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Formation mechanism of land subsidence in the North China Plain

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Land subsidence is a progressive and gradual geological disaster, whose development is irreversible. Due to rapid development of industrialization and urbanization, land subsidence occurs commonly in the North China Plain, and has become the main environmental factor impacting sustainable economic and social development. This study presents a brief review on the current situation of land subsidence in the North China Plain. Then the hydrologic, hydrogeologic and anthropogenic conditions favorable for the formation of land subsidence are analyzed, indicating that the formation of land subsidence is mainly determined by local geological condition and enabling conditions, e.g. long-term excessive exploitation of groundwater and engineering construction.
A correlation analysis was conducted in both the North China Plain and Cangzhou region, a typical area where severe land subsidence occurs, of the quantitative relationship between deep groundwater yield and the land subsidence. The analysis results indicate that the land subsidence volume accounts for 40% to 44% of deep water yield in the North China Plain, indirectly showing the proportion of released water from compressibility of the aquifer and the aquitard in deep groundwater yield. In Cangzhou region, this proportion was calculated as 58%, far greater than that of the North China Plain. This is induced by the local lithologic structure and recharge condition of deep groundwater in Cangzhou region. The analysis of soil samples in Cangzhou region shows that strong relations exist among different physical parameters, and good change laws of compression with depth and pressure are found for soil samples. The hydraulic conductivities of clay are six orders of magnitude greater than those of the aquifer, implying the strong hypothesis of land subsidence. This analysis provides data and scientific basis for further study on formation mechanism of land subsidence in Cangzhou region and objective evaluation of its development trend, and then provides technical support for study on prevention and control measures to efficiently inhibit the development trend of land subsidence.