Relation among the groundwater resources, grain production and human activities in the North China Plain

Shinobu Kaneko[1]; Akihiko Kondoh[2]; Changyuan Tang[3]; Kaisar Aji[4]

[1] Human and Earth sci,Chiba Univ; [2] CEReS, Chiba Univ.; [3] Graduate School of Sci. and Tech., Chiba Univ.; [4] Graduate Sci&Tech, Chiba university

http://dbx.cr.chiba-u.jp/members/skaneko/home/

In the recent years, water shortage has become a serious problem in North China Plain (NCP). The most important problem regarding the water shortage is the security of food production. Our research using socio-economic statistical data from 'Hebei Economic Statistical Yearbook' has demonstrated the interrelationship among geomorphology, groundwater flow systems (GFSs), socio-economic factors and grain production in the NCP. The relatively high grain productivity of counties located in piedmont plain resulted from availability of fresh water from GFS in alluvial fan. Whereas the grain productivity of counties located in eastern lowland is relatively low and vulnerable to weather conditions because less fresh groundwater is available in eastern area due to high Total Dissolved Solids (TDS) in shallow groundwater. The spatial change in normalized difference vegetation index (NDVI) in the NCP from Pathfinder Advanced Very High Resolution Radiometer (AVHRR) Land 10-day composite data set (PAL dataset) shows complex distribution and fits spatial distribution of grain productivity analyzed from the statistical dataset. Accordingly, we recognize that the high TDS zones were formed by evaporation residue at discharge areas of each GFS corresponding to each geomorphologic unit such as alluvial fan and palaeochannels, and high TDS causes low grain productivity in the NCP.

This study intends to confirm that each geomorphologic unit has hydrological function, using steady-state groundwater modeling. To investigate the structure of GFSs, explained by geomorphology of the NCP, the shape of the water table has been assumed as the boundary condition for the model. Regional flow system from the piedmont area to east end of the lowland, intermediate flow system from top to end of the alluvial fan and local flow system at palaeochannels are identified, and the discharge areas fit low productivity and high TDS areas. These results support our recognition that GFSs corresponding to each geomorphologic unit form high TDS zone and then affect distribution of grain productivity.