ISSN: 0973-4929, Vol. 14, No. (3) 2019, Pg. 349-350

Current World Environment

www.cwejournal.org

Aquifer Management using Isotopes

GOPAL KRISHAN

National Institute of Hydrology Roorkee- 247 667 (Uttarakhand), India.

Article History

Published on : 14 December 2019

Groundwater occurs in the saturated soil and rock below the water table in aquifers. Aquifer is a sub surface layer where pore spaces of water-bearing permeable rock, rock fractures, unconsolidated materials such as gravel, sand, or silt are completely filled with water under saturated conditions. The aquifers can be renewable water resources which are replenished by meteoric water over a period of time.[1] Aquifers have subsurface continuity in vertical and horizontal directions from sources such as rainfall, canal, applied irrigation and different lithological units overlay to form an aquifer system.[2] Water bearing capacity of the aquifers varies with depth, space & time, recharge/discharge zone etc.[2] Aquifer water quality often depends on mineral deposition and movement of pollutants in aquifers.[2]

Water table level fluctuates over time under (i) natural conditions- changes in weather cycles and precipitation patterns, stream flow and geologic changes,[3] and (ii) due to anthropogenic reasons like heavy groundwater abstractions.[3] There is water movement in aquifers depending upon permeability of the aquifer material which may be large enough to permit free movement of water or may be of relatively impermeable materials where the movement is very slow.[3] Beside water movement in an aquifer, this may be between 2 or among more water bodies.[4] The recharge/discharge processes and types of geological, hydrological and hydraulic data describe the hydrogeological framework of an aquifer system.[1]

Scientific assessment of this water movement right from origin to point of recharge site, flow patterns, residence time and replenishment rates of aquifers is crucial for groundwater management for its sustainability. In addition to this, various minerals and contaminants are mixed with the water and pollute groundwater at different times, scales and spatially. In earlier times various models were used to simulate groundwater flows but with the help of dating groundwater numerical models of groundwater flow can be improved in scarce dataset areas.[1]

CONTACT Gopal Krishan drgopal.krishan@gmail.com National Institute of Hydrology Roorkee- 247 667 (Uttarakhand), India.

Doi: http://dx.doi.org/10.12944/CWE.14.3.02

Application of environmental isotopes present in groundwater can be successfully used to track the origin/ recharge point, replenishment rates by assessing the residence times and fingerprint the sources of contaminants.[5-6] Some of these isotopes are as stable isotopes - deuterium and oxygen-18; tritium; dissolved carbon (C-14); chlorofluoro carbon (CFC); noble gases and other radioactive tracers such as nitrogen-15, carbon-13 have been successfully used in various groundwater studies.[5-6]

References

1. IAEA. 2013. Isotope methods for dating old groundwater. Ed by A. Suckow, P.K. Aggarwal and L. Araguas-Araguas.
2. CGWB. 2012. Concept note on National Project on Aquifer Management (NAQUIM).
3. IAEA, Water Resources Programme. 2019. Using Isotopic Techniques to Map and Analyse Groundwater Resources in the Sahel. IAEA Office of Public Information and Communication
4. Krishan, Gopal, Singh, Surjeet, Thayyen, Renoj J., Ghosh, N.C., Rai, S.P. & Arora, Manohar. 2019. Understanding river – subsurface water interactions in upper Ganga basin, India, *International Journal of River Basin Management*, DOI: 10.1080/15715124.2019.1683853
5. Lapworth DJ, Krishan G, MacDonald AM, Rao MS. 2017. Groundwater quality in the alluvial aquifer system of northwest India: new evidence of the extent of anthropogenic and geogenic contamination. Science of the Total Environment. 599–600 (2017) 1433–1444
6. Lapworth DJ, MacDonald AM, Krishan G, Rao MS, Gooddy DC, Darling WG. 2015. Groundwater recharge and age-depth profiles of intensively exploited groundwater resources in northwest India. Geophys. *Res. Lett.*, 42 (18): 7554-7562.