Evolution of Groundwater Dynamic under the Influence of Treatment of Groundwater Overdraft in the North China Plain

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Objectives:
Groundwater is the main water source in North China. The North China has suffered a cumulative groundwater deficit of 1800 billion m^3 due to large-scale groundwater exploitation, which is particularly prominent in the Beijing, Tianjin and Hebein. In order to systematically solve the problem of groundwater overdraft in North China, the government has continuously issued relevant policies since 2014. In North China, the study on dynamic response law and mechanism of groundwater level under the influence of overmining treatment has become a research hotspot.This paper studied the evolution of groundwater dynamic in the North China Plain after the implementation of overdraft treatment measures in recent years, which provided a basis for scientific evaluation of groundwater response and policy research under groundwater overdraft management in North China.

Methods:
Taking the Beijing-Tianjin-Hebei region of north China Plain as an example, this paper focused on the dynamic response of groundwater level under the background of overdraft management, analyzed the evolution process of groundwater level in different administrative regions in the past ten years, described the current situation of groundwater level falling funnel and the evolution characteristics of groundwater level in the center of funnel, and revealed the influencing factors of groundwater level change in different regions.

Conclusions:
（1）Shallow groundwater is mainly exploited in Beijing, deep confined water Group Ⅲ in Tianjin, and shallow groundwater and deep confined water in Hebei Province. With the implementation of various measures to control overdraft, the groundwater level has decreased first and then increased in the past decade, and has risen significantly since 2019. The shallow groundwater level in the Beijing-Tianjin-Hebei plain increased by about 2.1m and the deep groundwater level increased by about 4.4m by the end of 2021 compared with the end of 2018.

（2）In the Beijing-Tianjin-Hebei plain, shallow groundwater level drop-off funnels are concentrated in the piedmont of Taihang Mountain and the central plain, while deep confined groundwater level drop-off funnels are concentrated in the eastern plain. There are 7 shallow funnels and 9 deep funnels now（Fig.1 and Fig.2）. The central groundwater level of Beijing shallow Chaoyang-Shunyi funnel rised about 9m from 2016 to 2019, the central of Tianjin deep Xiqing funnel rised about 18m from 2014 to 2019, and the central of Hebei shallow Gaolisu funnel and deep Cangzhou funnel decreased about 16m. However, as North China is still in a serious shortage of water resources and high intensity groundwater exploitation, the situation of groundwater deficit and overdraft is still severe, and the task of groundwater management is still arduous.

Fig.1 Shallow funnel distributions in the Beijing-Tianjin-Hebei Plain of 2019 year-end

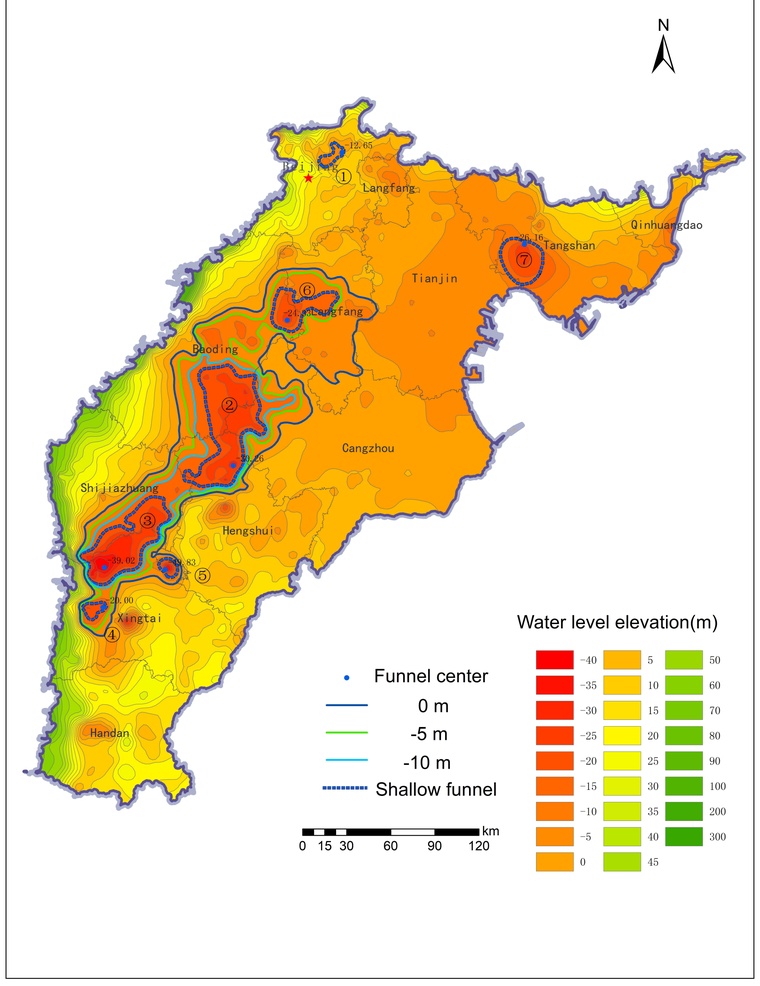

Fig.2 Deep funnel distributions in the Beijing-Tianjin-Hebei Plain of 2019 year-end