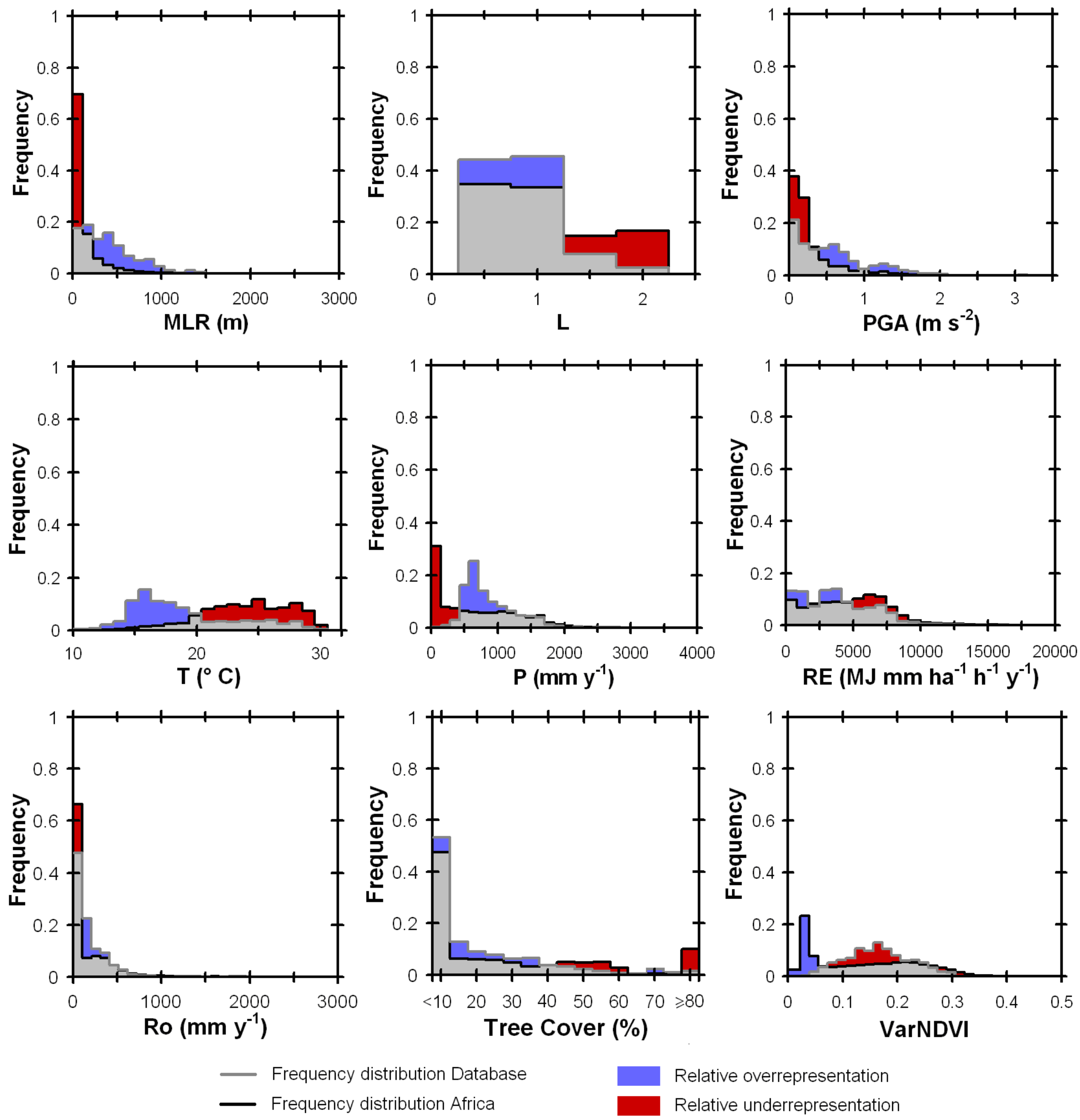

Figure 9: Relative frequency distribution of catchment characteristics for the 507 catchments for which the catchment boundaries could be delineated ('Database') compared to the frequency distribution of the same characteristic for entire Africa. See table 3 for an explanation of the variables. Relative overrepresentation (underrepresentation) means that the selected catchments overrepresent (or underrepresent) the indicated range of the characteristic.

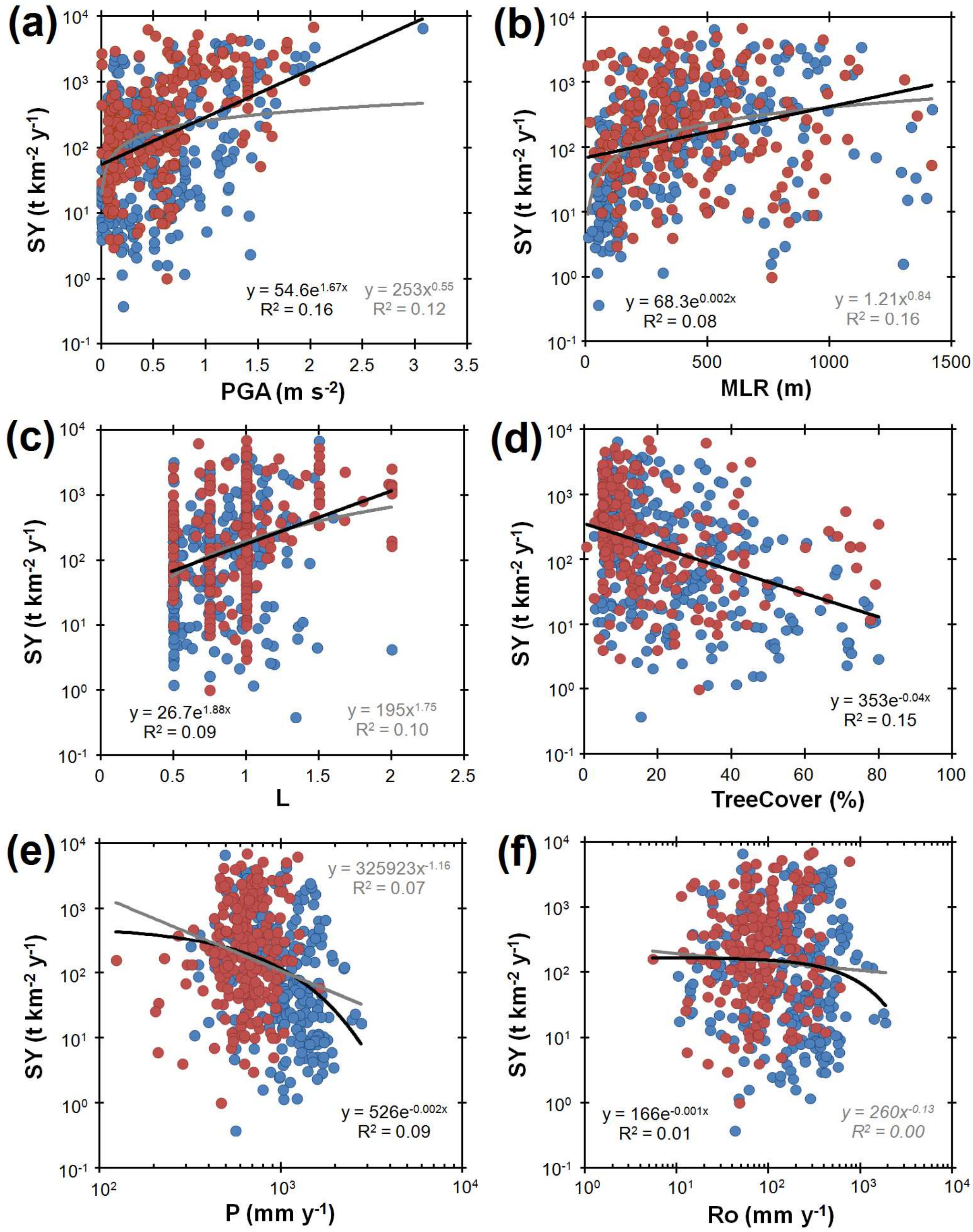

Figure 10: Scatter plots of observed catchment sediment yield (SY) and some characteristics for the 507 catchments for which the catchment boundaries could be delineated (figure 8). Blue dots represent SY observations derived from gauging station measurements (n = 269), while red dots represents SY values derived from reservoir sedimentation rates (n = 238). See table 3 for explanation of the catchment characteristics. Regressions are based on the pooled observations of both data types. The regressions in black show the best exponential fit, while regressions in grey show the best power fit. For (d) only an exponential relationship is shown since TreeCover represents a fraction. Equations in italic are insignificant at the 0.05 level (see table 4).

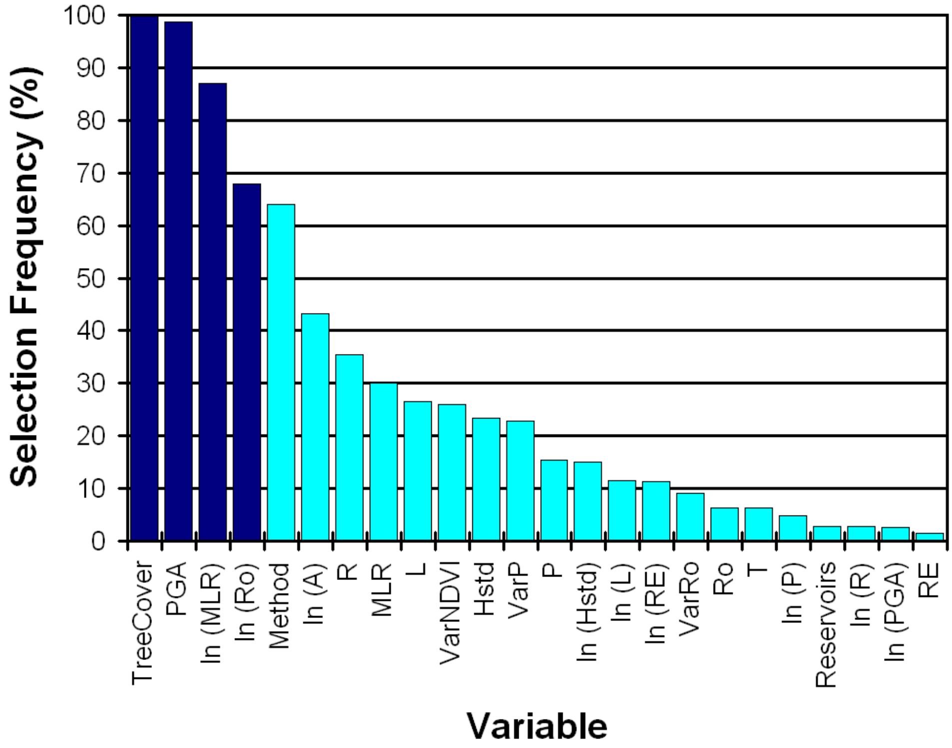

Figure 11: Frequency with which potential explaining variables were selected during an automated stepwise regression procedure to predict ln(SY) for 10,000 randomly selected subsets containing between 30 and 70% of the original 507 catchments for which the catchment boundaries could be delineated (see section 4.1). See table 3 for explanation of the variables. Variables in darker colour were incorporated in the proposed regression model (Eq. 1).

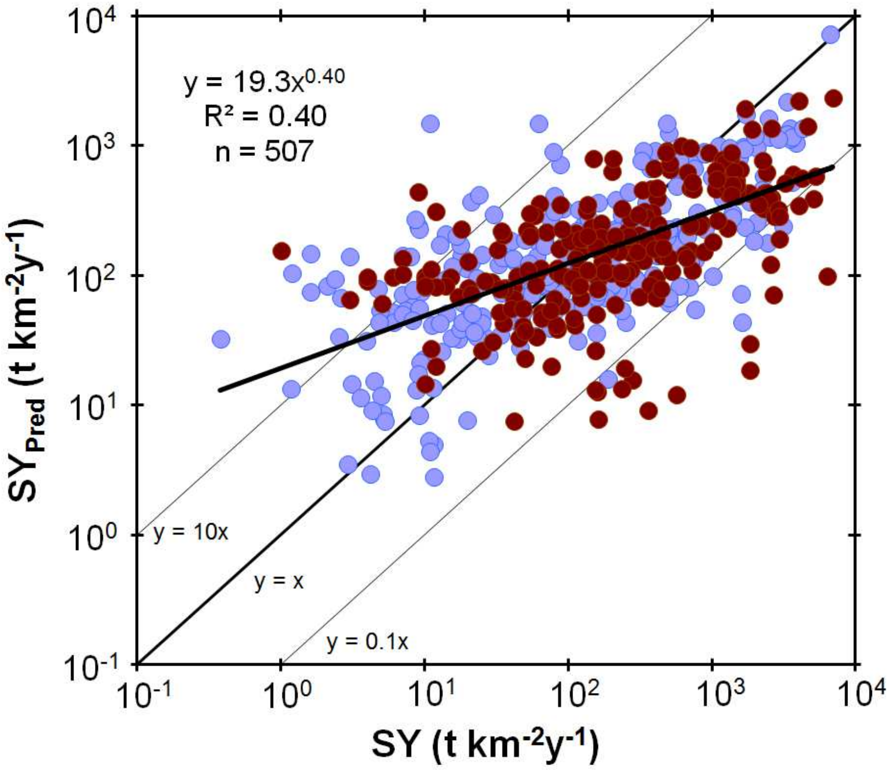

Figure 12: Observed catchment sediment yield (SY), versus the corresponding predicted value (SY_{Pred}), using the regression model (Eq. 1) for all catchments for which the catchment boundaries could be delineated (see section 4.1).

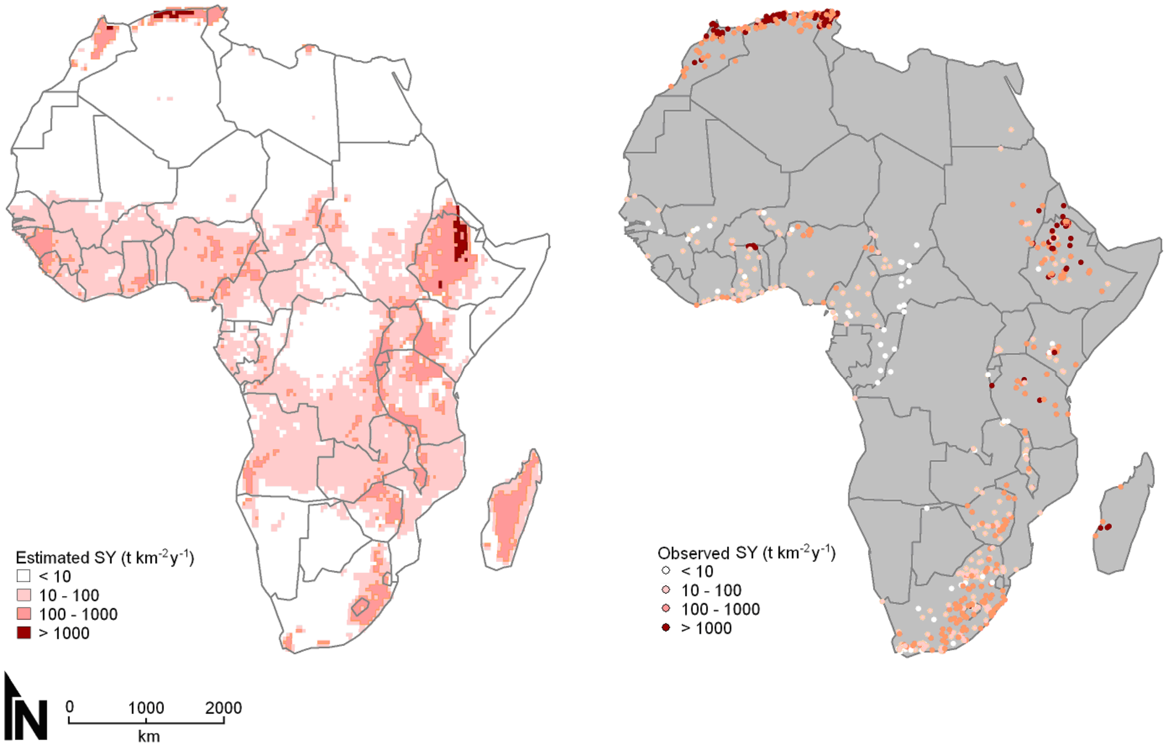

Figure 13: Left: Estimated spatial patterns of sediment yield (SY) in Africa, obtained by applying Eq. 1 to gridded datasets (table 3) and resampling the obtained pixel-values to a 50x50 km² resolution. Right: observed catchment sediment yields at their outlet location according to the same classification as the left map for all catchments with available SY observations (n = 682).

Appendix to:
"Sediment Yield in Africa"
Vanmaercke et al., 2014, Earth-Science Reviews

Table Explanation:

Column	Explanation
ID	Entry identifier.
Country	Country in which the SY observation was made.
River/Catchment Name	Name of the river/catchment (if available).
Measuring location	Description of the measuring location.
Lat (°)	Estimated latitude of the measuring location.
Lon (°)	Estimated longitude of the measuring location.
Coord. Quality	Estimated quality of the coordinates of the measuring location. 'A' indicates that the coordinates are most likely correct and accurate, 'B' indicates that the location is probably fairly accurate, but that the actual measuring location may be located further up- or downstream. 'C' indicates that the coordinates only provide a 'best guess' of the measuring location, subject to large uncertainties.
A (km²)	Catchment area (km²).
SY (t/km²/y)	Area-specific catchment sediment yield. For the majority of the observations, this value corresponds with the SY-value reported in the indicated data source. However, in some cases the SY-value was corrected for potential errors (e.g. corrected for the trapping efficiency of the resevoir) or (re-)calculated based on data provided in the listed sources. It is therefore recommended to also consult the original data sources, when using these SY values.
MP	Description of the measuring period. 'HY' stands for 'Hydrological Year' (the start and end date of such a year depends on the study considered). 'N.A.' means that the measuring period is not available.
MP length (y)	Duration of the measuring period in year. 'N.A.' indicates that the duration of the measuring period is unknown.
Type	Method used to obtain the SY value. 'R' indicates that the SY value was obtained from bathymetric surveys in a reservoir. 'GS' indicates that the value was obtained from measurements at a gauging station. 'GS (TL)' indicates that both the suspended sediment and the bedload were measured at the gauging station.
Data Quality	Estimated quality of the SY value. A = good quality, B = acceptebale quality, C = poor quality, U = unknown quality. See article text for an explanation of the criteria used. Please note that these estimates are only based on the information available to the authors and are to some extent subjective. They should be interpreted with care.
Reference	Original references for the indicated entry.
GIS	Indicates whether this catchment was considered (1) or not (0) in the detailed analysis of the paper (section 4).

ID	Country	River/Catchment Name	Measuring location	Lat (°)	Lon (°)	Coord. Quality	A (km²)	SY (t/km²/y)	MP	MP length (y)	Type	Data Quality	Reference	GIS
1	Algeria	Mouilah	near Maghnia	34.8783	-1.7568	B	1680	126	N.A.	N.A.	GS	U	Achite and Ouillon, 2007	1
2	Algeria	Abd	Ain Hamara	35.4039	0.6797	B	2480	136	1973 - 1995	23	GS	B	Achite and Ouillon, 2007	1
3	Algeria	Leham	unknown	35.6923	4.9323	B	5600	104	N.A.	N.A.	GS	U	Achite and Ouillon, 2007	0
4	Algeria	Tleta	Ghazaouet	35.0968	-1.8590	B	100	297	1972 - 1979	8	GS	U	FAO, 2008	0
5	Algeria	Ressoul	Ain Berda	36.6510	7.5926	A	103	214	1972 - 1979	8	GS	U	FAO, 2008	1
6	Algeria	Gueiss	F. El Gueiss	35.4741	6.9377	B	144	196	1972 - 1979	8	GS	U	FAO, 2008	1
7	Algeria	Chouly	R N 7	34.8659	-1.1353	B	170	75	1972 - 1979	8	GS	U	FAO, 2008	1
8	Algeria	Hachem	Bordj Ghobeni	36.5742	2.2956	B	215	1542	1972 - 1979	8	GS	U	FAO, 2008	1
9	Algeria	Bouroumi	Tarzoult	36.4152	2.6349	B	215	3345	1972 - 1979	8	GS	U	FAO, 2008	1
10	Algeria	Ebda	Arib Ebda	36.3179	2.0247	B	270	2493	1972 - 1979	8	GS	U	FAO, 2008	1
11	Algeria	Allalah	Sidi Akacha	36.4643	1.3118	B	295	6654	1972 - 1979	8	GS	U	FAO, 2008	1
12	Algeria	Reboa	Reboa	35.5035	6.5090	B	296	594	1972 - 1979	8	GS	U	FAO, 2008	1
13	Algeria	Assif Tala	R N 25	36.7265	3.9521	B	300	806	1972 - 1979	8	GS	U	FAO, 2008	0
14	Algeria	Chiffa	Amont des Gorges	36.4242	2.7587	B	316	2461	1972 - 1979	8	GS	U	FAO, 2008	1
15	Algeria	El Harrach	Hammam Melouane	36.4880	3.0450	B	387	1630	1972 - 1979	8	GS	U	FAO, 2008	1
16	Algeria	Djer	El Aferoun	36.4705	2.6172	B	395	1729	1972 - 1979	8	GS	U	FAO, 2008	1
17	Algeria	Haddad	S. A. Djillali	35.3852	0.4931	B	470	103	1972 - 1979	8	GS	U	FAO, 2008	0
18	Algeria	Hamman	Zit Emba	36.6460	7.3211	C	485	197	1972 - 1979	8	GS	U	FAO, 2008	0
19	Algeria	Deurdeur	Sidi Mokrebi	36.1295	2.2672	C	500	223	1972 - 1979	8	GS	U	FAO, 2008	0
20	Algeria	Melah	Bouchegoue	35.6322	0.5429	B	550	716	1972 - 1979	8	GS	U	FAO, 2008	0
21	Algeria	Kebir Est	Ain El Assel	36.7938	8.3739	C	680	903	1972 - 1979	8	GS	U	FAO, 2008	0
22	Algeria	Rouina	Rouina Mines	36.2515	1.8143	B	865	1151	1972 - 1979	8	GS	U	FAO, 2008	1
23	Algeria	El Abiod	Mchouneche	34.9429	5.9974	B	1050	401	1972 - 1979	8	GS	U	FAO, 2008	1
24	Algeria	Kebir Ouest	Ain Charchar	36.7432	7.2434	B	1130	92	1972 - 1979	8	GS	U	FAO, 2008	0
25	Algeria	Sly	Ouled B. Aek	36.0265	1.2657	B	1225	2037	1972 - 1979	8	GS	U	FAO, 2008	1
26	Algeria	Ksob	Medjez	35.8845	4.6168	B	1330	333	1972 - 1979	8	GS	U	FAO, 2008	1
27	Algeria	Rhiou	Ammi Moussa	35.8684	1.1155	B	1890	1822	1972 - 1979	8	GS	U	FAO, 2008	1
28	Algeria	El Arab	Khanga S Nadat	35.3589	7.1717	B	2085	539	1972 - 1979	8	GS	U	FAO, 2008	0
29	Algeria	Bousellah	Magraoua	36.4651	5.9054	B	2350	99	1972 - 1979	8	GS	U	FAO, 2008	0
30	Algeria	Mouilah	Maghnia	34.8792	-1.6917	A	2650	163.3	Sept 1977 - Aug 1995	18	GS	B	Ghenim et al., 2008	1
31	Algeria	Bou Namoussa	unknown	36.6633	7.9531	B	575	270	N.A.	N.A.	GS	U	Hooke, 2006	0

ID	Country	River/Catchment Name	Measuring location	Lat (°)	Lon (°)	Coord. Quality	A (km²)	SY (t/km²/y)	MP	MP length (y)	Type	Data Quality	Reference	GIS
32	Algeria	Bou Hamdane	near Bou Hamdane	36.4662	7.1125	B	1165	88	N.A.	N.A.	GS	U	Hooke, 2006	1
33	Algeria	Mellah	Bouchegouf	36.4590	7.7129	B	550	562	1975 - 1999	24	GS	B	Kanchoul et al., 2009	1
34	Algeria		Hamiz	36.6041	3.3519	B	139	1065.8	1935 - 1986	52	R	B	Lahlou, 1996; Bengueddach and Chabouni, 1997	1
35	Algeria		Lekhal	36.2587	3.7153	B	189	1709	1986 - ??	N.A.	R	B	Lahlou, 1996; Bengueddach and Chabouni, 1997	1
36	Algeria		Ain Dalia	36.2730	7.8236	B	193	5281.3	1989 - ??	N.A.	R	B	Lahlou, 1996; Bengueddach and Chabouni, 1997	1
37	Algeria		Meffrouch	34.9637	-1.4531	B	264	63.4	1962 - 1986	25	R	B	Lahlou, 1996; Bengueddach and Chabouni, 1997	1
38	Algeria		Sarno	35.2453	0.5969	B	264	719.9	1953 - 1986	34	R	B	Lahlou, 1996; Bengueddach and Chabouni, 1997	0
39	Algeria		Fergoug	35.5178	0.0477	B	420	1410.9	1970 - ??	N.A.	R	B	Lahlou, 1996; Bengueddach and Chabouni, 1997	0
40	Algeria		Zardezas	36.5892	6.8987	C	570	606.3	1948 - 1985	38	R	B	Lahlou, 1996; Bengueddach and Chabouni, 1997	0
41	Algeria		Ighil Emda	36.4696	5.2666	B	652	4039.5	1954 - 1986	33	R	B	Lahlou, 1996; Bengueddach and Chabouni, 1997	1
42	Algeria		near Beni Bahdel	34.7029	-1.5019	B	1016	145.6	1938 - 1986	49	R	B	Lahlou, 1996; Bengueddach and Chabouni, 1997	1
43	Algeria		H. Grouz	36.2271	6.2790	B	1220	414.6	1988 - ??	N.A.	R	B	Lahlou, 1996; Bengueddach and Chabouni, 1997	1
44	Algeria		Bakhada	35.3377	1.0545	B	1300	193.1	1936 - 1986	51	R	B	Lahlou, 1996; Bengueddach and Chabouni, 1997	1
45	Algeria		F.E. Gherza	34.8598	5.9238	B	1300	480.1	1952 - 1986	35	R	B	Lahlou, 1996; Bengueddach and Chabouni, 1997	1

ID	Country	River/Catchment Name	Measuring location	Lat (°)	Lon (°)	Coord. Quality	A (km²)	SY (t/km²/y)	MP	MP length (y)	Type	Data Quality	Reference	GIS
46	Algeria		K'sob	35.8394	4.5665	B	1500	205.6	1939 - 1986	48	R	B	Lahlou, 1996; Bengueddach and Chabouni, 1997	1
47	Algeria		Beni Amrane	36.6697	3.6079	B	3170	2598.4	N.A.	N.A.	R	B	Lahlou, 1996; Bengueddach and Chabouni, 1997	1
48	Algeria		Bouhanifia	35.2808	-0.0715	B	7850	112.4	1948 - 1985	38	R	B	Lahlou, 1996; Bengueddach and Chabouni, 1997	1
49	Algeria		Boughzoul	35.7435	2.7919	B	20500	454.8	1934 - 1986	53	R	B	Lahlou, 1996; Bengueddach and Chabouni, 1997	1
50	Algeria		Djorf Torba	31.5295	-2.7609	B	22000	160.4	1969 - 1985	17	R	B	Lahlou, 1996; Bengueddach and Chabouni, 1997	1
51	Algeria	El Harrach	near outlet	36.7356	3.1120	B	390	1615.4	N.A.	N.A.	GS	U	Milliman and Fansworth, 2011	0
52	Algeria	Agrioun	near outlet	36.6443	5.3439	B	660	7272.7	N.A.	N.A.	GS	U	Milliman and Fansworth, 2011	0
53	Algeria	Kebir	near outlet	36.8685	6.1024	B	1100	200	N.A.	N.A.	GS	U	Milliman and Fansworth, 2011	0
54	Algeria	Mazafran	near outlet	36.6840	2.7813	B	1900	1578.9	N.A.	N.A.	GS	U	Milliman and Fansworth, 2011	0
55	Algeria	Sebaou	near outlet	36.9083	3.8408	B	2500	480	N.A.	N.A.	GS	U	Milliman and Fansworth, 2011	0
56	Algeria	Isser	near outlet	36.8288	3.6585	B	4200	1976.2	N.A.	N.A.	GS	U	Milliman and Fansworth, 2011	1
57	Algeria	Seybousse	near outlet	36.8789	7.7711	B	5500	218.2	N.A.	N.A.	GS	U	Milliman and Fansworth, 2011	0
58	Algeria	Soumman	near outlet	36.7293	5.0892	B	8500	482.4	N.A.	N.A.	GS	U	Milliman and Fansworth, 2011	1
59	Algeria	Tafna	near outlet	35.2966	-1.4617	B	8800	113.6	N.A.	N.A.	GS	U	Milliman and Fansworth, 2011	1
60	Algeria	Cheliff	near outlet	36.0352	0.1341	B	44000	90.9	N.A.	N.A.	GS	U	Milliman and Fansworth, 2011	1
61	Algeria	Haute Tafna	near Beni Bahdel	34.6972	-1.4787	B	256	3000	1989 - 1998	10	GS	U	Terfous et al., 2003	0
62	Algeria	Isser	El Izdibar	34.8519	5.7384	C	1140	117	1989 - 1998	10	GS	U	Terfous et al., 2003	0
63	Algeria		Keddara	36.6485	3.4210	A	93	3215	1987 - 2001	15	R	B	Touaibia, 2010	1
64	Algeria		Bouroumi	36.3562	2.5582	A	150	6933	1986 - 2001	16	R	B	Touaibia, 2010	1

ID	Country	River/Catchment Name	Measuring location	Lat (°)	Lon (°)	Coord. Quality	A (km²)	SY (t/km²/y)	MP	MP length (y)	Type	Data Quality	Reference	GIS
65	Algeria	Oued Rherga	Guenitra	36.5838	6.9039	A	202	837	1984 - 2001	18	R	B	Touaibia, 2010	0
66	Algeria		Deurdeur	35.9968	2.2321	A	468	2306	1985 - 2001	17	R	B	Touaibia, 2010	1
67	Algeria		Cheffia	36.6228	8.0589	A	575	2713	1965 - 2001	37	R	B	Touaibia, 2010	1
68	Algeria	Fodda	Oued Fodda	36.0268	1.5981	A	800	2400	1932 - 2001	70	R	B	Touaibia, 2010	1
69	Algeria		Sidi Yacoub	35.9757	1.3133	B	920	1490	1985 - 2001	17	R	B	Touaibia, 2010	1
70	Algeria		Ain Zada	36.1527	5.1598	B	1070	438	1986 - 2001	16	R	B	Touaibia, 2010	0
71	Algeria		Hammam Debagh	36.4708	7.2183	A	1070	505	1987 - 2001	15	R	B	Touaibia, 2010	1
72	Algeria		Sidi Abdelli	35.0986	-1.1312	A	1100	210	1988 - 2001	14	R	B	Touaibia, 2010	1
73	Algeria		Oued Cherf	36.4621	7.2385	A	1735	300	1995 - 2001	7	R	B	Touaibia, 2010	0
74	Algeria		Ouizert	35.1198	-0.0328	B	2100	260	1987 - 2001	15	R	B	Touaibia, 2010	1
75	Algeria	Ghrib	Ghrib	36.1462	2.5680	B	2800	750	1939 - 2001	63	R	B	Touaibia, 2010	0
76	Algeria		Gargar	35.9158	1.0031	B	2900	2062	1988 - 2001	14	R	B	Touaibia, 2010	1
77	Algeria		Sidi M. Bénaouda	35.5634	0.6009	B	4900	336	1978 - 2001	24	R	B	Touaibia, 2010	0
78	Benin	Oueme	near outlet	6.3394	2.4634	B	50000	48	N.A.	N.A.	GS	U	Milliman and Fansworth, 2011	1
79	Botswana	Okavango	inlet of Okavango delta	-18.2696	21.7792	C	530000	0.4	N.A.	N.A.	GS (TL)	C	McCarthy and Metcalfe, 1990	1
80	Burkina Faso	Dano	Barrage du Moutori	11.2547	-3.1398	A	7.9	440.8	2002 - 2006	4	R	A	Schmengler, 2011	1
81	Burkina Faso	Wahable	Barrage de Wahable	11.5333	-3.1333	A	15	81.9	1988 - 2005	17	R	A	Schmengler, 2011	1
82	Burkina Faso	Fafo	Barrage de Fafo	11.5451	-3.0208	B	24	29.5	1988 - 2006	18	R	A	Schmengler, 2011	1
83	Cameroon		Foumban	5.7257	10.9009	C	1350	15	N.A.	1	GS	U	Dedkov and Mozzherin, 1984	0
84	Cameroon	Djerem	Mbakaou	6.3077	12.8115	B	20400	59	N.A.	1	R	U	Dedkov and Mozzherin, 1984	1
85	Cameroon	Mengong	Nsimi	3.1690	11.8123	A	0.58	2.9	1994 - 1996	3	GS	U	Liénou et al., 2005	1
86	Cameroon	Mayo Boula	Dargala	10.5321	14.6005	B	1517	221	1985 - 1986	2	GS	U	Liénou et al., 2005	1
87	Cameroon	Nyong	Mbalmayo	3.5123	11.5015	A	13555	5.2	1994 - 1996	3	GS	U	Liénou et al., 2005	1
88	Cameroon	Ntem	Ngoazik	2.2922	11.3345	B	18100	10.6	1981 - 1983	3	GS	U	Liénou et al., 2005	1
89	Cameroon	Ngoko	Mouloundou	2.0391	15.2085	B	67075	11.5	1989 - 1992	4	GS	U	Liénou et al., 2005	1
90	Cameroon	Logone	Kousséri	12.0809	15.0356	B	85000	15	1970 - 1974	5	GS	U	Liénou et al., 2005	0
91	Cameroon	Mayo Tsanaga	Douar	10.7830	13.8000	A	575	330	1977	1	GS	U	Lienou, 2007	0
92	Cameroon	Metchum	Gouri	6.2800	10.0300	B	2116	118	HY 1987/1988	1	GS	A	Lienou, 2007	1
93	Cameroon	Dja	Somalomo	3.3830	12.7330	A	5473	11.5	1989 - 1992	4	GS	U	Lienou, 2007	1

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94	Cameroon	Boumba	Biwala	3.2160	14.9160	A	10310	10.8	1989 - 1992	4	GS	U	Lienou, 2007	1
95	Cameroon	Risso	subcatchment S3	7.8639	14.7008	C	33	17	1967	1	GS	A	Lienou, 2007; Nouvelot, 1969	0
96	Cameroon	Nyong	near outlet	3.2454	9.9060	B	28000	3.6	N.A.	N.A.	GS	U	Milliman and Fansworth, 2011	1
97	Cameroon	Sanaga	near outlet	3.5692	9.6611	B	130000	46.2	N.A.	N.A.	GS	U	Milliman and Fansworth, 2011	1
98	Cameroon	Sanaga	Kiénké à Kribi	2.9386	9.9064	A	1435	19.6	2002 - 2003	2	GS	B	Ndam Ngoupayou et al., 2007	1
99	Cameroon	Sanaga	Mungo Mundame	4.5648	9.5357	A	2420	17	2002 - 2003	2	GS	B	Ndam Ngoupayou et al., 2007	1
100	Cameroon	Sanaga	Lom Bétaré Oya	5.6229	14.0793	B	11100	33.3	2002 - 2003	2	GS	B	Ndam Ngoupayou et al., 2007	1
101	Cameroon	Sanaga	Nachtigal	4.3507	11.6301	B	77000	28	1967 - 1968	2	GS	U	Olivry, 1977; Liénou et al., 2005	1
102	Cameroon	Mayo Tsanaga	Bogo	10.7350	14.5957	A	1535	188	1968;1969;1973;1985 - 1986;2002 - 2004	8	GS	U	Olivry, 1977; Liénou et al., 2009	1
103	Cameroon	Mbam	Goura	12.3379	14.5558	C	42300	85.9	1970 - 1974;1994 - 1996;2005 - 2006	10	GS	U	Olivry, 1977; Ndam Ngoupayou et al., 2007	0
104	Cape Verde	Ribeira Brava	near Ribeira Brava	16.6153	-24.2966	C	6.7	4300	1978 - 1983	6	GS	B	Olivry et al., 1989	0
105	Cape Verde	Ribeira Grande	near Estancia de Bras	16.6631	-24.3181	C	11	55	1978 - 1983	6	GS	B	Olivry et al., 1989	0
106	Cape Verde	Ribeira Seca	Grande	15.0493	-23.5814	C	1.9	157	2004 - 2009	6	GS	B	Tavares, 2010	0
107	Cape Verde	Ribeira Seca	Godim	15.0493	-23.5602	C	2.0	10.1	2004 - 2009	6	GS	B	Tavares, 2010	0
108	Cape Verde	Ribeira Seca	Longueira	15.0535	-23.6049	C	4.2	4266.5	2004 - 2009	6	GS	B	Tavares, 2010	0
109	Central African Rep.	Mpoko	Nzongo	4.1999	18.0300	C	23900	7.7	Nov 1991 - Nov 1994	3	GS	C	Coynel et al., 2005	0
110	Central African Rep.	Oubangui	Bangui	4.3547	18.5853	B	489000	5.1	Nov 1990 - Sept 1996	5	GS	C	Coynel et al., 2005	1
111	Central African Rep.	Ubangi	Mongoumba	3.6365	18.6015	B	553900	4.3	1993	1	GS	C	Laraque et al., 2009	1
112	Central African Rep.	Ouham	Batangafo	7.3090	18.2859	B	44700	9.3	1969 - 1970	2	GS	U	Liénou et al., 2005	1
113	Central African Rep.	Bangoran	near Bangoran	8.7499	19.2939	B	2590	4.4	N.A.	N.A.	GS	U	Walling, 1984	1

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114	Central African Rep.	Gribingui	near Kaga Bandora	6.9954	19.1830	B	5680	5	N.A.	N.A.	GS	U	Walling, 1984	1
115	Central African Rep.	Fafa	near Bouca	6.4977	18.2681	B	6750	3.1	N.A.	N.A.	GS	U	Walling, 1984	1
116	Chad	Pende	Doba	8.6593	16.8505	C	14300	25.4	HY 1969/1970 - HY 1970/1971	2	GS	B	Carré, 1972	0
117	Chad	Logone	Moundou	8.5598	16.0870	B	33970	65	HY 1969/1970 - HY 1970/1971	2	GS	B	Carré, 1972	1
118	Chad	Ouham	Manda	9.1888	18.2043	B	79600	9.7	HY 1968/1969 - HY 1970/1971	3	GS	B	Carré, 1972	1
119	Chad	Logone	Fort Foureau	12.0820	15.0355	B	85000	15.2	HY 1969/1970 - HY 1970/1971	2	GS	B	Carré, 1972	0
120	Chad	Chari	Fort-Archambault	9.1506	18.3940	B	193000	1.2	HY 1968/1969 - HY 1970/1971	3	GS	B	Carré, 1972	1
121	Chad	Chari	Chagoua	12.0876	15.0901	B	515000	2.5	HY 1969/1970 - HY 1970/1971	2	GS	B	Carré, 1972	1
122	Chad	Ardéba	Am Timan	11.0405	20.2937	B	80000	9	N.A.	N.A.	GS	U	Dedkov and Mozzherin, 1984	0
123	Chad	Logone	Lai	9.4010	16.2876	B	86000	50	N.A.	N.A.	GS	U	Dedkov and Mozzherin, 1984	1
124	Chad	Logone	Laï	9.3982	16.2883	B	56700	39	1969 - 1975	7	GS	U	Liénou et al., 2005	1
125	Chad	Logone	Bongor	10.2682	15.3678	B	71100	34	1969 - 1976	8	GS	U	Liénou et al., 2005	1
126	Congo DR	Kavimvira	outlet in lake Tanganyika	-3.3546	29.1545	A	42	9.1	1999 - 2000	1	GS	C	Bombi et al., 2000	1
127	Congo DR	Kalimabenge	outlet in lake Tanganyika	-3.4114	29.1344	A	89	70.6	1999 - 2000	1	GS	C	Bombi et al., 2000	1
128	Congo DR	Mulongwe	outlet in lake Tanganyika	-3.3769	29.1436	A	113	2.4	1999 - 2000	1	GS	C	Bombi et al., 2000	1
129	Congo DR	Kasaï	Mushie	-3.0357	16.9094	B	870000	8.9	1993	1	GS	C	Laraque et al., 2009	1
130	Congo DR	Upper Kafubu	Sambwa	-11.8006	27.6571	A	1540	4.7	1979 - 1984	5	GS	C	Lootens and Kishimbi, 1986	1
131	Congo DR	Lubwe	Biayi	-11.6428	27.4626	A	8.5	12.7	HY 1983/1984	1	GS	B	Lootens and Lumbu, 1986	1
132	Congo DR	Congo	near outlet	-6.0247	12.4416	B	3800000	11.3	N.A.	N.A.	GS	U	Milliman and Fansworth, 2011	1
133	Congo Republic	Likouala Mossaka	Makoua	0.0050	15.6120	B	14100	5.2	1993	1	GS	C	Laraque et al., 2009	1
134	Congo Republic	Likouala Aux Herbes	Botouali	-0.5319	17.3668	B	24800	4.2	1993	1	GS	C	Laraque et al., 2009	1

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135	Congo Republic	Sangha	Ouesso	1.6166	16.0624	B	158300	9.2	1993	1	GS	C	Laraque et al., 2009	1
136	Congo Republic	Lefini	Mbouambé	-2.9165	15.6337	B	13500	9.4	1987 - 1991	5	GS	U	Liénou et al., 2005	1
137	Congo Republic	Alima	Tchikapika	-1.2668	16.1779	B	20070	6	1987 - 1991	5	GS	U	Liénou et al., 2005	1
138	Congo Republic	Congo	Brazzaville	-4.2871	15.2907	B	3500000	8.7	1987 - 1991	5	GS	U	Liénou et al., 2005	1
139	Egypt	Nile	High Aswan	23.8944	32.8667	B	2960000	41.1	N.A.	N.A.	R	U	Shahin, 2003	1
140	Eritrea	Ghinda	near Imbatikala	15.4484	39.0896	B	174	2241.4	N.A.	17	R	U	Nyssen et al., 2004	1
141	Ethiopia	Koga	near Merawi	11.3667	37.0500	A	244	410	1983 - 1990; 1992	8	GS	C	BCEOM, 1997	1
142	Ethiopia	Fettam	Tilili	10.8500	37.0167	A	282	657	1980 - 1989; 1991 - 1992	12	GS	C	BCEOM, 1997	1
143	Ethiopia	Neshi	near Shambo	9.5500	37.3667	B	322	375	1980 - 1991	12	GS	C	BCEOM, 1997	0
144	Ethiopia	Chemoga	Debre Markos	10.3000	37.7333	B	364	444	1980 - 1992	13	GS	C	BCEOM, 1997	0
145	Ethiopia	Megech	Azezo	12.4833	37.4500	A	462	569	1980 - 1992	13	GS	C	BCEOM, 1997	1
146	Ethiopia	Muger	near Chancho	9.3000	38.7333	A	489	78	1980 - 1984; 1986 - 1992	12	GS	C	BCEOM, 1997	1
147	Ethiopia	Guder	Guder	8.9500	37.7500	B	524	90	1980 - 1981; 1983 - 1992	12	GS	C	BCEOM, 1997	0
148	Ethiopia	Dura	near Metekel	10.7833	35.5500	B	539	717	1980 - 1981; 1983 - 1985; 1987 - 1992	11	GS	C	BCEOM, 1997	0
149	Ethiopia	Upper Ribb	Debre Tabor	11.8500	38.0000	A	844	56	1982 - 1986; 1988 - 1990	8	GS	C	BCEOM, 1997	0
150	Ethiopia	Birr	near Jiga	10.6500	37.3833	A	975	2129	1980 - 1986; 1988 - 1991	11	GS	C	BCEOM, 1997	1
151	Ethiopia	Gumara	near Bahir Dar	11.8333	37.6333	A	1394	1390	1980 - 1992	13	GS	C	BCEOM, 1997	1
152	Ethiopia	Ribb	near Addis Zemen	12.0000	37.7167	A	1592	80	1982; 1984; 1986 - 1990; 1992	8	GS	C	BCEOM, 1997	1
153	Ethiopia	Gilgel Abbay	near Merawi	11.3667	37.0333	A	1664	1695.3	1980 - 1992	13	GS	C	BCEOM, 1997	1
154	Ethiopia	Angar	near Gutin	9.5500	36.6167	A	1975	89	1982 - 1983; 1987 - 1992	8	GS	C	BCEOM, 1997	0
155	Ethiopia	Dabana	near Abasina	9.0333	36.0500	A	2881	157	1980 - 1984	5	GS	C	BCEOM, 1997	1
156	Ethiopia	Beles	near Meketel	11.2000	36.3333	B	3431	456	1983 - 1990; 1992	9	GS	C	BCEOM, 1997	1

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157	Ethiopia	Angar	near Nekemte	9.4333	36.4167	A	4674	150	1980 - 1985	6	GS	C	BCEOM, 1997	1
158	Ethiopia	Abbay	near Bahir Dar	11.6000	37.4000	A	15321	68	1980 - 1981; 1983 - 1990; 1992	11	GS	C	BCEOM, 1997	1
159	Ethiopia	Abbay	Kessie	11.0667	38.1833	A	65784	751	1980; 1982 - 1990; 1992	11	GS	C	BCEOM, 1997	0
160	Ethiopia	Abbay	near border Sudan	11.2333	34.9833	A	172254	1946	1981; 1983 - 1991	10	GS	C	BCEOM, 1997	1
161	Ethiopia	Awash	Kolka	8.4690	39.1513	B	10115	1468	1959 - 1973	15	R	U	FAO, 2008	1
162	Ethiopia	Andit Tid	near Welde Ab	9.8000	39.7167	A	4.8	520	1989 - 1996	8	GS	B	Guzman et al., 2012	0
163	Ethiopia		Adihilo	13.4439	39.5675	A	0.72	950	N.A.	5	R	A	Haregeweyn et al., 2008	1
164	Ethiopia		Endazoey	13.4760	39.6765	B	1.4	695	N.A.	5	R	A	Haregeweyn et al., 2008	0
165	Ethiopia		Mejae	13.1945	39.5079	A	2.6	617	N.A.	5	R	A	Haregeweyn et al., 2008	1
166	Ethiopia		Adiakor	13.4083	39.5735	A	2.9	397	N.A.	5	R	A	Haregeweyn et al., 2008	1
167	Ethiopia		Gereb Segen	13.2570	39.4949	A	4.4	1182	N.A.	3	R	A	Haregeweyn et al., 2008	1
168	Ethiopia		Grashitu	13.2108	39.5078	A	5.1	1817	N.A.	5	R	A	Haregeweyn et al., 2008	1
169	Ethiopia		Gereb Shegel	13.5898	39.4549	A	8.6	487	N.A.	5	R	A	Haregeweyn et al., 2008	1
170	Ethiopia		Maideli	13.2208	39.5268	A	11	1429	N.A.	5	R	A	Haregeweyn et al., 2008	1
171	Ethiopia		Gindae	13.7715	39.3389	A	12	1216	N.A.	5	R	A	Haregeweyn et al., 2008	1
172	Ethiopia		Adikenafiz	13.2580	39.4083	A	14	1350	N.A.	6	R	A	Haregeweyn et al., 2008	1
173	Ethiopia		Gum Selasse	13.2422	39.5456	A	24	736	N.A.	7	R	A	Haregeweyn et al., 2008	1
174	Ethiopia	Angereb	Angereb reservoir	12.6132	37.4865	A	68	2927	1997 - 2007	20	R	A	Haregeweyn et al., 2012	1
175	Ethiopia	Unta	south of Dedo	7.4796	36.8802	B	113	6264.5	2010 - 2011	2	GS	B	Kissi et al., 2013	0
176	Ethiopia	Nada Kallo	near outlet in Gilgel Gibe reservoir	7.7570	37.3322	A	148	1176.1	2010 - 2011	2	GS	B	Kissi et al., 2013	1
177	Ethiopia	Nada Guda	near outlet in Gilgel Gibe reservoir	7.6881	37.2324	A	237	392.5	2010 - 2011	2	GS	B	Kissi et al., 2013	1
178	Ethiopia	Bulbul	near Daraba	7.7145	37.0868	A	507	675.5	2010 - 2011	2	GS	B	Kissi et al., 2013	1
179	Ethiopia	Nadie	near outlet in Gilgel Gibe reservoir	7.8670	37.2765	A	540	374.2	2010 - 2011	2	GS	B	Kissi et al., 2013	1
180	Ethiopia	Gilgel Gibe	near outlet in Gilgel Gibe reservoir	7.7577	37.1911	A	2738	279	2010 - 2011	2	GS	B	Kissi et al., 2013	1
181	Ethiopia	Boku	Lango	7.5167	38.7500	B	313	385	2008	1	GS	C	Meshesha et al., 2011	0

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182	Ethiopia	Debaba	Shala	7.4000	38.6333	B	470	214	2008	1	GS	C	Meshesha et al., 2011	0
183	Ethiopia	Blate	Shala	7.6167	38.4500	B	733	474	2008	1	GS	C	Meshesha et al., 2011	0
184	Ethiopia	Melka	Shala	7.4000	38.4167	B	746	326	2008	1	GS	C	Meshesha et al., 2011	0
185	Ethiopia	Meki	Ziway	8.1167	38.8667	B	1423	611	2008	1	GS	C	Meshesha et al., 2011	0
186	Ethiopia	Katar	Ziway	8.0500	38.9500	B	2772	494	2008	1	GS	C	Meshesha et al., 2011	0
187	Ethiopia	Midmar	near Axum	14.2090	38.9165	B	6.7	2100	N.A.	N.A.	R	U	Nyssen et al., 2004	0
188	Ethiopia	Jinbar	near Ambaras	13.2455	38.0868	A	30	2200	N.A.	1	GS	U	Nyssen et al., 2004	1
189	Ethiopia	Mesanu	near Ki'en	13.4984	39.5586	B	150	1680	N.A.	N.A.	GS	B	Nyssen et al., 2004	1
190	Ethiopia		Borkenna III dam	11.8045	39.7925	B	465	8387.1	N.A.	2	R	U	Nyssen et al., 2004	0
191	Ethiopia	Meki	Meki town bridge	8.1508	38.8225	B	1780	133	N.A.	5	GS	U	Nyssen et al., 2004	0
192	Ethiopia	Wabi Shebelle	Malka-Wakana	7.1772	39.4326	B	5290	21	N.A.	N.A.	GS	U	Nyssen et al., 2004	1
193	Ethiopia	Daketa	Hamero	7.9695	41.9399	B	14200	350	N.A.	N.A.	GS	U	Nyssen et al., 2004	0
194	Ethiopia	Fafen	Kebri-Dahar	6.7406	44.2860	B	25600	98	N.A.	N.A.	GS	U	Nyssen et al., 2004	1
195	Ethiopia	Wabi Shebelle	Hamero-Hedad	8.2142	42.0911	B	64490	124	N.A.	N.A.	GS	U	Nyssen et al., 2004	1
196	Ethiopia	Wabi Shebelle	Gode	5.9255	43.5473	B	127300	118	N.A.	N.A.	GS	U	Nyssen et al., 2004	1
197	Ethiopia	May Zegzeg	Hagere Selam	13.6393	39.1989	B	1.9	520	2000; 2006	2	GS	B	Nyssen et al., 2009	0
198	Ethiopia	Minchet	Anjeni	10.6785	37.5305	A	1.1	2456.2	1985 - 1993	9	GS	U	SCRP, 2000b	1
199	Ethiopia	Zerwa	Sidamo	6.9322	37.6378	A	0.73	10.9	1981 - 1992	12	GS	U	SCRP, 2000c	1
200	Ethiopia	Goppo	Sidamo	6.9322	37.6378	A	0.94	62.3	1981 - 1992	12	GS	U	SCRP, 2000c	1
201	Ethiopia	Maybar	South Wello	10.9960	39.6577	A	1.1	1326.6	1982 - 1989; 1992	9	GS	U	SCRP, 2000e	1
202	Ethiopia	Dizi	Illulabor	8.3667	35.6000	B	6.7	0.2	1989 - 1992	4	GS	U	SCRP, 2000f	0
203	Ethiopia	Hunde Lafto	Harerge	9.1201	40.9944	A	2.4	4296.6	1983 - 1991	9	GS	U	SCRP, 2000g	1
204	Ethiopia		Koka	8.3925	39.0859	A	4050	4749	N.A.	N.A.	R	U	Shahin, 2003	0
205	Ethiopia	Teghane	near Mek'ele	13.5300	39.4500	C	7.0	345	1996 - 2003	6	R	B	Tamene et al., 2006; Balthazar et al., 2012	0
206	Ethiopia	Laelaywukro	near Adi Kolen	13.4800	39.3600	B	9.9	649	1997 - 2003	7	R	B	Tamene et al., 2006Balthazar et al., 2012	0
207	Ethiopia	Korir	near Gurare	13.1500	39.2400	C	19	1058	1995 - 2003	9	R	B	Tamene et al., 2006Balthazar et al., 2012	0
208	Ethiopia	Gerebmihiz	near Adeba	13.1800	39.2800	C	20	3914	1997 - 2003	7	R	B	Tamene et al., 2006Balthazar et al., 2012	0

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209	Ethiopia	Endaselassie	outlet in Geba	13.4920	39.2085	A	121	733	2006 - 2007	2	GS	B	Vanmaercke et al., 2010; Zenebe et al., 2013	1
210	Ethiopia	Upper Tankwa	Abiy Addi	13.6165	38.9991	A	130	2272	2006 - 2007	2	GS	B	Vanmaercke et al., 2010; Zenebe et al., 2013	1
211	Ethiopia	Lower Tankwa	outlet in Geba	13.5378	38.8926	A	216	3627	2006 - 2007	2	GS	B	Vanmaercke et al., 2010; Zenebe et al., 2013	1
212	Ethiopia	Ilala	outlet in Geba	13.5837	39.3896	A	341	878	2004 - 2007	4	GS	B	Vanmaercke et al., 2010; Zenebe et al., 2013	1
213	Ethiopia	May Gabat	outlet in Geba	13.4702	39.2975	A	652	752	2006 - 2007	2	GS	B	Vanmaercke et al., 2010; Zenebe et al., 2013	1
214	Ethiopia	Agula	outlet in Geba	13.6252	39.4078	A	692	3784	2005 - 2007	3	GS	B	Vanmaercke et al., 2010; Zenebe et al., 2013	1
215	Ethiopia	Genfel	near Diyadib	13.6477	39.4184	A	733	497	2006	1	GS	B	Vanmaercke et al., 2010; Zenebe et al., 2013	1
216	Ethiopia	Suluh	near Diyadib	13.6494	39.4140	A	969	890	2004; 2006; 2007	3	GS	B	Vanmaercke et al., 2010; Zenebe et al., 2013	1
217	Ethiopia	Upper Geba	roadbridge Mekele - Hagere Selam	13.5409	39.3565	A	3035	1109	2006 - 2007	2	GS	B	Vanmaercke et al., 2010; Zenebe et al., 2013	1
218	Ethiopia	Middle Geba	near Adi Buda	13.5117	38.8951	A	4592	1065	2007	1	GS	B	Vanmaercke et al., 2010; Zenebe et al., 2013	1
219	Gambia	Gambia	near outlet	13.4209	-16.5522	B	77000	2.6	N.A.	N.A.	GS	U	Milliman and Fansworth, 2011	1
220	Ghana		Dua	10.9371	-0.8149	C	0.35	10270	1997 - 2007	10	R	A	Adwubi et al., 2009	0
221	Ghana		Kumpalgogo	10.9959	-0.3970	C	0.40	15699	1998 - 2007	9	R	A	Adwubi et al., 2009	0
222	Ghana		Doba	10.8902	-1.0530	B	0.70	1850	1998 - 2007	9	R	A	Adwubi et al., 2009	1
223	Ghana		Zebilla	10.9260	-0.5225	B	1.1	2668	1998 - 2007	9	R	A	Adwubi et al., 2009	1
224	Ghana	Birim	Bunso	5.7644	-1.0192	C	150	24.3	1991	1	GS	U	Akrasi and Ansa-Asare, 2008	0
225	Ghana	Anum	Konongo	6.6141	-1.2156	A	681	17.9	1991	1	GS	U	Akrasi and Ansa-Asare, 2008	1
226	Ghana	Oda	Anwia-Nkwanta	5.9987	-2.9628	C	1303	26.9	1991	1	GS	U	Akrasi and Ansa-Asare, 2008	0
227	Ghana	Ofin	Mfensi	6.7663	-1.7783	B	1515	24.8	1991	1	GS	U	Akrasi and Ansa-Asare, 2008	1
228	Ghana	Birim	Oda	5.9319	-0.9996	A	3248	40	1989 - 1991	3	GS	U	Akrasi and Ansa-Asare, 2008	1
229	Ghana	Ofin	Dunkwa	5.1163	-1.6169	C	8345	45.1	1989 - 1991	3	GS	U	Akrasi and Ansa-Asare, 2008	0

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230	Ghana	Pra	Assin-Praso	5.9325	-1.3663	B	9793	32.6	1989 - 1991	3	GS	U	Akrasi and Ansa-Asare, 2008	1
231	Ghana	Pra	Twifu-Praso	5.6034	-1.5548	B	20767	44.1	1989 - 1991	3	GS	U	Akrasi and Ansa-Asare, 2008	1
232	Ghana	Pra	Beposo	5.6014	-2.0587	B	22818	46.9	1987 - 1991	5	GS	U	Akrasi and Ansa-Asare, 2008	1
233	Ghana	Afram	Aframso	7.3251	-1.3830	B	308	14.8	N.A.	N.A.	GS	B	Akrasi, 2005	0
234	Ghana	Pru	Pruso	7.5410	-1.4962	B	1121	9.1	N.A.	N.A.	GS	B	Akrasi, 2005	1
235	Ghana	Daka	Ekumdipe	8.4034	-0.2185	B	6586	26.9	N.A.	N.A.	GS	B	Akrasi, 2005	0
236	Ghana	Oti	Saboba	9.6961	0.3483	B	54890	46.6	N.A.	N.A.	GS	B	Akrasi, 2005	1
237	Ghana	White Volta	Pwalugu	10.5899	-0.8356	B	57397	21.7	N.A.	N.A.	GS	B	Akrasi, 2005	1
238	Ghana	Black Volta	Lawra	10.6576	-2.8959	B	90658	15.2	N.A.	N.A.	GS	B	Akrasi, 2005	1
239	Ghana	White Volta	Nawuni	9.6953	-1.1048	B	96957	22.9	N.A.	N.A.	GS	B	Akrasi, 2005	0
240	Ghana	Black Volta	Bamboi	8.1588	-2.0347	B	128759	25.7	N.A.	N.A.	GS	B	Akrasi, 2005	1
241	Ghana		Bugri	10.7614	-0.1352	A	2.2	1828	1994 - 2007	13	R	A	Amegashie et al., 2011	1
242	Ghana	Ayensu	near outlet	5.4987	-0.3327	B	1700	88.2	N.A.	N.A.	GS	U	Milliman and Fansworth, 2011	0
243	Ghana	Ankobra	near outlet	4.8909	-2.2770	B	6200	290.3	N.A.	N.A.	GS	U	Milliman and Fansworth, 2011	0
244	Ghana	Pra	near outlet	5.0372	-1.6080	B	38000	63.2	N.A.	N.A.	GS	U	Milliman and Fansworth, 2011	1
245	Ghana	Volta	near outlet	5.7909	0.6579	B	400000	47.5	N.A.	N.A.	GS	U	Milliman and Fansworth, 2011	1
246	Guinea	Milo	Kankan	10.3673	-9.2960	A	9600	21.3	1987 - 1987	1	GS	U	Liénou et al., 2005	1
247	Guinea	Konkoure	near outlet	9.8212	-13.7655	B	16000	23.8	N.A.	N.A.	GS	U	Milliman and Fansworth, 2011	1
248	Ivory Coast	Bandama	Ravineau	5.9184	-4.9124	B	0.02	6.1	1964 - 1967	4	GS (TL)	C	Mathieu, 1971	1
249	Ivory Coast	St. Pedro	near outlet	4.7384	-6.6083	B	3300	21.2	N.A.	N.A.	GS	U	Milliman and Fansworth, 2011	1
250	Ivory Coast	Agneby	near outlet	5.2803	-4.3291	B	8900	168.5	N.A.	N.A.	GS	U	Milliman and Fansworth, 2011	0
251	Ivory Coast	Tano	near outlet	5.1162	-2.8939	B	16000	21.9	N.A.	N.A.	GS	U	Milliman and Fansworth, 2011	1
252	Ivory Coast	Comoe	near outlet	5.1889	-3.7110	B	78000	115.4	N.A.	N.A.	GS	U	Milliman and Fansworth, 2011	1
253	Ivory Coast	Sassandra	near outlet	4.9500	-6.0504	B	79000	36.7	N.A.	N.A.	GS	U	Milliman and Fansworth, 2011	1

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254	Ivory Coast	Bandama	near outlet	5.1512	-4.9654	B	97000	74.2	N.A.	N.A.	GS	U	Milliman and Fansworth, 2011	1
255	Kenya	Kaihungu	near Gatheru	-0.7438	37.0978	A	24	156	1991	1	GS	C	Brown et al., 1996	1
256	Kenya	Tana	Masinga	-0.9130	37.5149	A	7335	6330	1981 - 1983	3	R	U	FAO, 2008	1
257	Kenya	Tana	Kamburu	-0.8309	37.6744	A	9520	410	1974 - 1981	8	R	U	FAO, 2008	1
258	Kenya	Tana	Kindaruma	-0.8134	37.8001	A	10000	238	1968 - 1981	14	R	U	FAO, 2008	1
259	Kenya	Tana	Grand Falls	-0.2692	37.9983	B	17580	692	1948 - 1958	11	GS	U	FAO, 2008	1
260	Kenya	Mbagathi	Station: 3AA04	-1.4087	36.8713	C	272	16.4	N.A.	N.A.	GS	C	Kithiia, 1997	0
261	Kenya	Athi	Thwake	-1.7635	37.7158	C	5724	22.9	N.A.	N.A.	GS	C	Kithiia, 1997	0
262	Kenya	Athi	Tsavo	-2.9759	38.5180	B	10272	73.4	N.A.	N.A.	GS	C	Kithiia, 1997	0
263	Kenya	Athi	L. Falls	-3.0383	38.6961	C	25203	81.6	N.A.	N.A.	GS	C	Kithiia, 1997	0
264	Kenya	Nyando	near outlet Lake Victoria (?)	-0.2906	34.8743	B	3655	346	1950 - 2004	54	GS (TL)	C	Ma, 2006	1
265	Kenya	Nzoia	near outlet Lake Victoria	0.0741	33.9809	B	13691	218	1950 - 2004	54	GS (TL)	C	Ma, 2006	1
266	Kenya	Tana	near outlet	-2.2638	40.1931	B	42000	761.9	N.A.	N.A.	GS	U	Milliman and Fansworth, 2011	1
267	Kenya	Thiba	Station: 4DA2	-0.4139	37.3097	B	32	20	1974 - 1977	4	GS	C	Ongweny, 1978	0
268	Kenya	Rupingazi	Station: 4DC3	-0.5361	37.4375	A	197	37	1974 - 1977	4	GS	C	Ongweny, 1978	0
269	Kenya	Thiba	Station: 4DA10	-0.6208	37.3167	A	353	74	1974 - 1977	4	GS	C	Ongweny, 1978	0
270	Kenya	Nyamindi	Station: 4DB4	-0.6153	37.3694	A	375	12	1974 - 1977	4	GS	C	Ongweny, 1978	0
271	Kenya	Nyamindi & Rupingazi	Station: 4DC2	-0.7278	37.4889	A	740	67	1974 - 1977	4	GS	C	Ongweny, 1978	0
272	Kenya	Thiba	Station: 4DD2	-0.7317	37.5061	A	1500	308	1974 - 1977	4	GS	C	Ongweny, 1978	1
273	Kenya	Tana	Station: 4DE2	-0.8981	37.5028	A	6681	1002.8	1974 - 1977	4	GS	B	Ongweny, 1978	1
274	Kenya	Sirimon	Isiolo-Nanyuki road	0.0551	37.2071	A	62	8.6	N.A.	N.A.	GS	C	Ongwenyi et al., 1993	1
275	Kenya	Sagana	Kiganio	-0.8859	36.8626	B	501	8.2	N.A.	N.A.	GS	C	Ongwenyi et al., 1993	1
276	Kenya	Thiba	Machanga	-0.7712	37.6388	B	1970	160	N.A.	2	GS	C	Ongwenyi et al., 1993	1
277	Kenya	Nzoia	Broderick Falls	0.5833	34.8002	B	8500	50	N.A.	4	GS	C	Ongwenyi et al., 1993	1
278	Kenya	Ruiru river	Ruiru dam	-1.0468	36.7541	B	67	154	N.A.	N.A.	R	B	UN-WATER, 2006	1
279	Lesotho	Hololo	Khukhune	-28.7170	28.4046	B	212	80	1978 - 1982	5	GS	U	FAO, 2008	1
280	Lesotho	Maphutseng	Maphutsaneng	-30.3047	27.4733	B	323	500	1978 - 1982	5	GS	U	FAO, 2008	1
281	Lesotho	N. Phuthiatsana	Mapoteng	-29.1248	27.9635	B	386	2050	1976 - 1982	7	GS	U	FAO, 2008	1
282	Lesotho	Bokong	Bokong	-29.3268	28.4629	A	403	3	1978 - 1982	5	GS	U	FAO, 2008	1

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283	Lesotho	Matsoku	Seshote	-29.2714	28.5567	A	662	7	1978 - 1982	5	GS	U	FAO, 2008	1
284	Lesotho	Hlotse	Ha Setene	-28.9137	28.1083	B	728	790	1978 - 1982	5	GS	U	FAO, 2008	1
285	Lesotho	Khobelu	Tlokoeng	-29.2328	28.8785	A	852	14	1978 - 1982	5	GS	U	FAO, 2008	1
286	Lesotho	N. Phuthiatsana	Kolonyama	-29.0833	27.7162	A	905	740	1978 - 1982	5	GS	U	FAO, 2008	1
287	Lesotho	S. Phuthiatsana	Masianokeng	-28.9104	28.1301	A	945	1382	1976 - 1982	7	GS	U	FAO, 2008	1
288	Lesotho	Malibamatso	Ha Lejone	-29.1116	28.4958	A	1157	9	1976 - 1982	7	GS	U	FAO, 2008	1
289	Lesotho	Caledon	Mashili	-28.9813	28.2344	C	1560	730	1976 - 1982	7	GS	U	FAO, 2008	0
290	Lesotho	Senqu	Mokhotlong	-29.2822	29.0580	A	1660	30	1976 - 1982	7	GS	U	FAO, 2008	1
291	Lesotho	Malibamatso	Paray	-29.4848	28.6010	B	3240	60	1976 - 1982	7	GS	U	FAO, 2008	1
292	Lesotho	Senqu	Koma - Koma	-29.1057	28.0093	C	7950	70	1976 - 1982	7	GS	U	FAO, 2008	0
293	Lesotho	Senqu	White Hill	-30.0588	28.4733	B	10900	140	1976 - 1982	7	GS	U	FAO, 2008	1
294	Lesotho	Senqu	Seaka	-30.3889	27.5720	B	19875	210	1976 - 1982	7	GS	U	FAO, 2008	1
295	Liberia	Cavally (Cavalla)	near outlet	4.3500	-7.5330	B	28000	189.3	N.A.	N.A.	GS	U	Milliman and Fansworth, 2011	1
296	Madagascar	Beritsoka	Barrage	-20.2506	45.1671	C	575	3130	1970 - 1971	2	GS	U	FAO, 2008	0
297	Madagascar	Sakamaly	Migodo	-20.4171	45.0025	B	799	2440	1970 - 1971	2	GS	U	FAO, 2008	1
298	Madagascar	Morondava	Tslandava	-20.4335	44.1261	B	4255	1586	1970 - 1971	2	GS	U	FAO, 2008	1
299	Madagascar	Ikopa (Betsiboka)	near outlet	-15.8830	46.3330	B	30000	500	N.A.	N.A.	GS	U	Milliman and Fansworth, 2011	1
300	Madagascar	Tsiribihina	near outlet	-19.7324	44.3571	B	45000	266.7	N.A.	N.A.	GS	U	Milliman and Fansworth, 2011	1
301	Madagascar	Mangoky	near outlet	-21.3380	43.5446	B	59000	169.5	N.A.	N.A.	GS	U	Milliman and Fansworth, 2011	1
302	Malawi	Mindawo	near Malmbala School	-15.9425	35.0912	A	0.05	1605	N.A.	2	GS	A	Amphlett, 1984	1
303	Malawi	Mindawo 2	near Malmbala School	-15.9478	35.0923	A	0.07	250	N.A.	1	GS	A	Amphlett, 1984	1
304	Malawi	Bvumbwe	near Chigumula	-15.9317	35.0564	A	0.08	17.5	N.A.	2	GS	A	Amphlett, 1984	1
305	Malawi	Mphezo	near Malmbala School	-15.9742	35.0848	A	0.13	13	N.A.	1	GS	A	Amphlett, 1984	1
306	Malawi	Mlowe	outlet	-12.0881	34.0421	A	113	22.9	1997	1	GS	C	Hecky et al., 2003	1
307	Malawi	Namkokwe	near Outlet	-14.2228	34.6411	C	129	53.5	1997	1	GS	C	Hecky et al., 2003	0
308	Malawi	Nadzipulu	near outlet	-14.1719	34.5784	B	224	88.4	1997	1	GS	C	Hecky et al., 2003	1
309	Malawi	N. Rumphi	outlet	-10.6947	34.1919	A	680	233.8	1997	1	GS	C	Hecky et al., 2003	1
310	Malawi	Dwambadzi	near outlet	-12.4085	34.1066	C	778	7.2	1997	1	GS	C	Hecky et al., 2003	0
311	Malawi	Lufira	outlet	-9.8011	33.9042	A	1440	140.9	1997	1	GS	C	Hecky et al., 2003	1

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312	Malawi	N. Rukuru	outlet	-9.9105	33.9331	A	1970	145.2	1997	1	GS	C	Hecky et al., 2003	1
313	Malawi	Luweya	outlet	-11.7903	34.2052	A	2420	59.2	1997	1	GS	C	Hecky et al., 2003	1
314	Malawi	Songwe	near outlet	-9.6894	33.9387	C	4280	661.3	1997	1	GS	C	Hecky et al., 2003	0
315	Malawi	Dwangwa	near outlet	-12.6112	34.1715	B	7650	47.6	1997	1	GS	C	Hecky et al., 2003	1
316	Malawi	Linthipe	outlet	-13.8522	34.5592	A	8560	498.5	1997	1	GS	C	Hecky et al., 2003	1
317	Malawi	Bua	near outlet	-12.7915	34.2511	B	10700	47.9	1997	1	GS	C	Hecky et al., 2003	1
318	Malawi	S. Rukuru	near outlet	-10.7538	34.2084	B	12110	19.3	1997	1	GS	C	Hecky et al., 2003	1
319	Mali	Dounfing	near Same	12.6845	-8.0463	A	18	20.5	May 1994 - Apr 1996	2	GS	B	Droux et al., 2003	1
320	Mali	Djitiko	near Ouronima	12.0979	-8.4208	A	103	14.1	May 1994 - Apr 1996	2	GS	B	Droux et al., 2003	1
321	Mali	Belekoni	near Bougouni	11.3492	-7.4855	B	120	30.9	May 1994 - Apr 1996	2	GS	B	Droux et al., 2003	0
322	Mali	Niger	Bamako	12.6289	-7.9939	B	117000	4.9	1990 - 1992	3	GS	U	Liénou et al., 2005	1
323	Mali	Niger	Banankoro	11.6925	-8.6609	B	71000	8.2	HY 1991/1992 - HY 1997/1998	7	GS	B	Picouet et al., 2001; Picouet, 1999	1
324	Mali	Bani	Douna	13.2116	-5.9034	B	102000	3.9	HY 1991/1992 - HY 1997/1998	7	GS	B	Picouet et al., 2001; Picouet, 1999	1
325	Mali	Niger	Koulikoro	12.8721	-7.5435	B	120000	7.3	HY 1991/1992 - HY 1997/1998	7	GS	B	Picouet et al., 2001; Picouet, 1999	1
326	Mali	Niger	Ké-Macina	13.9572	-5.3568	B	141000	10.2	HY 1991/1992 - HY 1997/1998	7	GS	B	Picouet et al., 2001; Picouet, 1999	0
327	Morocco	Oued Saboun	Barrage de Saboun	35.6686	-5.7968	A	7.7	2937.5	1991 - 1999	9	R	B	Abdellaoui et al., 2002	1
328	Morocco	Nakhla	Nakhla	35.4461	-5.4019	A	107	1576	1961 - 1986	26	R	U	FAO, 2008	1
329	Morocco	Mharhar	Ibn Battouta	35.5939	-5.9882	A	178	3650	1977 - 1986	10	R	U	FAO, 2008	1
330	Morocco	Nekor	M.B.E.A. Khattabi	35.0891	-3.8106	A	780	4620	1981 - 1986	6	R	U	FAO, 2008	1
331	Morocco	Aoudour	near Douar Tayenza	34.8090	-5.1655	B	1039	3850	1969 - ??	N.A.	GS	U	FAO, 2008	1
332	Morocco	Issen	Abdelmoumen	30.6909	-9.2068	A	1300	200	1981 - 1986	6	R	U	FAO, 2008	1
333	Morocco	Tessaout	Moulay Youssef	31.6333	-7.2568	A	1441	1291	1970 - 1986	17	R	U	FAO, 2008	1
334	Morocco	N. Fis	Lalla Takerkoust	31.3359	-8.1423	A	1707	1100	1935 - 1986	52	R	U	FAO, 2008	1
335	Morocco	Querrha	B Ouender	34.5225	-4.5657	A	1756	3590	1969 - ??	N.A.	GS	U	FAO, 2008	1
336	Morocco	Mellah	Oued Mellah	33.4954	-7.3316	A	1800	127.7	1931 - ??	N.A.	R	U	FAO, 2008	1
337	Morocco	Loukos	El Makhazine	34.9430	-5.7066	A	1820	1299	1979 - 1986	8	R	U	FAO, 2008	1
338	Morocco	Bou Sellem	unknown	34.3963	-5.6852	C	2300	100	N.A.	N.A.	GS	U	FAO, 2008	0
339	Morocco	Inaouene	Touaba	34.1612	-4.7491	B	3324	1110	1969 - ??	N.A.	GS	U	FAO, 2008	1

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340	Morocco	Inaouene	Idris I	34.1262	-4.6644	A	3680	707	1972 - 1986	15	R	U	FAO, 2008	1
341	Morocco	Massa	Youssef b Tachfine	29.8028	-9.4664	A	3784	378	1973 - 1986	14	R	U	FAO, 2008	1
342	Morocco	Querrha	Ourtzarh	34.5351	-4.9556	A	4398	3340	1969 - ??	N.A.	GS	U	FAO, 2008	1
343	Morocco	Ziz	Hassan Eddakhil	32.0041	-4.4599	A	4400	511	1971 - 1986	16	R	U	FAO, 2008	1
344	Morocco	Sebou	A Timedrine	33.8161	-4.6398	A	4429	590	1969 - ??	N.A.	GS	U	FAO, 2008	1
345	Morocco	Beih	El Kansera	34.0062	-5.9058	A	4540	325	1935 - 1986	52	R	U	FAO, 2008	1
346	Morocco	Querrha	M'Jara	34.5938	-5.1978	A	6183	3500	1969 - ??	N.A.	GS	U	FAO, 2008	1
347	Morocco	El Abid	Bin El Quidane	32.0970	-6.4028	A	6400	675	1953 - 1986	34	R	U	FAO, 2008	1
348	Morocco	Bou Regreg	S. Mohamed b Abdellah	33.9391	-6.7267	A	9800	338	1974 - 1986	13	R	U	FAO, 2008	1
349	Morocco	Sebou	Pont Sebou	34.2991	-5.1348	B	12985	750	1969 - ??	N.A.	GS	U	FAO, 2008	1
350	Morocco	Draa	Mansour Eddahbi	30.9231	-6.7895	B	15000	410	1972 - 1986	15	R	U	FAO, 2008	0
351	Morocco	Sebou	Azib Soltane	34.2803	-5.4384	B	16276	650	1969 - ??	N.A.	GS	U	FAO, 2008	1
352	Morocco	Er Rbia	Al Massira	32.4559	-7.5641	B	28500	415	1979 - 1986	8	R	U	FAO, 2008	1
353	Morocco	Er Rbia	Imfout	32.7032	-7.9128	B	30000	160	1983 - ??	N.A.	GS	U	FAO, 2008	1
354	Morocco	Moulouya	Mohammed V	34.6459	-2.9614	B	49920	383	1976 - 1986	11	R	U	FAO, 2008	1
355	Morocco	Sra	near Bouhouda	34.6804	-4.5746	B	493	3500	N.A.	N.A.	GS	U	Hooke, 2006	1
356	Morocco	Lakhdar	Sidi Driss	31.8432	-7.0747	A	2850	370	N.A.	N.A.	GS	U	Jansson, 1982	1
357	Morocco	Sebou	Pont du Mdez	33.7049	-4.5151	A	3474	320	N.A.	N.A.	GS	U	Jansson, 1982	1
358	Morocco	Sebou	Azzaba	33.8238	-4.6945	B	4736	530	N.A.	N.A.	GS	U	Jansson, 1982	0
359	Morocco	Grou	unknown	33.9379	-6.7503	C	5540	300	N.A.	N.A.	R	U	Jansson, 1982	0
360	Morocco	Souss	near outlet	30.3488	-9.6160	B	16000	262.5	N.A.	N.A.	GS	U	Milliman and Fansworth, 2011	1
361	Morocco	Sebou	near outlet	34.2586	-6.6722	B	37000	1000	N.A.	N.A.	GS	U	Milliman and Fansworth, 2011	1
362	Morocco	Moulouya	near outlet	35.1162	-2.3492	B	51000	235.3	N.A.	N.A.	GS	U	Milliman and Fansworth, 2011	1
363	Morocco	Draa	near outlet	28.6989	-11.1647	B	114000	122.8	N.A.	N.A.	GS	U	Milliman and Fansworth, 2011	0
364	Morocco	Oued MJara	Barrage El Wahda	34.5966	-5.1985	B	5190	2910	N.A.	N.A.	GS	U	Walling, 1984	1
365	Mozambique		Kabora Bassa	-15.6707	31.8361	B	1000000	134.5	N.A.	N.A.	R	C	Bolton, 1984	0
366	Mozambique	Limpopo	near outlet	-25.0771	33.5812	B	410000	80.5	N.A.	N.A.	GS	U	Milliman and Fansworth, 2011	1
367	Mozambique	Zambezi	near outlet	-18.7587	36.2512	B	1300000	36.9	N.A.	N.A.	GS	U	Milliman and Fansworth, 2011	1

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368	Niger	Sirba	Tiambi	13.5289	1.3836	B	37370	18.1	HY 2006/2007 - HY 2007/2008	2	GS	A	Amogu, 2009	1
369	Niger	Sirba	Garbe Kourou	13.7316	1.6049	B	38704	24.8	HY 2006/2007 - HY 2007/2008	2	GS	A	Amogu, 2009	1
370	Niger	Gorouol	Alcongui	14.7486	0.5977	B	44540	17.7	HY 2006/2007 - HY 2007/2008	2	GS	A	Amogu, 2009	1
371	Niger	Niger	Farié-Haossa	13.7836	1.6495	B	650380	19.6	HY 2007/2008	1	GS	A	Amogu, 2009	1
372	Niger	Niger	Latakabiey	13.7583	1.6793	B	689130	19.6	HY 2007/2008	1	GS	A	Amogu, 2009	1
373	Niger	Niger	Brigambou	12.4672	2.7396	B	736250	15.2	HY 2007/2008	1	GS	A	Amogu, 2009	0
374	Niger	Niger	Diabou-Kiria	12.2740	2.9870	B	757640	15.1	HY 2007/2008	1	GS	A	Amogu, 2009	0
375	Niger	Gorouol	Dolbel	14.6167	0.2833	B	7500	22.1	HY 1976/1977 - HY 1982 - 1983	7	GS	B	Amogu, 2009; Gallaire, 1986	1
376	Niger	Niger	Niamey	13.5030	2.1070	B	700000	12.6	HY 1984/1985 - HY 1985/1986; HY 2006/2007 - HY 2007/2008	4	GS	B	Gallaire, 1986; Amogu, 2009	1
377	Niger	Niger	Kandadji	14.6146	0.9659	B	628830	4.8	HY 1976/1977 - HY 1982/1983; HY 2007/2008	8	GS	B	Gallaire, 1986; Amogu, 2009	1
378	Nigeria	Niger	near confluence with Benue	7.7603	6.7603	B	133000	68	N.A.	N.A.	GS	U	Dedkov and Mozzherin, 1984	0
379	Nigeria	Benue	near Lokoja	7.9045	6.9663	B	300000	73	N.A.	N.A.	GS	U	Dedkov and Mozzherin, 1984	1
380	Nigeria	Sokoto	Gusau	12.1443	6.6678	A	2653	257	1962 - 1965	4	GS	U	FAO, 2008	1
381	Nigeria	Zamfara	Anka	12.1213	5.9213	A	4126	344	1962 - 1965	4	GS	U	FAO, 2008	1
382	Nigeria	Gagare	Kaura Namoda	12.6016	6.5874	A	6172	225	1962 - 1965	4	GS	U	FAO, 2008	1
383	Nigeria	Bunsuru	Zurmi	12.7723	6.7873	A	6826	161	1962 - 1965	4	GS	U	FAO, 2008	0
384	Nigeria	Sokoto	Sokoto	13.0784	5.2629	B	12851	212	1962 - 1965	4	GS	U	FAO, 2008	1
385	Nigeria	Zamfara	Kalgo	12.3213	4.1999	B	16678	38	1962 - 1965	4	GS	U	FAO, 2008	1
386	Nigeria	Rima	Sabon Birni	12.5804	6.8813	C	19832	100	1962 - 1965	4	GS	U	FAO, 2008	0
387	Nigeria	Rima	Argungu	12.7572	4.5290	C	43490	7	1964 - 1965	2	GS	U	FAO, 2008	1
388	Nigeria	Ogun	near outlet	6.5755	3.4388	B	47000	23.4	N.A.	N.A.	GS	U	Milliman and Fansworth, 2011	0
389	Nigeria	Cross	near outlet	4.6403	8.4293	B	60000	125	N.A.	N.A.	GS	U	Milliman and Fansworth, 2011	1
390	Nigeria	Niger	near outlet	4.7212	6.7858	B	2200000	18.2	N.A.	N.A.	GS	U	Milliman and Fansworth, 2011	1

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391	Senegal	Gambie	Kedougou	12.5511	-12.1669	A	7500	7.9	1987 - 1987	1	GS	U	Liénou et al., 2005	1
392	Senegal	Gambie	Gouloumbou	13.4809	-13.7458	B	42000	2.1	1983 - 1984	2	GS	U	Liénou et al., 2005	1
393	Senegal	Sénégal	Bakel	14.9047	-12.4522	B	218000	10.3	1979 - 1987	9	GS	U	Liénou et al., 2005	0
394	Senegal	Sénégal	Dagana	16.5220	-15.5129	B	270000	10.6	1981 - 1983	3	GS	U	Liénou et al., 2005	0
395	Senegal	Sénégal	near outlet	16.1262	-16.4864	B	270000	11.1	N.A.	N.A.	GS	U	Milliman and Fansworth, 2011	1
396	South Africa		Mpanamana	-25.3083	31.9735	A	8.1	50	1957 - 2008	52	R	A	Baade et al., 2012	1
397	South Africa		Makhohlola	-25.2557	31.8598	A	13	10	1963 - 2008	46	R	A	Baade et al., 2012	1
398	South Africa		Silolweni	-24.8226	31.8365	A	14	50	1969 - 2008	40	R	A	Baade et al., 2012	1
399	South Africa		Nhlanganzwane	-25.2325	31.9752	A	14	60	1956 - 2008	53	R	A	Baade et al., 2012	1
400	South Africa		Mlondozi	-25.0350	31.9339	A	101	11	1951 - 2008	58	R	A	Baade et al., 2012	1
401	South Africa	Oranje	Aliwal North	-30.6818	26.7117	B	37000	480	N.A.	13	GS	U	Dedkov and Mozzherin, 1984	1
402	South Africa	Oranje	Prieska	-29.6608	22.7566	B	820000	85	N.A.	18	GS	U	Dedkov and Mozzherin, 1984	0
403	South Africa	Oranje	Bethulie	-30.5362	25.9704	C	6362	890	1929 - 1969	41	GS	U	FAO, 2008	0
404	South Africa		Compassberg Dam 10	-31.7200	24.5683	A	1.5	445	1970 - 2003	34	R	B	Foster et al., 2012	1
405	South Africa		Compassberg Dam 7	-31.7206	24.5675	A	6.3	153	1970 - 2007	38	R	B	Foster et al., 2012	1
406	South Africa		Cranemere	-32.5305	24.9872	A	58	175	1970 - 2007	38	R	B	Foster et al., 2012	0
407	South Africa	Kromme	near outlet	-34.1367	24.8439	B	900	200	N.A.	N.A.	GS	U	Milliman and Fansworth, 2011	1
408	South Africa	Matigulu	near outlet	-29.1143	31.6170	B	1000	220	N.A.	N.A.	GS	U	Milliman and Fansworth, 2011	1
409	South Africa	Keurbooms	near outlet	-34.0295	23.3987	B	1100	181.8	N.A.	N.A.	GS	U	Milliman and Fansworth, 2011	1
410	South Africa	Umtamvuna (Mtamvuna)	near outlet	-31.1006	30.2266	B	1500	286.7	N.A.	N.A.	GS	U	Milliman and Fansworth, 2011	0
411	South Africa	Umvoti (Mvoti)	near outlet	-29.3807	31.3367	B	2800	289.3	N.A.	N.A.	GS	U	Milliman and Fansworth, 2011	1
412	South Africa	Umhlantuzi (Mhlantuzi)	near outlet	-28.8170	32.0830	B	3700	297.3	N.A.	N.A.	GS	U	Milliman and Fansworth, 2011	1
413	South Africa	Umkomazi (Mkomaas)	near outlet	-30.1856	30.8185	B	4300	372.1	N.A.	N.A.	GS	U	Milliman and Fansworth, 2011	1
414	South Africa	Umgeni (Mgeni)	near outlet	-29.8765	31.0619	B	4400	386.4	N.A.	N.A.	GS	U	Milliman and Fansworth, 2011	0

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415	South Africa	Umfolozi (Mfolozi)	near outlet	-28.4541	32.4253	B	10000	240	N.A.	N.A.	GS	U	Milliman and Fansworth, 2011	1
416	South Africa	Umzimvubu (Mzimvubu)	near outlet	-31.6262	29.5536	B	16000	137.5	N.A.	N.A.	GS	U	Milliman and Fansworth, 2011	1
417	South Africa	Tugela (Thukela)	near outlet	-29.2172	31.4892	B	29000	303.4	N.A.	N.A.	GS	U	Milliman and Fansworth, 2011	1
418	South Africa	Oranje	near outlet	-28.6192	16.4507	B	1000000	89	N.A.	N.A.	GS	U	Milliman and Fansworth, 2011	1
419	South Africa	Brak	Ernest Robinson	-33.9022	22.1743	A	10	12	1955 - 1985	30	R	B	Rooseboom et al., 1992	1
420	South Africa	Broederstroom	Dap Naude	-23.8145	29.9663	A	14	357	1961 - 1987	26	R	B	Rooseboom et al., 1992	1
421	South Africa	Le Roux	Melville	-33.3965	22.3142	C	18	1	1945 - 1984	39	R	B	Rooseboom et al., 1992	0
422	South Africa	Gubu	Gubu	-32.6040	27.2738	A	23	161	1970 - 1981	11	R	B	Rooseboom et al., 1992	1
423	South Africa	Wit	Longmere	-25.2806	31.0009	A	27	250	1940 - 1979	39	R	B	Rooseboom et al., 1992	0
424	South Africa	Buffems	Maden	-32.7397	27.2994	A	30	42	1909 - 1981	72	R	B	Rooseboom et al., 1992	1
425	South Africa	Korinte	Korentepoort	-33.9986	21.1657	A	37	33	1965 - 1983	18	R	B	Rooseboom et al., 1992	1
426	South Africa	Le Roux	Raubenheimer	-33.4096	22.2815	A	43	7	1973 - 1984	11	R	B	Rooseboom et al., 1992	0
427	South Africa	Koekedouw	Ceres	-33.3635	19.2737	A	50	12	1953 - 1981	28	R	B	Rooseboom et al., 1992	1
428	South Africa	Konings	Klipberg	-33.9422	19.7941	A	54	1	1964 - 1983	19	R	B	Rooseboom et al., 1992	1
429	South Africa	Stettynskloof	Stettynskloof	-33.8363	19.2524	A	55	54	1954 - 1984	30	R	B	Rooseboom et al., 1992	1
430	South Africa	Sanddrif	Roode Elsburg	-33.4364	19.5685	C	59	202	1968 - 1983	15	R	B	Rooseboom et al., 1992	0
431	South Africa	Witwaters	Da Gama	-25.1412	31.0209	A	62	566	1971 - 1979	8	R	B	Rooseboom et al., 1992	1
432	South Africa	Leeu	Weltevrede	-27.2231	27.5702	A	63	377	1907 - 1978	71	R	B	Rooseboom et al., 1992	1
433	South Africa	Politsi	Magoebaskloof	-23.8173	30.0555	A	64	76	1970 - 1986	16	R	B	Rooseboom et al., 1992	1
434	South Africa	Sand	Witteklip	-25.2377	30.8980	A	64	160	1969 - 1979	10	R	B	Rooseboom et al., 1992	1
435	South Africa	Wit	Klipkopjes	-25.2206	31.0080	A	78	234	1960 - 1979	19	R	B	Rooseboom et al., 1992	1
436	South Africa	Matjesvlei	Menin	-28.0850	28.2773	A	80	44	1922 - 1978	56	R	B	Rooseboom et al., 1992	1
437	South Africa	Leeu	Roodepoort	-25.3870	29.4966	C	80	271	1896 - 1978	82	R	B	Rooseboom et al., 1992	0
438	South Africa	Ramadiepa	Hans Merensky	-23.7504	30.1077	A	88	25	1935 - 1987	52	R	B	Rooseboom et al., 1992	1
439	South Africa	Groot	Poortjieskloof	-33.8582	20.3714	A	94	103	1957 - 1979	22	R	B	Rooseboom et al., 1992	1
440	South Africa	Gamka	Gamka	-32.2387	22.5865	A	98	70	1955 - 1980	25	R	B	Rooseboom et al., 1992	1
441	South Africa	Hartenbos	Hartebeeskuil	-34.0965	22.0076	A	100	7	1969 - 1981	12	R	B	Rooseboom et al., 1992	1
442	South Africa	Nwandezi	Nwanedzi	-22.6349	30.3988	A	109	14	1963 - 1979	16	R	B	Rooseboom et al., 1992	1
443	South Africa	Keisies	Pietersfontein	-33.6676	20.0117	A	116	269	1968 - 1981	13	R	B	Rooseboom et al., 1992	1
444	South Africa	Sterkstroom	Buffelspoort	-25.7803	27.4874	A	119	84	1935 - 1980	45	R	B	Rooseboom et al., 1992	1

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445	South Africa	Wemmershoek	Wemmershoek	-33.8332	19.0820	B	125	310	1957 - 1984	27	R	B	Rooseboom et al., 1992	1
446	South Africa	Cordiers	Oukloof	-33.2478	22.0992	A	141	54	1929 - 1984	55	R	B	Rooseboom et al., 1992	1
447	South Africa	Loerie	Loerie	-33.8653	25.0392	A	147	280	1971 - 1984	13	R	B	Rooseboom et al., 1992	1
448	South Africa	Duiwenhoks	Duiwenhoks	-33.9970	20.9489	A	148	20	1965 - 1979	14	R	B	Rooseboom et al., 1992	1
449	South Africa	Luphephe	Luphephe	-22.6344	30.4021	A	150	36	1963 - 1979	16	R	B	Rooseboom et al., 1992	1
450	South Africa	Klip	Windsor	-28.4956	29.7405	C	150	315	1957 - 1990	33	R	B	Rooseboom et al., 1992	0
451	South Africa	Mnyamvubu	Craigie Burn	-29.1625	30.2874	A	152	29	1963 - 1983	20	R	B	Rooseboom et al., 1992	1
452	South Africa	Letaba	Ebenezer	-23.9411	29.9790	A	156	155	1959 - 1986	27	R	B	Rooseboom et al., 1992	1
453	South Africa	Wit	Primkop	-25.3835	31.0710	A	158	55	1970 - 1987	17	R	B	Rooseboom et al., 1992	0
454	South Africa	Klaserie	Jan Wassenaar	-24.5238	31.0700	A	165	121	1960 - 1979	19	R	B	Rooseboom et al., 1992	1
455	South Africa	Sterk	Welgevonden	-33.9015	18.8576	C	166	6	1954 - 1977	23	R	B	Rooseboom et al., 1992	0
456	South Africa	Nels	Calitzdorp	-33.4872	21.7055	A	170	135	1917 - 1981	64	R	B	Rooseboom et al., 1992	1
457	South Africa	Dorps	Combrink	-24.1633	29.0317	A	174	15	1964 - 1978	14	R	B	Rooseboom et al., 1992	1
458	South Africa	Hoeks	Moordkuil	-33.7170	19.4326	A	176	9	1950 - 1985	35	R	B	Rooseboom et al., 1992	1
459	South Africa	Mpapa	Jericho	-26.6452	30.4790	A	218	211	1966 - 1983	17	R	B	Rooseboom et al., 1992	1
460	South Africa	Umzinduzi	Henley	-29.6250	30.2469	A	238	42	1942 - 1987	45	R	B	Rooseboom et al., 1992	1
461	South Africa	Bethulie	Bethulie	-30.4804	25.9709	A	255	455	1921 - 1979	58	R	B	Rooseboom et al., 1992	1
462	South Africa	Kat	Katrivier	-32.5748	26.7573	A	258	310	1969 - 1988	19	R	B	Rooseboom et al., 1992	1
463	South Africa	Watervals	Buffelskloof	-24.9612	30.2594	A	278	20	1972 - 1987	15	R	B	Rooseboom et al., 1992	1
464	South Africa	Koster	Koster	-25.7085	26.8985	A	280	36	1964 - 1980	16	R	B	Rooseboom et al., 1992	1
465	South Africa	Dorp	Victoria-Wes	-30.0556	24.8004	C	280	53	1924 - 1954	30	R	B	Rooseboom et al., 1992	0
466	South Africa	Doring	Indwe	-31.5122	27.3311	A	295	646	1969 - 1984	15	R	B	Rooseboom et al., 1992	1
467	South Africa	Apies	Bon Accord	-25.6283	28.1885	A	315	178	1925 - 1980	55	R	B	Rooseboom et al., 1992	1
468	South Africa	Krom	Churchill	-33.9936	24.4895	A	357	10	1943 - 1987	44	R	B	Rooseboom et al., 1992	1
469	South Africa	Schoonspruit	Rietspruit	-26.1622	29.2310	A	375	65	1955 - 1989	34	R	B	Rooseboom et al., 1992	1
470	South Africa	Buffels	Bridle Drift	-32.9686	27.7380	A	375	751	1968 - 1981	13	R	B	Rooseboom et al., 1992	0
471	South Africa	Mgeni	Camperdown	-29.7375	30.5401	C	376	84	1901 - 1923	22	R	B	Rooseboom et al., 1992	0
472	South Africa	Mdloti	Hazelmere	-29.5974	31.0301	A	377	723	1975 - 1987	12	R	B	Rooseboom et al., 1992	1
473	South Africa	Nuy	Keerom	-33.5837	19.7072	A	378	88	1954 - 1981	27	R	B	Rooseboom et al., 1992	1
474	South Africa	Nahoon	Nahoon	-32.9106	27.8067	B	474	115	1964 - 1981	17	R	B	Rooseboom et al., 1992	1
475	South Africa	Hennops	Rietvlei	-25.8865	28.2683	A	479	40	1934 - 1977	43	R	B	Rooseboom et al., 1992	1
476	South Africa	Sterk	Doorndraai	-24.2812	28.7806	A	479	98	1953 - 1979	26	R	B	Rooseboom et al., 1992	1

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477	South Africa	Hex	Olifantsnek	-25.7939	27.2539	A	492	105	1928 - 1988	60	R	B	Rooseboom et al., 1992	1
478	South Africa	Leeu	Armenia	-29.3497	27.1359	A	529	32	1951 - 1987	36	R	B	Rooseboom et al., 1992	1
479	South Africa	Nuwejaars	Nuwejaars	-33.2933	26.1219	A	531	4	1958 - 1981	23	R	B	Rooseboom et al., 1992	1
480	South Africa	Usutu	Westoe	-26.5002	30.6196	A	531	5	1968 - 1980	12	R	B	Rooseboom et al., 1992	1
481	South Africa	Brak	Bellair	-33.7155	20.5930	A	558	34	1920 - 1981	61	R	B	Rooseboom et al., 1992	1
482	South Africa	Hex	Bospoort	-25.5724	27.3307	C	600	63	1953 - 1969	16	R	B	Rooseboom et al., 1992	0
483	South Africa	Modder	Rustfontein	-29.2696	26.6157	B	600	283	1955 - 1981	26	R	B	Rooseboom et al., 1992	0
484	South Africa	Buffeljags	Buffeljags	-34.0233	20.5449	A	601	7	1966 - 1983	17	R	B	Rooseboom et al., 1992	1
485	South Africa	Klippaat	Waterdown	-32.2919	26.8632	A	603	12	1958 - 1988	30	R	B	Rooseboom et al., 1992	1
486	South Africa	Marico	Kromellenboog	-25.4408	26.3451	A	606	132	1955 - 1983	28	R	B	Rooseboom et al., 1992	0
487	South Africa	Pienaars	Roodeplaat	-25.6199	28.3763	A	684	105	1959 - 1980	21	R	B	Rooseboom et al., 1992	1
488	South Africa	Elands	Lindleyspoort	-25.4982	26.6918	A	705	83	1938 - 1980	42	R	B	Rooseboom et al., 1992	1
489	South Africa	Umgeni	Albert Falls	-29.4304	30.4228	B	716	31	1974 - 1983	9	R	B	Rooseboom et al., 1992	0
490	South Africa	Hluhluwe	Hluhluwe	-28.1163	32.1873	A	734	137	1964 - 1985	21	R	B	Rooseboom et al., 1992	1
491	South Africa	Olifants	Bulshoek	-31.9951	18.7879	A	736	17	1922 - 1980	58	R	B	Rooseboom et al., 1992	0
492	South Africa	Boesmans	Wagendrift	-29.0444	29.8521	A	744	91	1963 - 1983	20	R	B	Rooseboom et al., 1992	1
493	South Africa	Mlazi	Shongweni	-29.8575	30.7203	A	750	231	1927 - 1987	60	R	B	Rooseboom et al., 1992	1
494	South Africa	Prins	Prinsrivier	-33.5128	20.7524	A	757	136	1916 - 1981	65	R	B	Rooseboom et al., 1992	1
495	South Africa	Tugele	Spioenkop	-28.6815	29.5012	B	774	426	1972 - 1986	14	R	B	Rooseboom et al., 1992	0
496	South Africa	Ngagane	Chelmsford	-27.9682	29.9344	A	830	160	1961 - 1983	22	R	B	Rooseboom et al., 1992	1
497	South Africa	Nzhelele	Nzhelele	-22.7372	30.1024	A	842	119	1948 - 1979	31	R	B	Rooseboom et al., 1992	1
498	South Africa	Buffels	Laing	-32.9556	27.5005	A	862	75	1950 - 1981	31	R	B	Rooseboom et al., 1992	1
499	South Africa	Mtata	Mtata	-31.5479	28.7351	A	868	89	1977 - 1987	10	R	B	Rooseboom et al., 1992	1
500	South Africa	Loop	Klipdrift	-34.1273	24.5660	B	881	38	1918 - 1977	59	R	B	Rooseboom et al., 1992	0
501	South Africa	Kaffir	Tierpoort	-29.4108	26.1487	A	922	113	1922 - 1979	57	R	B	Rooseboom et al., 1992	1
502	South Africa	Umgeni	Midmar	-29.5153	30.1759	A	928	10	1965 - 1983	18	R	B	Rooseboom et al., 1992	1
503	South Africa	Elands	Rust de Winter	-25.2372	28.5141	A	1147	33	1934 - 1977	43	R	B	Rooseboom et al., 1992	1
504	South Africa	Marico	Klein Maricoprt	-25.5246	26.1419	A	1180	21	1934 - 1983	49	R	B	Rooseboom et al., 1992	1
505	South Africa	Marico	Marico-Bosveld	-25.4682	26.3965	A	1219	52	1933 - 1977	44	R	B	Rooseboom et al., 1992	1
506	South Africa	Bronkhorst	Bronkhorstspruit	-25.8886	28.7222	A	1263	48	1948 - 1983	35	R	B	Rooseboom et al., 1992	1
507	South Africa	Bierspruit	Bierspruit	-24.9180	27.1387	A	1330	20	1960 - 1980	20	R	B	Rooseboom et al., 1992	1
508	South Africa	Mooi	Klerkskraal	-26.2311	27.1487	B	1335	17	1969 - 1982	13	R	B	Rooseboom et al., 1992	1

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509	South Africa	Van Wyksvlei	Van Wyksvlei	-30.3807	21.8107	A	1339	26	1884 - 1979	95	R	B	Rooseboom et al., 1992	1
510	South Africa	Wit Kei	Xonxa	-31.8167	27.1500	A	1487	881	1974 - 1986	12	R	B	Rooseboom et al., 1992	1
511	South Africa	Kammanassie	Kammanassie	-33.6492	22.4121	A	1505	54	1923 - 1981	58	R	B	Rooseboom et al., 1992	1
512	South Africa	Komati	Nooitgedacht	-25.5197	28.0325	B	1569	30	1962 - 1983	21	R	B	Rooseboom et al., 1992	0
513	South Africa	Tsomo	Ncora	-31.7855	27.6768	A	1772	269	1976 - 1988	12	R	B	Rooseboom et al., 1992	1
514	South Africa	Mooi	Boskop	-26.5722	27.1108	C	1952	8	1959 - 1981	22	R	B	Rooseboom et al., 1992	0
515	South Africa	Olifants	Clanwilliam	-32.2023	18.8857	A	2033	134	1935 - 1980	45	R	B	Rooseboom et al., 1992	1
516	South Africa	Leeu	Leeu gamka	-32.6901	23.1000	C	2088	140	1959 - 1981	22	R	B	Rooseboom et al., 1992	0
517	South Africa	Renoster	Koppies	-27.2449	27.6822	A	2147	136	1911 - 1978	67	R	B	Rooseboom et al., 1992	1
518	South Africa	Sand	Allemanskraal	-28.2947	27.1326	B	2655	373	1960 - 1989	29	R	B	Rooseboom et al., 1992	1
519	South Africa	Modder	Krugersdrift	-28.8869	25.9628	B	3355	157	1970 - 1989	19	R	B	Rooseboom et al., 1992	0
520	South Africa	Tarka	Lake Arthur	-32.2112	25.8127	A	3450	521	1924 - 1985	61	R	B	Rooseboom et al., 1992	0
521	South Africa	Sondags	Van Rhyneveldspas	-32.2236	24.5216	A	3544	210	1925 - 1978	53	R	B	Rooseboom et al., 1992	1
522	South Africa	Limpopo	Hartebeespoort	-25.7506	27.8613	A	3633	256	1923 - 1979	50	R	B	Rooseboom et al., 1992	1
523	South Africa	Koega	Paul Sauer	-33.7392	24.5888	A	3887	18	1969 - 1986	17	R	B	Rooseboom et al., 1992	1
524	South Africa	Vet	Erfenis	-28.5127	26.7767	B	4000	173	1959 - 1987	28	R	B	Rooseboom et al., 1992	1
525	South Africa	Buffels	Floriskraal	-33.2815	20.9891	A	4001	169	1957 - 1981	24	R	B	Rooseboom et al., 1992	1
526	South Africa	Schoonspruit	John Neser	-26.8165	26.6132	B	4200	1	1915 - 1977	62	R	B	Rooseboom et al., 1992	0
527	South Africa	Mogol	Hans Strydom	-23.9771	27.7252	A	4319	11	1975 - 1988	13	R	B	Rooseboom et al., 1992	1
528	South Africa	Pienaars	Klipvoor	-25.1478	27.8316	B	4585	14	1970 - 1987	17	R	B	Rooseboom et al., 1992	0
529	South Africa	Olifants	Stompdrift	-33.5125	22.5856	B	5235	58	1965 - 1981	16	R	B	Rooseboom et al., 1992	1
530	South Africa	Olifants	Loskop	-25.4299	29.3219	C	5820	58	1939 - 1977	38	R	B	Rooseboom et al., 1992	0
531	South Africa	Pongola	Pongolapoort	-27.4200	32.0792	A	7831	446	1973 - 1984	11	R	B	Rooseboom et al., 1992	1
532	South Africa	Vis	Elandsdrift	-32.5306	25.7610	B	8042	27	1973 - 1981	8	R	B	Rooseboom et al., 1992	0
533	South Africa	Riet	Kalkfontein	-29.5107	25.2570	B	8647	122	1938 - 1979	41	R	B	Rooseboom et al., 1992	1
534	South Africa	Mogalakwena	Glen Alpine	-23.2058	28.6886	B	10713	10	1967 - 1979	12	R	B	Rooseboom et al., 1992	1
535	South Africa	Sondags	Lake Mentz	-33.1807	25.1508	B	12987	271	1922 - 1978	56	R	B	Rooseboom et al., 1992	0
536	South Africa	Ongers	Smartt	-30.6258	23.2954	B	13114	4	1912 - 1980	68	R	B	Rooseboom et al., 1992	1
537	South Africa	Gamka	Gamkapoort	-33.2960	21.6330	B	17076	35	1969 - 1981	12	R	B	Rooseboom et al., 1992	1
538	South Africa	Oranje	Hendrik Verwoerd	-30.6237	25.5020	B	67845	352	1971 - 1979	8	R	B	Rooseboom et al., 1992	1
539	South Africa	Bloed	Rooikraal	-25.2945	29.6503	A	168	302	1921 - 1968	48	R	B	Rooseboom, 1978	1
540	South Africa	Witspruit	Egmont Dam	-30.0493	27.0360	A	326	120	1937 - 1955	19	R	B	Rooseboom, 1978	1

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541	South Africa	Mzimkulwana	Gilbert Eyles	-30.7189	30.1511	A	409	89	1951 - 1966	16	R	B	Rooseboom, 1978	1
542	South Africa	Kat	Upsher	-32.5703	26.6845	A	554	499	1931 - 1948	18	GS	B	Rooseboom, 1978	1
543	South Africa	Klein Vis	Buffelsfontein	-26.8986	26.8167	B	995	589	1931 - 1939	9	GS	B	Rooseboom, 1978	1
544	South Africa	Modder	Sannaspos	-29.1520	26.5386	B	1650	304	1935 - 1943	9	GS	B	Rooseboom, 1978	1
545	South Africa	Stormbergspruit	Burgersdorp	-31.0107	26.3282	A	2370	762	1935 - 1948	14	GS	B	Rooseboom, 1978	1
546	South Africa	Tarka	Kommandodrif	-32.0867	26.0366	A	3528	86	1956 - 1966	11	R	B	Rooseboom, 1978	1
547	South Africa	Olifants	Doornpoort	-25.8623	29.3049	A	3618	3	1925 - 1973	49	R	B	Rooseboom, 1978	1
548	South Africa	Tugela/Tugela	Colenso	-28.7367	29.8210	A	4200	463	1950 - 1959	10	GS	B	Rooseboom, 1978	1
549	South Africa	Groot Brak	Grassridge	-31.7547	25.4695	A	4483	223	1924 - 1966	43	R	B	Rooseboom, 1978	1
550	South Africa	Pongola	Intuembi	-27.9161	30.6633	C	7122	114	1932 - 1938	7	GS	B	Rooseboom, 1978	0
551	South Africa	Tugela/Buffels	Vant's Drift	-28.2348	30.5008	A	7930	559	1930 - 1932	3	GS	B	Rooseboom, 1978	1
552	South Africa	Vaal	Standerton	-26.9596	29.2443	A	8254	193	1929 - 1940	12	GS	B	Rooseboom, 1978	1
553	South Africa	Harts	Schweizer-Reneke	-27.1624	25.3457	A	9251	7	1934 - 1956	23	GS	B	Rooseboom, 1978	1
554	South Africa	Riet	Leeuwkraal	-24.9373	29.8174	B	10277	100	1929 - 1938	10	GS	B	Rooseboom, 1978	0
555	South Africa	Sondags	Jansenville	-32.9491	24.6643	B	11560	136	1930 - 1948	19	GS	B	Rooseboom, 1978	1
556	South Africa	Oranje	Aliwal-Oranjedraai	-30.3359	27.3547	B	12321	540	1929 - 1969	41	GS	B	Rooseboom, 1978	0
557	South Africa	Caledon	Jammersdrift	-29.7190	26.9807	B	13320	890	1929 - 1943	15	GS	B	Rooseboom, 1978	1
558	South Africa	Modder	Paardeberg	-28.9825	25.0931	C	14812	95	1939 - 1948	10	GS	B	Rooseboom, 1978	0
559	South Africa	Oranje	Oranjedraai	-30.3363	27.3541	B	24882	402	1964 - 1971	8	GS	B	Rooseboom, 1978	1
560	South Africa	Oranje	Oranjerivierbrug-Bethulie	-30.5346	25.9677	C	29316	418	1929 - 1952	24	GS	B	Rooseboom, 1978	0
561	South Africa	Vaal	Vaaldam	-26.8975	28.1405	B	37110	125	1938 - 1966	29	R	B	Rooseboom, 1978	1
562	South Africa	Hartbees	Rooiberg	-29.4106	21.2077	B	72208	6	1935 - 1960	26	R	B	Rooseboom, 1978	1
563	South Africa	Jakkalsrivier	near Bot River	-34.1998	19.1576	A	0.18	1.6	N.A.	N.A.	GS	A	Scott et al., 1998	1
564	South Africa	Biesievlei	Jonkershoek	-33.9770	18.9480	A	0.27	1.6	N.A.	N.A.	GS	A	Scott et al., 1998	1
565	South Africa	Lambrechtbos	Jonkershoek	-33.9682	18.9417	A	0.66	15.6	N.A.	N.A.	GS	A	Scott et al., 1998	1
566	South Africa	Swartboskloof	Jonkershoek	-33.9943	18.9534	A	1.8	42.2	N.A.	N.A.	GS (TL)	A	Scott et al., 1998	1
567	South Africa	Bosboukloof	Jonkershoek	-33.9602	18.9384	A	2.0	208	N.A.	N.A.	GS (TL)	A	Scott et al., 1998	1
568	South Africa	Langrivier	Jonkershoek	-33.9852	18.9725	A	2.5	34.6	N.A.	11	GS	A	Scott et al., 1998	1
569	South Africa	Bakkerskloof	Zachariahoek	-33.7615	19.0558	A	3.6	16.6	N.A.	N.A.	GS (TL)	A	Scott et al., 1998	1
570	Sudan	Dinder River	Gawisi	13.3286	34.0987	B	16000	75	1993 - 1996	4	GS	U	Billi and el Badri Ali, 2010	0

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571	Sudan	Rahad	Hawata	13.4130	34.6168	C	16049	81	1993 - 1996	4	GS	U	Billi and el Badri Ali, 2010	0
572	Sudan	Blue Nile	El Diem	11.2500	34.8238	B	198364	489	1993	1	GS	U	Billi and el Badri Ali, 2010	0
573	Sudan	Blue Nile	Roseires	11.7467	34.4018	B	209895	667	1964 - 1990	27	GS	U	Billi and el Badri Ali, 2010	0
574	Sudan	Blue Nile	Sennar	13.5417	33.6383	B	277286	339	1993 - 1996	4	GS	U	Billi and el Badri Ali, 2010	0
575	Sudan	Blue Nile	Khartoum	15.5714	32.5933	B	324859	708	1964 - 1990	27	GS	U	Billi and el Badri Ali, 2010	1
576	Sudan	Nile	Wadi Halfa	21.7920	31.3709	B	2600000	38	N.A.	N.A.	GS	U	Dedkov and Mozzherin, 1984	1
577	Sudan	Atbara	Khashm el Girba	14.8721	35.8968	B	20000	3422	1964 - 1976	13	R	U	FAO, 2008	0
578	Sudan	Gash	Kassala	15.4398	36.3918	B	24642	365.2	N.A.	2	GS	U	Nyssen et al., 2004	1
579	Sudan	Atbara	outlet	17.6676	34.0242	B	68800	203.5	N.A.	N.A.	GS	U	Nyssen et al., 2004	0
580	Tanzania	Morogoro	Morogoro	-6.8218	37.6688	B	19	390	N.A.	3	GS	U	Dedkov and Mozzherin, 1984	1
581	Tanzania	Rufiji	Stiegler's Gorge	-7.7989	37.8632	B	156600	106	1954 - 1970	17	GS	U	FAO, 2008	1
582	Tanzania	Rufiji	near outlet	-7.8059	39.3158	B	180000	144.4	N.A.	N.A.	GS	U	Milliman and Fansworth, 2011	1
583	Tanzania		Igurubi	-3.9993	33.7066	A	1.2	1078.6	1959 - 1978	19	R	C	Ndomba, 2011	1
584	Tanzania		Mbola	-4.8776	32.7211	C	6.4	635.4	1972 - 1978	6	R	C	Ndomba, 2011	0
585	Tanzania		Ulaya	-4.3992	33.4503	A	8.3	155.7	1947 - 1978	31	R	C	Ndomba, 2011	1
586	Tanzania		Malolo	-4.1044	32.8513	A	15	119.3	1962 - 1975	13	R	C	Ndomba, 2011	1
587	Tanzania		Tura	-5.5284	33.8327	A	105	109.5	1948 - 1978	30	R	C	Ndomba, 2011	1
588	Tanzania		Bulenya hills	-4.2889	33.7873	A	194	51.4	1961 - 1978	17	R	C	Ndomba, 2011	1
589	Tanzania	Ngonya	outlet in lake Tanganyika	-4.6260	29.6420	A	7.0	3131.6	Nov 1997 - Oct 1998	1	GS	C	Nkotagu en Mbwano, 2000	1
590	Tanzania		Imagi	-6.2061	35.7552	A	1.5	701.3	1930 - 1971	42	R	B	Rapp et al., 1972	1
591	Tanzania		Msalatu	-6.2038	35.7720	B	8.7	503.3	1944 - 1971	28	R	B	Rapp et al., 1972	1
592	Tanzania		Kisongo	-3.3391	36.5778	B	9.3	736.7	1960 - 1971	12	R	B	Rapp et al., 1972	0
593	Tanzania		Matambulu	-6.2856	35.7403	A	18	1009.8	1962 - 1971	10	R	B	Rapp et al., 1972	1
594	Tanzania		Ikowa	-6.1886	36.2243	A	640	393.6	1957 - 1969	13	R	B	Rapp et al., 1972	1
595	Tanzania	Kalambo	Kalambo village	-8.5924	31.2490	A	2575	3.8	1 Oct 1998 - 30 Sept 1999	1	GS	C	Sichingabula, 2000	0
596	Tanzania	Lufubu	Kabyolwe village	-8.5806	31.7134	C	7047	7.9	1 Oct 1998 - 30 Sept 1999	1	GS	C	Sichingabula, 2000	0

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597	Togo	Mono	near outlet	6.2565	1.8055	B	29000	55.2	N.A.	N.A.	GS	U	Milliman and Fansworth, 2011	1
598	Tunesia		El Melah	36.4648	10.6539	A	0.85	707.2	1994 - 1999	5	R	B	Boufaroua et al., 2006	1
599	Tunesia		M'Richet el Anse	36.0932	9.5948	A	1.6	1028.6	1993 - 2003	10	R	B	Boufaroua et al., 2006	0
600	Tunesia		Fidh Ben Naceur	35.7233	9.5903	A	1.7	1272	1993 - 2001	8	R	B	Boufaroua et al., 2006	1
601	Tunesia		Kamech	36.8717	10.8689	A	2.5	2121.6	1994 - 2006	12	R	B	Boufaroua et al., 2006	1
602	Tunesia		Saadine	36.1152	9.9439	A	2.7	2581.1	1994 - 1999	5	R	B	Boufaroua et al., 2006	1
603	Tunesia		Abdessadock	35.6827	9.2466	A	3.1	1374.2	1993 - 2000	7	R	B	Boufaroua et al., 2006	1
604	Tunesia		Dékikira	35.8844	9.6814	A	3.1	1660.7	1993 - 2006	13	R	B	Boufaroua et al., 2006	0
605	Tunesia		Sbahia 1	36.4953	10.2086	A	3.2	1359.7	1993 - 2006	13	R	B	Boufaroua et al., 2006	1
606	Tunesia		El Amadi	36.1756	8.7842	A	3.3	733.1	1999 - 2004	5	R	B	Boufaroua et al., 2006	1
607	Tunesia		Es Sénéga	35.4883	9.1049	A	3.6	1465	1993 - 2002	9	R	B	Boufaroua et al., 2006	1
608	Tunesia		Sadine1	35.7993	9.0662	B	3.8	1397.3	1992 - 2000	8	R	B	Boufaroua et al., 2006	1
609	Tunesia		El H'nach	36.0694	9.4486	A	4.0	1099.8	1993 - 2006	13	R	B	Boufaroua et al., 2006	1
610	Tunesia		Fid Ali	35.7061	9.6028	A	4.1	2053.6	1993 - 2004	11	R	B	Boufaroua et al., 2006	0
611	Tunesia		Es Séghir	36.4857	10.6847	A	4.3	148.7	1994 - 2004	10	R	B	Boufaroua et al., 2006	1
612	Tunesia		Brahim Zaher	35.5428	9.2433	A	4.6	1252.3	1994 - 1999	5	R	B	Boufaroua et al., 2006	1
613	Tunesia		Baouejer	35.5853	8.8658	A	4.9	408.4	1993 - 2000	7	R	B	Boufaroua et al., 2006	0
614	Tunesia		Janet	35.8729	9.1924	A	5.2	2532.4	1993 - 2003	10	R	B	Boufaroua et al., 2006	1
615	Tunesia		M'Rira	35.6094	8.4769	A	6.1	664.8	1993 - 2006	13	R	B	Boufaroua et al., 2006	1
616	Tunesia		Abdeladim	35.2169	8.5506	A	6.4	197.4	1993 - 2006	13	R	B	Boufaroua et al., 2006	1
617	Tunesia		Sadine2	35.7989	9.0795	A	6.5	2437.4	1992 - 2000	8	R	B	Boufaroua et al., 2006	1
618	Tunesia		Arara	35.3689	8.4015	A	7.1	2546.9	1993 - 2002	9	R	B	Boufaroua et al., 2006	1
619	Tunesia		Echar	35.5513	8.6792	A	9.2	262.5	1993 - 1999	6	R	B	Boufaroua et al., 2006	1
620	Tunesia		El Gouazine	35.9083	9.7036	A	18	168	1993 - 2006	13	R	B	Boufaroua et al., 2006	1
621	Tunesia	Oued Chiba	Chiba	36.6988	10.7716	A	64	4220	N.A.	12	R	B	Ghorbel and Claude, 1977	1
622	Tunesia	Oued Kasseb	Kasseb	36.7664	8.9933	A	101	5070	N.A.	8	R	B	Ghorbel and Claude, 1977	1
623	Tunesia	Oued Lakhmess	Lakhmess	35.9971	9.4775	A	131	2865	N.A.	9	R	B	Ghorbel and Claude, 1977	1
624	Tunesia		Nebaana	36.0524	9.8514	A	855	2300	N.A.	10	R	B	Ghorbel and Claude, 1977	1
625	Tunesia	Oued Mellegue	Mellègue	36.3110	8.6873	B	10300	695	N.A.	21	R	B	Ghorbel and Claude, 1977	1
626	Tunesia	Rhezela	Rhezela	37.0540	9.5403	A	48	1900	1984 - ??	N.A.	R	B	Lahlou, 1996	1

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627	Tunesia		Masri	36.5808	10.3097	C	53	4426.6	N.A.	N.A.	R	B	Lahlou, 1996	0
628	Tunesia	Bezik	Bezik	36.7239	10.6348	A	84	2430	1960 - ??	N.A.	R	B	Lahlou, 1996	1
629	Tunesia		Lebna	36.7521	10.9075	A	199	2906	1986 - ??	N.A.	R	B	Lahlou, 1996	1
630	Tunesia	Kebir	Kebir	36.2458	9.7844	A	271	844	1925 - ??	N.A.	R	B	Lahlou, 1996	1
631	Tunesia	Bou Hertma	Bou Hertma	36.3991	8.7940	C	390	1600	1976 - ??	N.A.	R	B	Lahlou, 1996	0
632	Tunesia		Houmine	36.9690	9.5861	A	418	1360.2	1983 - ??	N.A.	R	B	Lahlou, 1996	1
633	Tunesia		Siliana	36.1462	9.3608	A	1040	4035.9	N.A.	N.A.	R	B	Lahlou, 1996	1
634	Tunesia	Marguellil	Marguellil	35.5667	9.7392	A	1120	1500	1990 - ??	N.A.	R	B	Lahlou, 1996	1
635	Tunesia		Bir M'cherga	36.5152	10.0135	A	1263	350	N.A.	N.A.	R	B	Lahlou, 1996	1
636	Tunesia		Sidi Saad	35.3669	9.6723	B	8950	813.6	N.A.	N.A.	R	B	Lahlou, 1996	1
637	Tunesia		Sidi Salem	36.6507	9.3901	B	18250	234.2	N.A.	N.A.	R	B	Lahlou, 1996	1
638	Tunesia		Hadada	35.8387	9.1313	B	4.7	1060.8	N.A.	N.A.	R	B	Lahlou, 1996; Boufarou et al., 2006	1
639	Tunesia	Miliane (Meliane)	near outlet	36.7636	10.2966	B	2000	450	N.A.	N.A.	GS	U	Milliman and Fansworth, 2011	1
640	Tunesia	Medjerda	near outlet	37.0567	10.1520	B	22000	427.3	N.A.	N.A.	GS	U	Milliman and Fansworth, 2011	1
641	Uganda	Muzira	Muzira	-0.4787	30.3359	A	99	164	1 June 2009 - 31 May 2010	1	GS	C	Ryken, 2010; Ryken et al., 2013	1
642	Uganda	Buhweju	Nyakambu	-0.4318	30.4597	A	182	68	1 June 2009 - 31 May 2010	1	GS	C	Ryken, 2010; Ryken et al., 2013	1
643	Uganda	Kandenkye	Rwamunena	-0.6749	30.2783	A	359	23	1 June 2009 - 31 May 2010	1	GS	C	Ryken, 2010; Ryken et al., 2013	1
644	Uganda	Koga	Koga	-0.5788	30.4506	A	379	25	1 June 2009 - 31 May 2010	1	GS	C	Ryken, 2010; Ryken et al., 2013	1
645	Uganda	Itojo	Ndaija	-0.7233	30.3502	A	683	53	1 June 2009 - 31 May 2010	1	GS	C	Ryken, 2010; Ryken et al., 2013	1
646	Uganda	Bujaga	Nyeihanga	-0.6825	30.3894	A	859	41	1 June 2009 - 31 May 2010	1	GS	C	Ryken, 2010; Ryken et al., 2014	1
647	Uganda	Mijera	Rugarama	-0.6313	30.4463	A	1092	60	1 June 2009 - 31 May 2010	1	GS	C	Ryken, 2010; Ryken et al., 2015	1
648	Uganda	Nyamitanga	Ruharo	-0.6153	30.6868	A	2121	94	1 June 2009 - 31 May 2010	1	GS	C	Ryken, 2010; Ryken et al., 2016	1
649	Zambia	Izi	Mbete village	-8.8115	31.0413	A	54	8.3	1 Oct 1998 - 30 Sept 1999	1	GS	C	Sichingabula, 2000	1
650	Zambia	Lucheche	Kawe village	-8.8128	31.1516	B	312	1.2	1 Oct 1998 - 30 Sept 1999	1	GS	C	Sichingabula, 2000	1

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651	Zambia	Lunzua	Simumbele village	-8.7720	31.1478	A	686	14	1 Oct 1998 - 30 Sept 1999	1	GS	C	Sichingabula, 2000	1
652	Zambia	Upper Kaleya	near Mazabuka	-16.1833	28.0333	B	63	21	1997 - 2000	3	GS	A	Walling et al., 2001	1
653	Zimbabwe		Kariba	-16.5122	28.7661	B	514892	77.2	N.A.	N.A.	R	C	Bolton, 1984	0
654	Zimbabwe	Gwai	outlet	-17.9800	26.9256	B	14400	150	N.A.	1	GS	U	Dedkov and Mozzherin, 1984	0
655	Zimbabwe		Nyaru Shangwe	-20.2212	30.2836	A	108	704	1973 - 1984	12	R	U	FAO, 2008	1
656	Zimbabwe		Makaholi	-19.8485	30.7674	A	154	10	1970 - 1984	15	R	U	FAO, 2008	1
657	Zimbabwe		Chikwedziwa	-21.6863	31.3184	A	205	45	1950 - 1984	35	R	U	FAO, 2008	1
658	Zimbabwe		Mchingwe	-20.1967	29.5085	A	298	35	1967 - 1984	18	R	U	FAO, 2008	1
659	Zimbabwe		Mazoe	-17.5287	30.9943	A	348	64	1920 - 1984	65	R	U	FAO, 2008	1
660	Zimbabwe		Upper Umgusa	-20.0567	28.5739	A	401	48	1946 - 1984	39	R	U	FAO, 2008	1
661	Zimbabwe		Mchabisa (or: Mchabisa Sheet)	-21.0375	29.3689	C	435	88	1942 - 1984	43	R	U	FAO, 2008	0
662	Zimbabwe		Siya	-20.2470	31.6187	A	518	300	1977 - 1984	8	R	U	FAO, 2008	1
663	Zimbabwe		Ngezi	-18.7481	30.3937	A	1399	65	1944 - 1984	41	R	U	FAO, 2008	1
664	Zimbabwe		Manjirenji	-20.6007	31.5985	A	1536	319	1966 - 1984	19	R	U	FAO, 2008	1
665	Zimbabwe		Bangala	-20.6888	31.2207	A	1839	232	1963 - 1984	22	R	U	FAO, 2008	0
666	Zimbabwe		Ruit	-19.5781	31.7292	A	2615	333	1976 - 1984	9	R	U	FAO, 2008	1
667	Zimbabwe		Kyle	-20.2234	30.9826	A	3989	60	1961 - 1984	24	R	U	FAO, 2008	1
668	Zimbabwe		Rinette Weir	-21.2854	30.6321	A	6000	270	N.A.	9	R	U	Kabell, 1984	1
669	Zimbabwe		Jotsholo Weir	-18.6935	27.5841	B	14860	110	N.A.	6	R	U	Kabell, 1984	1
670	Zimbabwe		Chatikobu	-19.7166	32.0834	A	2.4	421	N.A.	N.A.	R	B	Van den wall Bake, 1986	1
671	Zimbabwe		Nyamembwe	-16.5225	31.5474	A	7.0	410	N.A.	N.A.	R	B	Van den wall Bake, 1986	1
672	Zimbabwe		Nyamasa	-17.1799	32.9265	B	7.1	157	N.A.	N.A.	R	B	Van den wall Bake, 1986	1
673	Zimbabwe		Masvaru	-19.2490	32.6049	C	8.6	469	N.A.	N.A.	R	B	Van den wall Bake, 1986	0
674	Zimbabwe		Demba	-20.3706	31.5966	C	10	332	N.A.	N.A.	R	B	Van den wall Bake, 1986	0
675	Zimbabwe		Mabgwe Matema	-20.2881	29.7295	A	28	80	N.A.	N.A.	R	B	Van den wall Bake, 1986	1
676	Zimbabwe		Masunswa	-17.0828	32.1347	C	29	348	N.A.	N.A.	R	B	Van den wall Bake, 1986	0
677	Zimbabwe		Banga	-20.8387	31.0724	C	38	12	N.A.	N.A.	R	B	Van den wall Bake, 1986	0
678	Zimbabwe		Mapanzure	-20.7671	31.1529	A	43	526	N.A.	N.A.	R	B	Van den wall Bake, 1986	1
679	Zimbabwe		Dowe	-20.0896	31.9004	A	52	306	N.A.	N.A.	R	B	Van den wall Bake, 1986	1
680	Zimbabwe		Ngwenya	-19.9171	28.8874	A	54	245	N.A.	N.A.	R	B	Van den wall Bake, 1986	1

ID	Country	River/Catchment Name	Measuring location	Lat (°)	Lon (°)	Coord. Quality	A (km²)	SY (t/km²/y)	MP	MP length (y)	Type	Data Quality	Reference	GIS
681	Zimbabwe		Hazeldene	-18.9116	32.3074	C	59	91	N.A.	N.A.	R	B	Van den wall Bake, 1986	0
682	Zimbabwe		Questeds	-20.4311	27.8320	A	61	84	N.A.	N.A.	R	B	Van den wall Bake, 1986	1