2014

ANNUAL REPORT

IWHR

China Institute of
Water Resources and
Hydropower Research

中国水利水电科学研究院

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WELCOME MESSAGE

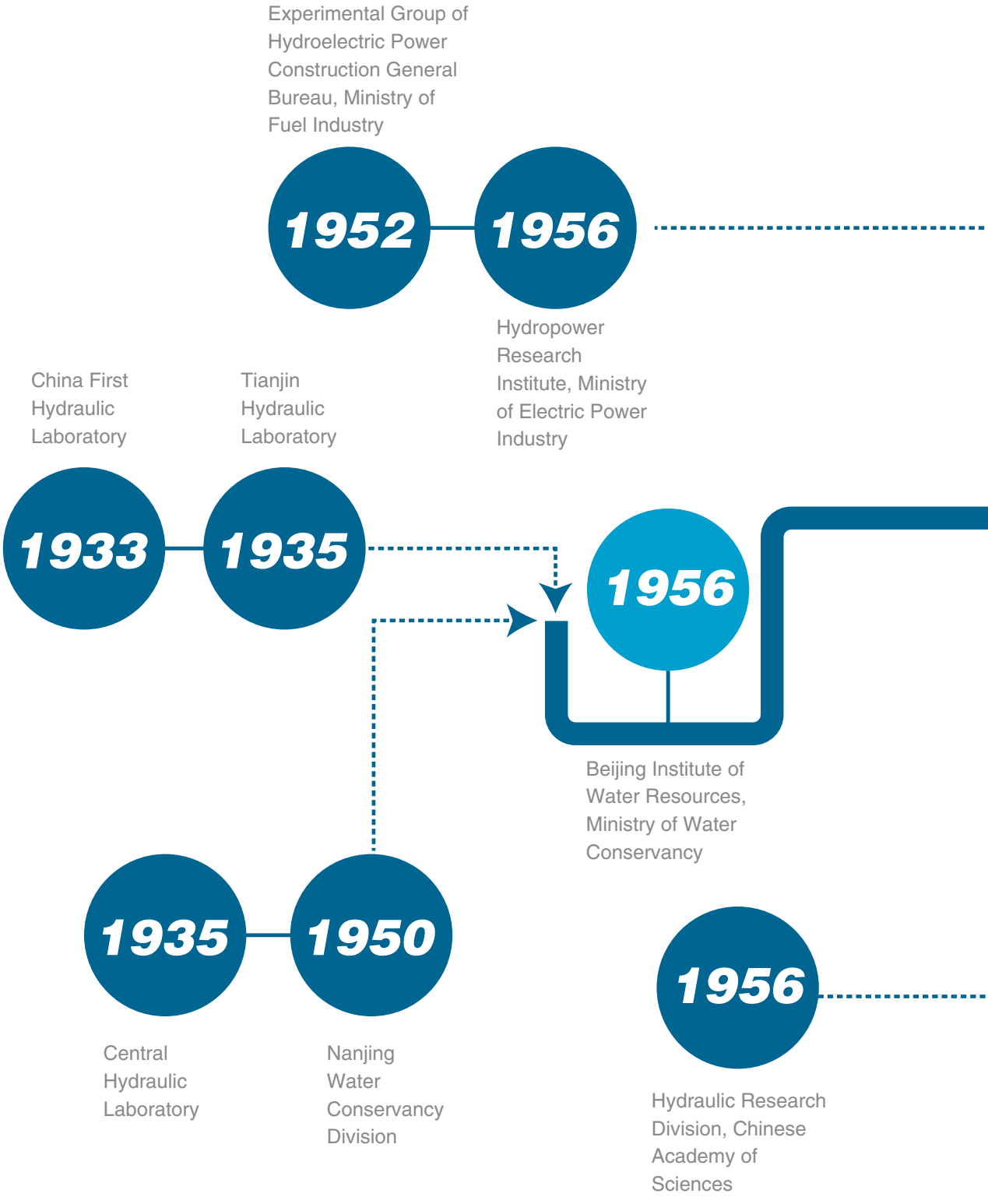
China Institute of Water Resources and Hydropower Research (IWHR) is a national research institution under the Ministry of Water Resources of China, and is engaged in almost all the disciplines related to water resources and hydropower research. With over 50 years of development, IWHR has grown into an indispensable think tank of the Chinese government for decision making and a backbone technical consultant in water related areas. It is at the same time the host of multiple international organizations or their Chinese branches, including WASER, WASWAC, ICOLD, ICID, IAHR, GWP and IHA, etc.

In 2014, IWHR received 200 foreign visitors and dispatched experts to 24 countries and regions in order to boost knowledge sharing as well as technical exchange and cooperation. We devoted tremendous efforts to the preparation of the 7th World Water Forum, coordinating sessions under the Thematic Progress and the Science & Technology Progress. We also worked with China Three Gorges Corporation and other partners as joint sponsors for the upcoming 2015 IHA World Congress in Beijing. Other events that marked this year include the successful convening of the 11th annual joint seminar with KICT, the election of IWHR expert as the Vice President of ICID and the establishment of International Association for Hydro-Environment Engineering and Research (IAHR) Beijing Office in IWHR.

In 2014, IWHR accomplished great breakthroughs in R&D, attaining overall progress in flood control and disaster mitigation, water resources management and eco-environment improvement, efficient irrigation, drinking water safety, as well as the construction, operation and management of key water projects. The contract volume of IWHR grew by 12.7%, hitting another record high of CNY 1.249 billion. Throughout the year, IWHR accomplished 757 papers, 43 monographs, 67 patents and 26 standards in addition to 31 main awards and prizes, including one first grade prize and four second grade prizes of the National Prize for Progress in Science and Technology and 26 provincial awards.

Looking ahead into the year 2015, we will build on our existing efforts and hold the hands of our international partners more firmly on the joint adventure to the future. The ship of IWHR can never sail without the support and driving of all its international friends, to whom we would like to extend our heartfelt appreciation. Hope we could do more to better the future of water in China and the whole world!

Kuang Shangfu, Ph.D.
President of IWHR


Experimental Group of Hydroelectric Power Construction General Bureau, Ministry of Fuel Industry
1952
1956
Hydropower Research Institute, Ministry of Electric Power Industry
China First Hydraulic Laboratory
Tianjin Hydraulic Laboratory
1933
1935
1956
Beijing Institute of Water Resources, Ministry of Water Conservancy
1935
1950
Central Hydraulic Laboratory
Nanjing Water Conservancy Division
1956
Hydraulic Research Division, Chinese Academy of Sciences

HISTORY

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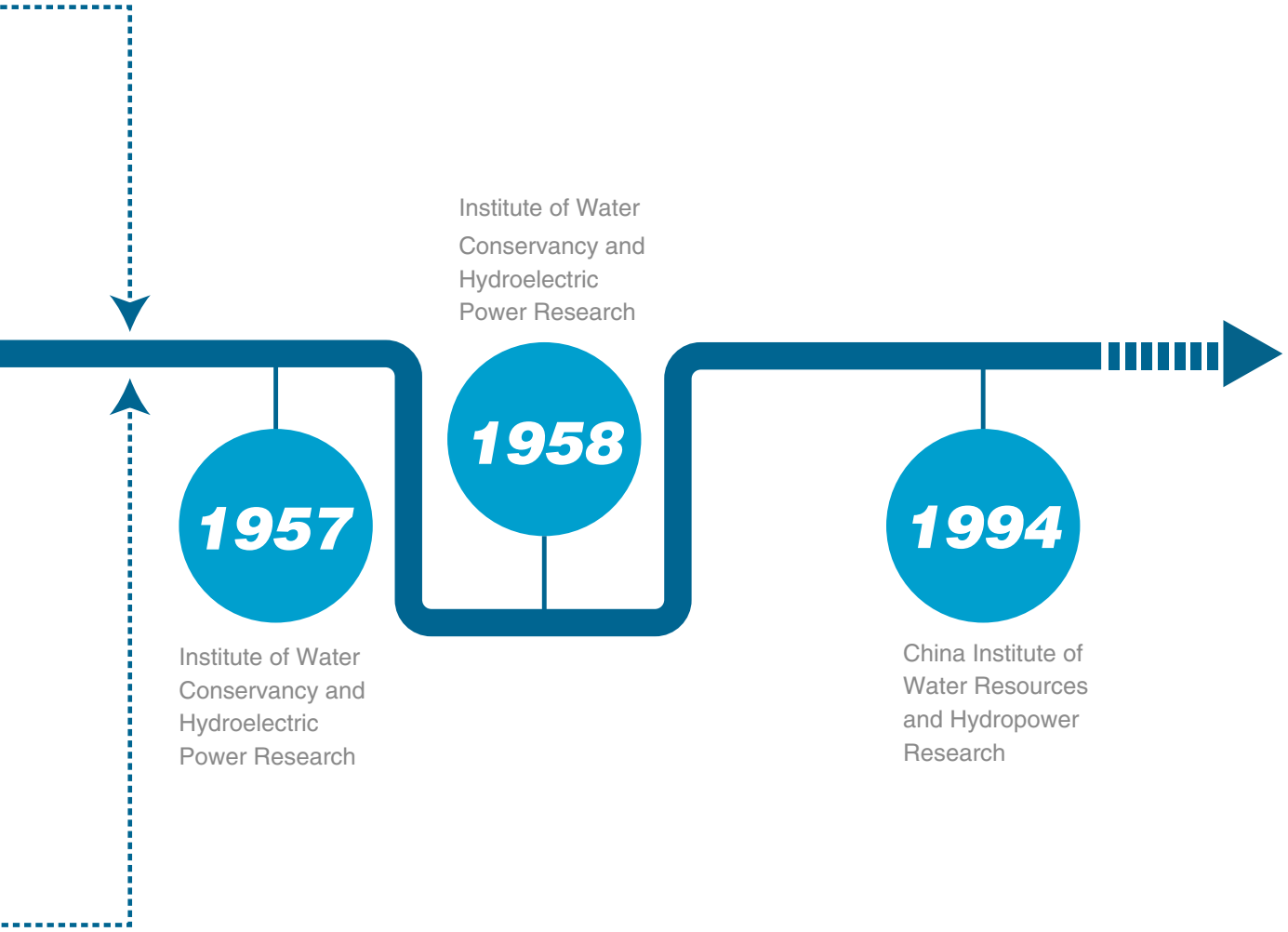

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Mission Achievement

Management Achievement

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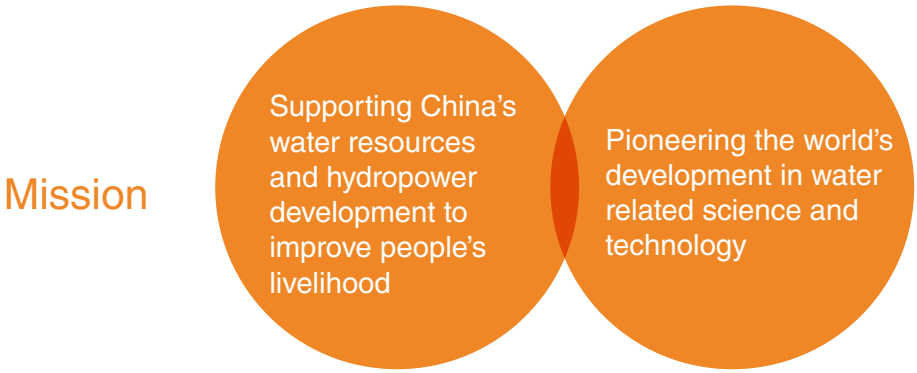
CHINA INSTITUTE OF WATER RESOURCES AND HYDROPOWER RESEARCH

Magnificent sunset © Wang Jun (IWHR)

Vision and Strategy

Vision


Vision
Striving to be the pioneer for creation and innovation of water related frontier science and technology


Mission
Supporting China's water resources and hydropower development to improve people's livelihood
Pioneering the world's development in water related science and technology


Spirit
Innovation
Practicality
Devotion
Dedication

Strategy


1 Goal
• A world-class research institute of water resources and hydropower by 2020
2 Priorities
• Strategic, overarching, forward-looking and fundamental problems of water sciences
• Key technological problems incurred in huge hydro projects
3 Capacities
• Innovativeness in science and technology
• Competitiveness in market
• Competency in international arena
4 Bases
• Scientific and technological innovation
• Research, development and industrialization
• Training of top professionals
• International cooperation and academic exchange
5 Developments
• Human resources
• Relevant disciplines
• Research infrastructure and facilities
• Institutional settings
• Organizational culture
6 Excellences
• Research team
• Disciplines
• Facilities
• Management
• Technical achievements
• Socio-economic benefits

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Tianchi Lake © Li Lei (IWHR)

Mission Achievement

Representative Researches

Study on security of "water-ecology-economy" of West Liaohe Plain

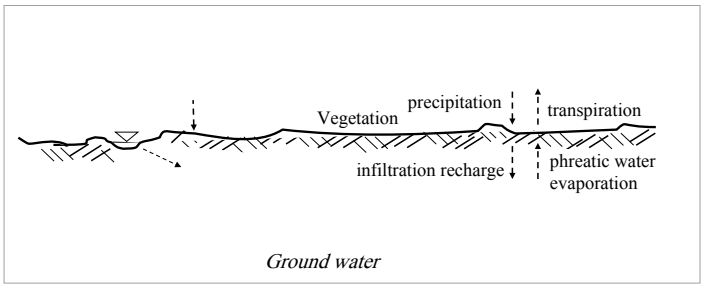
CHEN Minjian, LI Heyue, WANG Lin, etc.

Background

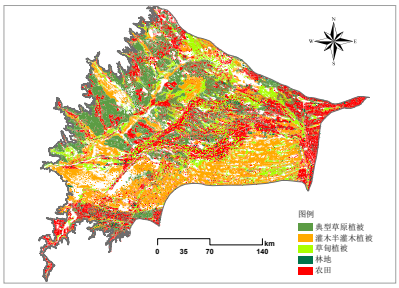
The West Liaohe River Plain is a region interlaced with agricultural and pastoral areas, observing an average annual precipitation of 200-400 mm, water surface evaporation of over 1000 mm, and drought index of 3-7. The irrigation dominated regional economy places a slew of great impact on the local soil and water resources and ecological security. This project, focusing on the hydrological circulation and ecological security of the region, is conducted right on time to solve the water related resource, environmental and economic problems, which is of great importance to the water and economic security of the region.

Contents

- Studying the characteristics of hydrological cycle of semiarid areas. The vertical water cycle plays an important role in this area and it's different from arid areas such as Northwestern China and semi humid areas such as Northern China.
- Studying the ground water recharge mechanism, mainly the precipitation and irrigation infiltration, as well as the assessment of conditions for ground water recharge.
- Analyzing the quantitative relationship of grassland vegetation and underground water evaporation, proposing the suggested critical depth of groundwater.
- Identifying of the ecologically sustainable groundwater levels of agricultural and pastoral areas, prioritizing the development of aquifers, so as to define the proper approach to develop groundwater.
- Building a security evaluation platform for water-ecology-economy system, which has integrated the indexes of industrial structure and social development.



Vertical hydrological cycle of West Liaohe Plain



Ecological pattern in West Liaohe Plain

Achievements

- The vertical hydrological cycle of precipitation-infiltration-groundwater and ecological security theory for semi-arid regions are established.
- A great deal of evidence of the vegetation succession is discovered, revealing the evolution process of grassland ecological system and the driving forces.
- The eco-hydrological mechanism of the West Liaohe River Plateau is revealed and the methods to calculate the ecologically sustainable groundwater levels are built which reflect the physical process.
- The ecologically sustainable groundwater levels are defined for irrigation areas and pastoral areas according to the threshold critical depth and the respective management system is established; the dynamic groundwater supplement and dissipation structure of the West Liaohe River Plain is put forward, clarifying the rule of recharge and discharge.
- Five main structural relationships is revealed between the security of resource, ecosystem and socio-economic development, building the driving relationship and security guarantee system among water, ecosystem and economy.

Application

With the guidance of the project, regions and counties of the Tongliao City have established differentiated groundwater management for the pastoral and agricultural areas. The threshold critical depth for irrigation areas is 7 m to protect the aquifer, and 2 m for pastoral areas to protect the grassland vegetation. A plan is put forward to restore parts of the grassland, especially those low yielding farmland and barren land. The total area is expected to be at least around 2500 km^2. The plan will generate remarkable ecologic benefit and indirectly increase the reserve of groundwater by 500 million m^3. Based on the plan, the government of Tongliao City has set a restoration target of about 3000 km^2, the detailed task of which has been allocated to each county.

Field observation of the threshold critical depth for vegetation

Building groundwater monitoring wells

Research on strong motion monitoring and seismic input mechanism of dam

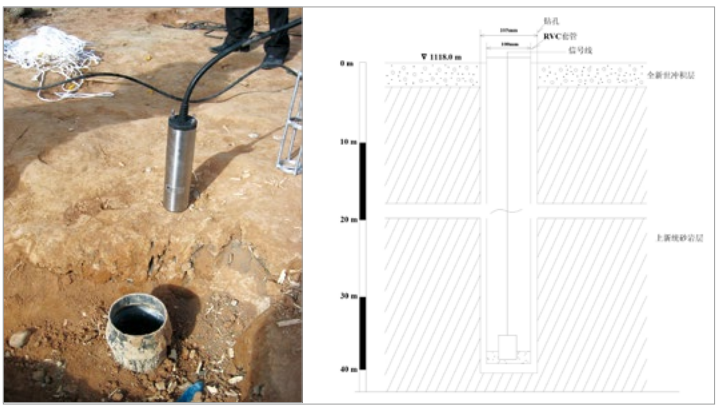
HU Xiao, ZHANG Yanhong, ZHONG Jufang, etc.

Background

The hydropower development zones of China in southwest and northwest are all located in regions of high seismic intensity, which makes the seismic safety of projects during construction and operation very important. Due to the complexity of morphological and geographical conditions at the dam sites, the seismic input mechanism remains a great challenge. This project is a research on the strong motion monitoring of dams and seismic input mechanism, which is able to provide rapid and multi-perspective safety assessment for early warning against the structural seismic disaster that is necessary for the timely smart decision making in case of earthquake. The strong motion monitoring technique amplifies and develops the seismic safety theory and method of dam earthquake engineering, providing technical reference for anti-seismic design of hydraulic structures.

Contents

- Collecting the existing record of strong motions in China and other countries, building an earthquake database for high dams and reservoirs consisting multi-layer geospatial data and basic data of dams.
- Studying the anti-seismic smart decision making system, which serves as a guidance for the quick safety report and anti-seismic reinforcement of dams.
- Using the software and hardware technology of solid-state-storage accelerograph as well as the modern network technology to support the real time remote transmission of strong motion data.
- Establishing the strong motion monitoring array of pilot dams.
- Establishing the remote management and analysis system for strong motions of key dams.
- Studying the seismic input mechanism of dams.



Acceleration monitoring point at dam foundation deep hole

Achievements

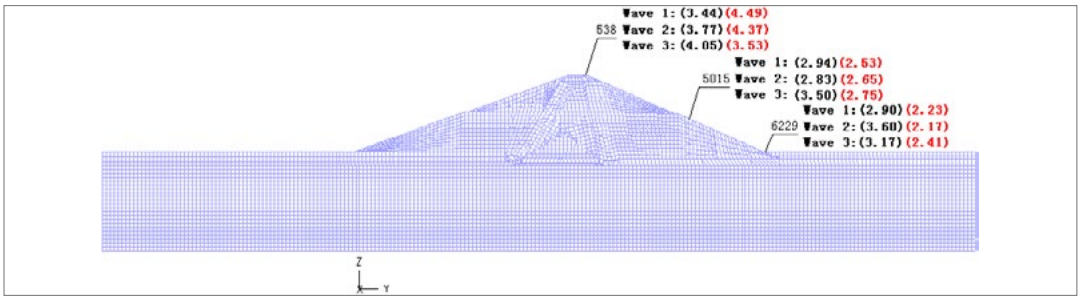
- Based on the MapGis system, the basic database for some key dams in China is built along with the thematic layers for earthquake geological guidelines, active faults, spatial distribution of earthquake, and potential source distribution.
- A smart decision making system is built consisting of statistical module for quick safety report as well as mathematical and mechanical module for earthquake engineering of dams.
- The seismic input mechanism is explored, including the seismic peak ground acceleration, envelop function, evolutionary power spectrum model parameters, spatial variation of stationary power spectrum, etc. The attenuation relation of ground motion is analyzed regarding western China.
- Strong motion monitoring stations are built for pilot dams located on active faults, realizing the smart remote monitoring and rapid safety evaluation of strong motions.

Application

The achievement of this project has been applied to the pilot dams for seismic safety monitoring and for the composition of rules and regulations for monitoring of strong hydraulic and water resources motions, which have already been promulgated and put into force in 2009 and 2011 respectively. The achievement could also be rolled out for other large and medium water resources and hydropower projects.

The monitoring point at right dam abutment bedrock

The monitoring point at top of right dam abutment



The acceleration response values given by dynamic analysis at monitoring point (three groups of seismic waves)

Impacts of climate change on drought and flood disasters and its risk assessment technology

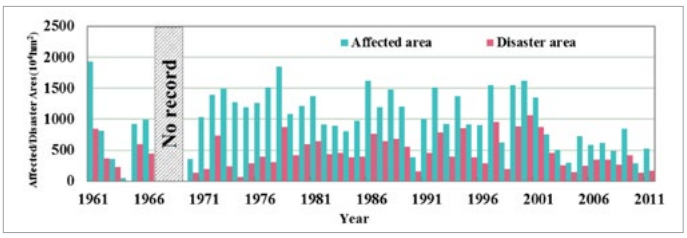
YAN Denghua, WANG Hao, ZHANG Jianyun, etc.

Background

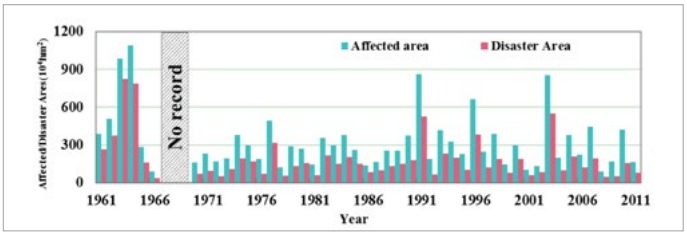
Huang-Huai-Hai Plain (North China Plain) is suffered from high frequency and big damage of drought and flood disaster. In China, 60% of natural disaster damage is caused by flood and drought, while the drought and flood damage in Huang-Huai-Hai Plain accounts for 25% of the country's total. Due to climate change, frequency, severity and coverage area of extreme meteorological and hydrological events in the Huang-Huai-Hai Plain are all increasing, leading to great damage, posing major risk to the mid and long term strategy for national development. This project is a research on the momentum and cause of change in drought and flood disaster of the region under climate change in order to predict the relevant risk and provide theoretical and technical support for the evaluation of climate change impact on droughts and floods in Huang-Huai-Hai Plain.

Contents

- Establishing a comprehensive evaluation system for drought and flood disaster based on historical data and prototype observation so as to reveal the changing momentum of drought and flood disaster in the region.
- Identifying the causal factors of flood and drought disaster, analyzing the mechanism of disaster formation, revealing the mechanism driving the evolution of regional drought and flood disaster.
- Establishing the theoretical system and method for evaluating the drought and flood disaster risk and applying to the Huang-Huai-Hai Plain for risk evaluation and zoning.
- Revealing the momentum of disaster evolution of the region under different climate scenarios, proposing an overall risk adaptation strategy as well the specific strategies for risks of different types and in different regions.



Change of drought area



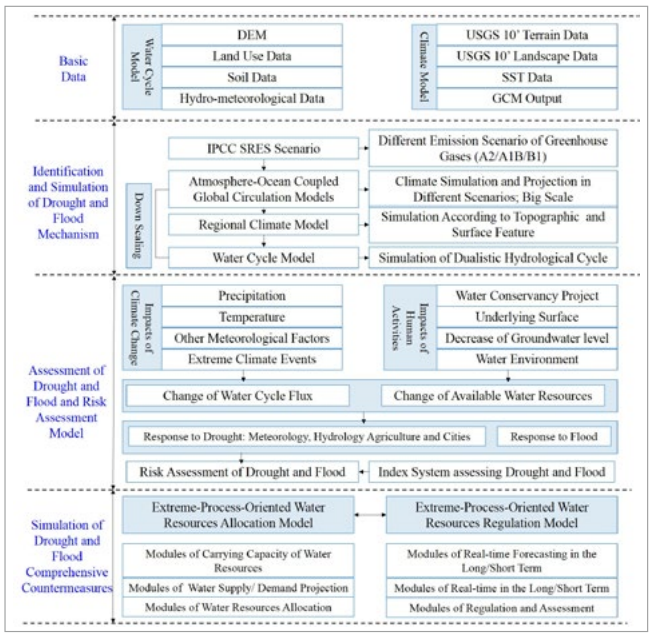
Change of flood area

Achievements

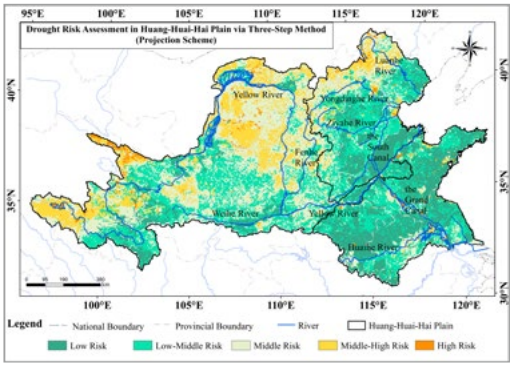
- The theory and methodology are established for evaluation of regional drought and flood events based on the general water balance evolution.
- Drought and flood disaster generation mechanism and recognition method are put forward by coupling the macro, micro and multiple factors, which reveals the disaster generation mechanism for droughts and floods in Huang-Huai-Hai Plain.
- Risk adaptation theory is established for drought and flood disaster based on risk analysis and zoning, and the risk adaptation plan is put forward against the drought and flood disaster in Huang-Huai-Hai Plain.

Application

Based on many prototype observation, theoretical analysis and evaluation method are applied to the Huang-Huai-Hai Plain, recognizing the relation between climate change and the severity and frequency of drought and flood disasters in this region. Policy suggestions and specific measures are put forward for comprehensive drought and flood adaptation in Huang-Huai-Hai Plain, and an evaluation is done for the effect of rational water resources development and socio-economic structure adjustment upon risk mitigation.



Model system



Drought risk assessment in Huang-Huai-Hai Plain

Mechanism, key technology and pilot study for urban flood resilience

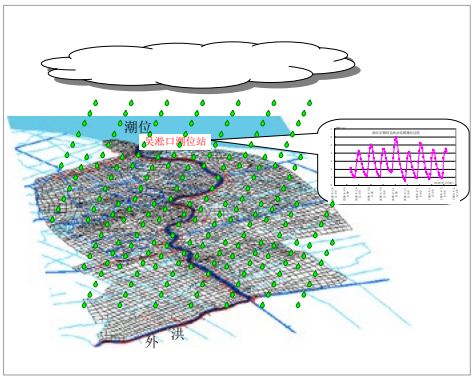
CHENG Xiaotao, LI Na, FENG Jie, etc.

Background

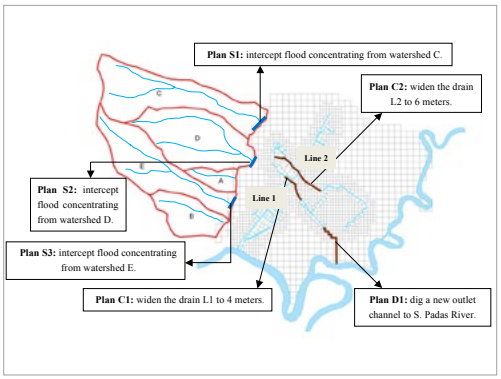
City is a place concentrated with people and fortune, making the flood protection of which a major and tough task in flood protection system. Along with the rapid urbanization, the features and generation mechanism of urban flood have experienced great change. The existing data series and empirical methods are no longer sufficient enough to provide scientific reference for proper planning and timely warning. This project develops the urban flood simulation modelling, warning and evaluation technology with independent intellectual property rights, which could provide technical reference for urban flood prevention planning.

Contents

- R&D of urban flood simulation technology based on two dimensional unsteady flow, considering the impacts of crowded buildings, drainage facilities and flood control system.
- Establishing the flood damage evaluation method based on GIS technology, socioeconomic database and urban flood simulation modelling.
- Studying the index system for urban flood warning and the method to define the threshold evaluation value.
- Building a flood warning platform with the functions of automatic triggering, continuous computation and real time warning, etc.
- Establishing a technical system for the planning and designing of urban flood prevention.



Application of the model for flood risk assessment of the Shanghai Municipality



Application of the model in flood control and drainage planning project of Temon Town of Malaysia

Achievements

- A risk evaluation model is established for urban flood based on the composition and evolution of flood disasters in modern cities, revealing the disaster generation mechanism of urban floods.
- Simulation models for urban flood under different scenarios are studied, as well as the model for rapid and precise evaluation of urban flood damage in line with the characteristic of Chinese cities.
- An urban flood warning and forecasting system is developed with independent intellectual property right, realizing the rapid warning of urban flood by zone, time, category and level.
- Technologies are proposed for urban planning and designing, including the three dimensional roads, and the multiple use of underground space, etc.

Application

The research achievement of this project has been included in the Guideline on Urban Flood Risk Management which is published by the Typhoon Commission (TC) under UNESCAP-WMO, becoming the international guideline for urban flood prevention and control. The urban flood analysis software has been applied to 16 cities, including Harbin, Shenyang, Beijing, Tianjin, Jinan, Shanghai, Fuzhou, Guangzhou, and so on. The flood damage evaluation technology has been applied in eight major cities in the Taihu Lake basin as well as Guangzhou, etc. The urban planning and designing technology regarding flood control has been applied to the new community of Lüliang city and the new Red Flag Community of Fenghuang County.

Flood risk evaluation for the site of World Expo in Shanghai

Teaching the trainees from Southeast Asia to use UFSM model in Bangkok

Research on seepage barrier system of evaporation pond sited on sandy foundation in cold region

WEN Yanfeng, LI Weichao, XIE Dingsong, etc.

Background

The production of synthetic natural gas will generate a great deal of hazardous wastes like waste water, which is usually treated by building evaporation ponds. Many industries currently construct evaporation ponds to dispose of waste liquid. With this method, the water can be drawn out efficiently through evaporation by sunlight, and the remaining solutions can be extracted. To avoid contaminating the surrounding soil and underground water, a paved barrier is necessary on the bottom and sides of the pond to prevent the outward infiltration of stored waste liquid. If the seepage control structure of the evaporation ponds, especially those built on sandy foundations with strong permeability in cold region, has construction quality problems such as fissures and wholes, the waste water will gradually sink to the local soil. Some might even seriously contaminate the local water source and the eco-environment. Therefore, the effective seepage control is of great importance to the evaporation pond sited on sandy foundation in cold region, for which this project focuses on the key technologies including the sandy bank slope, seepage controlling structure, and impervious materials, and the research achievements are used as a guidance for real project design.

Contents

- Analyzing the deformation and stability of excavated sand slope and rock-fill dam during construction and operation, assessing the design of sand slope.
- Studying the working mechanism of different anchoring types in seepage barrier as well as the calculation method and damage mode for anchoring stability, and analyzing the seepage structure stability.
- Carrying out the corrosion resistance test and the freezing-thawing test, evaluating the protective effect of seepage controlling materials such as HDPE and GCL in cold region and waste water environment.
- Discussing the mechanism of seepage controlling and self-healing of GCL, evaluating the risk and summarizing countermeasures of seepage due to barrier deficiency.
- Discussing the effective structure type and stability of slope cover on sand slope in cold region, clarifying the damage mechanism of slope cover and development process of hazard.

Construction of seepage control system

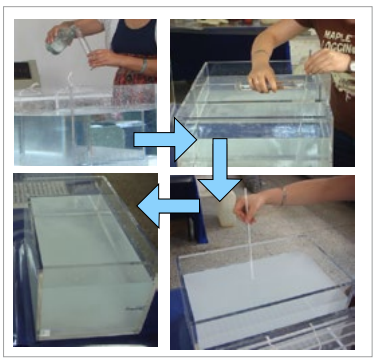
Achievements

- The long term durability and stability of HDPE and GCL lining in large volume waste water evaporation pond in cold region has been verified.
- A seepage barrier consists of two layers of geo-membrane and one layer of GCL is proposed, long term stability, leakage, and construction convenience of this proposed seepage barrier is analyzed. It shows that this barrier is applicable for controlling the leakage waste water evaporation pond sited on permeable foundation in cold region.
- To evaporation pond in cold region, bagged concrete is suggested as the side slope cover on seepage barrier.

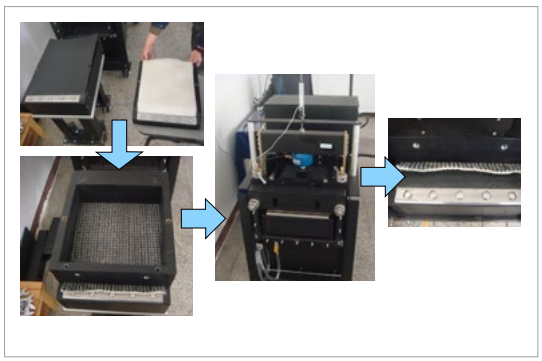
Application

This research have been applied in the design and operation of evaporation pond for Keqi Coal Gas Project, and it is meaningful to the design of other evaporation ponds.

Keqi evaporation pond



Corrosion resistance test



Interface friction test

Study on evolution mechanism and regulation of runoff and sedimentation at different scales in the Yellow River Basin

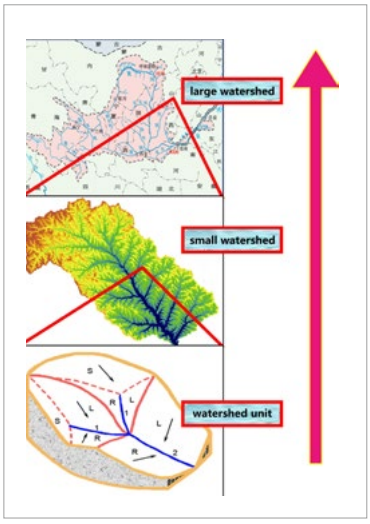
CAO Wenhong, ZHANG Xiaoming, ZHAO Yang, etc.

Background

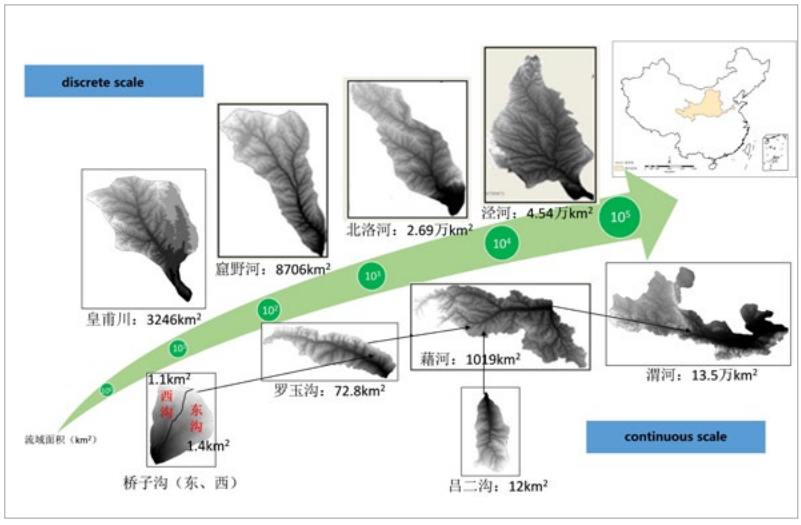
Runoff sediment decreased dramatically in recent years. What is the reason and what kind of new environmental problems will this bring? What kind of adjustment shall be done in the planning of river basin treatment in middle and downstream areas of the Yellow River? To answer all these questions, we need to have comprehensive analysis on the runoff-sedimentation relationship and regulatory technology at different scales of the river basin. Analysis shall also be done on the corresponding change of runoff-sedimentation process, the relevant mechanism for runoff and sedimentation decrease and the respective contribution rate to the change under both natural and human impact at different scales such as small, medium and large river basin.

Contents

- Studying the evolutionary process of runoff-sedimentation and laws of its change along scales, including the quantitative expression of river basin geomorphology, source identification for erosion sediment of slope/gully (river channel) system, the scale dependence and scale domain identification of sediment transportation and models for scale illustration of hydrological process of the river basin.
- Discussing mechanism on how different environmental factors drive the runoff-sedimentation change at different scales as well as the respective contribution rate.
- Studying the technical methods for runoff-sedimentation regulation of multiple scales.



Units of different scales



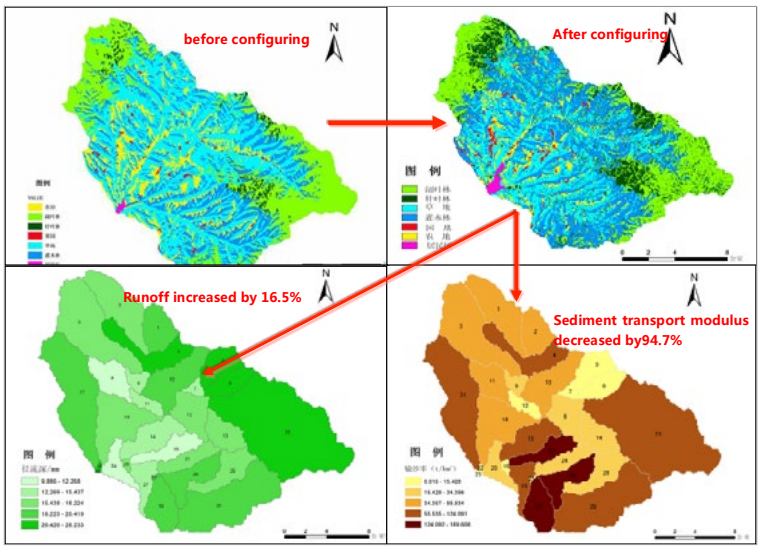
Building river basin database of different scales for Yellow River

Achievements

- A database with multiple evolutionary processes, including meteorology, soil, hydrology, soil use and socioeconomy, is established for the Loess Plateau which is a typical river basin with different scales. A finger print recognition method is put forward for source identification of sediment at different time section and location of slopes, gullies and river channel system.
- The variation law of runoff-sedimentation transportation at different scales is discussed, and a model is built for scale transformation of sediment transportation, which could be used for the multiple scales joint research of runoff-sedimentation evolution under changing environment.
- Driving mechanisms of different environmental factors for water and sediment decrease at different scales are analyzed, identifying the cutoff value of optimum forest coverage rate at the Loess Plateau area, defining the corresponding relationship between construction quality of terraced land and the regulatory rainstorm standard.
- Based on the optimization of drainage culvert location of check dam, a use-right-after-siltation soil conservation technology for controlled area of check dam is put forward. The optimum structure and disposition of land use, along with the typical layout of soil and water conservation mesaures are proposed.

Application

This project has provided technical support for making the relevant national soil conservation planning as well as the management rules and evaluation standard for pilot projects. The project achievements have been widely applied to Loess Plateau for projects of returning-farmland-to-forest and soil conservation and in Shanxi and Gansu provinces for the planning of check dam system.



Optimization effect of middle scale land coverage matching for Qingshui River

Research and application of high accuracy multi-source satellite unified timing system

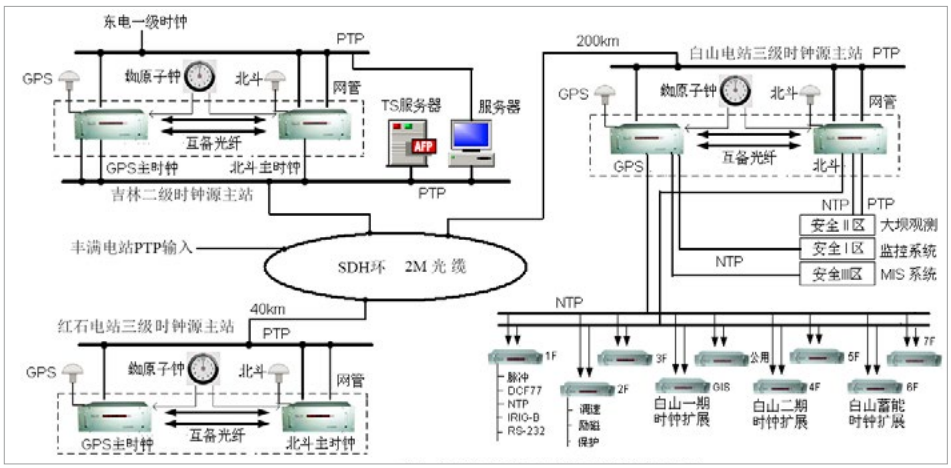
TAO Lin, LI Wei, YUAN Pinglu, etc.

Background

Correct time label is of great importance to the security of power system. According to the requirement of the power grid, all power plants and substations need a unified time synchronization system. In the existing conventional time synchronization system, the clock source of different power plants are usually chosen individually with time set according to the local clock which leads to the time difference of clocks, affecting the operation safety. Using the Beidou Navigation Satellite System, this project develops a high accuracy multi-source satellite unified timing system, helping the power plants, substations and the entire mining enterprises to achieve unified timing.

Contents

- Proposing an overall solution for multi-source satellite unified timing system of large hydropower plants.
- Solving the accuracy deficiency in unified timing of large hydropower plants due to wide regional distribution, large amount of equipment, diversified interfaces and multiple zoning.
- Structuring the time network of power grid for time synchronization with three levels, with the time synchronization system on the network being the level I time source, that of regional center and some hydropower plants being the level II time source, and that of the rest hydropower plants and 500KV substations being the level III time source. The time source of each level receive the benchmark signal of ground-based time of the upper level and provide ground-based time to the next level. In order to enhance the system liability, every level has a space-based and ground-based mutual backup system. DCLS or PTP signal could be used as ground-based signal.
- For hydropower plants, the main station of time source (main clock) will be built first, then the second and third level extended clocks according to the distribution of generating units and switch stations. All the clocks will be connected to the upper level clock with optical fiber, which will add up to a clock network covering the entire power plant.



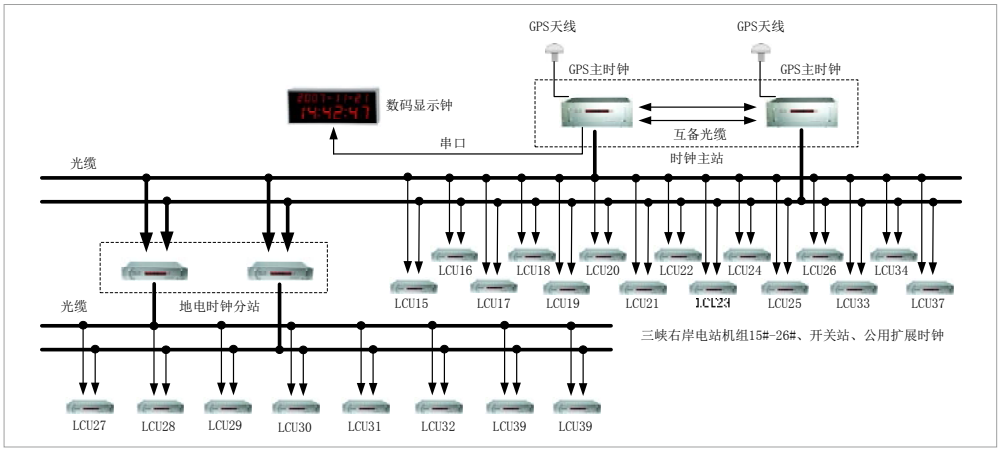
Clock system of Baishan Power Plant

Achievements

- A stratified, open and unified time synchronization plan is put forward based on multiple clock sources, which has been applied to the right bank power plant of the Three Gorges Project since 2006.
- GPS and Beidou Navigation Satellite timing signals are used as space-based hot standby main clock source. DCLS or PTP signal of power grid is used as the ground-based standby time source, Rubidium atomic clock or constant oven controlled crystal oscillator (OCXO) as the local time source. All these add up to a smart time synchronization technology with multi-source backup and seamless handover.
- The clock is synchronized through distributed network communication system, which is able to provide inter-region and long distance time service with sub-microsecond precision.

Application

The achievement of this project has been applied to the Three Gorges Project, Gezhouba Hydropower Project and Baishan Hydropower Plant, providing overall solutions for unified timing of equipments of the entire plants. This system has also been rolled out to more than 30 large and medium hydropower plants including Xiluodu, Xiangjiaba, Longyangxia, Gongboxia, Ruilijiang, Shawan and Hongjiang projects.



Clock system of Three Gorges Power Plant

Studies on identification, evaluation and evolution of damage in aged dam concrete

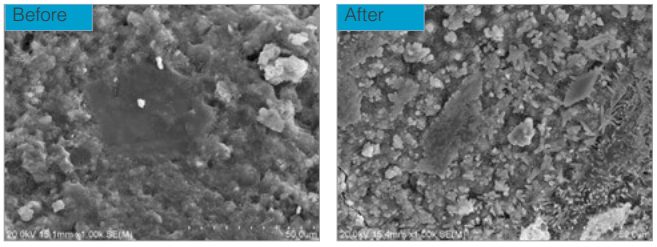
CHEN Gaixin, LIU Yanxia, LIU Chenxia, etc.

Background

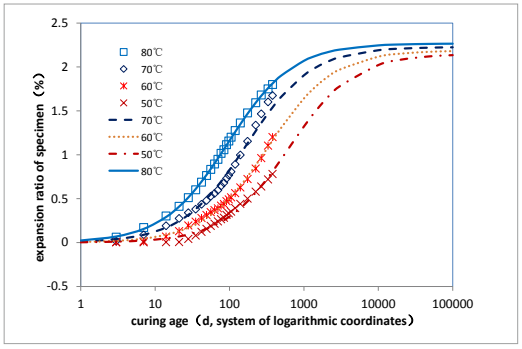
Most of the concrete dams built between 1950 and 1970 in China are inevitably aging. Some of them are over 50 years old and the safety issue as well as the durability of the dam concrete are nowadays in the spotlight of the society. Freezing-thawing (FT), leaching and alkali-aggregate reaction (AAR) are three most common aging causes for dam concrete, either of which would cause serious safety issue and great ecnomical loss. Before evaluating the damage extent for the dams and selecting appropriate repairing scheme, the first step is to identify and evaluate the damage, as well as to find out the evolution law of damage in dam concrete.

Contents

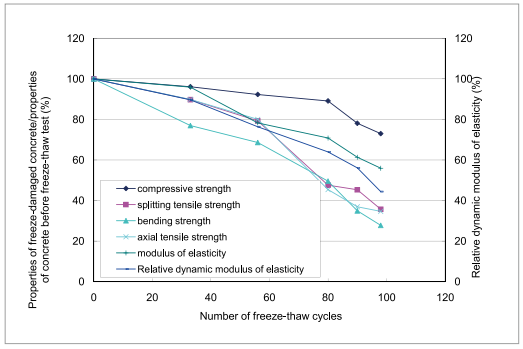
- Studying the evolution law of long-term mechanical performance of dam concrete in normal environment and the corresponding theoretical basis.
- Revealing the evolution of damage in dam concrete under harsh environmental factors (such as freezing-thawing, alkali aggregate reaction, leaching).
- Studying the identification and evaluation method for damage in concrete during the operation stage of dams.
- Recommending technical measures to protect the dam concrete form aging or damage.



Typical SEM images of concrete before and after leaching



Evolution of expansion ratio of AAR-affected concrete



Evolution of properties of FT-affected concrete

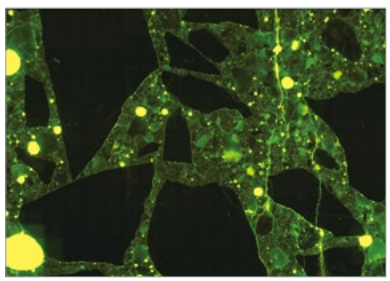
Achievements

- The driving mechanism of concrete dams is revealed, showing that the evolution of long term performance of dam concrete is resulted from the combining effects of internal causes (continuous hydration of cement, AAR) and external causes (freezing and thawing, temperature variation).
- The evolution rules of macro-properties of concrete under typical damaging factors, freezing-thawing, leaching and AAR are revealed.
- A new property-decaying model for dam concrete is proposed, in which the damage degree is the variant. Differenct from the existing models, the new model can be used to predict the aging status of dam concrete under harsh environment.
- A new damage-evaluating method based on digital-image-processing technique is developed. An automated panoramic fluorescent microscope is developed by which the structrual characteristics of microcracks in concrete slices can be quantified and analyzed automatically. The evolutions of microcrack characteristics in concrete during FT/AAR damaging processes is obtained and the correlation between the microcracks and macro properties are established. Quantitative panoramic microcrack analyzing technique could be developed as a promising tool of diagonosing dam concrete.

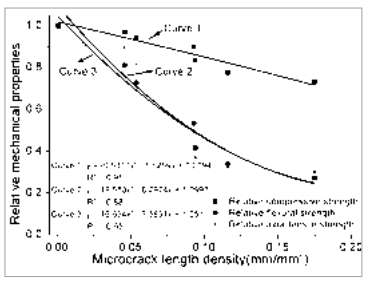
Application

- Quantitatively microcrack-analyzing technique. Applied in damage evaluation for the concrete cores from the foundation of the generating units of underground power plant of a pumped storage hydropower station. Also applied in damage-evaluation of concrete from Fengman dam.
- Alkali-aggregate reactivity identification. Applied in raw material selection for the central route of South-to-North Water Diversion Project.
- Part of the experimental results has been incorporated in the Technical Specifications for Durability of Hydraulic Concrete.

Automatic panoramic fluorescent microscope



Typical panoramic fluorescent image of concrete damaged by loading



Correlation between mechanical properties and microcrack density of FT-damage concrete

Research on dynamic assessment techniques of agriculture drought and its application

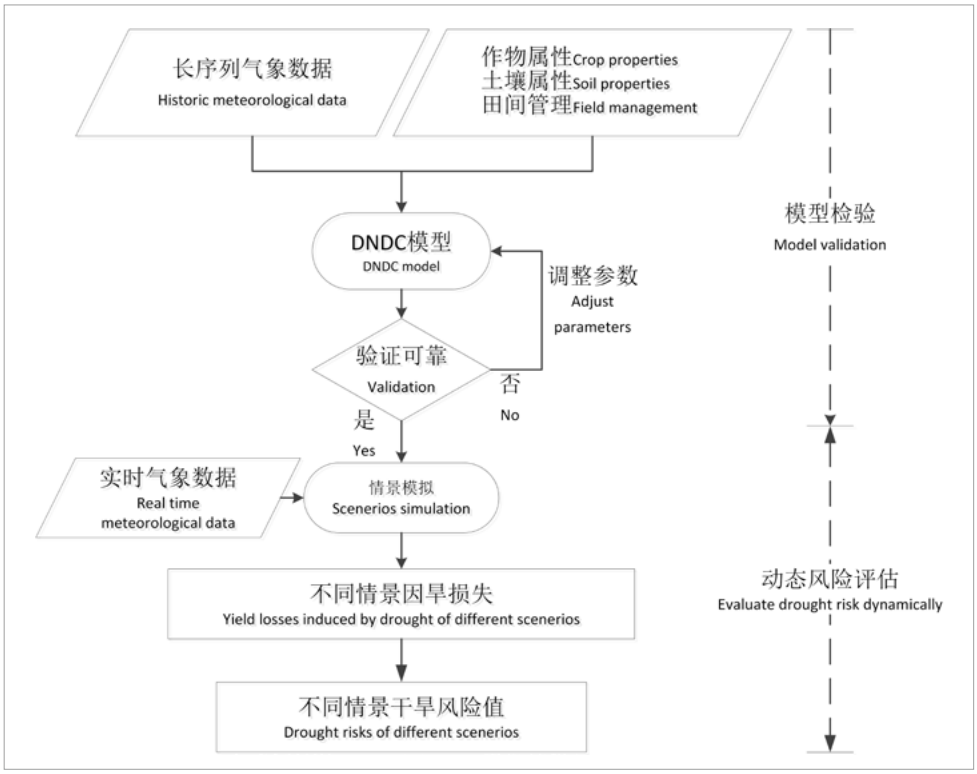
Lv Juan, SUN Hongquan, SU Zhicheng, etc.

Background

With global climate changing adding up, the drought reduction is increasingly arduous and urgent. Of the shift from passive emergency response to active drought risk management, one of the main aspects is the dynamic analysis and management of agricultural droughts. This research establishes an application system for real-time drought analysis as well as the dynamic assessment for drought risk, which meets the needs for drought relief in China.

Contents

- Studying the key technology on real-time drought monitoring and analysis.
- Studying the dynamic assessment technology of drought-induced losses and risk.
- Studying the information integration technology of drought reduction and disaster relief.
- Studying the database and system construction on drought reduction and disaster relief.



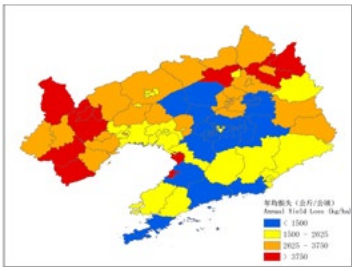
The procedure of the dynamic drought risk analysis based on the DNDC model and scenarios

Achievements

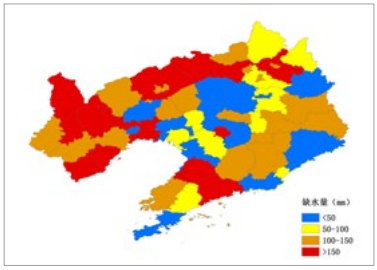
- Integration technology is proposed for 9 types of multiple heterogeneous data in fields such as meteorology, water regime, soil moisture, and water resources, etc. A drought management database is created, and a relatively complete and robust drought evaluation system is established.
- A comprehensive drought analysis methodology with multiple drought indices is proposed, considering the physical characteristics and classification of the indices, which basically the final result is the synthesis of various inter-class indices, each of which is the synthesis of several inner-class indices first.
- Drought losses and risk assessment technology is developed based on a crop growth model -- DeNitirfication DeComposition (DNDC) model -- and scenario analysis method, while the impacts of water stress and the final yields in different drought conditions are dynamically analyzed upon the crop growing simulation.
- A drought management application system of drought reduction and disaster relief is established, with functions of comprehensive real-time drought analysis, dynamic assessment of drought losses and risk, as well as decision making and command for drought reduction.

Application

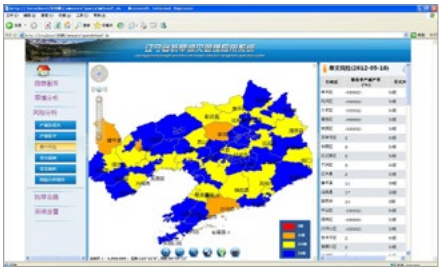
The research is applied in northeast China's Liaoning Province for a real-time analysis of agricultural droughts and a dynamic assessment of drought losses and risks, which has provided technology supports for decision makers on drought management.



Annual yield losses distribution derived from the crop simulation in Liaoning Province



Crop water deficit distribution in Liaoning Province



Management system of drought reduction and disaster relief for Liaoning Province

Technology on diverting and regulating water from Niulan River into Dianchi Lake to improve the water environment

MA Wei, LI Jinxiu, PU Chengsong, etc.

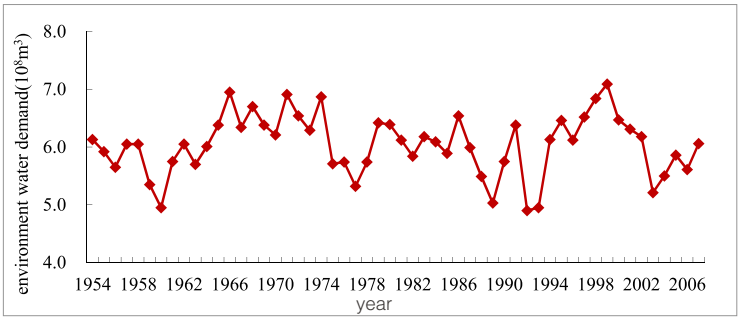
Background

Dianchi, an important lake in Kunming, southwest China's Yunnan Province, determines the health of urban ecosystem. Due to the extreme scarcity of water resources and influenced by economic and social development, the water body is reused repeatedly. Pollutants are constantly discharged into the lake, deteriorating the water quality and causing serious eutrophication problems. Blue algae boom happens throughout the year. Diverting water in from out the basin is one of the measures for comprehensively improving the water environment of the lake, but the effect of restoration requires scientific reasoning and analysis. This research thus is conducted to provide reference for the planning and design of the diversion project.

Contents

- Researching on the water allocation plans of Dianchi Lake Basin in different level years.
- Forecasting the flux of pollutants discharged into the lake in the targeted level year.
- Designing total quantity control plan of pollutants discharged into the lake based on the requirements of capacity and total quantity control.
- Conducting dynamic simulation of water environment evolution of the lake while analyzing the impact of inflow from Niulan River upon the water quality of the lake.
- Researching on the joint operational plan and integrated technology of water diversion and control between Dianchi Lake and Deze Reservoir, the source of Niulan River.

Blue-green algae bloom in Dianchi Lake



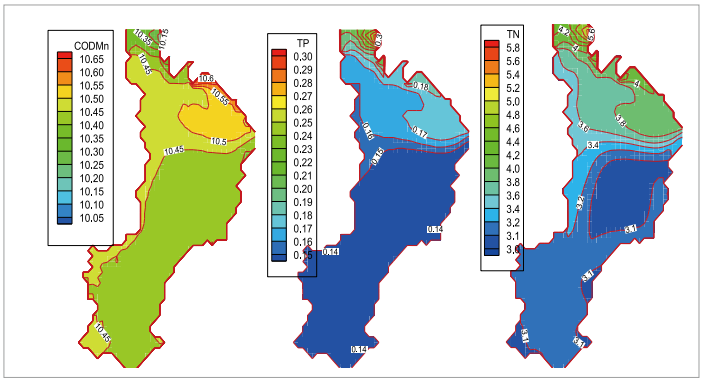
Environmental water replenishment into Dianchi Lake in long-serial years

Achievements

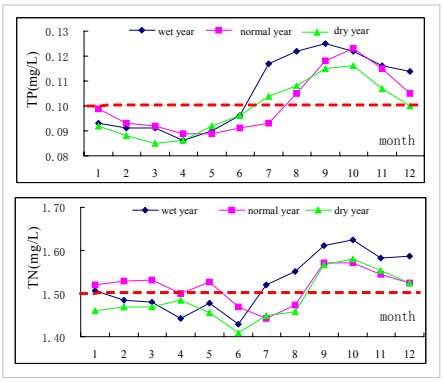
- Water allocation and supply guarantee system for Dianchi Lake Basin is established, featuring both short-distance and long-distance water diversion while covering short-term and long-term needs.
- Forecasting technology of non-point source pollution load for Dianchi Lake Basin is developed based on HSPF basin mechanism model.
- Hydrodynamics and water quality changing pattern of Dianchi Lake is analyzed, while the capacity and total quantity control plan of the lake is proposed.
- Integrated technology system of water diversion and control is decided for improving the water environment of Dianchi Lake by diverting water in from Niulan River, including dynamic optimization of water resources, precision simulation of lake basin, and joint operation between the lake and the reservoir.

Application

The research is applied in the planning, design, construction, operation and management of Niulan River water diversion project.



Simulation of pollutant diffusion and transference in Dianchi Lake area



Year-round changes of water quality of Dianchi Lake in operation of design level

Study on technology of the integrated optimal allocation of water quality and water quantity in Liaohe River Basin

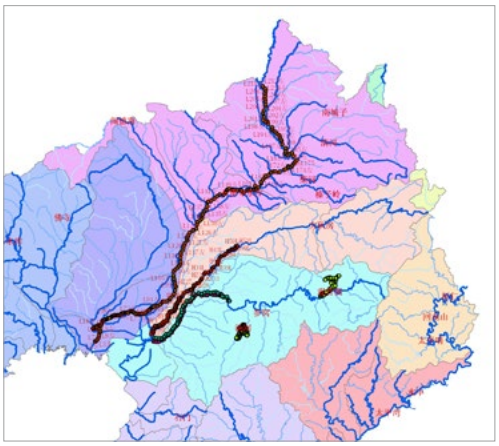
DU Qiang, ZHUGE Yisi, LI Guoqiang, etc.

Background

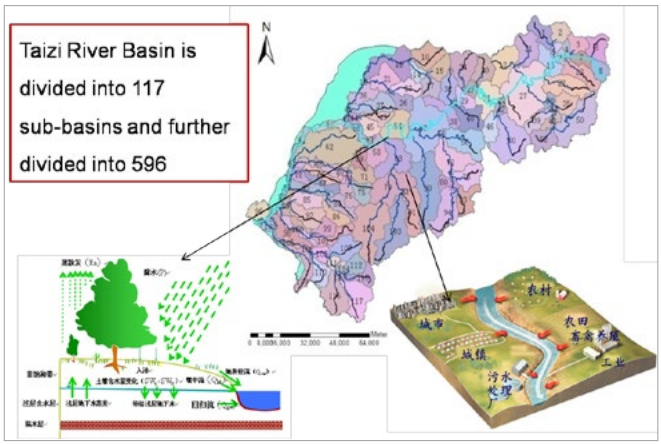
The contradiction between water demand and supply is acute in Liaohe River Basin, where the river ecological water demand is inadequately guaranteed and the pollution is serious. It has become a key research topic for comprehensive water pollution control of the basin to improve water environment quality of the river from the perspective of integrated water quality and quantity management while controlling the pollution source and bringing into play the regulation function of reservoir and dam projects. This research is conducted on the analyzing methodologies and applied demonstration of optimal water quality and quantity distribution to provide technical support for the overall target of water pollution control of Liaohe River.

Contents

- Studying the classification, grading and staging environmental demand of each zone of Liaohe River Basin.
- Researching on the basin-wide water quality and quantity simulation model with distributed hydrological models, hydrodynamics of river system and water quality model as its core.
- Building multi-objective optimal allocation model of water quality and quantity for Liaohe River Basin.
- Studying the response relationship between water quality of main channels and regulation preparedness plans for typical river water quality targets.



Generalization of river channels and water system



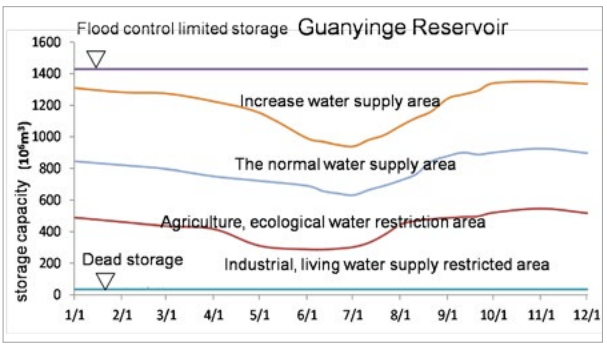
Non-point model of Taizi River Basin

Achievements

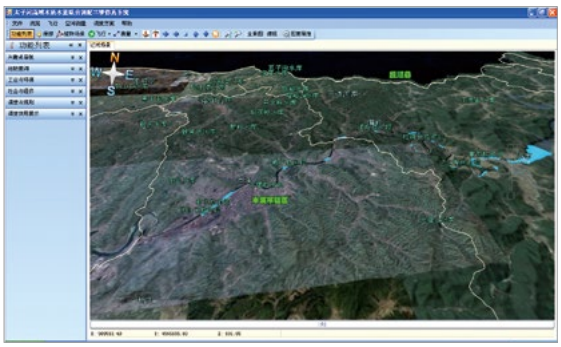
- Calculation system of environmental flows is established for different zones, classification, grading and staging of Liaohe River Basin.
- Multi-objective optimal allocation model of water quality and quantity of Liaohe River Basin, with the improvement of water quality and river function as the key constraint, is established for analyzing the response relationship between different regulation preparedness plans and water quality, and for developing identification system of preparedness plan for water distribution.

Application

The 3D simulation system for optimal distribution of water quality and quantity in Taizi River Basin, as well as the decision-making support system for joint operation of water quality and quantity in Liaohe River Basin, have been installed, tested and put into use in the Water Supply Bureau of Liaoning Province.



Reservoir dispatching rules



Decision-making support system for joint operation of water quality and quantity in Liaohe River Basin

Research and demonstration of appropriate safe drinking water technology using rainwater as source water in northwest rural area

LIU Linghua, ZHOU Huaidong, LIU Laisheng, etc.

Background

In China's northwestern region where water shortage is serious, people build small-scale hydraulic structures such as cellars, ponds and small reservoirs to address the problem of water scarcity. However, the water quality can not meet the "standard for drinking water quality" with an excessive level of microorganism, ammonia-nitrogen, turbidity, chromaticity and organisms, etc. This research tackles the problem of water supply in rural area through rainwater harvesting, and provides small-scale centralized water supply technology that suits the local rural conditions.

Contents

- Studying the technologies related to rainwater harvesting, including the regional potential of harvestable rainwater resources, technology of efficient rainwater harvesting and storage, and rainwater-harvesting policies.
- Studying the technologies for protecting water quality, as well as preventing and controlling pollution, in areas of rainwater harvesting.
- Studying the technologies of water purification in areas of rainwater harvesting.
- Demonstrating construction and protection of rainwater harvesting areas as well as water quality guarantee technologies.

Water quality examination of rainwater

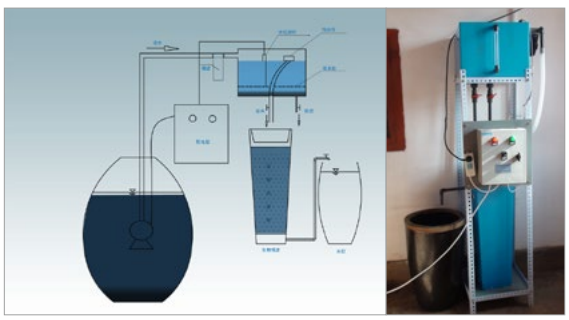
Technology and device for removal of high-concentration multi-grade sand

Achievements

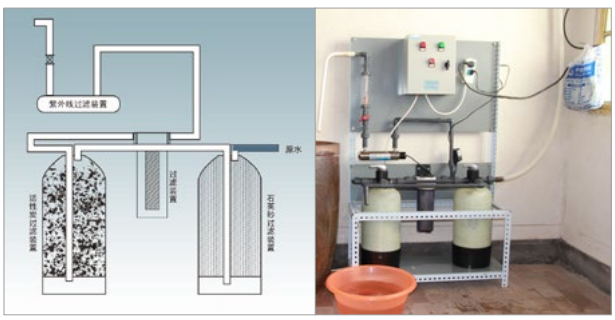
- Major pollutants and changing patterns of water quality in northwest China's arid rainwater-harvesting region are identified.
- Five technologies and devices are developed for controlling pollutants in rainwater-harvesting area of water source: 1) Technology and device for removat of high-concentration multi-grade sand; 2) integration technology and device of automatic initial rainwater discarding and vertical rotational-flow desanding; 3) filtration and deposition technology; 4) rainwater pollution control technology and device combining initial split-flow rainwater and filtration; and 5) pollution prevention and controlling technology with ecological corridor.
- Seven purification technology, technique and device of harvested rainwater for drinking are developed: 1) technology and device of automatic household biological slow land filtration of harvested rainwater; 2) automatic rough and fine filtration rainwater treatment device; 3) flocculation-fine filtration rainwater treatment device; 4) water purification technology and device integrated with ultrafiltration; 5) automatic hydraulic water purification device of micro-flocculation and biological filtration; 6) household generator of sterilizing fluid for drinking water; (centralized) rough and slow filtration technique specially for high-turbidity rainwater.
- Both the centralized and distributed guarantee modes of safe drinking water from rainwater harvesting are integrated and two demonstration areas are constructed.

Application

The technology and device for pollution control and drinking water purification in water source area has been applied as a demonstration in four villages of four townships in Xifeng District, Qingyang City and Huining County, Baiyin City, both in northwest China's Gansu Province. The research output has also been included into the governmental planning of safe drinking water in rural areas.



Device of automatic household biological slow filtration



Automatic rough and fine filtration rainwater treatment device

Impact of Nan'an Reservoir construction on the ecological flow of Nanxi River mainstream

Baiyinbaoligao, WANG Xiuying, HUANG Ziyi, etc.

Background

Nanxi River in Zhejiang Province is a national AAAA scenic spot, characterized by its riverine landscape. Nan'an reservoir is a major water conservancy project planned by Zhejiang Province, and is located 2 km from the border of the scenic spot. No study has been done to address the impact of Nan'an reservoir construction on aquatic ecology of Nanxi River mainstream and downstream scenery, so nobody knows whether the reservoir should be built and how to protect the mainstream aquatic ecology. However the local government needs decision support. This study investigates above problem and obtains the ecological flow demand for river reach downstream from the Nan'an reservoir and interprets the impact of Nan'an reservoir construction on the ecological flow. This study provides technical support for environment-friendly project planning and operation.

Contents

- Analyzing the hydro-ecological characteristics of the river section downstream of the reservoir, including hydrology, hydraulics and ecological features of organisms.
- Identifying ecological protection targets and choosing methods for determining ecological flow appropriate for the different features of the upstream natural river and the downstream tidal estuary.
- Selecting affected waterside scenic spots to analyze and evaluate the impact of flow regime changes before and after Nan'an reservoir construction on above scenic spots.

Eco-hydrological protection target: plecoglossus altivelis

Migration of plecoglossus altivelis in the mainstream of Nanxi River and three-field distribution

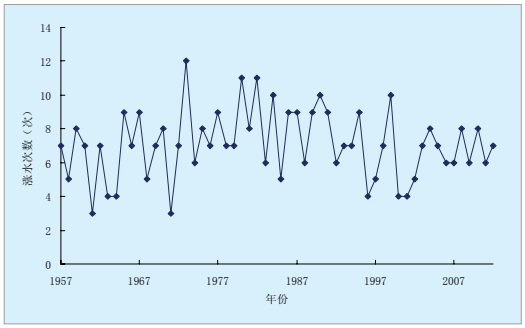
Hydraulic features and feeding habits

Achievements

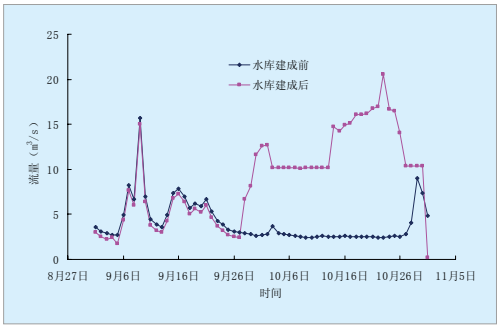
- The eco-hydrological features of Plecoglossus Altivelis, the indicator species in Nanxi River, in different life stages are identified, and it is confirmed that the composition and distribution of aquatic flora and fauna is a key influence factor of its distribution.
- In consideration of ecological protection, Tennant method, wetted perimeter and flow duration curve (90% frequency) are utilized to calculate the ecological water demand in the river section downstream the Nan'an reservoir. The ecological flow from Nanxi reservoir is optimized to increase the ecological protection efficiency.
- After screening the Nanxi waterscape, the change ratio of water surface width is selected as the main evaluation indicator to analyze the impact of flow regime changes on the waterscape.

Application

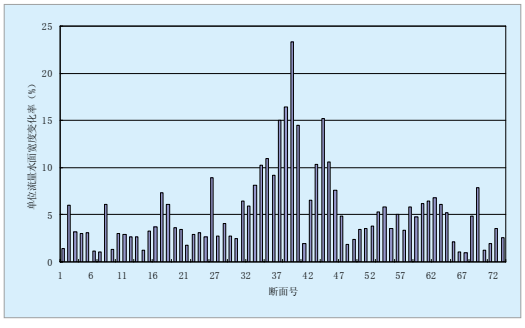
The research results are used for feasibility study of reservoir projects and the environmental impact assessment as well as for the design of ecological outflow from reservoirs.



a (numbers of rising time during Mar.-May Migrating Toward the Upstream Reach)



b (Typical year P=50% flow process before and after the reservoir Sept.-Oct. Spawning Period)



c (the change ratio of water surface width in different cross section)

Comprehensive study on the selective intake with stoplog gate in the reconstruction project of Fengman Hydropower Station

SUN Shuangke, LIU Haitao, ZHENG Tiegang, etc.

Background

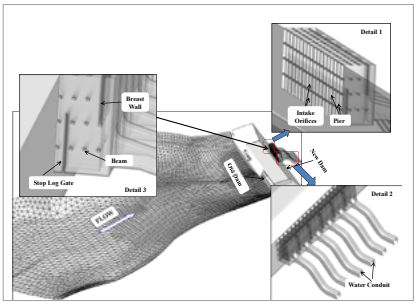
Fengman Hydropower Station Reconstruction project involves a new dam to be constructed 120 m downstream the old Fengman dam. After the new dam is completed, parts of the old one are demolished to form a breach outflow, while the underwater part remains in the reservoir area. The remaining parts of the old dam act like a parapet wall, affecting the temperature upstream the new dam and temperature at the water intake. In order to minimize the impact of discharged low-temperature water, stratified water intake measures are adopted. The scope of this work is the experimental and numerical study of hydrodynamics and temperature distribution in New Fengman Dam forebay. The main goal is to predict the water temperature discharged from the powerhouse and to ultimately propose solutions to increase water temperature.

Contents

- Establishing a complete water temperature physical model and testing the characteristics of intake water temperature upstream the dam.
- Analyzing the impact of the stoplog gate operation in different level years on intake water temperature using 3D numerical simulations.
- Studying the hydraulic features of stratified water intake at stoplog gate by large-scale hydraulic modeling of water intake.

Fengman Hydropower Station

Physical modelling test on general water temperature



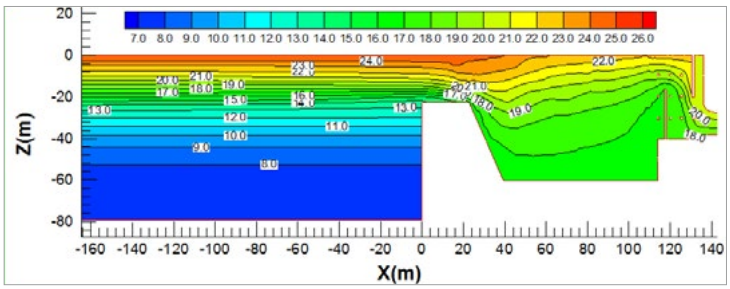
3D mathematical model

Achievements

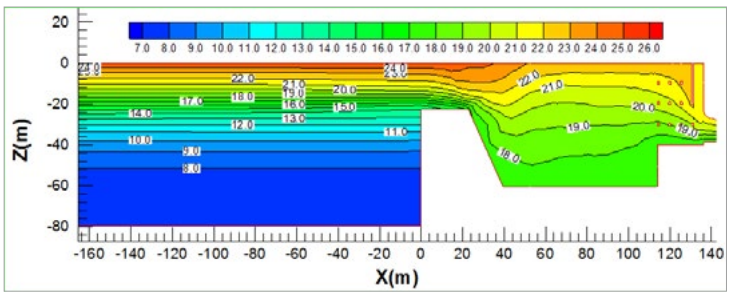
- A complete water temperature physical model of a scale 1:120 is established in combination with stratified electrical heating to simultaneously simulate the water temperature field and velocity field; and quantitative research on the impact of stoplog gate operation on the intake water temperature is done.
- Based on FLUENT, the general fluid mechanical calculation software, a secondary development of the 3D numerical simulation of stratified reservoir temperature distribution and water intake temperature is made.
- The water temperature modeling and numerical simulation both suggest that the operation or not of stoplog gate has negligible impact on the intake temperature. Therefore it is suggested to abolish the stoplog gate water intake design.

Application

The research results vindicate the proposal made by the owner and design group, replacing stoplog gate water intake with the conventional water intake, saving investment as well as ensuring the desired effect.



3D Calculation of water temperature distribution in a reservoir area (with stoplog gate)



3D Calculation of water temperature distribution in a reservoir area (without stoplog gate)

Study on quality testing of concrete cut-off wall of 150 m depth in the foundation of a rock fill dam

YAO Chenglin, DENG Zhongjun, JIA Yongmei, etc.

Background

A designed concrete cut-off wall of 150 m depth in the foundation of a rock fill dam was built at an ongoing hydraulic project in China's plateau area . It was the largest and the deepest underground concrete cut-off wall under construction domestically. However, there are no technical standards on quality inspection for that deep cut-off walls. The conventional non-destructive testing methods and equipments are not available. This study was based on a group of quality inspection methods for quality control of cut-off wall of 150 m depth during construction .

Contents

- Analyzing and comparing multiple non-destructive testing methods for quality control of the cut-off walls, and suggesting a couple of available methods to that deep cut-off walls.
- Analyzing the relationship between the acoustic parameters and property parameters of concrete and suggesting the suitable methods to detect defects in the deep concrete cut-off walls.
- Studying the comprehensive test methods for that deep concrete cut-off wall, selecting the instruments suitable to use at alpine and frigid areas and drafting protection measures for the instruments.
- Conducting in situ test for a concrete cut-off wall of 150 m depth at a plateau area (the elevation of 4100 m, at -30℃) to ensure the reliability.

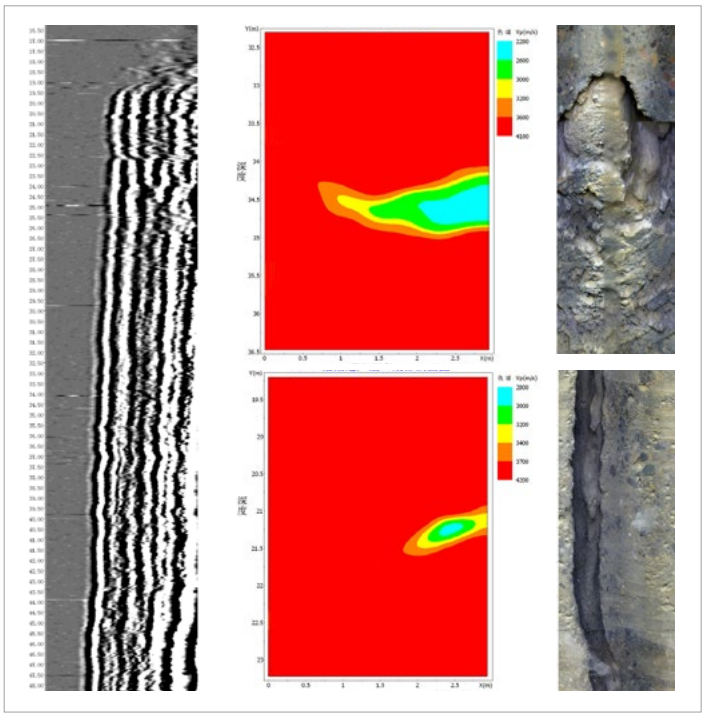
Environmental inspection and comprehensive detection of alpine and frigid areas

Achievements

- The study suggests that the comprehensive ultrasonic method is suitable for quality testing of deep foundation concrete diaphragm wall.
- The study uses comprehensive ultrasonic and borehole television to realize the detection depth breakthrough, customizing the suitable instruments and drafting protection measures at alpine and frigid areas.
- Through the field test in a 150 m deep cut-off wall, the results show that the method has high precision, more reliable and correct result.

Application

The study results have been applied to quality inspection of an aforementioned cut-off wall, successfully detecting and locating the faults in concrete, hence giving the construction team valuable guidance to adopt remedy measures.



Borehole TV imaging detection

Technical guide for hydraulic turbine regulating system in grid

ZHANG Jianming, LI Hua, MENG Zuohong, etc.

Background

Currently the published hydraulic turbine governing system norms in China and abroad involve only technical and testing requirements in regards of the technical performance of the turbine regulating system noumenon, and lack of standards pertinent to grid-connected performance. At the backdrop of fast increasina grid capacity and the demand for wide-ranging grid interconnection in China, a pertinent standard is in urgent need. Hence this technical guide is drafted .

Contents

- Summary and considered the research, manufacturing, the current situation of grid-connected operation and its future trend of hydraulic turbine regulating system.
- Drafting the technical standards of the hydraulic turbine regulating system in regards of grid-connected performance and technical requirements. This technical guide aims at improving electricity quality and power grid safety.

Technical guide for hydraulic turbine regulating system in grid

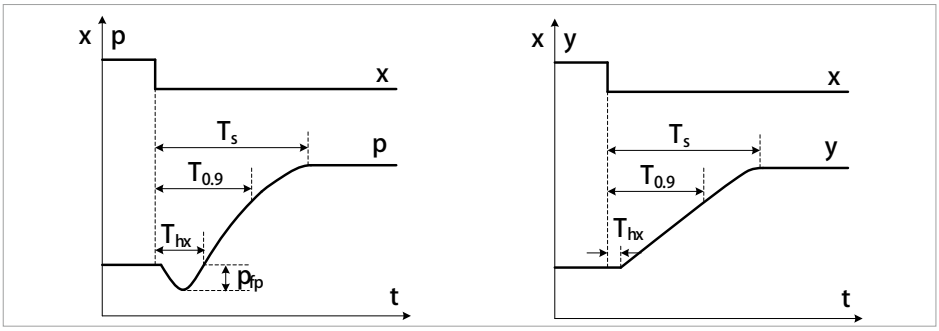
Achievements

A technical guide for hydraulic turbine governing system in grid-connected operation is completed, covering scope, references, terms and definitions, general rules, technical requirements, tests and appendix.

- Technical and performance requirements: basic requirements, control functions, primary frequency control, load regulation, isolated grid operation, technical requirements of oil pressure supply unit and automatic components, fault protection and fault tolerance.
- Test content include: routine test, primary frequency control test, model parameter testing, load regulation test, coordination between primary frequency control and AGC, and black start test, etc.

Application

This specification guide has been published and carried out by National Energy Administration as an industry standard, numbered DL/T1245-2013.



The active power/openning response during PFC frequency step disturbance

Best Papers of IWHR's Journal

Journal of China Institute of Water Resources and Hydropower Research

Study and application of the improved finite element equivalent stress method to analyze the strength of gravity dams

YANG Huichen, JIA Jinsheng, ZHENG Cuiying

Abstract: The improved finite element equivalent stress method is proposed and studied in this paper. It is proved that higher accuracy is acquired through the improved method, especially when the size of FEM model is large. The difference and similarity of results derived from conventional finite element equivalent stress method, material mechanical method and the improved finite element equivalent stress method are analyzed. Results show that the improved finite element equivalent stress method can avoid stress concentration, and it also can better reflect the influence of base stiffness on the equivalent stress. The application to the equivalent stress analysis of Shoukoubao CSG dam, the first CSG dam in China, gets quite satisfactory results.

Keywords: gravity dam, equivalent finite element stress method, material mechanical method, Shoukoubao project

The study on theory and method of comprehensive evaluation of agriculture water utility

LEI Bo, LIU Yu, XU Di

Abstract: The agricultural water Service Functions has characteristics of diversity, indivisibility and non-excludability. These characteristics determined the comprehensiveness of agriculture water utility. According to service functions of agriculture water, this paper defined the concept of agricultural water utility and its category. Furthermore, from the view of economics, this paper also explained the theory of maximizing consumer's effect of agriculture water utility. Based on above theory and theory of Multi-Objective Evaluation, this paper offered a framework of comprehensive Evaluation of agriculture water utility, including evaluation object, index system and mathematical method. In the last part of paper, case study was made on Da Xing district, Beijing by using of AHP.

Keywords: Keywords: agriculture water, service functions, utility, evaluation

Study on estimation, regionalization and classification of non-point source pollution for small and mid-size river basins management

CUI Wei, Baiyinbaoligao, CHEN Wenxue, CHEN Xingru

Abstract: For dealing with problems such as the large number of rivers, lack of basic data, difficulties in setting the priorities when managing non-point source pollution for small and medium-sized river basins, a set of methods are put forward based on RS and GIS techniques. The methods can estimate the pollution load, identify the principal pollutant and primary pollution source, and determine the prior control area & river promptly and effectively. Taking the Harbin city as example, the non-point source total nitrogen (TN) and total phosphorus (TP) pollution sources are firstly analyzed. Then pollutant load distribution is estimated using export coefficient model (ECM) referring to the data of statistical yearbook, water resources bulletin and land use data in 2010. The non-point source TN & TP load proportion together with primary pollution source are identified using the equal-standard-pollution-load method. Based on this work, the Harbin region is divided into five sub-regions according to equal-standard-pollution-load. 58 small and medium-sized river regions are classified into five classes using cluster analysis method. Therefore the prior area and river basin are determined .

Keywords: non-point source, small and midsize river basins, export coefficient model, equal-standard-pollution-load, cluster analysis, delineation

Vibration monitoring and dynamic response analysis of the base-tower about offshore wind turbine

YANG Feng, GAO Jizhang , ZHANG Jinjie , ZENG Di

Abstract: The pile foundation structure is used in most offshore wind farm of China. The structure of pile foundation and tower is a typical slender-tall structure. In the complex ocean environment loads, the structure system has obvious dynamic, stochastic and non-linear properties. This paper analyzed the correlation between structure vibration and environmental loads, such as wind, wave and other environmental loads. The paper concludes that the vibration acceleration at the top of the tower increases with the mean square deviation of wind according to long-term vibration monitoring data of Xiangshui offshore wind farm in Jiangsu province. The paper also developed a model for dynamic simulation and analysis, and the model calculation results reflect the response of offshore wind turbine power under different conditions. The above research results provide the reference for offshore wind turbine design.

Keywords: offshore wind turbine, pile foundation, vibration monitoring, dynamic response analysis

Overview on research of ground motion inputting for earth-rock fill dam

YANG Zhengquan, LIU Xiaosheng, WANG Xiaogang, ZHAO Jianming

Abstract: The dynamic response characteristics and anti-seismic performance of high earth-rock fill dams, are the overriding concern in dam engineering area. Confirmation of the ground motion input is the primary work for dam structure dynamic analysis, and the important influential factor on accuracy of the analysis. In this paper, the main topics related to the on method of ground motion input in the dynamic analysis of earth-rock fill dam are discussed, and the study situation of these problems is generalized and reviewed. Some problems which need to be studied further are presented, too.

Keywords: hydro-structure, dynamic analysis, earth-rock fill dam, ground motion inputting, overview

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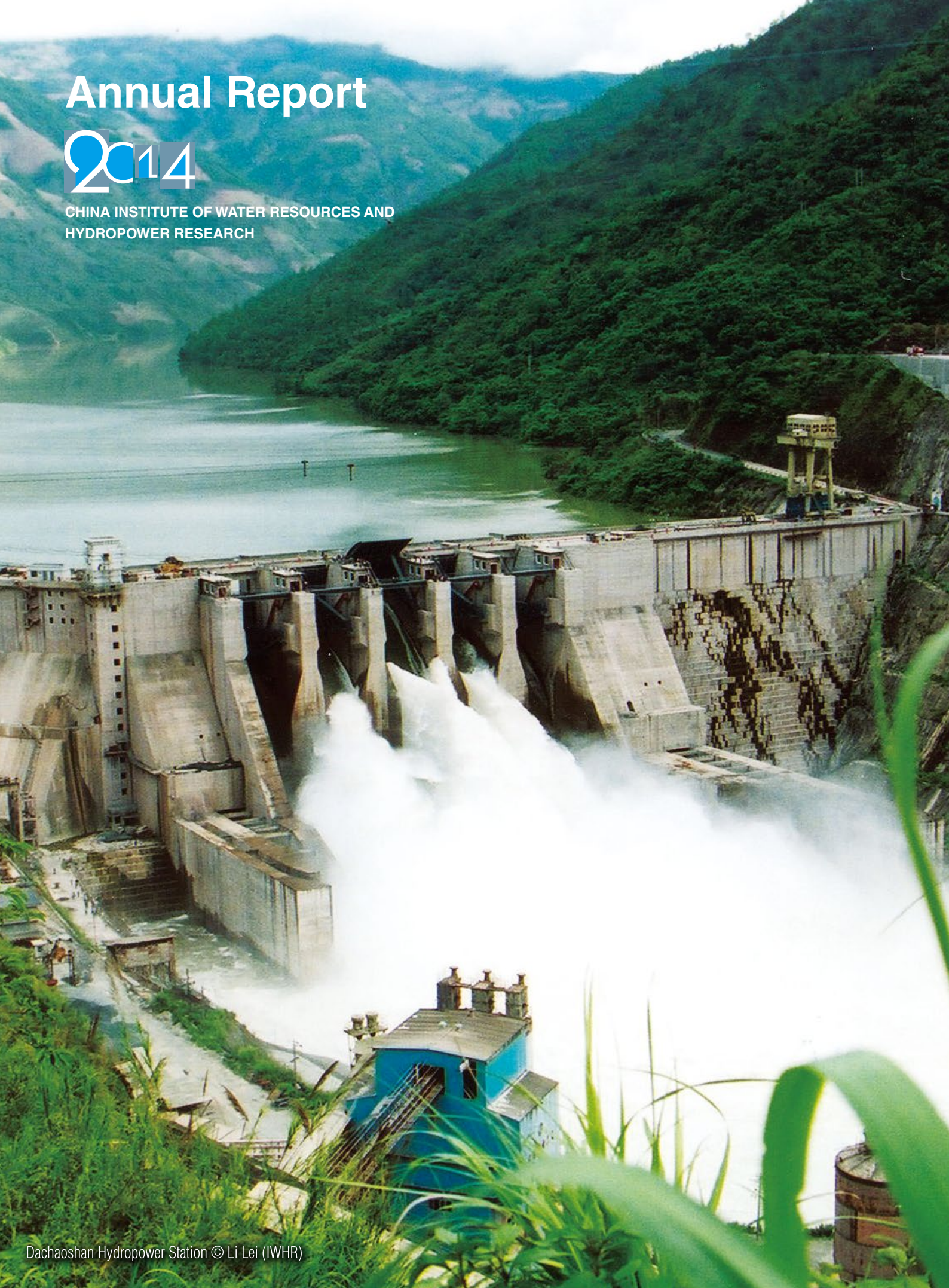


Dachaoshan Hydropower Station © Li Lei (IWHR)

Management Achievement

Highlights of 2014

1

The research of basin water cycle evolution mechanism and efficient water resources utilization, of which IWHR is the lead institute, won first prize of National Prize for Progress in Scienec and Technology

2

IWHR joined in Beijing Employee Mutual Aid Guarantee Fund to increase the reimbursement rate of medical insurance

3

IWHR won Global Human Settlements Model of Green Technology for the research on photovoltaic solar water pumping for the conservation of grassland and farmland in China

4

IWHR reaped a record-high volume of contracts from National Natural Science Foundation of China, and received the sponsorship of National Fund of Social Science for the first time

5

Prof. Xu Di, director of IWHR's Department of Irrigation and Drainage, won May Day Labor Medal of Central State Organs

6

Journal of Hydraulic Engineering, edited and published by IWHR, was included in the list of China's most world-influential academic journals for 2013, and was titled for the 13th time China's top 100 excellent academic journal

7

IWHR reached an agreement with International Association for Hydro-Environment Engineering and Research (IAHR) to host its world secretariat in Beijing

8

Prof. Ding Kunlun from IWHR was elected vice president of International Commission on Irrigation and Drainage (ICID)

9

The research on key technology and engineering application of high CFRD won second prize of National Prize for Progress in Science and Technology

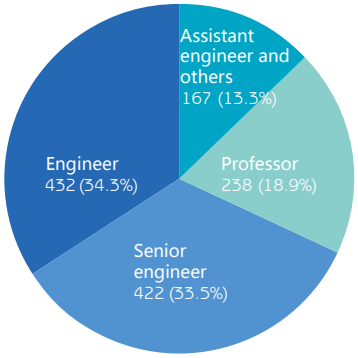
10

IWHR was certified by Ministry of Water Resources as the advanced unit for the work of final accounting statements

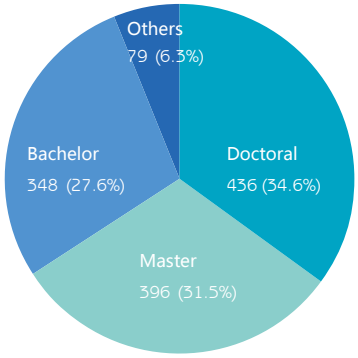
Statistics

Human resources

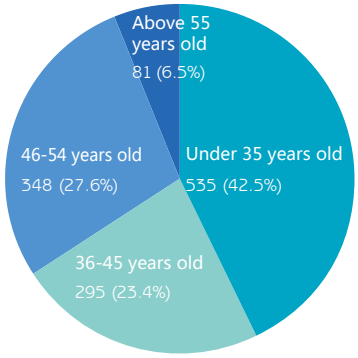
IWHR has 1,452 staff members in 2014, including 1,259 technical professionals.



By title



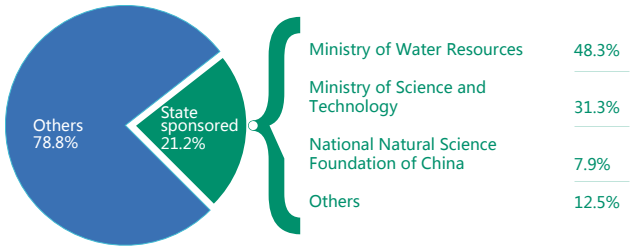
By educational level

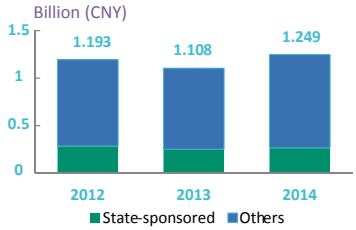


By age

Research Contracts

Research contracts signed in 2014: 1,468 in number and CNY 1.249 billion in value





Awards

Among the 299 completed researches that have been approved, 1 is granted an international prize, 5 on state level and 26 on provincial/ministerial level.

Type	Amount	Grade
State level	5	First prize (1)
		Second prize (4)
Provincial (ministerial) level	26	Special prize (1)
		First prize (10)
		Second prize (15)
Global level	1	

Some of the prized researches:

- Basin water cycle evolution mechanism and efficient water resources utilization
- Key technologies and application of hydraulic optimal design of Francis turbines
- Key technologies and application of extra-high core-wall rockfill dam
- Water control mechanism, key technologies and application for ecological restoration of arid inland river basin
- Remote sensing technologies of agricultural drought and flood disasters
- Key guarantee technologies and application for reservoir and dam safety
- Research and development platform for hydraulic machinery
- Research on impact of climate change upon China's water security and the counter
- Research and demonstration of integrated technologies for water supply safety in rural areas
- Computational theories and applied practice for atomized flow discharged from high dams
- Research on seismic safety assessment system of concrete dams
- Key construction technology research and application for Pubugou high embankment dam
- Research and application of new daming technology with mangnesium oxide micro-expanded concrete for the whole dam
- Research and application of key efficient irrigation technologies with clean energy in mountainous areas
- Research and application of key anti-crack and intelligent monitoring technologies for concrete dams in high-altitude large-temperature-difference areas
- Key technology research and equipment development for ice-jam prevention and ice breaking

Intellectual Properties

IWHR obtains 67 patents in 2014 (including 18 inventions and 49 utility models), participates in the editing of 26 technical codes, and also publishes 43 books and 757 papers.

	Patents		Technical codes		Books	Papers
	Inventions	Utility models	Chief edited	Co-edited		
Amount	18	49	11	15	43	757

Journals

Journal of Hydraulic Engineering

Journal of China Institute of Water Resources and Hydropower Research

International Journal of Sediment Research

International soil and Water Conservation Research

China Flood & Drought Management

International cooperation

International exchange

IWHR President Kuang Shangfu meeting Deputy Secretary of Australia's Department of Industry

Delegates from World Bank visiting IWHR's Daxing Experimental Base

Officials from Nepalese Ministry of Irrigation visiting IWHR and talking on IWRM and irrigation

RusHydro delegates visiting IWHR's laboratories

IWHR Vice President Jia Jinsheng attending the 5th ISC Meeting and the 2nd Stakeholder Consultations Meeting of the 7th World Water Forum

IWHR Chief Engineer, then ICID President Gao Zhanyi, addressing the opening ceremony of 22nd International Conference on Irrigation

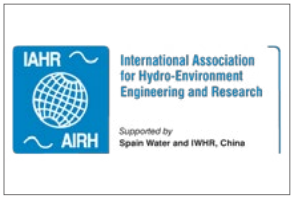
Researchers of a China-Australia project on water resources utilization visiting Eucmbene Lake in Australia

IWHR Vice President Wang Xiaogang attending the 11th IWHR-KICT Joint Seminar in Korea

Organizing Beijing Briefing on 2015 World Hydropower Congress

Attending the 82nd Annual Meeting of ICOLD in Indonesia

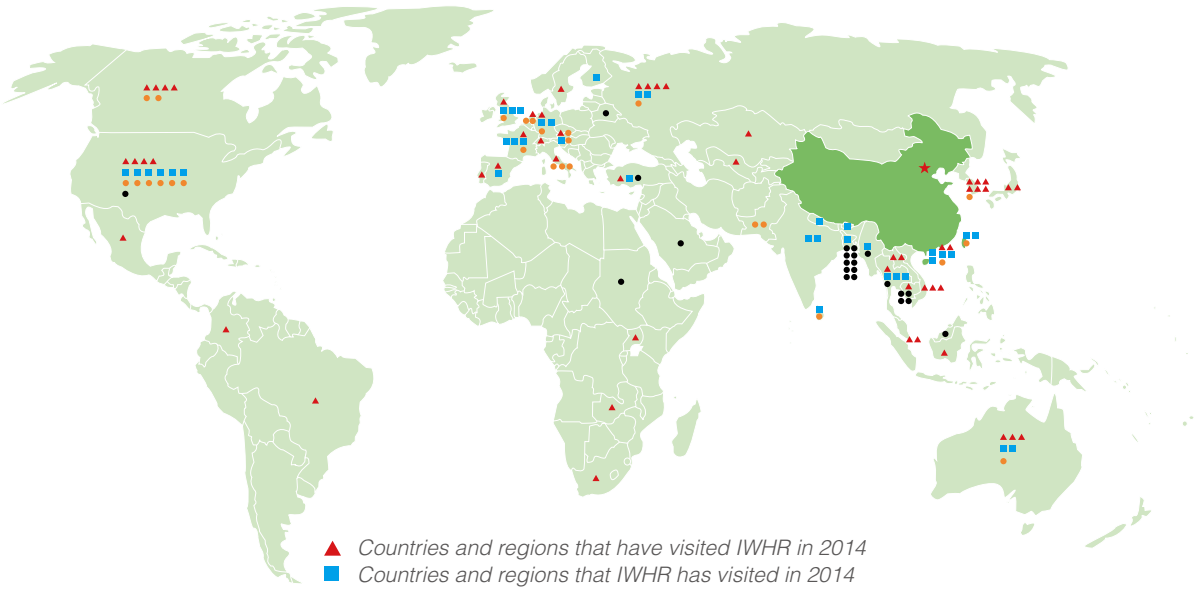
Prof. Ding Kunlun speaking at the 65th ICID International Executive Council meeting after being elected ICID vice president



Hosting the Beijing Office of IAHR, which has revamped its logo to adapt to the new change

Partnership with cooperative agreements

2014 IWHR global footprints



▲ *Countries and regions that have visited IWHR in 2014*
■ *Countries and regions that IWHR has visited in 2014*
● *Countries and regions that have cooperative agreements with IWHR since 2008*
● *Countries and regions in which IWHR has newly-signed international projects in 2014*

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Baoquan Pumped-Storage Power Plant © Li Lei (IWHR)

APPENDIX

Organization

President and Vice Presidents

Commissions

- Academic Commission
- Board of Professional Title Assessment
- Board of Academic Degree Assessment

Administration Divisions

- General Office
- Division of Personnel, Labor and Education
- Division of Research, Management and Planning
- Division of International Cooperation
- Division of Finance and Assets Administration
- Division of Supervision and Audit

Research Departments

- Department of Water Resources
- Research Center on Flood and Drought Disaster Reduction (*incl. the Remote Sensing Technology Application Research Center and the Department of Water Resources History*)
- Department of Water Environment
- Department of Irrigation and Drainage
- Earthquake Engineering Research Center
- Department of Geotechnical Engineering
- Department of Structures and Materials
- Department of Sediment Research
- Department of Hydraulics
- Research Center for Sustainable Hydropower Development
- Department of Water Resources for Pastoral Areas

Key Laboratories

- State Key Laboratory of Simulation and Regulation of Water Cycle in River Basin
- Key Laboratory for Hydraulics and Sedimentation Science and RiverTraining (*of the Ministry of Water Resources of China*)
- Key Laboratory for Construction and Safety of Water Project (*of the Ministry of Water Resources of China*)

Division of Comprehensive Business

- General Office
- Section of Postgraduate Education
- Standardization Research Center
- Section of Academic Journals and Library

Enterprises

- Beijing IWHR Corporation
- Beijing IWHR Technology Co., Ltd.
- Beijing IWHR-KHL Co., Ltd.
- Beijing Zhongshui Runke Certification Co., Ltd.
- Tianjin Institute of Hydroelectric and Power Research

Secretariats of Organizations

- World Association for Sedimentation and Erosion Research
- World Association of Soil and Water Conservation
- Chinese National Committee on Large Dams
- Chinese National Committee on Irrigation and Drainage
- Beijing Office of International Association for Hydro-Environment Engineering and Research
- Global Water Partnership China
- China Office of International Hydropower Association

Research Divisions

Department of Water Resources

Fundamental and applied research on the theories and applications in hydrology and water resources, including the fundamental theories and simulative technologies of water cycle, the assessment, planning, allocation, saving, regulation, management, protection and macro-strategy research of water resources, and the consulting and international cooperation in related fields.

Research Center on Flood and Drought Disaster Reduction (incl. the Remote Sensing Technology Application Research Center and the Department of Water Resources History)

Research on key issues of flood control, drought relief and disaster reduction, including disaster formation mechanism, forecasting and warning, risk assessment, management and rescue technology of risk and emergency, application of remote sensing and other high-technologies, water resources history and water culture.

Department of Water Environment

Evolution mechanisms and simulation technologies of water environment and ecology; methods and standards of assessment and monitoring, as well as protection and recovery technologies of water environment; guarantee technologies of drinking water safety; environmental impact assessment of projects; theories and information technologies of water environment management.

Department of Irrigation and Drainage

Strategies, planning and related standards of water resources development in rural areas; water-efficiency irrigation and management technologies of farmland water and soil environment; research, equipment development, transfer, promotion and application of water supply technologies in rural areas; quality inspection and product certification of equipment.

Earthquake Engineering Research Center

Theories and analysis of earthquake engineering; dynamic test of structures and equipment; monitoring and forecasting of reservoir earthquake; anti-earthquake analysis and safety assessment of electrical equipment.

Department of Geotechnical Engineering

Property study of geotechnical materials; behavior simulation, safety assessment and centrifugal testing of geotechnical structures such as embankment dams, high slopes and underground tunnels and chambers.

Department of Structures and Materials

Temperature stress and control of hydraulic structures; numerical, visual and digital simulation of projects; safety monitoring and inspection; anti-seepage, repair and reinforcement of projects.

Department of Sediment Research

River channel evolution and improvement; reservoir sedimentation and regulation; conservation and control of water and soil; sediment issues in estuary, coastal and hydraulic projects; prevention and control of sediment disasters; fundamental theories and simulation technologies of sediment movement.

Department of Hydraulics

Hydraulics of high-velocity flow, flow-induced vibration and project layout; hydraulic control and ice dynamics; cooling water and cooling tower research for thermal and nuclear power projects; river and ecological hydraulics; hydraulic prototype observation and equipment development.

Research Center for Sustainable Hydropower Development

Strategies, policies, planning and key technologies of sustainable hydropower development, including the theories, methods and assessment system of hydropower sustainability (green hydropower); strategic planning of hydropower development; ecological and environmental protection, as well as reservoir-induced relocation policies, of hydropower projects; bioremediation of hydro-fluctuation belt in reservoir areas.

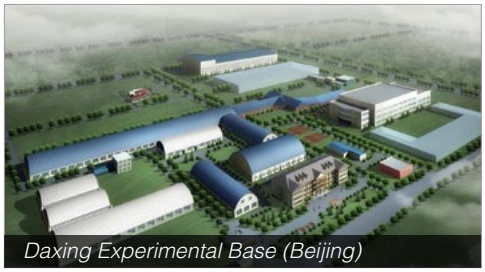
Department of Water Resources for Pastoral Areas

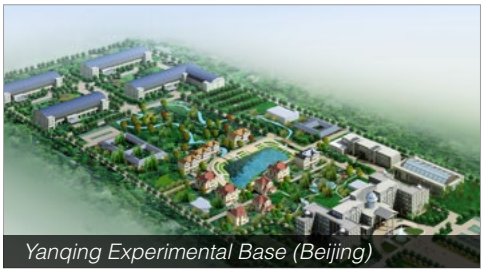
Water resources and water environment for pastoral areas; water-efficiency irrigation and drainage, conservation of water and soil, and ecological recovery of grasslands; clean energy development and utilization, as well as water supply equipment, for pastoral areas.

Scientific Research Bases

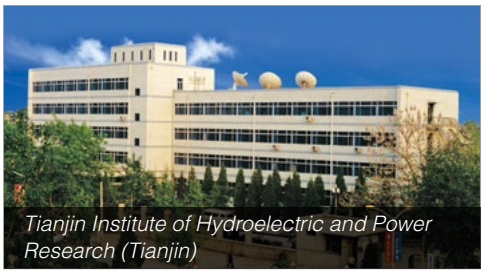

Technology Innovation Base (South, Beijing)


Technology Innovation Base (North, Beijing)


Daxing Experimental Base (Beijing)

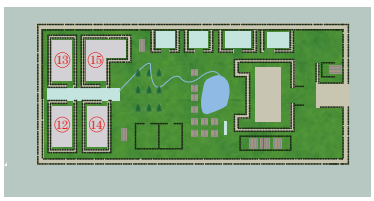

Yanqing Experimental Base (Beijing)


Base of Water Rescources for Pastoral Areas (Inner Mongolia)


Tianjin Institute of Hydroelectric and Power Research (Tianjin)

Laboratories in Daxing and Yanqing bases include:

Daxing Experimental Base



Yanqing Experimental Base

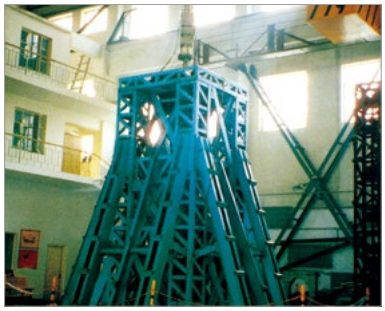
(1) Laboratory of Water Cycle and Deployment
(2) Laboratory of Water-Sediment Regulation and River Training
(3) Laboratory of Soil and Water Conservation
(4) Laboratory of Fundamental Theoretical Research on Sediment Transport
(5) Laboratory of Hydraulics
(6) National Center for Efficient Irrigation Engineering and Technology Research - Beijing
(7) Laboratory of Rural Drinking Water Safety, NCEIR
(8) National Center for Quality Supervision and Test of Agricultural Irrigation and Drainage Equipment
(9) Laboratory of Hydraulic Regulation
(10) Laboratory of River Environment
(11) Hydraulic Machinery Laboratory
(12) Laboratory of Automatic Control and Simulation
(13) Laboratory of Quality Inspection and Simulation for Speed Governing System of Small Hydro
(14) Integrated Laboratory of Engineering Technology on Water Resources and Soil-Water Conservation
(15) Integrated Laboratory of Engineering Mechanics

Large Equipment

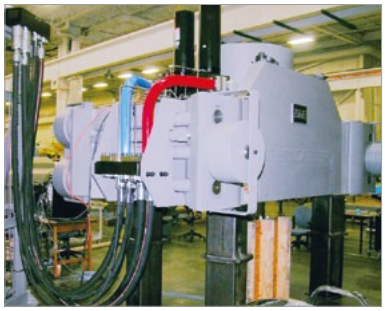
Vacuum tank (vacuum percentage 98.7%; flow discharge 1.0 m)

Universal test stand of advanced hydraulic machinery model

LXJ-4-450g-t geotechnical centrifuge



Tri-axial earthquake simulating shaking table with 6 degrees of freedom



15000 KN universal testing machine

Creep testing system for fully-graded concrete

Hydraulic flume and water tank

Eddy covariance system

Multi-functional GC-MS Machine

2014 Annual Report of IWHR
Published on March 30, 2015

Beijing IWHR Corporation

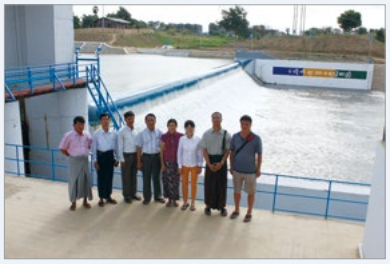
Scope of business

- Consulting, design and equipment development of safety monitoring and automation system
- Foundation anti-seepage, reinforcement and treatment
- Inspection, diagnosis and assessment of project health
- Survey, design, research, development and application of water resources, hydropower and wastewater treatment projects, engineering supervision and equipment supervision
- Treatment and recycling of municipal wastewater, up-to-standard discharge of industrial wastewater, water supply project, desalination project
- General contracting (EPC) of overseas hydropower projects
- Complete set of electromechanical equipment and technical services in hydropower station
- Vibration testing, dynamic response simulation and safety assessment of hydraulic turbine and powerhouse

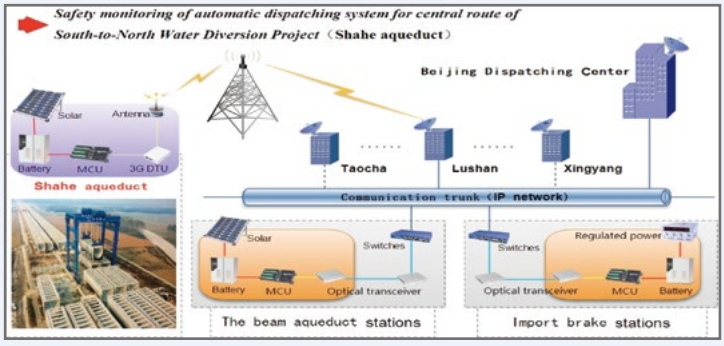
Representative products/projects

Leakage plugging project for Daping Hydropower Station in Yunnan Province

Dunhua Hydraulic Elevater Dam



Rubber dam in Myanmar



Safety monitoring of automatic dispatching system for central route of South-to-North Water Diversion Project

Beijing IWHR Technology Co., Ltd.

Scope of business

- Electro-machinery engineering technology for hydropower stations
- Technical service of hydraulic machinery, experimental research of prototype, operational status monitoring and integration service of power generating units
- Computer monitoring and system integration of water resources and hydropower projects
- Automatic system integration of river basin water regime forecasting and water dispatching
- Turbine governors
- Water resources informatization and training simulation system

Representative products/projects

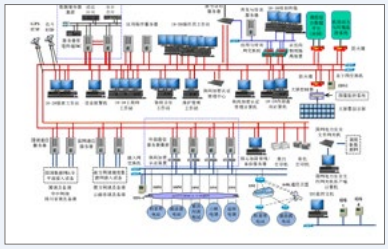
EPC projects of electro-machinery equipment, H9000 computer monitoring system for hydropower stations, ip9000 intelligent integration platform, HR9000 automatic water regime forecasting system, SD2008 automatic water dispatching system, experimental research of hydro-machinery models, operation and guarantee of power generating units

Generating units of Bac Binh Hydropower Station

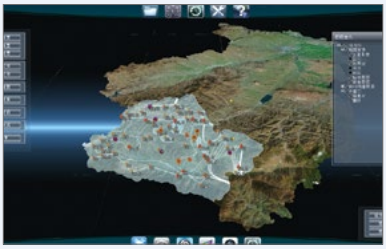
Powerhouse of Bac Binh Hydropower Station

Spillway of Bayramhacili Hydropower Station

Generating units of Gullubag Hydropower Station



Computer monitoring system for Chengdu Cascade Control Center of China Three Gorges Corporation



3D flood season monitoring image

Computer monitoring system for Xiluodu Hydropower Station

Radar water level gauge for Ertan Dam

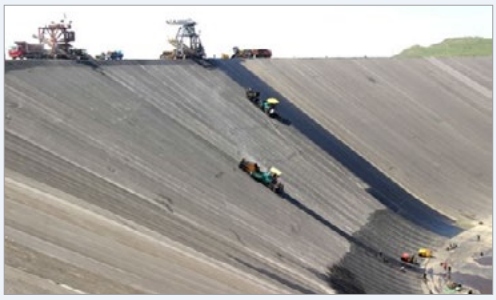
Beijing IWHR-KHL Co., Ltd.

Scope of business

- Research, development, manufacturing and integral construction of waterstop materials
- Research, development and manufacturing of hydraulic concrete and macromolecular materials
- Inspection, safety assessment and technical consulting of hydraulic structures
- Repair and reinforcement of hydraulic structures
- Research, development, manufacturing and construction of hydraulic bituminous concrete materials

Representative products/projects

GB waterstop materials have been applied in more than 100 hydropower stations in and outside China, including Shuibuya Hydropower Station. Our company has conducted optimization of concrete mixing and performance test for over 100 hydropower stations, including the Three Gorges Project. We have also completed the inspection, safety assessment, repair and reinforcement of a large number of hydraulic structures, as well as the construction of bituminous concrete face for the upper reservoirs of many pumped-storage power plants.



Construction of bituminous concrete face for the upper reservoir of Hohhot Pumped-Storage Power Plant in Inner Mongolia

Surface waterstop construction for the concrete face of Liyuan Hydropower Station in Yunnan Province

Inspection and safety assessment for the central route of South-to-North Water Diversion Project

Optimization of concrete mix and performance test for Xiluodu Hydropower Station

Tianjin Institute of Hydroelectric and Power Research

Scope of business

- Efficient hydraulic-model of hydraulic machinery (pump) technology
- Automatic component (device) manufacturing technology
- Integrated control system technology
- Smart grid device
- Power transmission and distribution equipment
- Debugging and installation guidance and transportation of the products we offered

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Representative products/projects

Efficient hydraulic-model of pump

Axial pump

Energy-saving rollover flap valve

Mobile hydraulic driven pump unit

Water circulation pump for high Temperature and Pressure

Salt chemical circulation pump

Double micro-computer (PLC) static excitation system for synchronous generator

Filter reactor

Harmonic control system

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