Geophysical Research Abstracts
Vol. 20, EGU2018-15974-1, 2018
EGU General Assembly 2018

The effects of climate change and acidic deposition on long-term surface water dissolved organic carbon concentrations in upland catchments in the UK.

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There are concerns about rising trends in surface water dissolved organic carbon (DOC) concentrations in UK upland catchments over the past decades. Several mechanisms have been proposed to explain these trends including changes in climate and declines in sulfate deposition across Europe. Because of the implications for drinking water treatment and supply, there is an increasing interest in whether the rising trends of DOC will continue or stabilize. In this paper, the INCA carbon water quality model was applied to the upland catchment of the River Severn at Plynlimon on Wales and simulated the effects of both climate and sulfate deposition on surface water DOC concentrations. The model was able to simulate present-day (1995-2015) trends in DOC in Plynlimon. Using a parameter set derived from a present-day calibration, climatic projections were employed to estimate the future trends on DOC in uplands and consider potential impacts for catchment management. The model was run with climatic scenarios generated by weather@home climate modelling platform and with sulfate deposition scenarios by European Monitoring and Evaluation Programme (EMEP) between 1975-2100. Our research shows that historical declines in sulfate deposition can explain the historical increase in DOC. For the future trends, our results show that the rising trends in DOC are likely to continue in the near future (2020-2049) and the level of DOC concentrations are stabilized in the far future (2070-2099). Extreme weather events also trigger occasional releases of DOC, such as in summer and winter storm events and the results show that the considered climate scenarios are to increase the DOC concentrations in winter months.