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Groundwater management and development by integrated remote sensing and geographic information systems: prospects and constraints

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Description / Abstract

Groundwater is one of the most valuable natural resources, which supports human health, economic development and ecological diversity. Overexploitation and unabated pollution of this vital resource is threatening our ecosystems and even the life of future generations. With the advent of powerful personal computers and the advances in space technology, efficient techniques for land and water management have evolved of which RS (remote sensing) and GIS (geographic information system) are of great significance. These techniques have fundamentally changed our thoughts and ways to manage natural resources in general and water resources in particular. The main intent of the present paper is to highlight RS and GIS technologies and to present a comprehensive review on their applications to groundwater hydrology. A detailed survey of literature revealed six major areas of RS and GIS applications in groundwater hydrology: (i) exploration and assessment of groundwater resources, (ii) selection of artificial recharge sites, (iii) GIS-based subsurface flow and pollution modeling, (iv) groundwater-pollution hazard assessment and protection planning, (v) estimation of natural recharge distribution, and (vi) hydrogeologic data analysis and process monitoring. Although the use of these techniques in groundwater studies has rapidly increased since early nineties, the success rate is very limited and most applications are still in their infancy. Based on this review, salient areas in need of further research and development are discussed, together with the constraints for RS and GIS applications in developing nations. More and more RS- and GIS-based groundwater studies are recommended to be carried out in conjunction with field investigations to effectively exploit the expanding potential of RS and GIS technologies, which will perfect and standardize current applications as well as evolve new approaches and applications. It is concluded that both the RS and GIS technologies have great potential to revolutionize the monitoring and management of vital groundwater resources in the future, though some challenges are daunting before hydrogeologists/hydrologists.

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