Factors affecting dissolved organic carbon concentrations in groundwater

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Understanding the factors affecting the fate and concentrations of dissolved organic carbon (DOC) in groundwater is essential in order to maintain drinking water quality and quantify greenhouse gas emissions. These factors however are poorly understood due to the complex interactions between DOC and groundwater chemistry, carbon sources and processes of natural carbon sequestration.

We analysed 2,953 North American observations collected by the National Water Quality Assessment (NAWQA) program of the U.S. Geological Survey (USGS) to examine the influence of geochemical and aquifer characteristics on groundwater DOC concentrations using RStudio. Climatic and landuse data for each sample point were also extracted using ArcGIS to determine whether climate and landuse had significant effects on groundwater DOC concentrations.

Our results show that aquifer age, sample depth, elevation, climate, calcium, iron, sodium, potassium, pH, sulfate, manganese, silica and dissolved oxygen are all significant factors controlling groundwater DOC concentrations. These variables explain approximately 55% of the variability in groundwater DOC concentrations, with aquifer age explaining the largest proportion. This is the first large-scale study to combine and quantify the importance of geochemistry, climate and landuse on groundwater DOC concentrations.