Geophysical Research Abstracts,
Vol. 11, EGU2009-3416-1, 2009
EGU General Assembly 2009

Are transit times key process-based tools for regional classification and prediction in ungauged basins?

D. Tetzlaff, C. Soulsby, M. Hrachowitz, and M. Speed
School of Geosciences, University of Aberdeen, United Kingdom (d.tetzlaff@abdn.ac.uk)

In recent years, transit times (TTs) have been increasingly explored as a process-based tools for conceptualising hydrological processes in an integrated manner at a range of scales. Traditionally the identification of the appropriate transit time distribution (TTD) for a hydrological system (e.g. hillslope or catchment), and the derivation of metrics such as the mean transit time (MTT) have required quantitative assessment of input-output relationships for conservative tracers using lumped parameter models. Such work has allowed the main landscape controls on TTs to be identified and facilitated the prediction of MTT in ungauged basins in particular geomorphic provinces. This has shown TT to be a useful diagnostic index of similarity that can be valuable in process-based catchment classification.

In this contribution, we used well-constrained MTT estimates (with uncertainty) from 32 experimental catchments (1 to 250km2 in area) with contrasting geologic, topographic, pedologic and climatic characteristics in Scotland. The MTT was highly variable ranging from 30 days to ca. 1200 days for individual catchments. Moreover, MTT was also found to be closely correlated with key hydrometric design statistics such as the Q95, Q5, Mean Annual Flood (MAF) and the slope of the hydrograph recession curve. Analysis of the TT estimates, in conjunction with GIS-based quantitative assessment of key landscape controls, showed that MTT could be predicted to within 25% for ungauged basins from catchment soil cover, drainage density and topographic wetness index. For ungauged basins it was found that the hydrometric design statistics (Q95, Q5, MAF and the recession slope) could be more simply and accurately forecasted from MTT predictions than a single set of catchment characteristics. We demonstrate that TTs – predicted from mapped landscape characteristics - are useful integrating diagnostic metrics for regional classification, prediction and process assessment in ungauged montane basins. This is an important advance as montane headwaters are often data poor but critical environments influencing the quantity, quality and ecology of downstream flows.