World Academy of Science, Engineering and Technology
International Journal of Geological and Environmental Engineering
Vol:12, No:01, 2018

Groundwater Recharge Pattern in East and West Coast of India: Evidence of Dissimilar Moisture Sources

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Abstract : The stable isotope (δ^{18} O and δ^{2}H) composition of groundwater of the coastal areas of Periyar and Mahanadi basins falling along East and West coast of India during North-East (NE) monsoon season have been studied. The east and west coast regions are surrounded by the Bay of Bengal and the Arabian Sea respectively, which are considered to be the primary sources for precipitation over India. The major difference between the Bay of Bengal and the Arabian Sea is that a number of large rivers feed the Bay of Bengal, whereas the Arabian Sea is fed by very few small rivers, resulting in enriched stable isotopic composition of the Arabian Sea than the Bay of Bengal. Previous studies have reported depleted ratios of stable isotopes during Northeast monsoon along East and West coasts due to the influence of the Bay of Bengal moisture source. The isotopic composition of groundwater of the Mahanadi delta in the east coast region varies from -6.87 ‰ to -3.40 ‰ for δ^{18} O and -45.42 ‰ to -22.43‰ for δ^{2}H. However, the groundwater of the Periyar basin in the west coast has enriched stable isotope value varying from -4.3‰ to -2.5 ‰ for δ^{18} O and for δ^{2}H from -23.7 to -6.4 ‰ which is a characteristic of South-West monsoon season. This suggests the groundwater system of the Mahanadi delta and the Periyar basins are influenced by dissimilar moisture sources. The δ^{18} O and δ^{2} H relationship ($\delta^{2}H = 6.513\ \delta^{18}O - 1.39$) and d-excess value (< 10) in the east coast region indicates the influence of NE monsoon implying the quick groundwater recharge after precipitation with significant amount of evaporation. In contrast, the δ^{18} O and δ^{2}H regression line ($\delta^{2}H = 8.408\ \delta^{18}O + 11.71$) with high d-excess value (>10) in the west coast region implies delayed recharge due to SW monsoon. The observed isotopic enrichment in west coast suggests that NE winter monsoon rainfall does not replenish groundwater quick enough to produce isotopic depletion during the season.

Keywords : Arabian sea, bay of Bengal, groundwater, monsoon, stable isotope
Conference Title : ICIHG 2018 : International Conference on Isotope Hydrology and Geochemistry
Conference Location : Zurich, Switzerland
Conference Dates : January 15-16, 2018