Jonathan F. Sykes

Professor Emeritus, Department of Civil and Environmental Engineering,
University of Waterloo, Waterloo, Ontario Canada N2L3G1
sykesj@uwaterloo.ca

Ph.D.,	1975	Department of Civil Engineering University of Waterloo
M.A.Sc.	1973	Department of Civil Engineering University of Waterloo
B.A.Sc.	1972	Department of Civil Engineering University of Waterloo

https://uwaterloo.ca/civil-environmental-engineering/people-profiles/dr-jon-f-sykes

Research Profile

The characterization of a groundwater system can only be done using groundwater models; the models integrate all observed data into a framework that includes all fluid fluxes such as recharge and inflows/outflows at boundary conditions and includes the stratigraphy and lithology and related parameters of the groundwater system of interest. My research pioneered the estimation of spatial-temporal estimates of recharge for groundwater modelling that is a function of precipitation, temperature, solar radiation, relative humidity, wind speed, soil characteristics, and vegetative parameters such as root depth and leaf area index. We have used our framework for the estimation of groundwater recharge to investigate the impact of climate change on groundwater systems in Canada and the United States. I also have considerable experience in the modelling and assessment of dense non-aqueous phase liquids (DNAPLS) and published one of the first papers on the modelling of the biodegradation of organics in groundwater.

In recent years I have been a principal investigator of a research team whose mandate is the development of numerical tools and analysis procedures that can be used to evaluate deep geologic repositories (DGR) for used nuclear fuel. The host geosphere includes both fractured crystalline rock and sedimentary basins. The work culminated with the submission to Canada's Nuclear Waste Management Organization (http://www.nwmo.ca/) in 2011 of a keystone document that presents regional and site-scale groundwater analyses in support of their proposal for a DGR in argillaceous limestone for low and intermediate level nuclear waste. The work included investigating the impact on density-dependent groundwater flow of glaciation and deglaciation.

The importance of modeling groundwater recharge as a physically based process was developed in Jyrkama and Sykes (2002) and Jyrkama and Sykes (2007). The papers investigate spatially and temporally varying recharge to the Cohansey aquifer at Toms River, New Jersey and in the Grand River Basin in Ontario Canada. The research on recharge formed the basis of ongoing research on the impact of climate change on groundwater quality and quantity.

My modelling experience includes MODFLOW 2005, HydroGeosphere, FRAC3DVS, SWIFT as well as many other models. In the United States, there have been only two sites (Woburn and Toms River) that

have connected environmental contamination to cancer clusters. I am one of the few individuals that have worked on the groundwater analysis of both sites.