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Assessing uncertainty in recharge estimates through glacial drift

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The superficial glacial deposits that cover much of the Triassic Sandstone aquifer in Shropshire, UK are comprised of lodgement tills, glacial outwash deposits and glaciolacustrine clays. These facies are laterally and vertically heterogeneous. Moreover, their hydraulic properties vary significantly within and between facies. Data collection is being carried out within the Tern catchment in Shropshire to develop statistical models that characterize the structural and hydraulic property distributions of the drift. Data collection involves both geophysical and invasive sampling methods. Resistivity profiling provides detailed information on the structure of the facies at the metre to hundred metre scale, while point electromagnetic measurements supported by 3D geological modelling using existing auger and borehole data are providing kilometre to catchment scale descriptions of the variations in the relative proportions of the different facies. A preliminary stochastic model has been constructed using these data to describe the range of geometries of the till sheets, glacial outwash and the surface of the Triassic sandstones observed across the catchment. This stochastic model has been used to construct many alternative non-conditional realizations of the structure of drift that can be used with the code ECLIPSE to model recharge patterns under different climatic and groundwater conditions. The results of the simulations provide a first estimate of the uncertainty in the recharge magnitude at the hundred metre scale. Recharge varies considerably from realization to realization with annual recharge magnitudes up to 20% of the available precipitation. Considerable care has been taken to reduce the influence of lateral boundary conditions through the use of guard zones and to ensure that the results can be used to develop upscaled models of recharge for use in regional groundwater modelling. Links between the surface evaporation and the underlying geology are found to be extremely important.