Poster ID: B43A-0340
contact information: stefan.strohmeier@uni-bayreuth.de

UNIVERSITÄT BAYREUTH

Bayceer
Bayreuth Center of Ecology and Environmental Research

Hydrological Controls of DOC in Runoff in a Forested Watershed in Germany

S. Strohmeier[1], S. Frei[2], K.H. Knorr[2], Andrea Blomenhofer[3], Nicole Foullois[3], J.H. Fleckenstein[2], S. Peiffer[2], E. Matzner[1]

[1]Department of Soil Ecology, [2]Department of Hydrology, University of Bayreuth, 95447 Bayreuth, Germany, [3]Bavarian Environment Agency, 95030 Hof/Saale, Germany

Background

Why does Dissolved Organic Carbon (DOC) matter?

- Water Quality / Drinking water purification
- Mobility and transport of toxic metals
- Source of energy and carbon for microorganisms
- Carbon budgets of watersheds

Research Goals

1. To identify the hydrological controls for the export of DOC from forested watersheds
2. To analyze the trend of DOC in runoff
3. To predict the future DOC concentrations in a changing environment

Data

- Long term monitoring data (1989-2008) from the Lehstenbach catchment
- Bi-weekly DOC and water chemistry data
- Daily runoff and precipitation data

Research Location

The Lehstenbach catchment is located in the southeastern part of Germany. Annual precipitation averages 1150 mm and mean annual temperature is 5.3 °C. The catchment size is 4.5 km^2 and its elevation ranges from 877 to 695 m a.s.l.

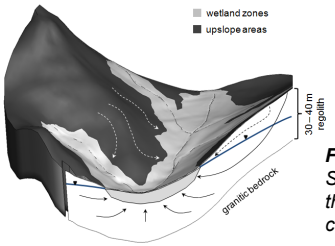

Figure 1: *Schematic model of the Lehstenbach catchment*

Preliminary Results

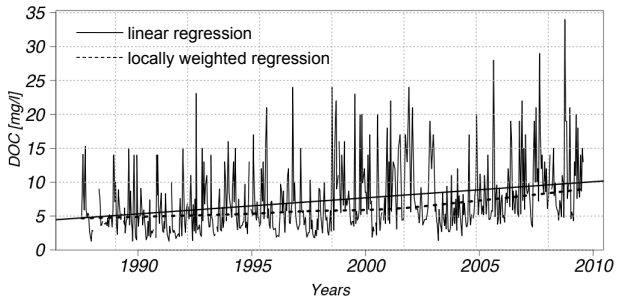

Figure 2: *DOC concentrations in runoff from 1989-2008 showing an upward trend of DOC concentrations with an increasing slope after year 2000.*

- Upward trend of DOC in runoff, from ⌀ 4.7 mg l^{-1} (1989) to ⌀ 9.0 mg l^{-1} (2008)
- Increase in DOC concentration of 0.23 mg l^{-1} yr^{-1}

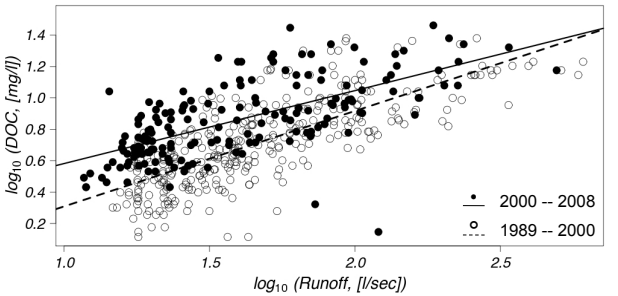

Figure 3: *Scatterplot and linear regression lines of DOC concentrations and runoff in logarithmic scale. Higher DOC concentrations under unchanged runoff conditions indicate that runoff does not explain upward trend of DOC in runoff*

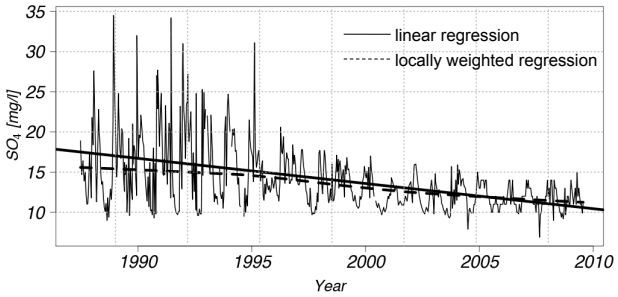

Figure 4: *Sulfate concentrations from 1989 to 2008 in mg l^{-1}. The change in atmospheric (sulfate) deposition explains the upward trend of DOC in runoff.*

Conclusions

- Runoff largely explains the short term dynamics, but not the long term upward trend in DOC concentrations
- DOC maxima occur together with runoff maxima. However, the DOC maxima show high variations, possibly depending on pre/ post wetting conditions
- Lower sulfate deposition rates lead to desorption and deprotonation of organic matter. Hence, the DOC concentration in runoff increases

Outlook

- High frequency measurements of DOC and particulate organic carbon (POC) in relation to runoff during rain events will help to better understand the spatial and temporal hydrological controls on DOC/POC dynamics
- Qualitative aspects of DOC/POC in relation to hydrological controls and different terrestrial sources
- Applying other methods of time series analysis to model DOC concentrations and to link them to hydrological models

Acknowledgements: This study is integrated in the TERRECO graduate program at the University of Bayreuth, Germany. Funds are donated by the German Research Foundation and the Bavarian Environment Agency (LfU). Data has been provided by the LfU (www.lfu.bayern.de).