



Dynamics Of Dissolved Organic Carbon In Two Contrasting Headwater Streams Investigated By High Frequency Measurements



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Background & Research Goals

- Dissolved organic carbon (DOC) is an important constituent in terrestrial and aquatic ecosystems as it influences nutrient cycling, pollutant transport, soil formation, light-penetration, acidification, and gross carbon cycling
- The transfer of DOC from terrestrial to aquatic ecosystems is related to watershed characteristics and environmental boundary conditions, like rainfall patterns. Changing land use or climate might influence DOC dynamics and water quality, thus impacting important ecosystem services
- Our research goals were:
 1. To investigate the role of precipitation and discharge for the dynamics of DOC in runoff from different forest ecosystems
 2. To identify the spatial sources of DOC in runoff in a forested catchment

Research Sites

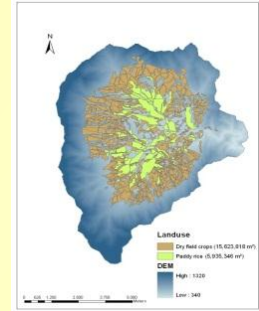


Fig. 1: Haeon catchment, South Korea with steep slopes and broad-leaved trees

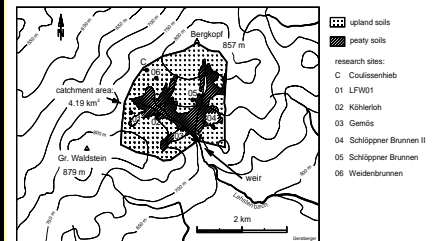


Fig. 2: Lehstenbach catchment, Bavaria, Germany, with moderate slopes, 30% wetland area and Norway spruces

Methods



- A spectroscopic device (spectro::lyser, S::can, Vienna) was used to measure DOC concentrations in runoff in time intervals < 30 minutes
- Precipitation, runoff, and groundwater table levels (Paper 2) were measured in time intervals < 30 minutes
- Fluorescence spectra & PARAFAC of DOC to identify spatial sources of DOC (Paper 2)
- Measurements at the Lehstenbach lasted one year, at Haeon, several monsoon episodes were investigated

Results

- The DOC concentrations in runoff ranged from 1-5 and from 5-35 mg l⁻¹ in the Haeon and in the Lehstenbach catchment, respectively
- DOC concentration against discharge relationship resulted in hysteretic loops which were clockwise at Haeon (Fig.4) but counter-clockwise at Lehstenbach (Fig. 5)
- At Lehstenbach, hysteretic loops in winter were less pronounced than in summer

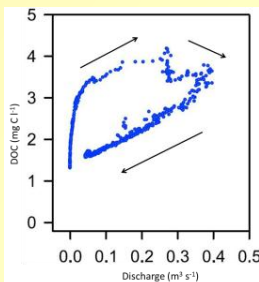


Fig. 4: Clockwise hysteretic loop during monsoon in the Haeon catchment

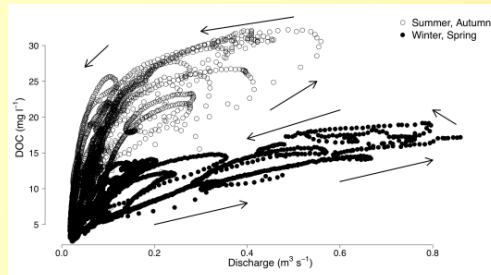


Fig. 5: Counter-clockwise hysteretic loops in the Lehstenbach catchment

Conclusions

- DOC export from forested catchments is mainly driven by high precipitation and discharge events
- The DOC in runoff from Lehstenbach catchment originates from the wetland areas, whereas the DOC in Haeon originates from the forest floor
- Catchments comprising wetland areas are susceptible to high DOC exports
- Future changes of precipitation and discharge regime will have largest effects on DOC export if occurring in the growing season

References:

Paper 1: Jeong, Bartsch, Fleckenstein, Matzner, Tenhunen, Lee, Park, Park (2012), Differential storm responses of dissolved and particulate organic carbon in a mountainous headwater stream, investigated by high-frequency, in situ optical measurements, *J. Geophys. Res.*, 117, G03013, doi:10.1029/2012JG001999.

Paper 2: Strohmeier, S., Knorr, K.-H., Reichert, M., Frei, S., Fleckenstein, J. H., Peiffer, S., and Matzner, E. (2012), Concentrations and fluxes of dissolved organic carbon in runoff from a forested catchment: insights from high frequency measurements, *Biogeosciences Discuss.*, 9, 11925-11959, doi:10.5194/bgd-9-11925-2012, 2012.