

Analysis of the relationship between hydrological processes and soil salinization: Study in the southern coastal plain of Laizhou Bay, China



Lin Gao; Yang Qiu; Zhiye Wang; Chuanming Ma*
China University of Geosciences (Wuhan)



Introduction

Soil salinization is when salinity in groundwater accumulates on the surface with pore water under capillary action and evaporation. The cumulative process can be affected by many factors, such as precipitation, evaporation, topography, vegetation, groundwater, etc. In coastal areas, the salinization of groundwater caused by seawater intrusion, the salinity of rainfall caused by storm surges, and the leaching of soil salinity caused by pumping irrigation may induce soil salinization. There needs to be quantitative research on soil salinization aiming at the water-salt transport chain in the hydrological process above the coastal area. This study selected the southern coastal plain of Laizhou Bay, the most affected area by seawater intrusion disasters in China, as the study area. Using $\delta^{18}\text{O}$ and δD stable isotope, hydrogeological, and geochemistry methods, the contribution of groundwater salinization caused by seawater intrusion, precipitation, and pumping irrigation to soil salinization was quantitatively analyzed.

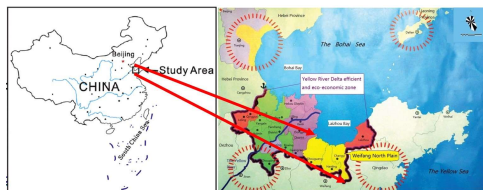
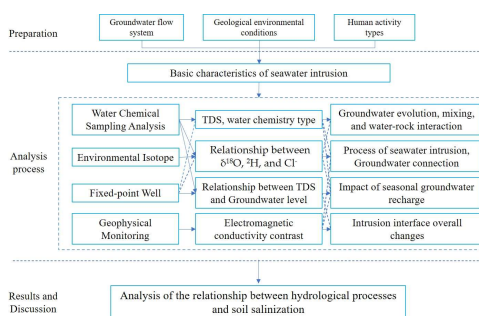


Fig.1 Location and range diagram of the study area

Methods



Results

In the areas near the coast and affected by the brackish-freshwater transition zone (<25-30 km), the results show that the salt transfer caused by pumping irrigation is the most critical factor contributing to soil salinization. But the salinity in groundwater comes from seawater, and the contribution of soil salt leaching is small. In the areas away from the coast (>30 km), the donation of salinity transfer by precipitation and pumping irrigation to soil salinization is similar, and the salinity carried by the precipitation shows a seasonal law.

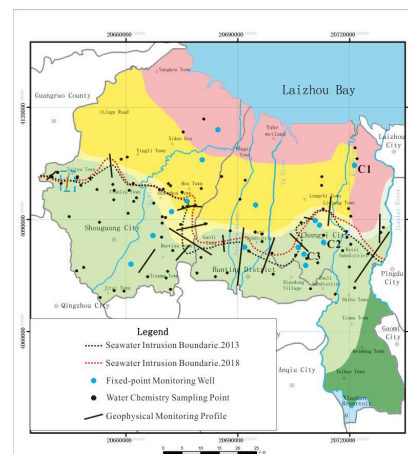


Fig.2 Multiple monitoring method deployment and seawater intrusion boundaries

Conclusions

Based on the analysis of long series of groundwater level monitoring data, it is found that the degree of soil salinization changes synchronously with the groundwater level. The water chemistry analysis process is further verified by the correlation between the groundwater table and soil salinization, which shows the correlation between seasonal pumping irrigation and other human activities. The results of this paper can provide a reference for the sustainable utilization of groundwater resources and efficient utilization of agricultural land in coastal areas.