Evolving characteristics of groundwater resources in the Northeast Vast Plain of China

CHANG-LEI DAI1,2,3, BAO-MING CHI4, YONG YE5 & ZHI-GANG WANG6
1 School of Water Conservancy and Electric Power, Heilongjiang University, Heilongjiang Harbin, 150080, China
daichanglei@126.com
2 Institute of Frigid Zone Groundwater, Heilongjiang University, Heilongjiang Harbin 150080, China
3 Postdoctoral Scientific Research Station of Civil Engineering, Harbin Institute of Technology 150080, China
4 Institute of Disaster Prevention Science and Technology, Beijing 101601, China
5 Institute of Water Resources, IWHR, Beijing 100044, China
6 Songliao Water Resources Commission, Ministry of Water Resources, Jilin Changchun 130026, China

Abstract With the influence of monsoon climate, precipitation in northeast China occasionally varies significantly. Therefore, a huge amount of groundwater is exploited every year, and aquifers have to supply 45% of the total water demands in northeast China. One of the most famous large plains in China, the Northeast Vast Plain, is located in an area that crosses the Liaoning Province, Jilin Province, Heilongjiang Province, and the Inner Mongolian Autonomous Region, and consists of the Liaohe Plain, the Songnen Plain and the Sanjiang Plain. With a total area of $33.70 \times 10^4$ km$^2$, the Northeast Vast Plain has become a famous area of industrialization, energy supply and grain production. Based on research from China and worldwide on the large-scale phreatic cycle and the result of the Second National Water Resource Integrated Evaluation by the Ministry of Water Resources, this paper gathers the statistics of groundwater recharge of every subarea in the Northeast Vast Plain during 1956–2000 (a total of 45 years). Then, groundwater resources and environment problems, especially the effect of humans against nature, is construed. The evolving characteristics of groundwater in those 45 years are pointed out. By choosing different elements to represent the natural evolution and the effect of human activities, and discussing the groundwater resources evolving process and its related degree, this paper finds out the coupling mechanism of groundwater resources in the Northeast Vast Plain of China, and illustrates the principles that the groundwater system responds to exterior factors such as natural changes and especially human activities. The paper also forecasts the evolving direction of groundwater resources in the Northeast Vast Plain, and brings forward some countermeasures and tactics to redress and control groundwater resources by humans. This paper provides a certain reference value to sustainable utilization of groundwater resources and sustainable social economic development in northeast China.

Key words Northeast Vast Plain; groundwater resources; evolution; natural evolvement; human activity