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Stochastic simulation of soil water status on reclaimed land in northern Alberta

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Abstract

Studies of spatial variability and simulation of available soil water and extractable soil water are scarce and yet such data are essential in hydrologic and solute transport modeling. A study was conducted to characterize spatial variability of available soil water and extractable soil water on a reclaimed site in northern Alberta. The vegetation on site included grasses, legumes and shrubs. The site was reclaimed and the reconstructed profile was made up of 40-100 cm of clay loam/peat material overlying fine tailings sand. Soil water was measured using neutron moisture meters on a frequency of approximately two weeks during the growing season for a 2-year period. Spatial characterizations of available soil

water (ASW) and extractable soil water (ESW) on the driest and wettest measurement days were conducted using geostatistical methods. A sample semi-variogram was estimated and several permissible theoretical models fitted and the model of best fit was determined using the Akaike Information Criterion (AIC). The spherical model was found to best represent the semi-variogram for available soil water and extractable soil water. Both the available soil water and extractable soil water had very high degrees of spatial dependence (> 99%) and the range of within which sample points were auto-correlated was less than 1 m. The conditional stochastic simulation of extractable soil water at unsampled locations that were 5 m north of the sampled locations indicated a high degree of uncertainty. This implies that generation of exhaustive data sets may require more sampling points at closer spacing to reduce uncertainty.

Keywords

geostatistics; spatial variability; semi-variogram; uncertainty; Alberta; Canada; Stochastic; simulation

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