



Process-based, distributed and terribly uncertain? Using the ESTEL model for hypothesis testing and the investigation of hydrological processes

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ESTEL is a finite element groundwater flow model, based on Richards' equation and incorporating random walk particle transport. ESTEL has been applied in several cases to the investigation of catchment hydrological processes. Recent studies have included the testing of streamflow generation hypotheses and in particular the controls on pre-event water contributions to streamflow, which are still poorly understood. These studies are reviewed and the limitations associated with each application are analysed. A new application of ESTEL is described that attempts to incorporate uncertainties in model structure, parameterisation, input data, boundary and initial conditions. This methodology is applied to investigate the dominant hydrological processes operating within a 2D transect of a hillslope in the Sleepers River research watershed, Vermont and preliminary results are shown. Previous modelling attempts have identified that there are important conceptual uncertainties surrounding the location of an impermeable till layer and the distribution of soil types in general, in this 2D transect. The influence of these uncertainties, as translated into the numerical model application, on the investigation of the hydrological processes is studied.