

Evaluation of regional groundwater flow system for basin water resource management

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In the Kanto plain, which has the Tokyo metropolitan area, one of the world's largest urban areas, groundwater has been developed extensively in various places as an important water resource. While groundwater development has supported the development and expansion of urban areas, it has led to decreases in groundwater resource and land subsidence. As the measures, the national government and municipalities have regulated groundwater pumping by laws and ordinances. However, in recent years, groundwater demands have been increasing again as private water sources at facilities such as hospitals, as responding to the increase in the burden of maintenance cost of water supply and sewage infrastructure due to the declining population, and as water resource against for emergent water source for natural disasters. Responding to these groundwater demands, basin-scale water resources management is required in order to properly use of groundwater without reoccurring land subsidence. In addition, in order to properly manage water resources, it is essential to grasp the influence of the use of groundwater in each region and to grasp changes in regional groundwater flow.

The authors have carried out the studies on groundwater flow system in the plain part of Saitama prefecture, located in the central Kanto plain, to clarify the process and the mechanism of the transition of groundwater flow accompanying groundwater development. Groundwater flow in this area has been changing due to the groundwater development and the pumping restrictions. In order to respond to the future groundwater demand, that is, to predict how the groundwater flow will change with future groundwater re-development in various places, it is necessary not only to grasp the current state of groundwater flow but also to understand the mechanism of the historical change of groundwater flow due to groundwater development. In addition, in this area, the groundwater flow has been also affected by the groundwater use in the surrounding prefectures. Thus, it is also required to grasp the regional groundwater flow in regional scale.

In this area, hydraulic heads in the developed aquifers have recovered due to groundwater pumping regulation. In this process, although the overall hydraulic head distribution of the area has not changed, the difference of water heads in the area has decreased. These results show that although the mechanism of groundwater flow has not changed significantly, the groundwater flux may have decreased. However, the current hydraulic head distribution and the groundwater flow mechanism are quite different from the original ones (state before large-scale development). This suggests that groundwater flow in the area is just a state in which land subsidence is kept and it is becoming a new steady state. In this presentation, based on the results of our studies, we will discuss the groundwater flow in the current condition and in the historical changes with human activities in the area, and issues to grasp regional groundwater flow appropriately.

Keywords: basin water resource management, sustainable groundwater development, regional groundwater flow system, Tokyo metropolitan area