THE MACAULAY LAND USE RESEARCH INSTITUTE

UNDERSTANDING TRANSPORT PROCESSES AT CATCHMENT SCALES

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POLICY RELEVANCE: In order to predict how catchments will respond to future changes in land use, management and climate there is a need for underpinning understanding of key physical processes that describe how water and pollutants are transported from the land to surface- and ground-water bodies, at relevant spatial and temporal scales. In some systems, responses in surface and groundwaters may be delayed because of time-lags in transportation.

MODEL SIMULATIONS: Models of catchment systems must represent key transport processes and be assigned suitable parameter values if they are to simulate future behaviour correctly. Calibration procedures based on limited historic data are often inadequate to distinguish a good model from a bad model. Other types of data, such as tracers, can aid with model identification.

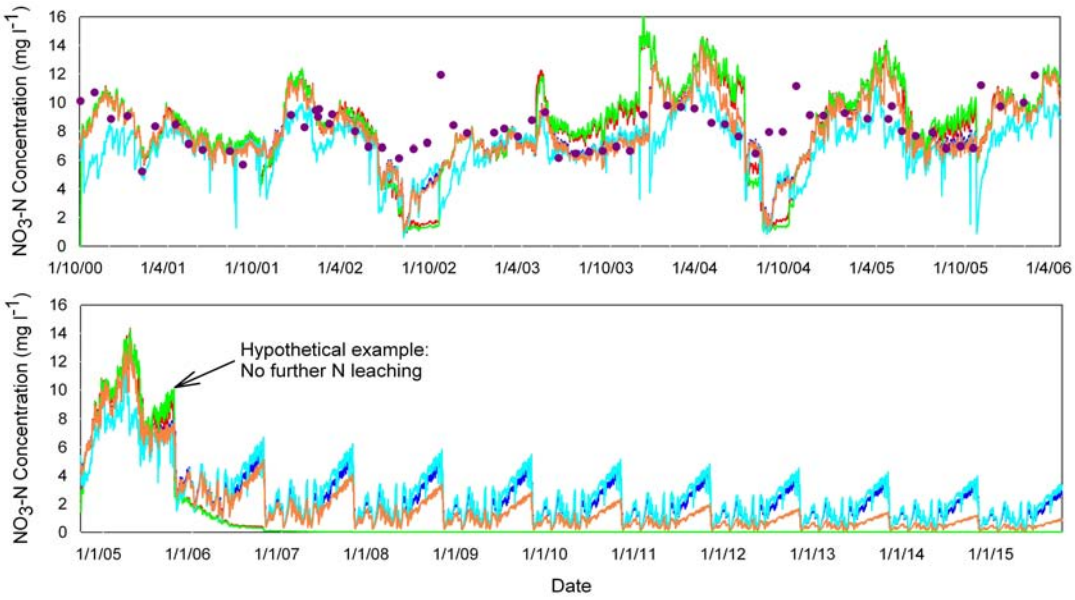


Figure 1: Which model?

Figure 1 shows five very different parameterisations of a model of stream nitrate that give similar simulations of historic behaviour. However, their simulated responses to changes in management are very different.

EXAMPLE: The Lunan catchment is designated as a groundwater Nitrate Vulnerable Zone because of high concentrations of nitrate in groundwater that is used as a source of drinking water. Recent monitoring of boreholes indicates that several sites regularly exceed the EU drinking water limit of 11.3mg/l of nitrate-N. There is growing evidence from data collected in the Lunan catchment of the importance of groundwater. Recent studies using atmospheric tracer dating techniques, suggest that groundwater in the catchment is of mixed ages ranging from a few years up to as much as 30-40 years. This could have implications for how the catchment and groundwater recover from the high levels of nitrate, even if management practices are successful in reducing present day leaching of nitrate from agricultural land.

Figure 2: Nitrate concentrations measured in Lunan boreholes

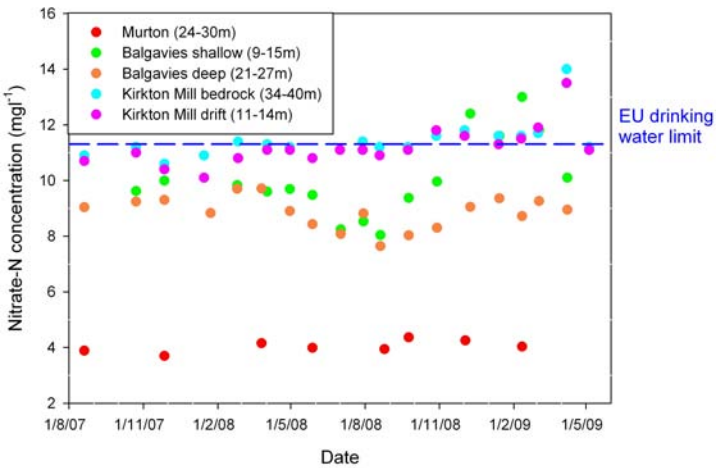
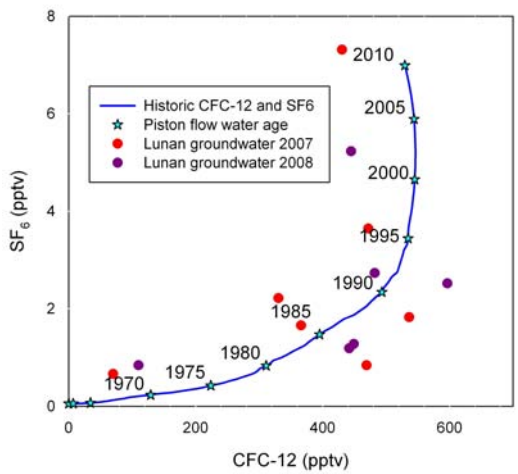


Figure 3: Results of groundwater dating for Lunan boreholes



At the Macaulay Land Use Research Institute we are developing suitable monitoring and modelling of transport processes to ensure that future behaviour and responses of catchment systems can be predicted.