Sediment and water quality modelling in ungauged basins requires the ability to predict spatial patterns in erosion processes. Sediment sources (e.g. erosion of river banks and gullies) and sinks (e.g. floodplain deposition), and transport through stream networks are heavily influenced by overbank flows. Modelling them requires the prediction of flood quantiles such as bankfull discharge within the flow regime. Historically, the more common purpose for modelling hydrological response in ungauged basins is water resource planning, which is often calibrated to accurately simulate annual water yields rather than flood quantiles. Is traditional modelling of hydrological response adequate for water quality prediction in ungauged basins?

Using data from tropical Queensland catchments, two methods for predicting flow statistics were compared: (i) Regional relationships between catchment characteristics including rainfall and evapotranspiration, and observed flow statistics, and (ii) Runoff models of the hydrological response, calibrated to gauged flow. The SedNet model which constructs spatially distributed budgets of sediment and nutrients employs method (i). The Source Catchments model employs method (ii). We compared several flow statistics including mean annual flow, and the 5-year flood representing bankfull flow. As expected, daily runoff modelling provided more accurate prediction of mean annual flow, being within 50% of observations at 75% of gauges, compared to within 60% for regionalisations. Both methods had similar performance at predicting the 5-year flood, being within a factor of 2 times observed values at 75% of gauges. It is concluded that both methods are appropriate for modelling flow peaks if carefully calibrated.