

Hydrological characteristics revealed by tracer approach in irrigation area of Heihe river basin, northwest China

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[Introduction]

Social concern on issues of water resources has been growing for last several years. It is essential to have a sustainable control of water resources with enough understanding of the hydrological cycle such as groundwater recharge and flow processes.

It has been reported that there are several issues on hydrological cycle in Heihe river basin, northwest China. Therefore, there are several hydrological studies in Heihe river basin discussing interaction between river and groundwater, groundwater level change due to irrigation and so on. However, it is not enough to estimate available groundwater in the irrigation area quantitatively and qualitatively.

[Purpose of the study]

Purpose of this study is to clarify groundwater recharge and flow processes including effect of the irrigation (human activities) using physical and geochemical field data in irrigation area on Heihe river basin.

[Methodology]

Field observations were performed in September 2008 in irrigation area (middle reaches) in Heihe river basin. Groundwater, river water and irrigation water were sampled for multi tracer analysis (oxygen and hydrogen stable isotopes and Inorganic solute concentrations), groundwater level was measured and several existing local information were collected.

[Results]

Inorganic constituents of river water showed relatively high concentrations of Ca, Mg, HCO_3 , SO_4 . Characteristics in inorganic constituents in irrigation water were similar to river water. It suggests that irrigation water is originally from river water.

Stable isotope and ion compositions of Heihe river main stream did not change as it flows. It suggests that inflow of brunch and groundwater are not contributed for discharge of main stream.

Inorganic constituents in groundwater showed regional characteristics. They were similar to river water in upper reach but were different in lower reaches. In lower reaches, Na, Mg, Cl, SO_4 were dominant and total concentrations were higher than those in upper reaches.

Although stable isotope compositions of groundwater in upper reaches and lower reaches were similar to those of river water, those in middle reaches were lighter than river water. These results suggest that groundwater in upper and lower reaches is recharged by river water and groundwater in middle reaches is recharged by other source than river water. It seems that there are regional characteristics in recharge and flow processes of groundwater.

Stable isotope and ion compositions were similar in spatially close wells which have different depth (e.g. 7m and 19m, 18m and 70m) in middle reaches. It might suggest that first aquifer seems to be thick about 20-70m in particular region in middle reaches.