H13A - 1340

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DOC and Nitrate Export Linked to Dominant Rainfall-Runoff Processes, End-Members and Discharge – a Long-Term High Frequency Measurement Campaign

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Background & Methods

Introduction and Hypothesis

The Weierbach catchment (Luxembourg) is characterized by a double discharge peak behaviour following a rainfall event.

DOC and nitrate are measured in the catchment on a long-term basis and at high-frequency.

The behaviour of DOC and nitrate concentrations are linked to the rainfall-runoff characteristics.

Hypothesis:

High frequency measurements of DOC and nitrate will help to better identify the driving factors of their export.

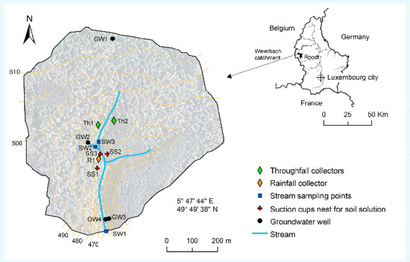
DOC and nitrate export depend on discharge volume, seasonality, and the rainfall-runoff characteristics.

Innovative Measurements

UV-Vis spectrometer.

- Field deployable UV-Vis spectrometer (spectro::lyser)
- 2 year times series
- In-situ high frequen-cy (15 min) meas-urements of DOC, nitrate, turbidity and the light absorption spectrum from 220 to 720 nm (reso-lution of 2.5 nm)

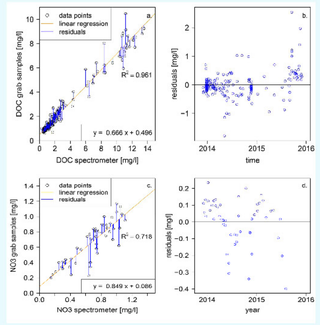
Research Area



The Weierbach catchment.

- 45 ha headwater experimental catchment
- 100% forest-ed (mixed forest)
- Loamy soils (0.5 to 2 m)
- Bedrock: schist

Calibration of *In-Situ* Measurements

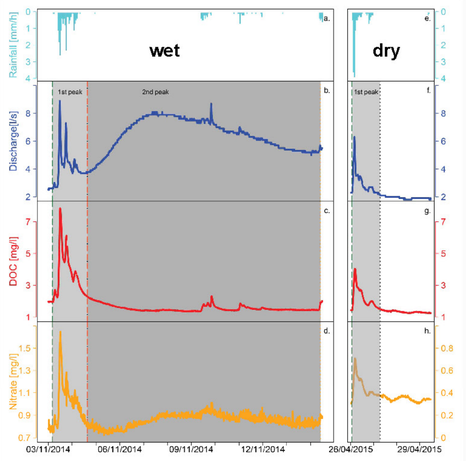


Automatic sampling of several events and weekly to biweekly manual sampling.

Comparison of the lab results of the grab samples with the *in-situ* measure-ments of the spectrometer.

Results & Conclusion

Linking DOC and Nitrate Concentrations to Rainfall-Runoff Processes



Wet initial conditions:

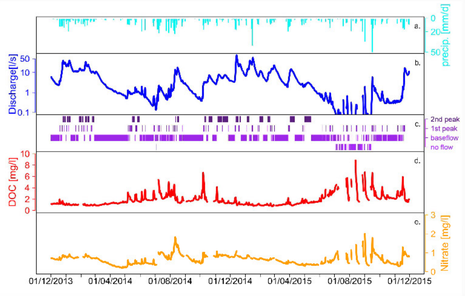
Double runoff peak behaviour:

Delayed 2nd peak explained by a delayed runoff reac-tion via subsurface/shallow groundwater flow with increased nitrate concentrations

Dry initial conditions:

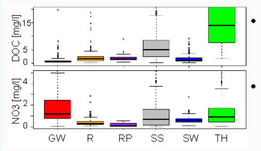
One runoff peak together with a strong peak in DOC and nitrate concentration explained by a fast near surface runoff reaction.

Event Separation & DOC and Nitrate Concentration in Runoff



- High flows in winter: high nitrate concentrations
- Recession periods in spring: increasing DOC and decreasing nitrate concentrations.
- Lowflow and no flow in summer: strong rainfall events creating DOC and nitrate peaks.

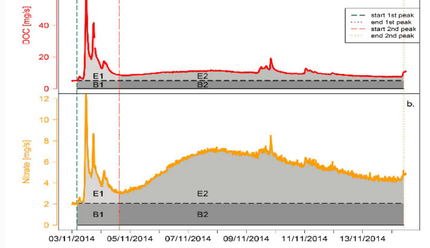
DOC and Nitrate Concentrations in Various End-Members



GW=groundwater, R=rainfall; RP=riparian zone, SS=soil solution, SW=stream water, TH=throughfall

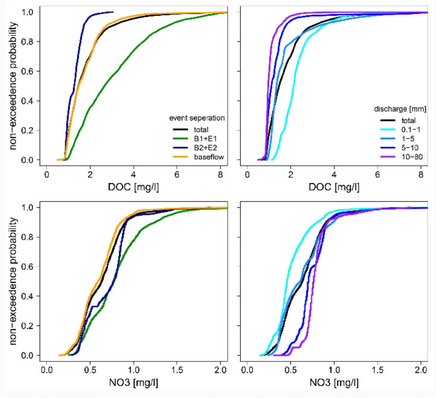
- Biweekly sampling of various end-members.
- Soil water has a high-er DOC concentration than groundwater and vice versa for nitrate.
- High DOC (& nitrate) concentration in throughfall

Separating Fluxes during Events



Export separation between first (1) & second (2) peak and eventflow (E) & baseflow during event (B)

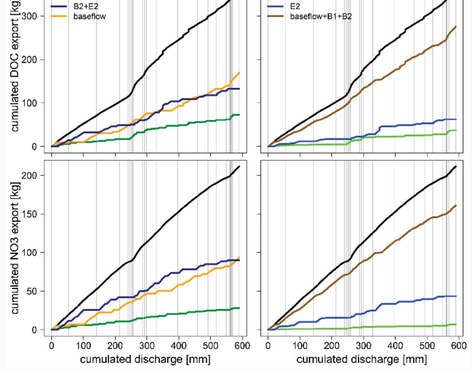
Concentration Probability Separated by Events & Discharge Volume



DOC: highest concentration at low flows & first peak

Nitrate: highest concentration at high flows

DOC and Nitrate Export



Over the entire 2 year period, the majority of DOC and nitrate export happens during the 2nd peaks (B2+E2) and the baseflow periods.

During first peaks, a higher ratio of DOC (compared to total export) is exported than for nitrate.

Conclusion

DOC and nitrate export show an almost linear constant relationship with discharge volume.

Exceptions are the low flow periods in summer and fall (e.g. April to July and September to October 2014):

- Steeper slope for DOC, due to higher importance of export during first peaks (E1).
- Flater slope for nitrate, due to inexistance of second peaks (E2).

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