USGS

WATER RESOURCES RESEARCH GRANT PROPOSAL

Title: The Spatial Variability of Natural Groundwater Recharge

Focus Categories: HYDROL, MP, WQN1

Keywords: groundwater recharge, groundwater hydrology, groundwater management, groundwater modeling, inverse modeling, hydrologic models, geographic information systems, mathematical models, resource planning, water resources development

Duration: 7/99-6/00

Federal Funds Request: $13,883

Non-Federal Matching Funds Pledged: $27,365

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Abstract

Understanding the distribution and rate of groundwater recharge is a basic prerequisite for effective groundwater resource management and is one of the keys to economic development in rapidly expanding urban, industrial, and agricultural regions. Recharge, defined as the entry of water into the saturated zone, varies spatially and is dependent on a wide variety of factors including the topography, geology, soils, vegetation, land use, precipitation, and climate. The variability and complexity make it one of the most difficult and uncertain hydrologic parameters to quantify in the evaluation of groundwater resources.

Quantitative methods that provide accurate delineation of recharge zones and rates are essential to reliable groundwater models and groundwater protection. Although many techniques have been proposed for estimating recharge, there is still no widely accepted

method to quantify recharge that uses easily obtainable data that can be simply, satisfactorily, and practically applied in regional groundwater studies.

This proposed project seeks (1) to explore and determine the relative significance of some of the factors (e.g. climate, vegetation, topography, soils, and geology) that control groundwater recharge and (2) to develop improved methods for estimating groundwater recharge rates at scales suitable for groundwater modeling and water resource planning. The first technique couples a water balance and parameter estimation (inverse) model. The second proposed technique applies a modified Thornthwaite - Mather soil water balance (Thornthwaite, 1957; Eaton, 1995; Swanson, 1996) to a three dimensional, gridded digital elevation model (DEM) within a Geographic Information System (GIS).

The methods developed provide regulators with a water resource management tool capable of providing spatially distributed estimates of the rates and distribution of groundwater recharge. In addition, these techniques might be used to evaluate the impacts of urbanization, land use changes, and climate change on the patterns and rates of recharge as well as provide inputs for the spatial distribution of recharge into regional groundwater flow models.