



Modelling unsaturated flow through heterogeneous drift using ECLIPSE

K. E. Thatcher (1), R. Mackay (1) and A. Priestley (2)

(1) Hydrogeology Research Group, University of Birmingham, Edgbaston, Birmingham, UK,
(2) Schlumberger, Abingdon Technology Center, Abingdon, UK (ket445@bham.ac.uk)

ECLIPSE is Schlumberger's 3-dimensional multi-phase flow and transport modelling system for oil reservoir simulation. It is currently being developed to also model regional groundwater systems and is ideal for use in the analysis of large scale unsaturated – saturated zone problems that are increasingly of interest to groundwater managers, notably in the estimation of future recharge to groundwater reservoirs and the quantification of the point and distributed pollutant exchanges between the land surface and the aquifer. The advantages of ECLIPSE lie in its efficiency, accuracy and robustness for solving the complex 2-phase flows of air and water in heterogeneous unsaturated media. As part of an ongoing process of development of ECLIPSE to be usable by groundwater modellers, studies are currently being undertaken using ECLIPSE to investigate flow patterns and recharge rates through the superficial glacial drift deposits that occur over the Triassic Sandstone aquifers in the Shropshire region, UK. Two and three dimensional models of the drift sequences comprised of lodgement tills, glacial outwash and glaciolacustrine facies are being used to determine the influence of the structure of these formations on the recharge magnitude and distribution from the metre to the kilometre scale. Standard oil reservoir boundary condition models have been adapted to simulate the land surface fluxes due to precipitation and evapotranspiration. A large number of runs have been performed using realizations generated from statistical models of the geometries and connections of the different facies observed in the region. The results both demonstrate the value of using ECLIPSE and the importance of quantifying the local scale structural controls on the recharge magnitude and pollutant travel times in the unsaturated zone.