

Investigating DOC export dynamics using high-frequency instream concentration measurements

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We explored:

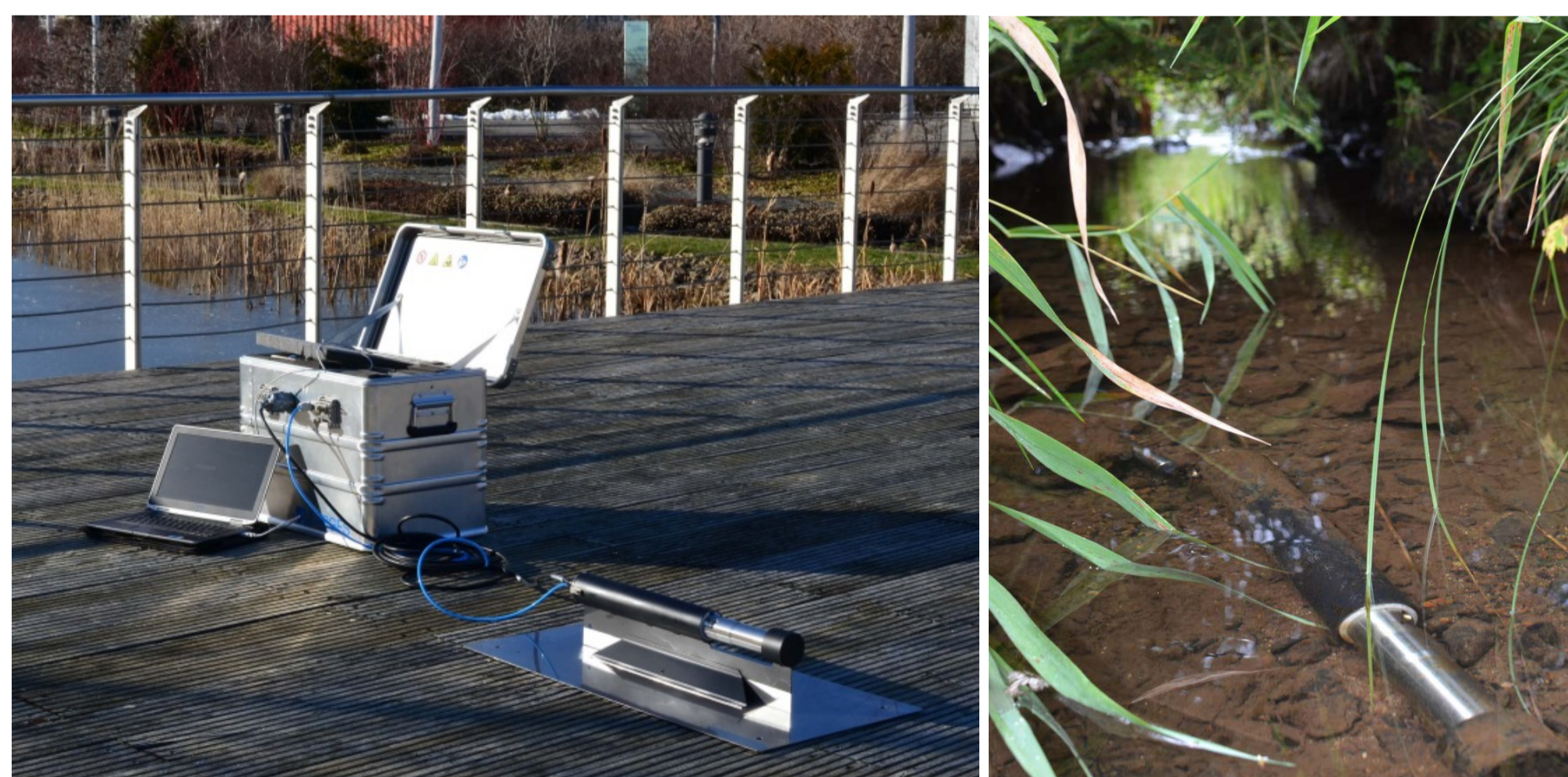
What can high resolution in-situ UV-Vis measurements tell us about dissolved organic carbon (DOC) export dynamics from catchments under different hydrological and climatic conditions

Background

Increasing transport of DOC from soils to streams and subsequent higher DOC loads in surface waters cause problems for drinking water purification from surface waters. Growing interest in high resolution time series of water quality data. Being able to monitor DOC using in-situ high frequency measurements is considered fundamental to better understand DOC behaviour under different hydrological and climatic conditions.

Methods

Flexible UV-Vis probe setup, measuring light absorbance from 220-735 nm (2.5 nm increments). Values for DOC are obtained using a built-in algorithm and local calibration. Stream discharge (Q) is obtained from hydraulic weirs and developed stage-discharge rating curves (Q vs. h)



Flexible UV-Vis setup; ensures flexible application under field conditions

Field sites

Continuous DOC and Q data from three catchments of different size:

- 1st-order catchment (0.4 km²) in the Haeon watershed, South Korea, forested, monsoonal climate with intense runoff events
- Lehstenbach catchment (4.2 km²), South-East Germany (Fichtelgebirge), forested with peat-forming riparian wetlands
- Rappbode catchment (44 km²), Central Germany (Harz), mixed landuse, mainly forested

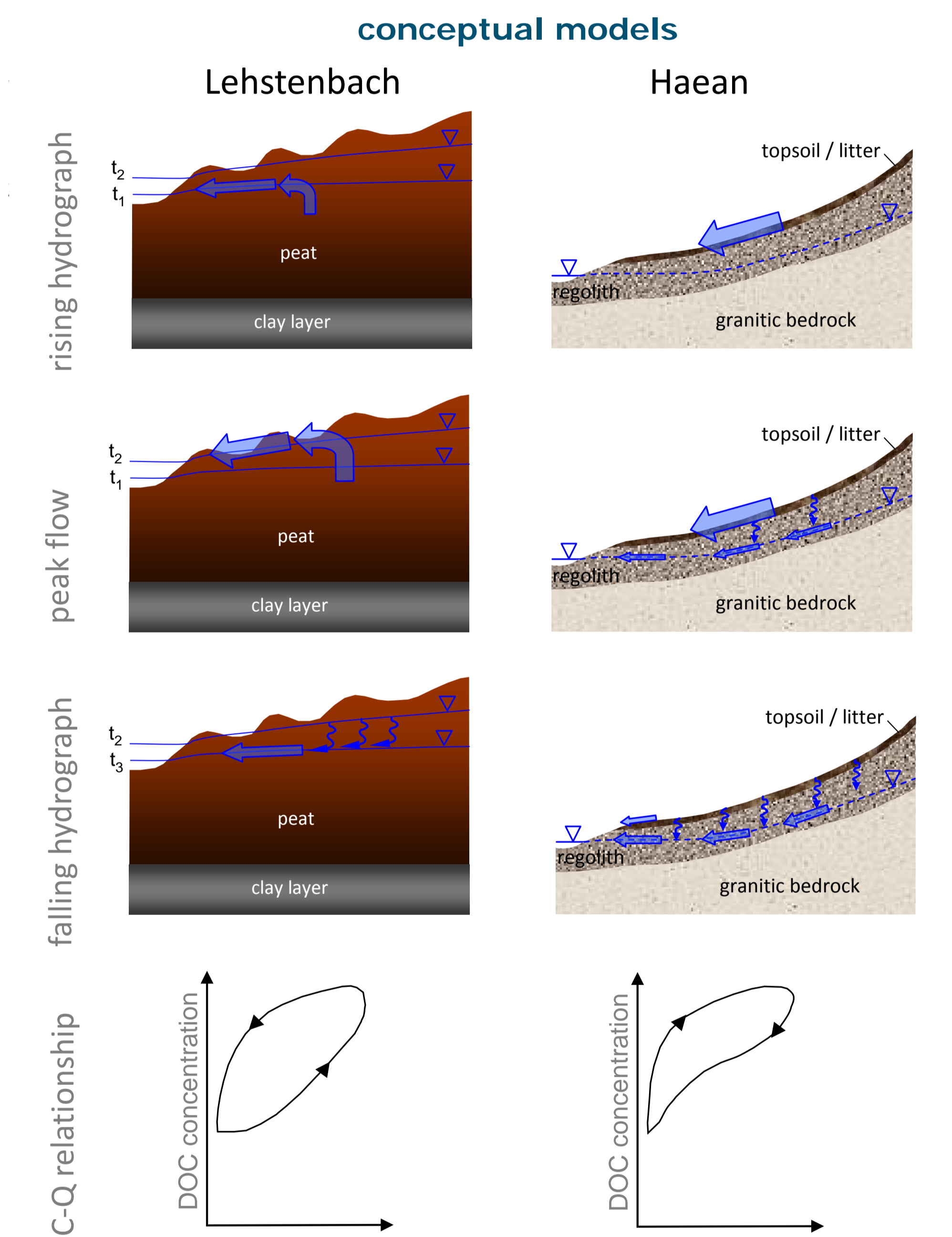
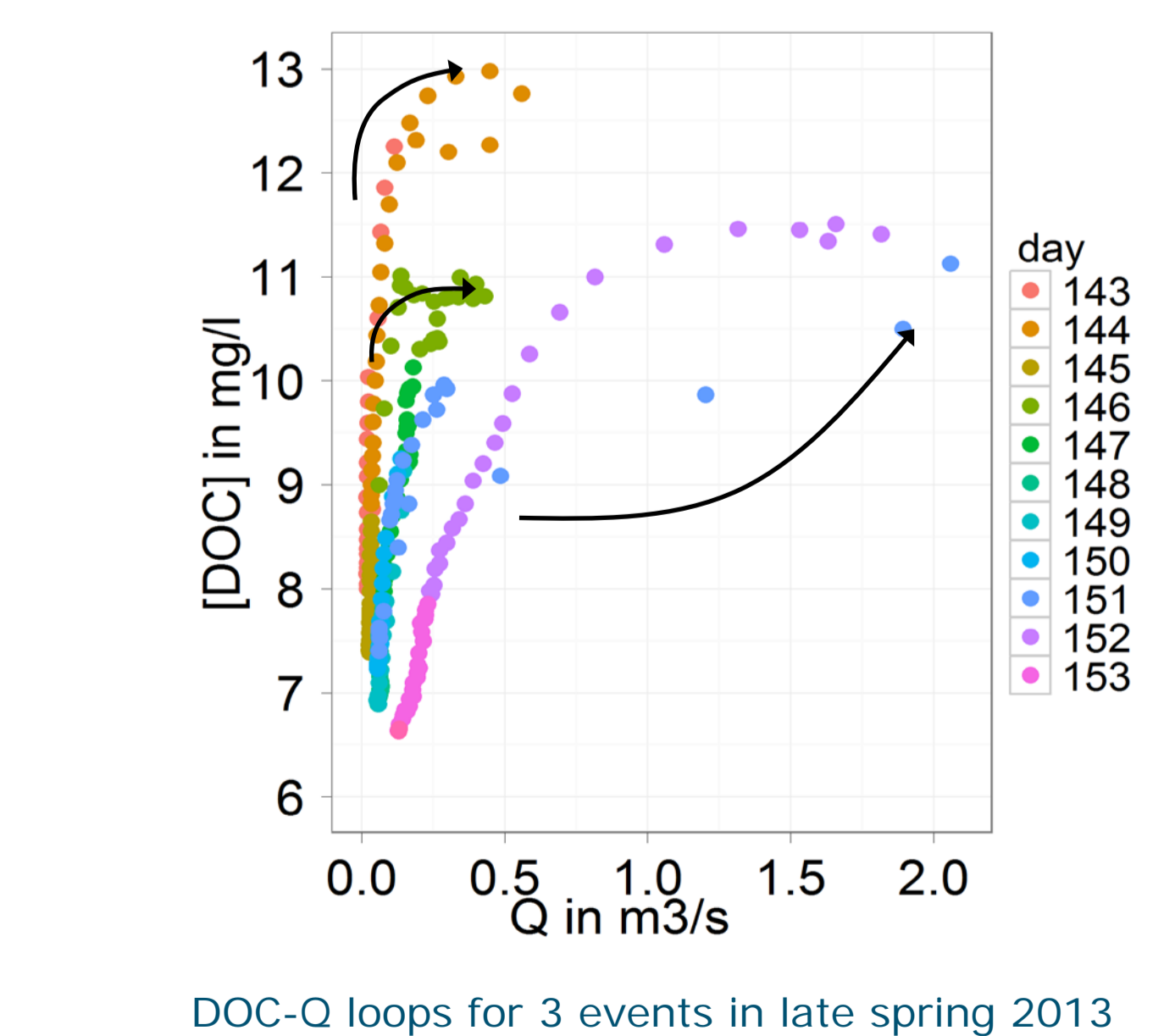
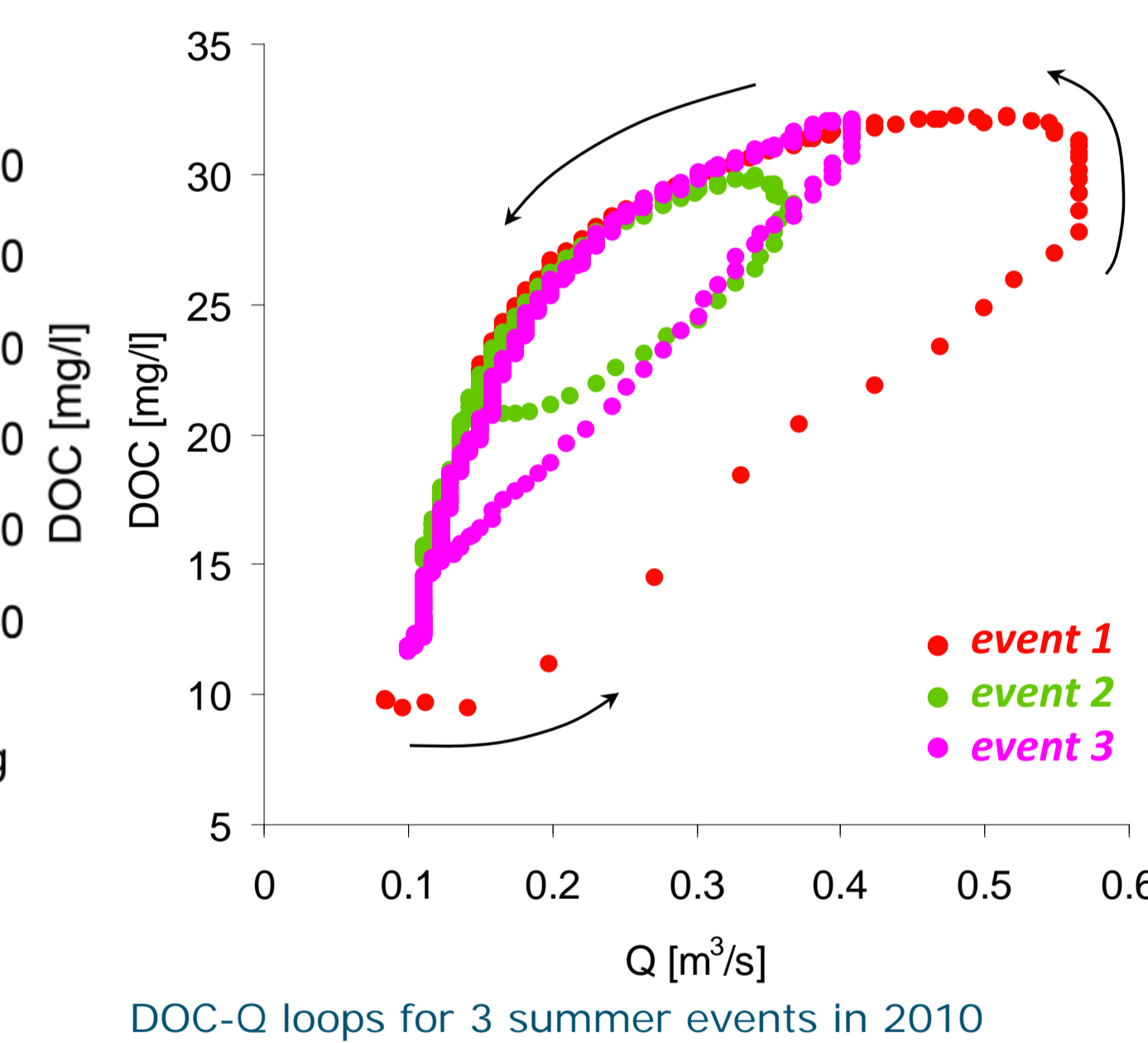
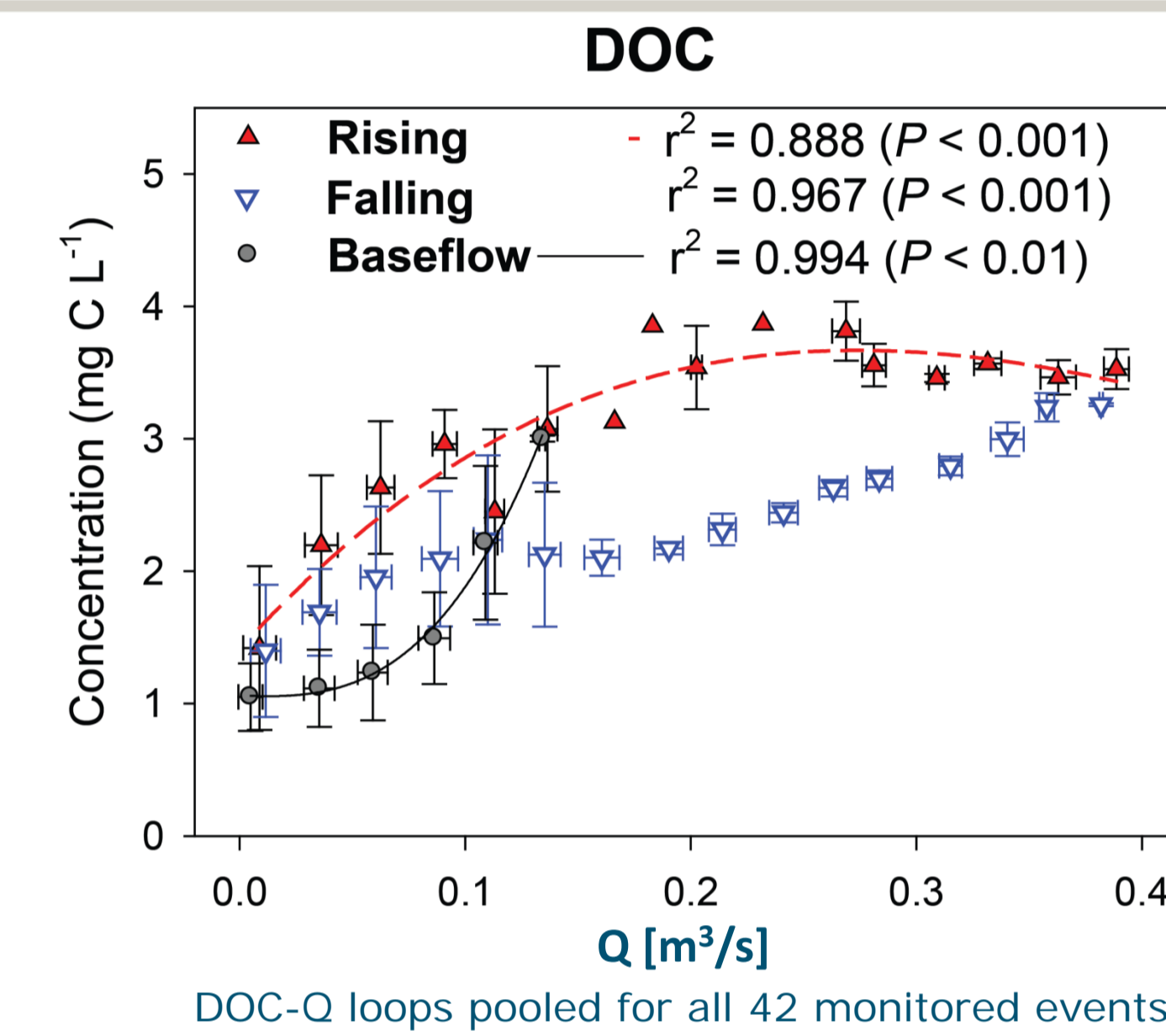
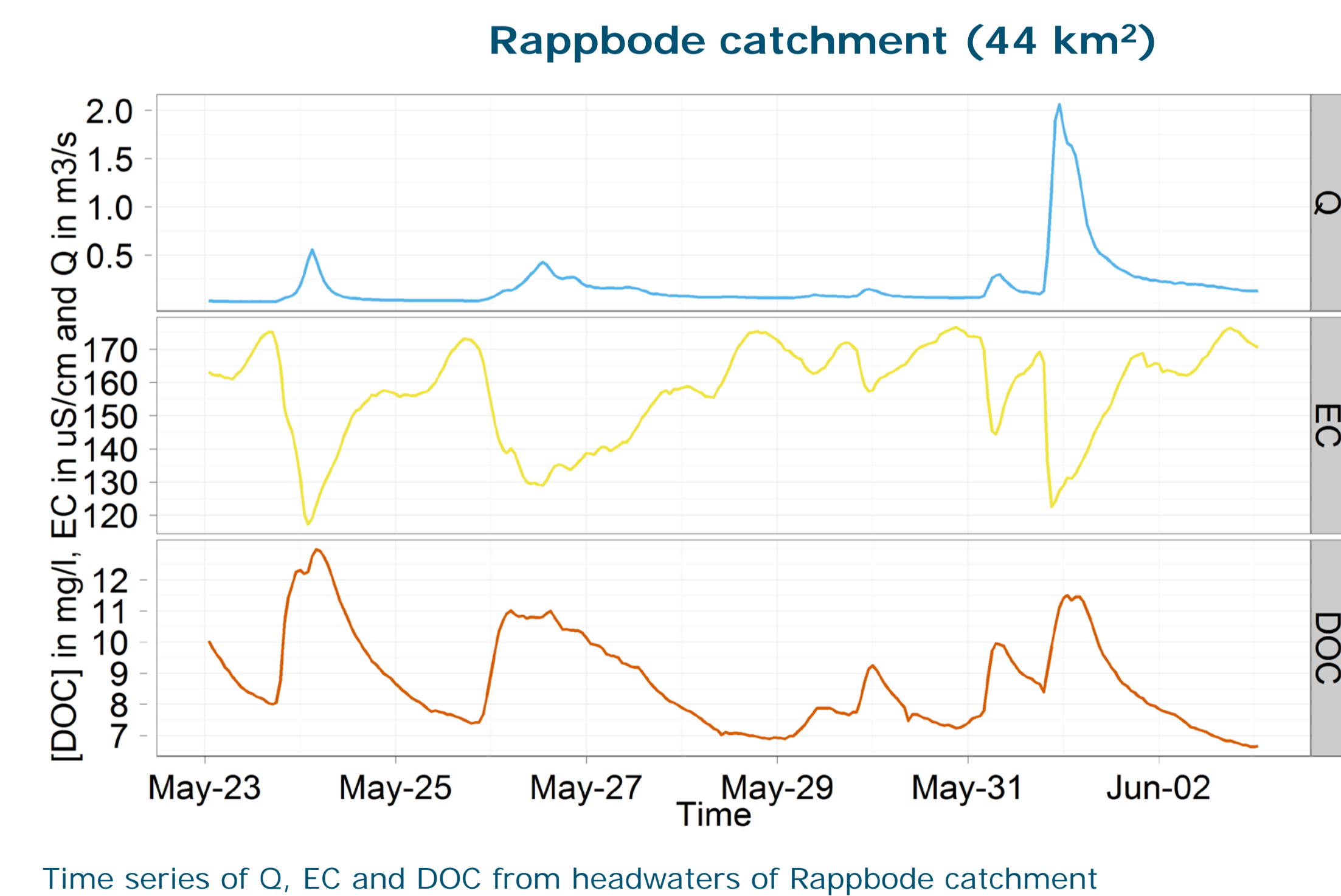
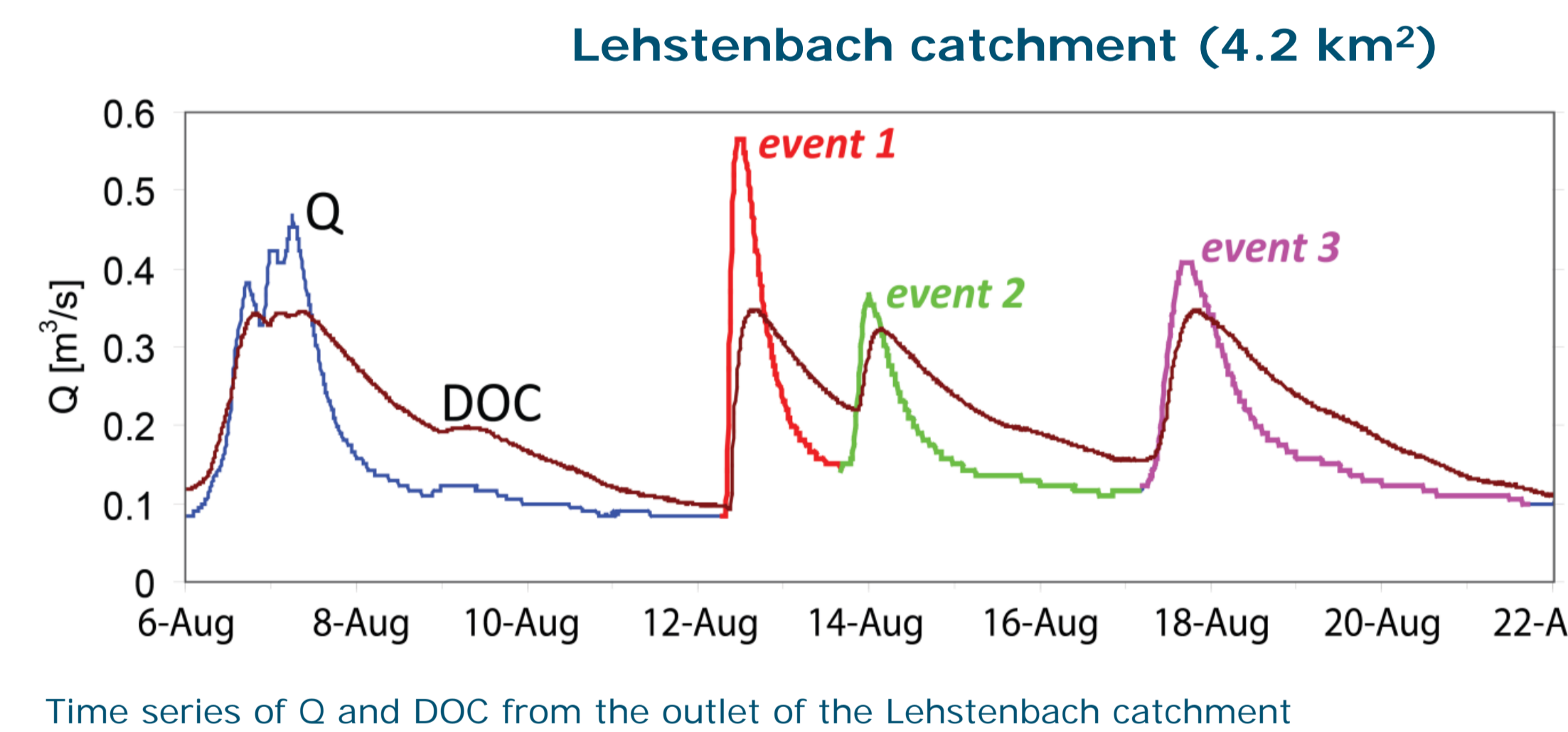
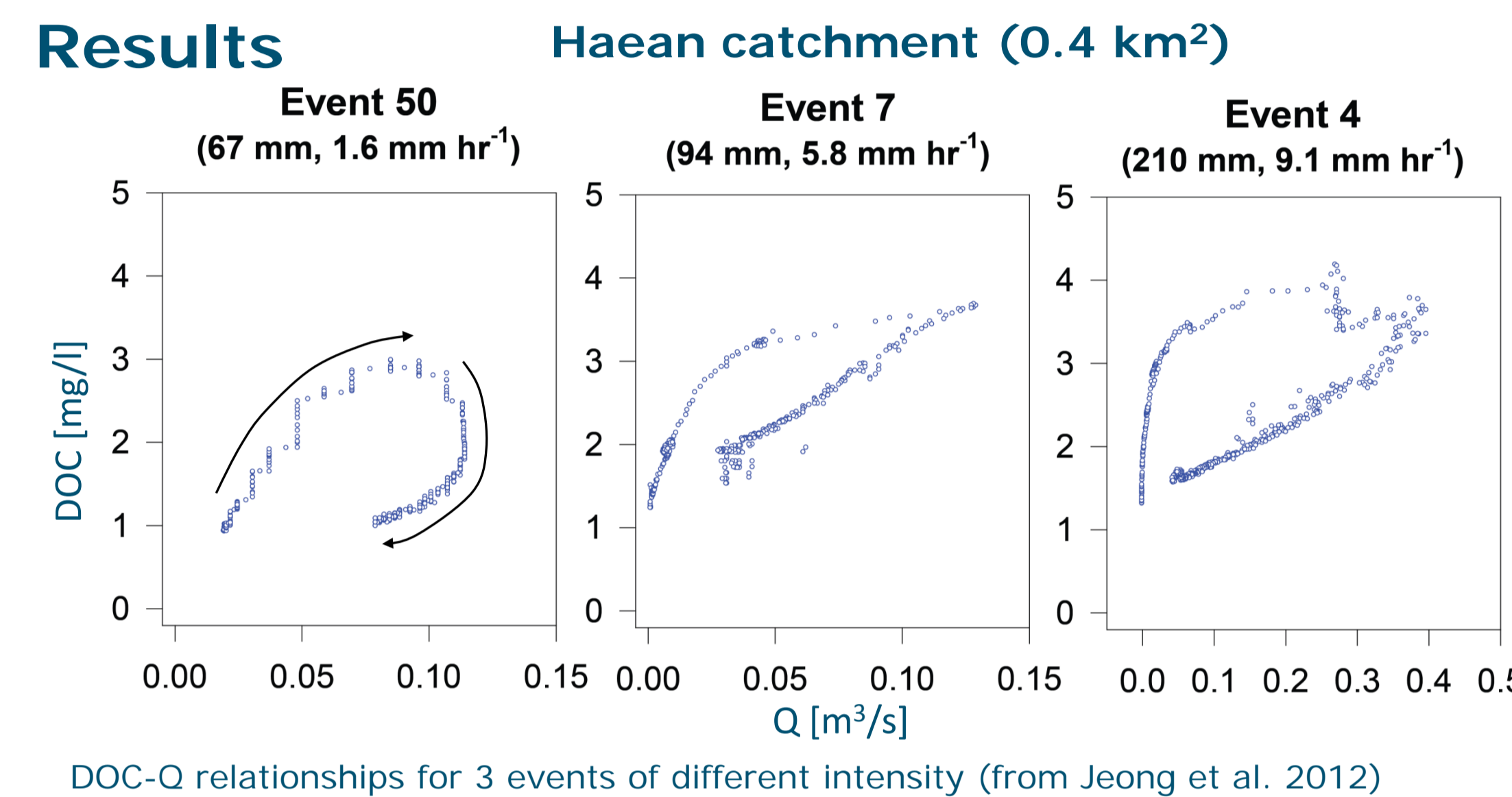
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We found:

- In-situ UV-Vis spectrometers allow to obtain certain water quality parameters (e.g. DOC) at high frequency in hydrologically dynamic catchments
- DOC-Q loops can be used to identify source areas and flow paths and give insight into mobilization mechanisms
- Catchment size, structure (e.g. topography, morphology) and climate strongly influence DOC-Q loops → loops are distinct for a catchment type

Results



flow routes: fresh peat (high DOC) decomposed peat (low DOC) (width = magnitude)

counter-clockwise: groundwater dominated, delayed response → riparian zones
clockwise: surface runoff dominated, fast response → top soil flushing during event

References:

Jeong J.J., Bartsch S., Fleckenstein J.H., Matzner E., Tenhunen J., Lee S.D., Park S.K., Park J.H. (2012) Differential storm responses of dissolved and particulate organic carbon in a mountainous headwater stream investigated by high-frequency in-situ optical measurements. *Journal of Geophysical Research - Biogeosciences*, 117, doi 10.1029/2012JG001999

Strohmeier S., Reichert M., Frei S., Knorr K.-H., Fleckenstein J.H., Peiffer S., Matzner E. (2013) Concentrations and fluxes of dissolved organic carbon in runoff from a forested catchment: insights from high frequency measurements. *Biogeosciences*, 10: 905-916