Carbon fluxes in an acid rain impacted boreal headwater catchment (Jizera Mountains, Czech Republic)

Anne Marx¹, Simone Hintze², Jakub Jankovec³, Martin Sanda³, Jaromir Dusek³, Tomas Vogel³, Robert van Geldern³, Johannes A.C. Barth³

¹ Friedrich-Alexander-University Erlangen-Nuremberg (FAU), Department of Geography and Geosciences, GeoZentrum Nordbayern, Schlossgarten 5, 91054 Erlangen, Germany
² Czech Technical University in Prague, Faculty of Civil Engineering, Thakurova 7, 166 29 Prague, Czech Republic

Introduction
Terrestrial carbon export via inland aquatic systems is a key process in the budget of the global carbon cycle. This includes loss of carbon to the atmosphere via gas evasion as well as carbon fixation in sediments. Headwater streams are important as the first endmembers of the transition of carbon between soils, ground- and surface water and the atmosphere. Here a small stream in the Uhlirska Catchment was studied.

Measurements
- Groundwater, soil water and stream water sampling campaigns were carried out between 2014 and 2015
- DIC, DOC, POC concentration and isotope analyses (Dissolved inorganic, dissolved and particulate organic carbon)
- CO₂ degassing was calculated via isotope modelling approach (Venkiteswaran et al. 2014)

Conclusions
- Carbon export via aquatic system is dominated by CO₂ degassing 55 % CO₂ > 31 % DOC > 11 % DIC > 3 % POC
- Isotope ranges indicate predominant silicate weathering and little turnover of organic material
- No 8¹³C-DIC variation from upland to wetland domain due to permeable bedrock
- CO₂ degassing caused an enrichment of the 8¹³C-DIC values of up to 6.8 % between a catchment gauge and the catchment outlet (~865 m distance)

Basin characteristics
- Location: 15°09’E, 50°49’N
- Altitude: 776-886 m a.s.l.
- Drainage area: 1.78 km² (subcatchment: 1.18 km²)
- Annual average temperature: 4.7°C (1961-1997)
- Annual average precipitation: > 1400 mm (1966-1997)
- Dominant tree species: Norway spruce, 5 % grassland
- Average age of spruce forest: Up to 80 yrs (15 % of spruce), 15 yrs (85 % of spruce)
- Dominant soil type: Dystric Cambisols, Histosols, Gleysols
- Bedrock: Granite, deluviofluvial sediments, glacial tills

Map of experimental Uhlirska catchment

Carbon export and isotopes Uhlirska catchment

Fig 1: Gauging station Cerna Nisa stream and peatland in Uhlirska catchment.

Fig 2: Modeled DIC and CO₂ degassing trajectories (Venkiteswaran et al. 2014).

Fig 3: Location of Uhlirska catchment and sampling sites.

Fig 4: Monthly and discharge-weighted mean (DWM) carbon export rate.

Fig 5: Carbon isotope ratios (δ¹³C) of DIC, DOC, and POC (in % VPDB) measured between September 2014 and August 2015.

REFERENCE

CONTACT
Anne Marx, e-mail: anne.marx@fau.de