

An Overview of China's Water Statistics

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Abstract

A tremendous amount of statistical material on China's water system has become available since the 1900s. In this article, we provide an overview of the published sources of China's water statistics, mainly concerning hydrologic and social water supply and use statistics. Aggregate statistics and balances are available through publications of the Ministry of Water Resources and the National Bureau of Statistics, and specialized publications present information on sectors and individual enterprises in greater detail. Most materials are available only in Chinese, and some key information is available on the internet. An elementary reliability analysis is mentioned in the paper. The conclusions show that hydrologic data are reliable based on the rigorous compilation system while some unreasonable data do exist in water supply and use statistics. While shortcomings in coverage and quality affect many water indicators, China's statistics can be used for meaningful analysis, provided that the factors affecting data quality are given due consideration, and checks using other indicators are performed.

Keywords: Water Statistics, Hydrologic Data, Water Supply and Use

Introduction

China has undergone tremendous social and economic reforms over the past 30 years, and the changes are likely to continue for decades to come. Meanwhile, great challenges have been presented to water resources management, such as growing demand for water and a scarcity of available resources, coupled with severe water pollution and other water related environmental concerns. Recently, the State Council carried out the First National Census for Water, aimed to totally grasp the conditions of rivers and lakes, water structures, water use for social and economic use, development and harnessing of rivers and lakes, soil and water conservation, capacity building in the water sector. This paper mainly considers water statistics in China, which is essential for addressing severe water issues and problems mentioned above.

China has a long history in compilation and publication of water statistics. A wealth of hydrologic data has been collected and published by the water sector during the latter of the 19th century. At present many hydrologic yearbooks of that time are available. Unlike the hydrologic statistics, until the 1980s, the Ministry of Water Resources began to focus on water supply and water use data. The

first national water resources bulletin was published in 1997. With the aggregation of water pollution, water quality data also has been concerned at that time.

All these compiled data have been used by policy makers, businesses, and analysts inside and outside the country. Most statistics are available in aggregated reports only; little primary statistical information, i.e., reports from individual enterprises, is made public. Money need to pay for the statistics if someone intends to use these data.

For some analytic purposes, the public sources are insufficient, and some hydraulic information providers exist that can fill in some of the gaps. However, accessibility to primary statistical data is limited not only by usual hydraulic concerns about proprietary data, but also by the Chinese governments' low threshold for declaring information confidential. Definitions of what constitutes officially secret information are vague, and the punishments for releasing information that is declared secret after it is released can be heavy, so commercial information sources often are unable or unwilling to provide much detail beyond what lies in the public domain, al-

though they may be able to provide information before it is available to the general public.

In this article, we provide an overview of the published sources on China’s water statistics. The most aggregate summary statistics, and some more detailed reports, are easily available, and may be found on the internet and in widely distributed annual publications in both Chinese and English. The majority of the published information, however, is printed and distributed only in Chinese, rendering access difficult for most interested parties in other countries. Because of the great volume of material available, in this article we can provide only a broad view of what is available

and highlight some of the main issues that users of these sources should be aware of.

Water statistics in China

At present, water administration in China is shared by several ministries of the State Council and called “nine dragons administer water” [1]. Each ministry has its own right to manage related water issues (Table 1), which certainly lead to conflicts and disputes over ministry policies and strategies. The Ministry of Water Resources, according to Water Law [2], is the main water administration department of the State Council and takes charge of national water resources management and supervision.

Department	Scope of water administration responsibilities	Major functions
Ministry of water resources	Surface and ground water management, river basin management, flood control, water and soil conservation	The planning of water development and conservation, flood control, water and soil conservation, designation of water function regionalization, unified water administration
State Environmental protection Administration	Prevention and treatment of water pollution	Water environmental protection, water environmental function regionalization/zoning, to establish national water environmental quality standards and national pollutant discharge standards
Ministry of Construction	Urban and industrial water use, urban water supply and drainage	Planning, construction and management of water supply projects and drainage and sewage disposal projects
Ministry of Agriculture	Water uses for agriculture, and fishery aqueous environment protection	Non-point source pollution control, protection of fishery water environment and aquatic environmental conservation
State Forest Bureau	water resources conservation	Forest protection and management for protecting watershed ecology and water resources
State Electric Power Company	Hydro-power Development	Construction and management of large and mid-scale hydro-power projects
State Reform and Development Commission	Participation in the planning of water resources development and ecosystem building	Planning of water resource development, allocation of production force and ecological environment construction, coordinating the planning and policy of agriculture, forest and water resources, development
Ministry of Communication	Pollution control related to navigation of ships on rivers	Pollution control and management of inland navigation
Ministry of Health	Supervision and management of environmental health	Supervision and management of the drinking water standard

Table 1: Water administration agencies under the State Council and their functions in China.

(Revised based on F. Yan., *et al.* 2006).

Each ministry has the right to collect and compile related data (Figure 1). Statistics derive from different ministries is hardly consistent with each other. The reason lies in that different coverage and statistical method been applied during data collection. According to the first national census for water in 2011, the total quantity of annual water use of the economy and society amounts to 621.32 billion m3, while the number in China water resources bulletin is 610.72 billion m3. The relative tolerance is 1.74%.

There is a unique hydraulic administrative system in China. According to the Water Law of P.R. China, the combination of watershed water management and administrative region water management is applied in water resources administration (Figure 2). The Ministry of Water Resources, main department of water administration under the State Council, is responsible for the national integrated water resources management and supervision. As to the river basin management, there are seven river basins under

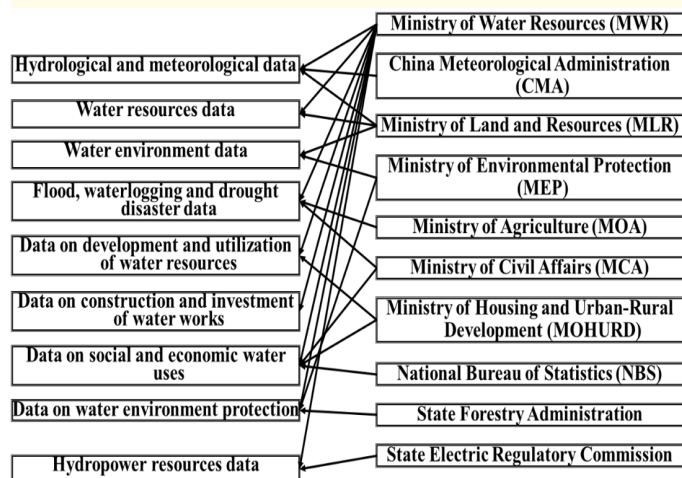


Figure 1: Primary data sources of different ministries in China.

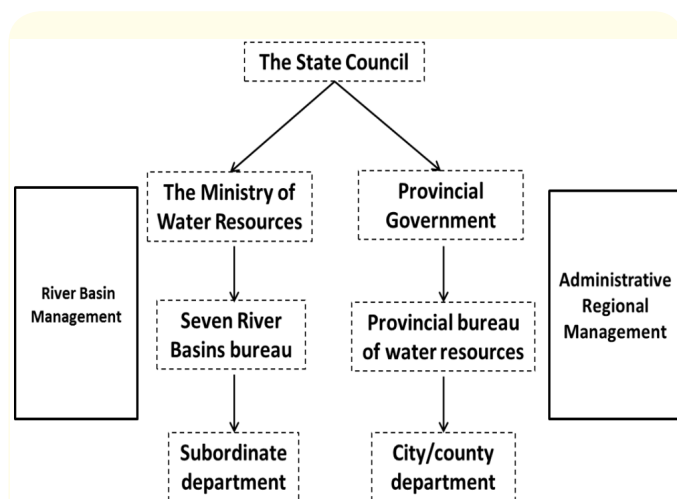


Figure 2: Water administrative systems in China.

the Ministry of Water Resources, including Song Liao river, Hairiver, Huai river, Yellow river, Yangtze river, Taihu river and Pearl river basin.

The role of water statistics can be expressed as follow. First, good data can support policy formulation. Second, complete water data system is helpful to the intensification of water resources management. Last but not least, a good water data system is beneficial to promote sustainable use of water resources.

Water statistics in China can be published as bulletins, year-books, white books, data collection and survey reports. Although there are some monthly statistics, most data is released yearly. Usually in the second half of one year the authority releases the data of last year.

Primary data sources

In this paper, we mainly focus on the water statistics collected and published in China, where mainly contain hydrologic data, water supply and use data. An overview each of them is provided in the text respectively. Because of its importance to hydraulic staffs and users, the First National Census for Water also gets concern in the follow passage. We don't involve water quality data because the Ministry of Environment Protection takes responsibility of publication those data.

Hydrologic data

China has a long period of observing hydrologic phenomenon since heavy flood and draught hit the nation occasionally in history. In the Qin and Han dynasty, people constructed stone poles to observe the water level. Some hydraulic books emerged along with the proceeding of society. Hydrologic yearbook began to be published systematically in 1922 by the Yangtzeriver bureau. After the foundation of People's Republic of China, the hydrology work proceeded fast than ever. The Ministry of Water Resources organized the compiling of historical hydrologic data. The work began in Chang Jiang and Huai river basin in 1949, followed by Yellow River, Pearl River and other basins.

The data complied mainly contains water level, flow, sand, precipitation, evaporation, water centigrade, etc. Around 44 thousand pieces of data were compiled, and 91 books were published until 1959. In the same year, Ministry of Hydroelectric made a national wide uniform for hydrologic data processing, which was regulated in 1964. The publication work was stopped in the late of 1980s and not continued until the year of 2001. National hydrologic yearbook contains 10 volumes and 74 books.

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The publication of China hydrologic yearbook has a complete system. Staff in the local hydrologic station measures metadata originally. The metadata was interpolated and sorted for the first time. Then data is passed to local bureau where the work group compiles and censors the data another time. Finally, all the local data will be sent to the national committee, where the publication of yearbook being decided upon the data's accuracy and rationality. Besides national hydrologic yearbooks, data are also published

both in river basin level and provincial level yearly. China hydrology basic database system structure is showed in figure 3.

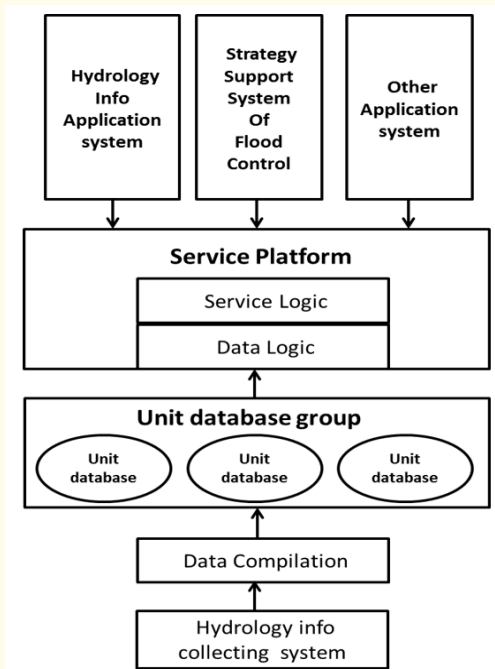


Figure 3: China hydrology basic database system structure [4].

China hydrologic yearbook includes systematical hydrologic data for users to cite and analyze. The data in the yearbook is listed in order [3] by:

1. Water level data, consists of daily average water level, subtracted flood level and dam flood level;
2. Tide data, where the user can find hourly tide level, high and low tide level, monthly or yearly tide level, subtracted tide level, daily highest or lowest tide level and storm tide level;
3. Flow data, including observed flow results, cross-section data, flow of gate dam, flow of water plant, daily average flow, flood factors, flood factors of gate dam and reservoir factors;
4. Tide flow data, with observed tide flow outcome, monthly and yearly tide flow, tide flow of gate dam, discharge of tide flow and hydrological factors of tide;
5. Sediment transport rate, with observed transport rate of suspended load, daily average transport rate of suspended load, daily average sediment concentration, observed transport rate of bed load, daily average transport rate of bed load, monthly and yearly transport rate of bed load;
6. Sediment grading data, with observed suspended load grading, observed velocity, sediment results, daily average suspended grading, monthly and yearly average suspended grading, observed bed load grading, observed gravel grading;

7. Water centigrade and ice slush data, with daily water centigrade, ice thickness, ice slush condition, observed ice slush flow, daily average ice slush flow;
8. Precipitation data, with daily precipitation, extracted precipitation, and maximal precipitation;
9. Water surface evaporation data, with daily water surface evaporation and auxiliary terms.

According to the Water Law of the People's Republic of China [2], basic hydrologic statistics should be opened to its users. Many hydrologic data can be found in library of institute or university. However, some local hydrologic data still remains undeclared. Users may resort to monetary or other access to obtain those data.

Water supply and use data

The classification of water supply consists of surface water source-including water transfer between basins, ground water source and other water source (Figure 4). Surface water supply contains data from water storage project (reservoir), water diversion project, water lifting project and water transfer project. Ground water supply is surveyed shallow ground water and deep ground water respectively. Usually the water underground around 100 meters and being pressured is ranged as deep ground water. Ground water exploitation mostly occurs in the north of China. Other water supply source mainly contain rainfall collection, sewage reuse and seawater utilization. The quantity of seawater utilization is not contained in the total water supply quantity.

Figure 3: Category of water supply in China water resources bulletin.

Basically, water use in China has a unique classification and statistical system, which is classified into four categories including agricultural water use, industrial water use, life water use and ecological water use. In detail, each of the categories is divided to two small items (Figure 5).

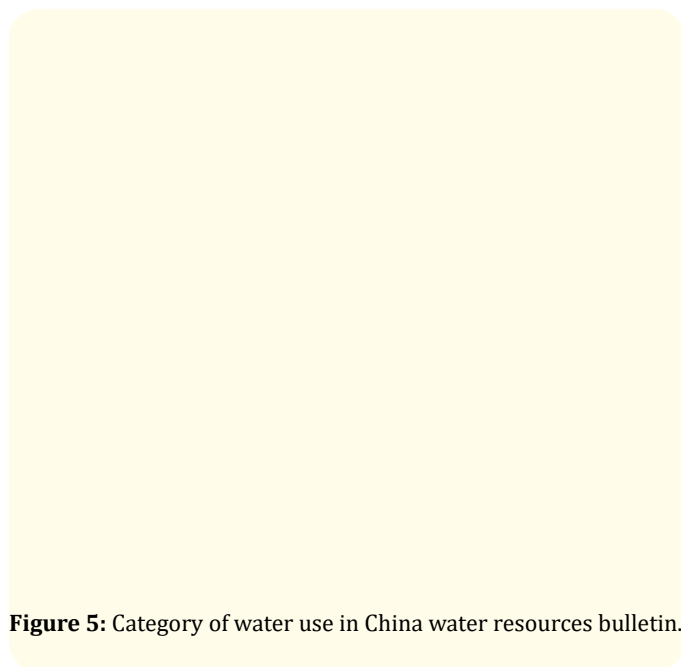


Figure 5: Category of water use in China water resources bulletin.

The main source of water supply and use data is China water resources bulletin, which is published yearly by the Ministry of China Water Resources. The user also can obtain wanted data in China water yearbook, China water statistical yearbook, China environmental yearbook and other survey reports, where most of the water supply and use data is cited from China water resources bulletin.

There is no systematically census on water supply and use during the beginning of People's Republic of China. The earliest water use data emerged in the 1980s since the ministry of water resources organized a national survey on water development and utilization at that time. Then in the 1990s, the first middle-long term water supply and demand plan was finished, in which the user can obtain the water supply and use statistics of that time. Before 1994, some provinces or local governments collected social water use data and made their own bulletin on water resources. Seventeen provinces in the north area began to publish water resources bulletin officially from 1994 to 1996. Since 1997, the national wide bulletin was published. River basin and province even some cities also have their own bulletin published today.

In this paper, the author mainly introduces China water resources bulletin, which basically is regard as the most authorities' sources of water supply and use. Both government staffs and institute researchers are likely to take the bulletin data first in their work.

China water resources bulletin, which is published yearly since 1997 by the ministry of water resources, mainly focuses on water resources volume, development and utilization, water quality and important water events of last year. The statistics, regarding on situation of coming water, water use and water quality, are open to the society, aimed to help hydraulic staff or official to make strategies and cultivate the water saving awareness of people.

The statistical method applied in water resources bulletin is comprehensive. The investigate group takes regional water use quantity as objects of statistical. Combining with common management information and economic society statistic message, the water use quantity is calculated by the union of practical investigation and quota index method.

The compilation and publication of the bulletin has an all-around system (Figure 6). The bulletin is published by ministry of water resources. There is a national bulletin committee, which most members come from Hydraulic and hydroelectric institute of China, taking the responsibility to finish the national bulletin. In the river basin and provincial level, each of those departments also has their own compilation committee, usually compromise of basic staff and technical staff. The collected and compiled data will be hand to superior level until the national committee.

According to the code of bulletin compilation, there should be many stations for data collection. In matter of fact, two sources of data collection are realized presently. One is that the staffs from provincial water resources department evaluate related index empirically. The other is some data observed by local stationers. It is a pity that a part of data is evaluated because there is no data observation infrastructure. Once the series data merged, data momentum is likely occurring. For example, an indicator may be obtained by using usual growth rate if there is no measurement.

Unlike the hydrologic statistics, the water supply and use data is closely related to local government's benefit, which may be another reason for the data's instability. Especially the declaration of "Three Red Lines" item regarding on the most rigorous water management system put forward by the State Council in 2011. Many

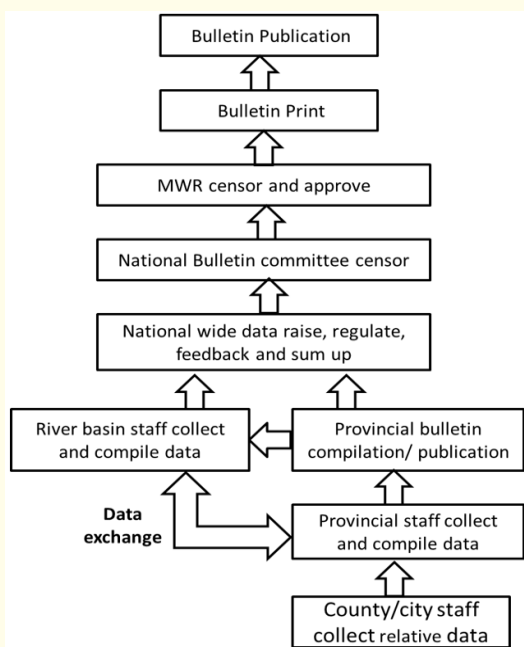


Figure 6: The publication process of China water resources bulletin.

provincial authorities’ resort to falsification on the water use data so as to get better water right in the future. Hence, a healthy skepticism is necessary when users citing and drawing conclusions from these materials.

First national water census

According to the decision of the State Council, the Ministry of Water Resources (MWR) organized the First National Census for Water. Due to obtain a systematically hydraulic condition in China, the Office of the State Council Leading Group of First National Census for Water was established, including variety of branches in local and river basin level. The census, which involved a huge investigating system, lasted three years from 2011 to 2013. The scope of census covered territory of People’s Republic of China (excluding Hong Kong special administrative region, Macao special administrative region and Taiwan area). The adopted investigating methods consist of comprehensive survey, sampling survey, typical survey and key project survey. The contents of census mainly include basic conditions of river and lakes, basic conditions of water structures, water use of the economy and society, development and harnessing of rivers and lakes, soil and water conservation, capacity building in the water sector, etc.

The census applied localization principle and taken the county level administration as the basic working unit. With the approval of the State Council, the simple results of water census were published by Ministry of Water Resources and National Bureau of Statistics (NBS), which denoted the firstly succeed was arrived.

The method applied in the census mainly focusing on practical investigation. The basic unity is county and the survey object is water users. Each of the large water uses was investigated while the common water users were selected to investigation. Then the water use quantity of all industry can be concluded by comprehensive calculation.

With the approval of the State council, the primary results of the water census were published on the 26th, March 2013. The census investigated around 99 million objects and arranged more than 9 million tables been finished. The working group received 400 million data regarding rivers, lakes, water projects, water structures, water use, etc. Basically, the census figured out the overall condition about national water system and grasped the development, utilization and protection of social-economic water use. The census also knew well about the capacity of water sector construction and management. Based on the national water census, the best water information system ever has been established, which is a substantial backup for the construction of national water information system.

Reliability of China’s water statistics

The data problems are unlikely to be unique to China, other transition and developing countries experience similar difficulties (Holz, 2005). However, whether China’s statistics reliable surges much debates among scholars, experts, economists and political leaders who are concerned about China’s rapid economy growth rate. For example, in remarks to the U.S. ambassador in 2007, Vice Premier Li Keqiang stated, “GDP figures are ‘man-made’ and therefore unreliable,” according to a Wiki leaks release of a U.S. diplomatic cable [5]. Then the question we care about here is whether the water statistics in China also have the similar problems. Can we cite the water statistics directly in our study or research?.

Few concerns about accuracy and reliability of China’s water statistics has been claimed presently. But that cannot denote safe of the data. In the contrary, there are similar problems regarding China’s water data, where we would discuss in the next.

Though there can be some mistakes, hydrologic data in China is mostly reliable since systematical collecting, compiling and censoring. There is a final quality appraisal meeting about national hydrologic yearbook each year, holding by department of hydrology, Chinese Ministry of Water Resources. In 2011, Code for Compilation and Publication of Hydrological Yearbook is applied firstly in the whole nation. The appraisal meeting hold in Hulunbeier city demonstrated that the error rate of hydrologic data statistic is 1/100000 and the national average scores is 96.8. The national committee pursues a perfect management and fine quality guarantee system to provide reliable hydrologic statistics.

Water supply and use data, however, confronts lasting skeptics since its publication. According to code of practice for water resources bulletin [6], data sources mainly derive from available data of relative bureau, combining with necessary typical survey, observation and monographic study. But quantity of data is evaluated empirically by local staffs in fact. There is no strict observation system in local department for obtaining original metric statistics. Not surprisingly, after the first national water census, the data announced by the State Council have a big gap compared with water resources bulletin data.

However, some substantial problems need to be deal with in the following work, such as the provincial or more detail water use data is inconsistent with the data derive from the China Water Resources Bulletin.

Data from table 2 indicates that there is a big difference between the two bulletins, especially the industrial water use data, whose relative tolerance grow to 17.70%. The data of national census for water, which is released by the State of Council, is superior to the China water resources bulletin statistics, which is issued by the ministry of water resources. So how to coordinate the two sets of data is a tough problem for the national committee of water resources bulletin.

Item	CWRB	BNCW	Absolute error	Relative tolerance
Total water use	6107.2	6213.2	106.0	1.74%
Agricultural	3743.6	4168.2	424.6	11.34%
Industrial	1461.8	1203.0	-258.8	-17.70%
Life	789.9	735.6	-54.3	-6.87%
Ecology	111.9	106.4	-5.5	-4.92%

Table 2: Difference between water resources bulletin and First National Census for Water in China.

Considering the problems confronted at present, many managers and experts are pursuing a rational method to revise history water use data by water census data. Methods such as interpolation, trend deviation or least square method are applied in revision. However, the barrier is still difficult to tackle and the rationality is need more analysis before a convincing outcome being released [7-14].

Conclusion

While large amounts of data on China's water supply and use system are available, recent reports of inconsistencies in water statistics may tempt some observers to dismiss all of the country's statistical materials as fabrications. The issues discussed in this paper show that it would be unwise to accept all water statistics at face value, but also that outright rejection is also unwarranted. China's water statistics can be used for meaningful analysis, provided that careful consideration of the factors that influence coverage and quality of specific indicators is combined with a realistic assessment of the degree of accuracy needed for the analytic task. It is often worthwhile to perform simple checks using other statistics. A healthy skepticism, rather than prejudice, and informed cross-checks are called for in drawing conclusions from these materials.

Definitions and coverage of statistical categories are sometimes unclear, and occasionally some indicators are subject to misreporting. Despite these problems, the publicly available material is vast, of generally good quality, and tremendously useful so long as care is taken to account for potential biases.

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