

Analysis of water supplement effect of river-lake ecological recovery in North China

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Objectives:

From 2019 to 2022, the recent goal of comprehensive management of groundwater overexploitation in North China has realized. Based on the practice of annual normalization of large-scale river and lake ecological water supplement and groundwater replenishment in North China in recent years (Table 1), this paper systematically evaluated the impact and effectiveness of ecological water supplement, and provided a basis for ensuring the stable promotion of river and lake ecological recovery and improving the quality and stability of water ecosystem.

Methods:

The paper analyzed the changes of groundwater level, the influence of groundwater infiltration recharge, river-lake water quality, water surface area and length of water-bearing rivers, and systematically evaluated the effect of ecological water supplement using the method of statistical analysis, numerical simulation, remote sensing interpretation.

Conclusions:

1. The ecological water supplement of rivers and lakes had a significant impact on groundwater recharge in the past five years, and the shallow groundwater level of 10km around 22 major rivers and lakes had increased significantly and continuously. Compared with the same period in 2018 before groundwater overdraft control, the water level at the end of 2022 rose by an average of about 5m, and nearly 1m compared with 2021, which was a wet year (Fig.1).

2. The maximum influence distance of groundwater recharge around the Grand Canal from Beijing to Hangzhou and other 5 rivers and lakes can be 13 km (Table 2).

3. The water quality of rivers and lakes continued to improve, and the proportion of water quality stations of class I—III increased from 67% (by the end of 2019) to 72% (by the end of 2022).

4. The water space of rivers and lakes has been significantly improved, and the water surface area and length of water-bearing rivers increased significantly. By the end of 2022, the water surface area of rivers and lakes was 1.28 times that of 2018, and the length of rivers with water was 1.38 times. Most rivers in North China now have water all the way.

Table1 The ecological water supplement in each year from 2018 to 2022

year	Planned water supplement (billions of cubic meters)	Actual water supplement (billions of cubic meters)	Completion rate (%)	Number of rivers and lakes
2018	-	6.41		3
2019	22.1	34.92	158%	21
2020	33.2	44.23	133%	22
2021	28.34	84.68	299%	22
2022	42.08	70.22	167%	48

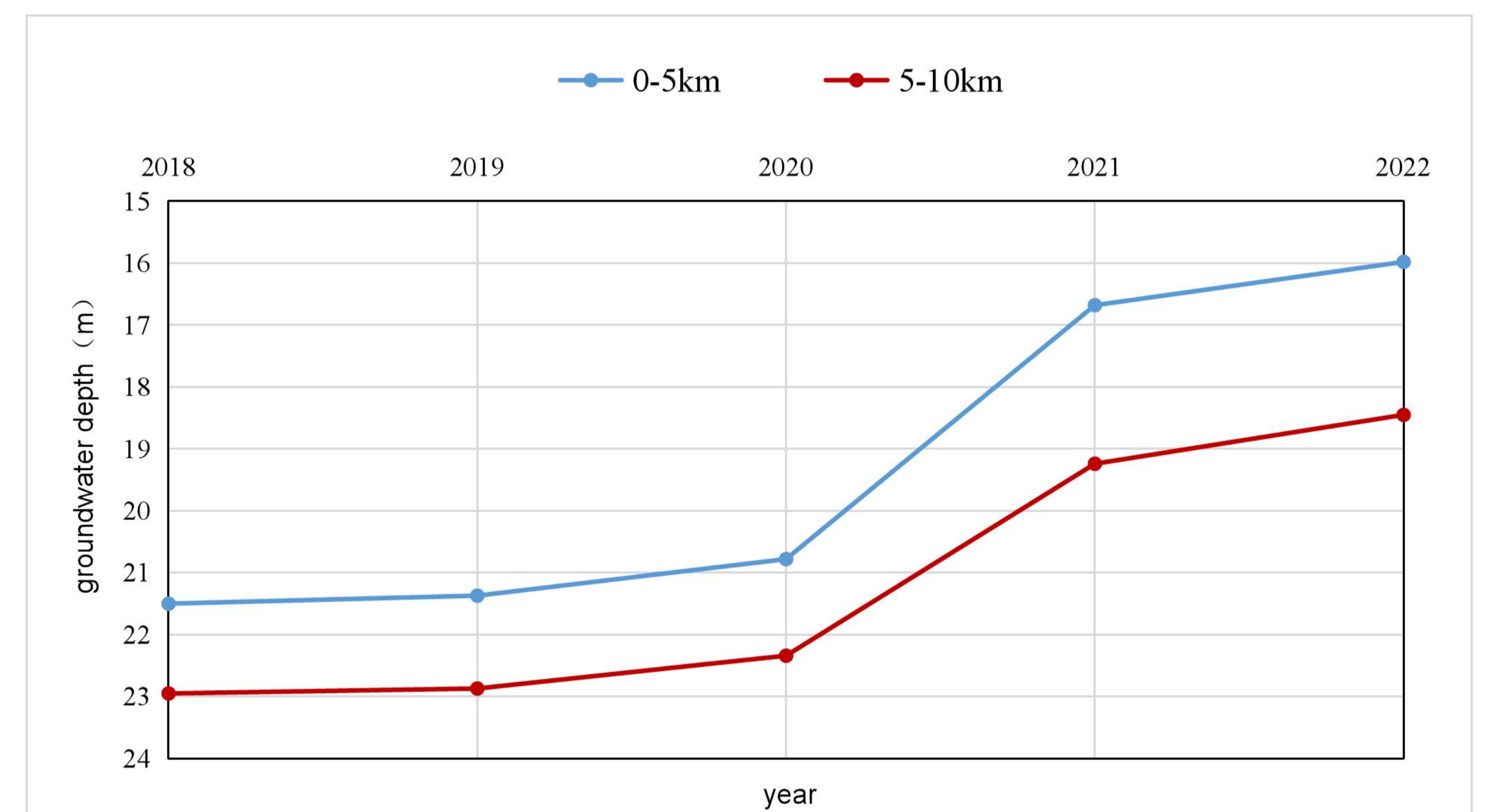


Fig.1 Changes of shallow groundwater level in 0-5 km and 5-10 km around the main rivers and lakes (2018-2022)

Table 2 Influence distance and area of groundwater recharge in River and Lake (by the end of 2022)

Ecological water supplement of rivers and lakes	The influence distance (km)	The influence area (km ²)
The beijing-hangzhou grand canal	0.07~9.60	3120
The yongding river	3.95~11.76	2427
The north juma river	0.56~11.60	658
The bao river	7.32~12.84	745
The tang river	7.48~11.69	1309
The sha river and zhulong river	4.95~13.50	2851
Total	/	11110