

Rainfall– Recharge relationship in local and regional scale in Granite terrain of India through Tritium tracer studies

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Archaean granites and related rocks occupy most part of southern semi arid peninsular India with a thin cover of red soil and characterized by seasonal (monsoon) precipitation. Natural recharge through injected tritium tracer technique was measured in granite covered Aurepalle watershed in semi arid region in the state of Andhra Pradesh, India for 5 monsoon seasons and in several watersheds / river basins in different states of India for one monsoon season during the period 1980-2004. The technique assumes layered movement model concept (piston flow model) for movement of moisture in the soil and unsaturated zone.

The mean natural recharge rates obtained in sub watersheds within Aurepalle watershed for 5 seasons and from 12 study areas in granite terrain vary from 22 mm/y to 105 mm/y for the seasonal rainfall ranging from 350 to 750 mm. The large variation of spot recharge values observed within the watershed area was due to spatial heterogeneity in hydraulic properties of soil zone and variation in rainfall distribution. Quantitative estimation of natural recharge in spatial and temporal scale has revealed that seasonal recharge could be inferred from rainfall by means of the following equations 1 and 2.

(Aurepalle watershed in granite terrain for 5 monsoons)

$$RE = 0.39 (RF) - 155 \quad n = 12, r = 0.861$$

(Several watersheds in granite terrain for one monsoon)

$$RE = 0.15 (RF) - 34 \quad n = 12, r = 0.783$$

Where RE = natural recharge in mm, RF = seasonal rainfall in mm, n = no of points, r = correlation coefficient

The equations shows fraction of rainfall in excess of the threshold value that represents natural groundwater recharge. The minimum rainfall required to effect recharge to phreatic aquifer system is estimated to be about 390 mm for the Aurepalle watershed and about 225 mm for granitic terrain in general. The rainfall recharge relationship established would enable the planners to evaluate the safe yield of the watershed or basin in granite terrain and dynamic groundwater potential of a granite region for other years for which rainfall data alone is available.

Keywords: Granite terrain; Natural recharge; tritium tracer; rainfall recharge relationship