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The Dataset of Groundwater in the Baiyangdian Lake Catchment of China

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Abstract: During the study of the groundwater flow system in the Baiyangdian Lake catchment, thirty six water samples of surface water and groundwater were collected on June 2009. Based on the field work, the Dataset of Groundwater in the Baiyangdian Lake catchment of China was completed by standard information processing. The dataset includes five group files: (1) the catchment boundary data based on the ASTER GDEM (Watershed_BYD), (2) GIS data of rivers and lakes (River_Lake_BYD), (3) water level contours of the shallow groundwater in the lower reaches of the catchment (ContourWaterLevel_BYD), (4) the field survey data including sampling sites of surface waters, the first, the second and the third aquifers, the water table depth of the shallow groundwater, the tritium contents of groundwater (sampling data), (5) the annual average tritium content of precipitation from 1954 to 2007. The dataset was archived in .shp and .xlsx data formats with the data size of 318 KB (in .rar file) .

Keywords: the Baiyangdian Lake; catchment; groundwater; tritium; precipitation

1 Introduction

Researches on shallow groundwater flow system in the Baiyangdian Lake catchment[1–6] were carried on with the support of the fund from the Key Program of National Natural Science Foundation titled as Study on water cycle in the Baiyangdian Lake catchment based on a multi-scale observation and comparison. During the research, the catchment boundary, the river system, sampling sites and their geo-locations were got in the field survey and analysis in the laboratory. At the same time, the water table depth was measured and the historical annual average tritium content of precipitation was estimated. The geographic data comprise the dataset of groundwater in the Baiyangdian Lake catchment. The dataset is helpful for those studies on the catchment.

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2 Metadata of Dataset

The metadata of groundwater dataset in the Baiyangdian Lake basin[7] is summarized in Table 1. It includes the dataset full name, short name, authors, year of the dataset, temporal and spatial resolution, data format, data size, data files, data publisher, and data sharing policy, etc.

Table 1 Metadata summary of the dataset of groundwater in the Baiyangdian Lake catchment

Items	Description		
Dataset full name	Groundwater dataset in the Baiyangdian Lake basin		
Dataset short name	GroundwaterDataBaiyangdian2009		
Authors	Yuan, R. Q. L-4605-2016, Shanxi University, rqyuan@sxu.edu.cn Song, X. F. L-4602-2017, Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences, songxf@igsnrr.ac.cn		
Geographical region	The Baiyangdian Lake catchment	Year:	2009
Data format	.dbf, .shp, .xls	Data size	318 KB
Data files	The dataset including five group files: (1) boundary data of the Baiyangdian Lake Catchment (Watershed_BYD); (2) river system data (River_Lake_BYD); (3) contours of water level of the shallow groundwater (ContourWaterLevel_BYD); (4) in situ data collected in June 2009 including sampling sites, the water table depth, and tritium content (SamplingData); (5) annual average tritium content data in precipitation(1954−2007)		
Foundation(s)	National Natural Science Foundation of China (40830636)		
Data publisher	Global Change Research Data Publishing & Repository, http://www.geodoi.ac.cn		
Address	No. 11A, Datun Road, Chaoyang District, Beijing 100101, China		
Data sharing policy	***Data*** from the Global Change Research Data Publishing & Repository includes metadata, datasets (data products), and publications (in this case, in the *Journal of Global Change Data & Discovery*). ***Data*** sharing policy includes: (1) ***Data*** are openly available and can be free downloaded via the Internet; (2) End users are encouraged to use ***Data*** subject to citation; (3) Users, who are by definition also value-added service providers, are welcome to redistribute ***Data*** subject to written permission from the GCdataPR Editorial Office and the issuance of a ***Data*** redistribution license; and (4) If ***Data*** are used to compile new datasets, the 'ten per cent principal' should be followed such that ***Data*** records utilized should not surpass 10% of the new dataset contents, while sources should be clearly noted in suitable places in the new dataset[8]		

3 Methods

3.1 Study Area

The Baiyangdian Lake catchment is located in the central part of the North China, with warm temperature, semi-humid monsoon climate, and it covers an area of about 31,200 km^2. The western part of the study area is mountainous region, and the eastern part is a plain composed of alluvial fans and alluvial plain. All rivers originate from the mountainous area, flow through the plain area and discharge into the Baiyangdian Lake. These rivers have run dry since the 1970s due to the construction of reservoirs in the upper reaches of the rivers.

3.2 Data Collection and Processing

The ASTER GDEM data[9] was used to produce the catchment boundary and the river system using the ArcGIS software. The catchment boundary and the river system were con-

firmed by field surveys. The sampling sites selected were distributed along the direction of shallow groundwater flow on the north, the south and the central parts, respectively. The distribution of sampling sites was augmented advisably in the central part due to dense population and convergent flow of surface water and groundwater. The elevations of the sampling sites were measured by GPS. The average of the measurement was compared with the elevations estimated from maps with a scale of 1∶50,000 to confirm the accuracy. Water table depth of the shallow groundwater was measured on June 2009. The contours of water level of the shallow groundwater were drawn using the ArcGIS software.

Thirty six water samples of surface waters and groundwater were collected. Every water sample was collected into two 500 mL glass bottles that were filled to overflowing and double capped. Samples were measured for tritium contents by the ultra-low background liquid scintillation spectrometer (Quantulus1220) after distillation and electrolyzed enrichment in the Key Lab of Groundwater Science and Engineering of Ministry of Land and Resources.

The historical annual average tritium content of precipitation was estimated. Many GNIP sites surround the catchment. Among them, the Shijiazhuang Site locates on the southwest and the Tianjin Site lies in the direction of northeast. The both sites are very close to the boundary of the catchment with a distance less than 150 km to Baoding the center of the catchment. Given the same geographic unit (the North China Plain) and the consistent hydro-meteorological conditions, the historical annual average tritium contents of precipitation at Baoding were estimated by inverse distance interpolation method from the records of the Shijiazhuang and the Tianjin sites for the period from 1985−2002. The historical data for the periods from 1954 to 1984 and from 2003 to 2007 were extrapolated routinely by the regression relation with the records from the Ottawa site (Canada). Those data composed the historical annual average tritium content of precipitation of Baoding Station in the catchment from 1954 to 2007.

4 Results and Validation

4.1 Data Products

The dataset consiste of five group files: (1) The boundary of the Baiyangdian Lake Catchment (Watershed_BYD) (Figure 1); (2) The river system of the Baiyangdian Lake Catchment (River_Lake_BYD); (3) The contours of water level of the shallow groundwater (ContourWaterLevel_BYD); (4) The data of the field survey on June 2009 including sampling sites, the water table depth, and tritium content (SamplingData); (5) The historical annual average tritium content in precipitation from 1954 to 2007.

4.2 Data Validation

The history dataset from 1954 to 2007 were validated as follow: (1) the trend and the occurrence of peak values of the estimation are consistent with the records of the Ottawa site. It is rational due to the precipitation tritium content in the northern hemisphere controlled by nuclear weapon tests since 1954. As a result, the precipitation tritium content increased dramatically until the 1980s. After then, the content decreased quickly; (2) the historical annual average tritium contents in precipitation were calculated using the methods of Wu[10]

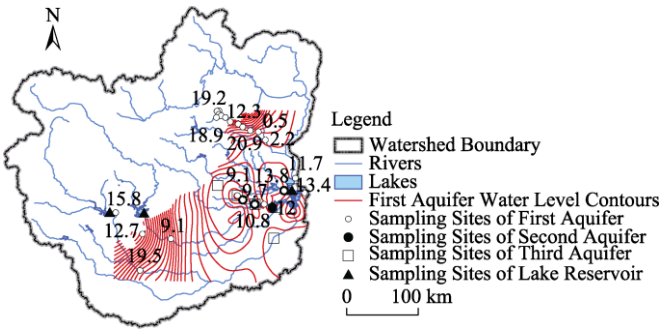

Figure 1 The boundary, the river system, sampling sites of groundwater and surface water, the contours and tritium contents (unit: TU) of groundwater in the first aquifer in the Baiyangdian Lake catchment

and Lian[11]. The linear correlation coefficients of 0.99 and 0.76, which is very close to the recovered record of the Shijiazhuang site[12].

5 Discussion

The dataset was completed based on the field survey and data analyses. All data is the first-hand data. The data is accurate and reliable, which can provide fundamental data for studies of the Baiyangdian Lake catchment.

Author Contributions

Song, X. F. and Yuan, R. Q. designed the algorithms, collected and processed the data. Yuan, R. Q. wrote the data paper.

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