Using hydroclimatic indices to define catchment similarities and differences in large scale catchments in NE Scotland

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Catchment classification is an important tool to aid in translation from catchment heterogeneity and process complexity to a reproducible framework for comparison of like catchments. The ability to identify certain types of catchments is important to transfer and extrapolate knowledge of processes, particularly to ungauged basins.

Here, contemporaneous hydrological and climatological data of 10 years were compiled for 21 mesoscale catchments across the NE of Scotland and analysed at both an annual and seasonal scale, identifying significant inter and intra-variance of catchments. The aim was to gain an understanding of current hydroclimatic conditions and how these vary spatially and temporally across a geographic region.

Catchments were processed through a cluster analysis to identify similar behaviour, with 4 groupings being identified. These groupings were then explained via a principal component analysis (PCA), with 2 components explaining 74% of the variance with topographical indices and variation in annual precipitation being significant factors for catchment groupings. In addition, Mann-Kendall tests of trend were employed to identify emerging patterns of increase or decrease for these catchment types in both annual and seasonal precipitation, runoff and temperature across the 21 catchments. Results show an increase in trends of temperature at both the annual and seasonal level, with Southern-most catchments exhibiting a distinct pattern of warming temperatures. A second cluster analysis was conducted using these Mann-Kendall results to identify any overlap in the hydroclimatic groupings and trend groupings, to investigate linkages between specific catchment types and their response to hydroclimatic trends. The results indicate that patterns of hydroclimatic trends are not consistent with type groupings, with catchments demonstrating variability both temporally and spatially.

Such way of identifying catchment similarity based on hydroclimatic and physical characteristics can provide a framework for extrapolating information to other catchments. The development of such a classification framework provides us with the basis to inform hydrological modelling and assess the impacts of potential climate change amongst specific.