Geophysical Research Abstracts
Vol. 18, EGU2016-601, 2016
EGU General Assembly 2016

Using a simple mixing model to assess the role of riparian wetlands in moderating stream water temperatures

Jonathan Dick, Doerthe Tetzlaff, and Chris Soulsby
University of Aberdeen, Northern Rivers Institute, Geography and Environment, Aberdeen, United Kingdom (jonathan.dick@abdn.ac.uk)

Stream water temperature is a fundamental physical characteristic of riverine systems, influencing many processes; from biological productivity to many other aspects of water quality. Given climatic global warming projections, and the implications for stream thermal regimes, they are increasingly considered as part of river basin management plans. Along with the effects of energy exchanges at the water-air interface and riparian vegetation cover, advective heat transport from the different sources of water generating stream flow can strongly influence temperature within the stream channel. Riparian wetland areas are important geomorphic components of landscapes in many parts of the world, and are often a dominant source of stream flow during hydrological events. During wet periods large volumes of water may be displaced into stream channels via near-surface flow paths, which typically have high variability. In dry conditions, more groundwater with less variable temperatures dominate. The mixing of these waters can have great influence over the thermal regimes of streams over a range of flow conditions.

Here, we present the use of a simple mixing model to predict daily mean stream water temperature on the basis of mixing groundwater and near surface riparian waters as the end-members in a 3.2km2 watershed in the Scottish Highlands. The resulting model fit was analysed against energy balance components and the spatial extent of the wetland to investigate the importance of energy-exchange in riparian wetlands in determining stream temperatures. Results showed generally good agreement between modelled results and measured temperatures under wet conditions. Model fit was generally better in winter than during the summer months (when the model under predicted temperatures), with a strong correlation evident between net radiation and the fit of the model. This indicated the limited skill of the simple mixing structure to account for the increased importance of energy exchange at the stream – air interface in warm summer periods. Periods when the model didn't fit particularly well and consequently had higher residuals were confined to periods when the extent of the riparian wetlands was most restricted and energy exchange at the stream – air interface dominated. These findings have implications the extent of proposed riparian planting, and for the effects of climate change which is projected to increase average temperatures, and shift precipitation towards the winter period altering the saturation dynamics.