



Generalised Additive Models to understand long-term trends of dissolved organic carbon concentrations in surface waters

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In the literature, several causes of recently increasing dissolved organic carbon (DOC) concentrations in surface waters across eastern North America and northern and central Europe have been debated. One of the most likely drivers of the widespread increase of DOC concentrations since the early to mid 1990s were decreasing atmospheric acid depositions. More specifically, it was observed that the spatial distribution of linear trends between DOC and sulphate concentrations was consistent for surface waters in Canada, Finland, Norway, Sweden, the UK and the USA. However, to the best of our knowledge, non-linear methods have not been applied to examine temporal trends of DOC and surrogates of acid deposition such as sulphate concentrations and pH. This type of analysis could provide a refined understanding of how decreasing acid deposition affected DOC concentrations over time. In this study, we used Generalised Additive Models (GAM) to detect non-linear trends of DOC and pH during the last 20 years for three streams draining forested headwater catchments of the Mulde River in the Ore Mountains, East Germany. The analysis accounted for both seasonal patterns and the influence of stream flow on DOC. We found consistent temporal non-linear trends for DOC and pH. Furthermore, trends of DOC and pH may be decoupled during the last 5 years. While DOC concentrations were still increasing, pH tended to level off. Overall, our GAM analysis appeared to be a promising tool to gain further insight into potential drivers of increasing DOC trends in surface waters.