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## Water Resources Monitoring System Construction in Shanxi Province, China

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### Abstract

Shanxi province is located in the middle reach of the Yellow River, which is also the important energy and chemical industry base of China. Water resources shortage and over exploitation of groundwater is serious in Shanxi Province. Therefore, Shanxi has promoted the construction of water resources monitoring system since 2010. The monitoring system consists of 262 water source areas, 865 water intake sites for municipal water supply, 115 irrigation areas, 43 river control sections, 259 sewage outlets, and 504 groundwater gauge points. All the monitoring datasets from the above points are integrated into a water resources management information system (MIS). Based on the MIS, a decision support system (DSS) is built for routine management and emergency water regulation. The DSS is divided into two levels. The top level, also named provincial level, can access all the data of the monitoring points and remote control nodes. It is a data storage center, and also a decision-making and command center. The bottom level, called municipal level, can only access the monitoring data of the points under its jurisdiction. The bottom level is also responsible for local water resources dispatch in the scope of authority. The MIS and DSS have greatly improved the scientific and informatization ability of water resources management, and the water shortage situation and the over exploitation of groundwater in Shanxi Province have been greatly alleviated by optimal scheduling based on the MIS and DSS.

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### 1. Introduction

Shanxi province is facing a severe water shortage due to less rainfall which caused by climate change and human activities. The experiences around the world show that water resources monitoring (WRM) can promote sustainable management of surface water and groundwater resources [1]. In 2006, the Canadian federal government merged and reconstructed the WRM system, mainly including two surface water monitoring programs—the National Hydrometric Program and the Fresh Water Quality Monitoring program [2]. The WRM can collect water quality and quantity data and make the data publicly available, which is critical for informed decision-making by water administrative department, citizens, and public officials. In the United States of America, Florida [3] and some other watersheds like Spring Creek [4] have built the water resources monitoring system. Since 1960s, many researches [5] have been done to build [6] or optimize [7] the water resources monitoring system [8], not only for surface water [9], but also for groundwater [10]. In 2010, the water administrative department of Shanxi province launched the construction of a water resources monitoring system. The program aims to provide data and information to users for various needs, such as establishing baseline and reference conditions of water quantity/quality, determining long-term trends, handling routine management of water resources, measuring response to remedial measures and regulatory decisions, detecting emerging issues and threats, protecting ground water etc. This paper describes the framework, the management information system, the decision support system and management levels of Shanxi’s WRM.

### 2. Framework

The overall framework of the Shanxi’s WRM system consists of five levels: (1) water resources monitoring; (2) computer network; (3) data resources management platform; (4) the application supporting platform; (5) application system (DSS and MIS). The WRM system is equipped with the information security system and the interface and transmission standard system to guarantee the safety and stable operation.

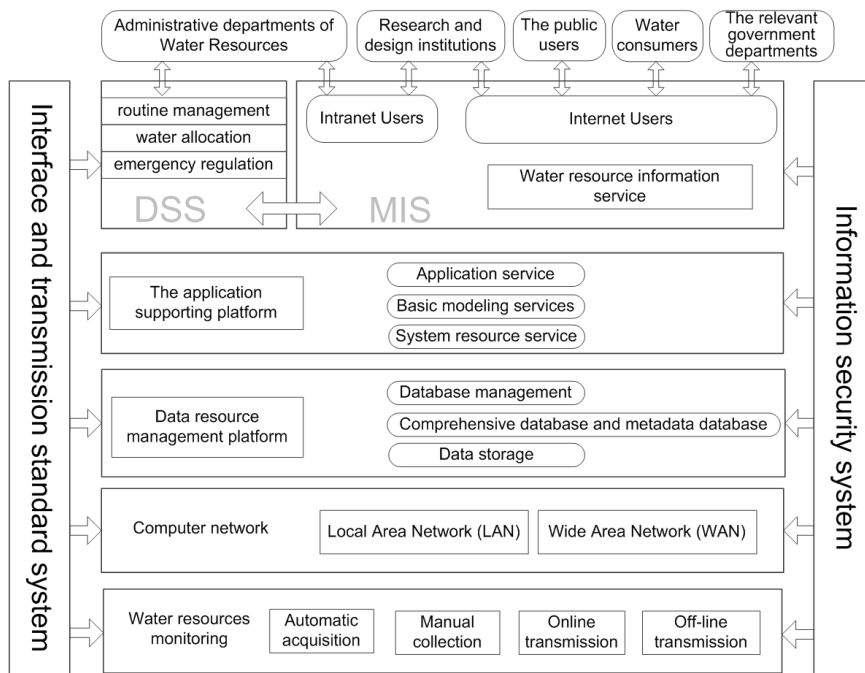


Fig. 1. Framework of water resources monitoring system

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