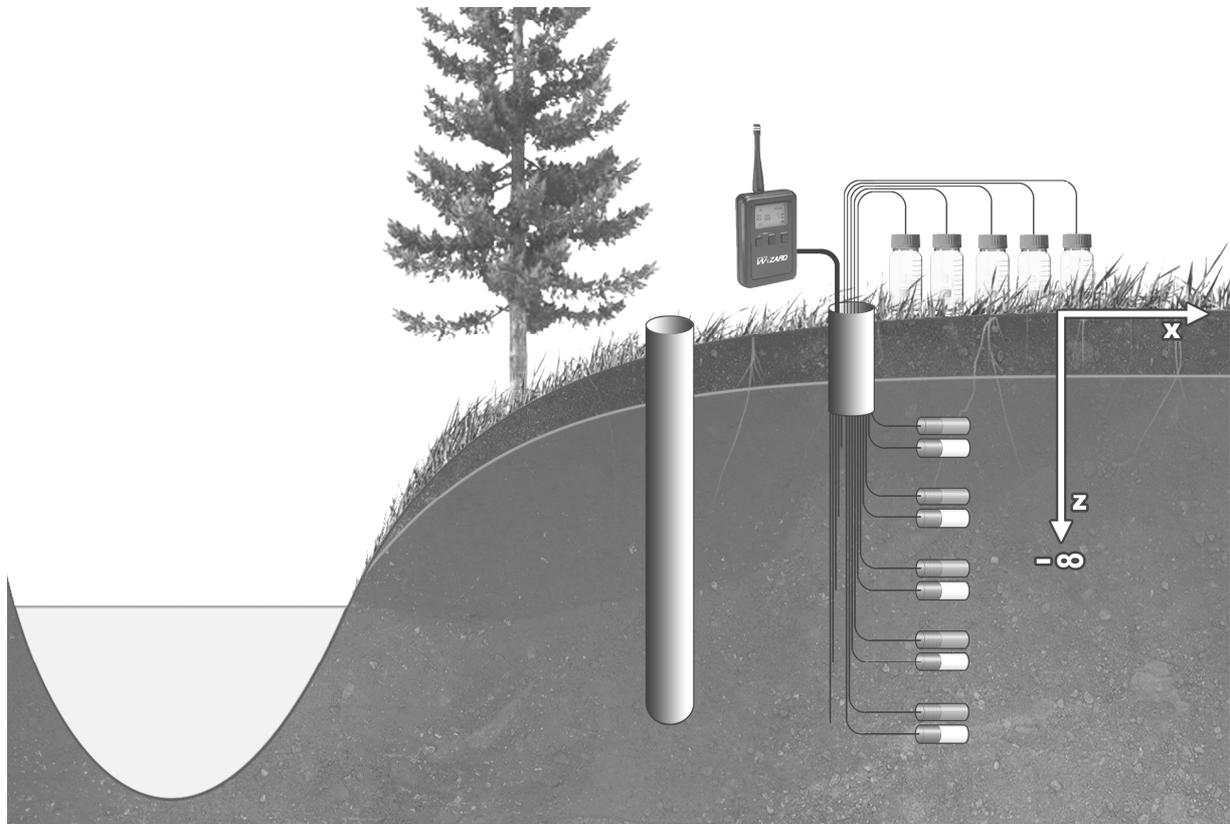
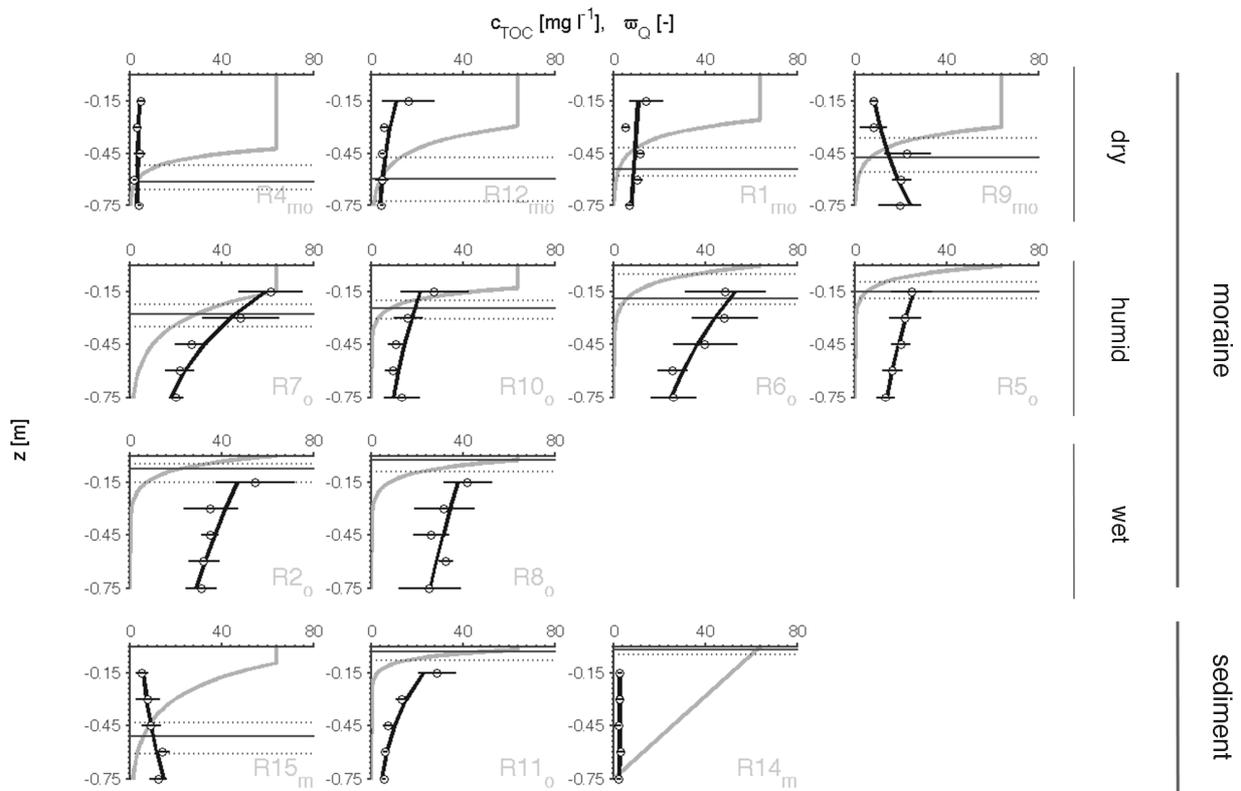


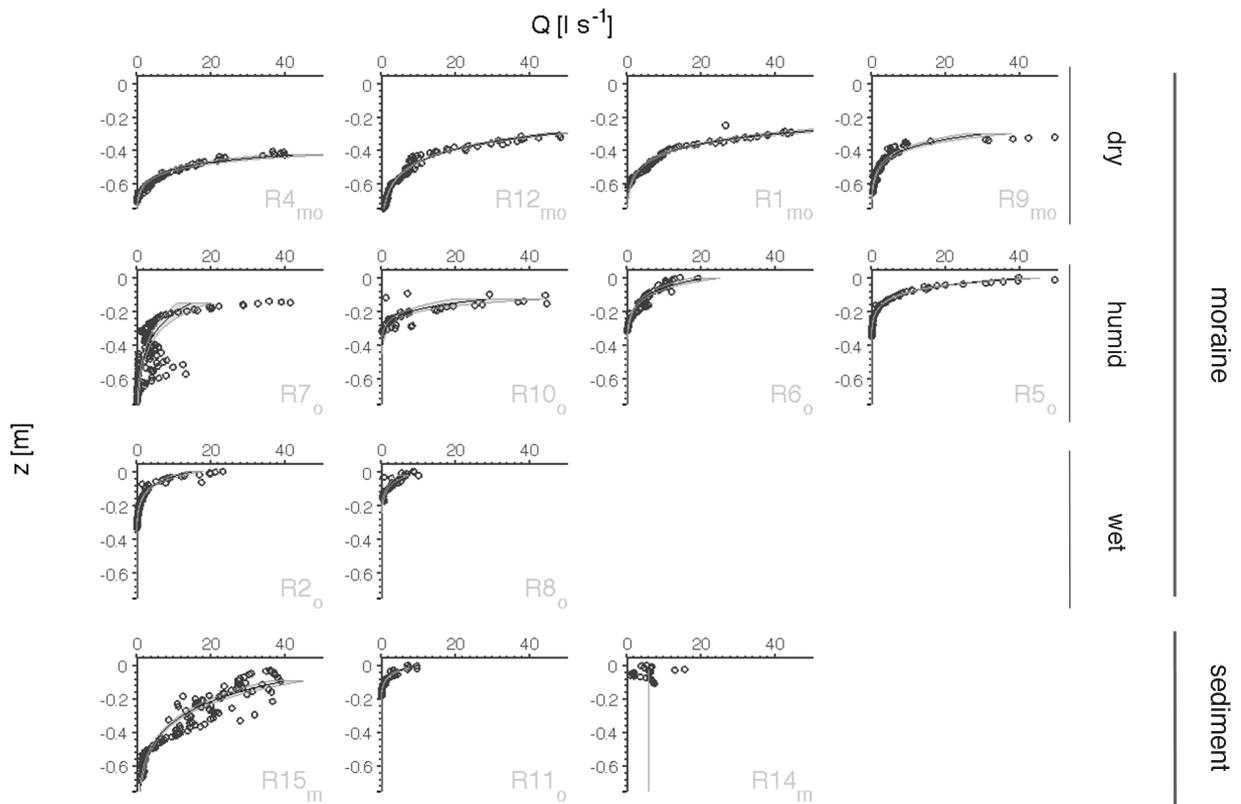
**Figure 1:** Locations of the (numbered) riparian monitoring sites (empty white circles) in the Krycklan catchment (outlined by thin black lines in inset b) and the gauging station (black triangle) at the outlet of Svartberget (outlined by thin black lines in inset c). Streams and lakes are represented by black areas and thin black lines. Parts of the catchment underlain by till are shown as white areas and others underlain by alluvial sediment deposits are marked by the cross-hatched areas respectively while wetlands are highlighted as grey shaded patches. Wetlands and lakes are highlighted as grey patches. Only site numbers are shown and “R” prefixes used in the text (preceding the site digits) were omitted for better readability.



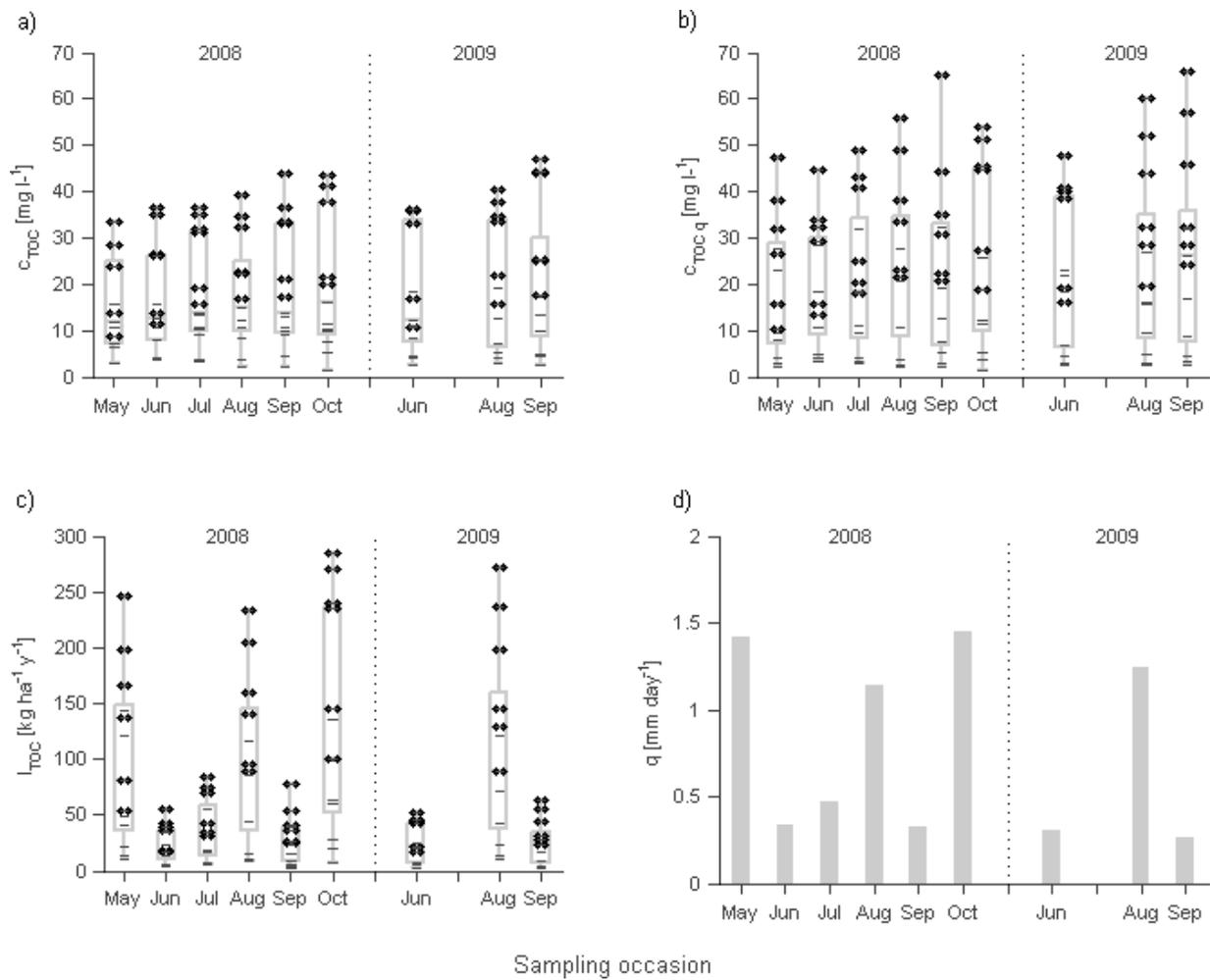
**Figure 2:** Illustration of an instrumented riparian monitoring site. Pairs of suction lysimeters are installed at 15, 30, 45, 60 and 75 centimeters below the soil surface at a distance of about 2 m from the stream. A perforated PVC tube equipped with an automatic water logging device is located at mid-distance between the stream and the suction lysimeter nest. The schematic coordinate system on the right side of the figure, illustrates the orientation and datum of the z axis (depth, groundwater table) in relation to the x axis (lateral flow, solute concentration).



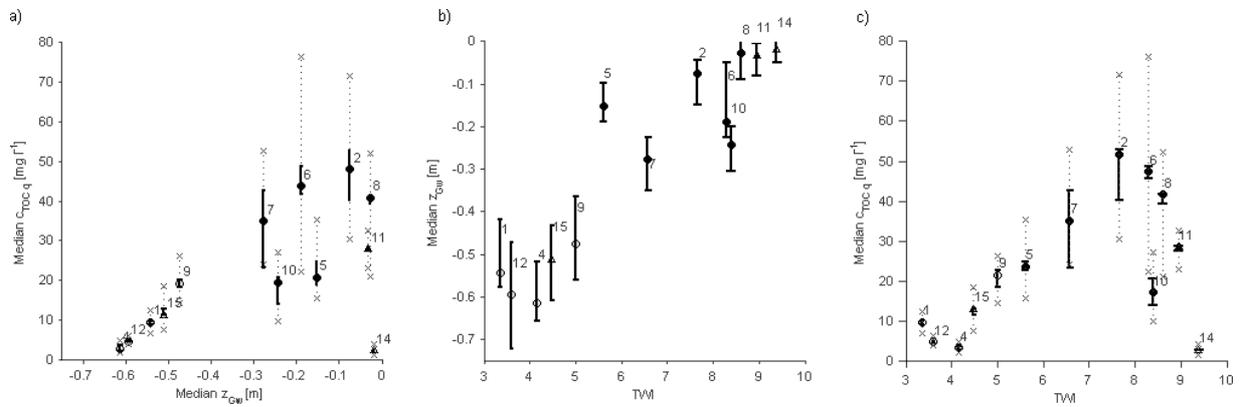
**Figure 3:** Average TOC concentrations  $c_{TOC}$  (circles) from 9 sampling occasions (2008-2009), interpolated TOC profiles (black lines), median groundwater position (solid, grey horizontal line) and the (dimensionless) weighting functions  $\omega$  obtained from lateral flow profiles (light-grey curves) for all 13 sites. The range of temporal variability of TOC concentrations at different depths is represented by horizontal black lines (average concentration  $\pm 1$  standard deviation) and the range of temporal variability of groundwater positions is indicated by dotted grey horizontal lines (10<sup>th</sup> and 90<sup>th</sup> percentile of groundwater positions). Each subplot contains a site label located in the lower right corner. The subscripts next to each site number in the labels indicate mineral (m), mineral-organic (mo) and organic (o) soil profiles. Rows 1 to 3 represent soil plots underlain by till deposits and sorted according to increasingly shallow average groundwater positions (dry, humid and wet locations in the 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> row respectively). The lower 4<sup>th</sup> row contains sites underlain by sediment deposits.



**Figure 4:** Binned measurements of groundwater level plotted against specific discharge (circles). Fitted, site-specific lateral flow profiles and their respective 95% confidence intervals are shown as thin black lines and (thin) grey shaded areas. Each subplot contains a site label located in the lower right corner. The subscripts next to each site number in the labels indicate mineral (m), mineral-organic (mo) and organic (o) soil profiles. Rows 1 to 3 represent soil plots underlain by till deposits and sorted according to increasingly shallow average groundwater positions (dry, humid and wet locations in the 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> row respectively). The lower 4<sup>th</sup> row contains sites underlain by glaciofluvial sediment deposits.

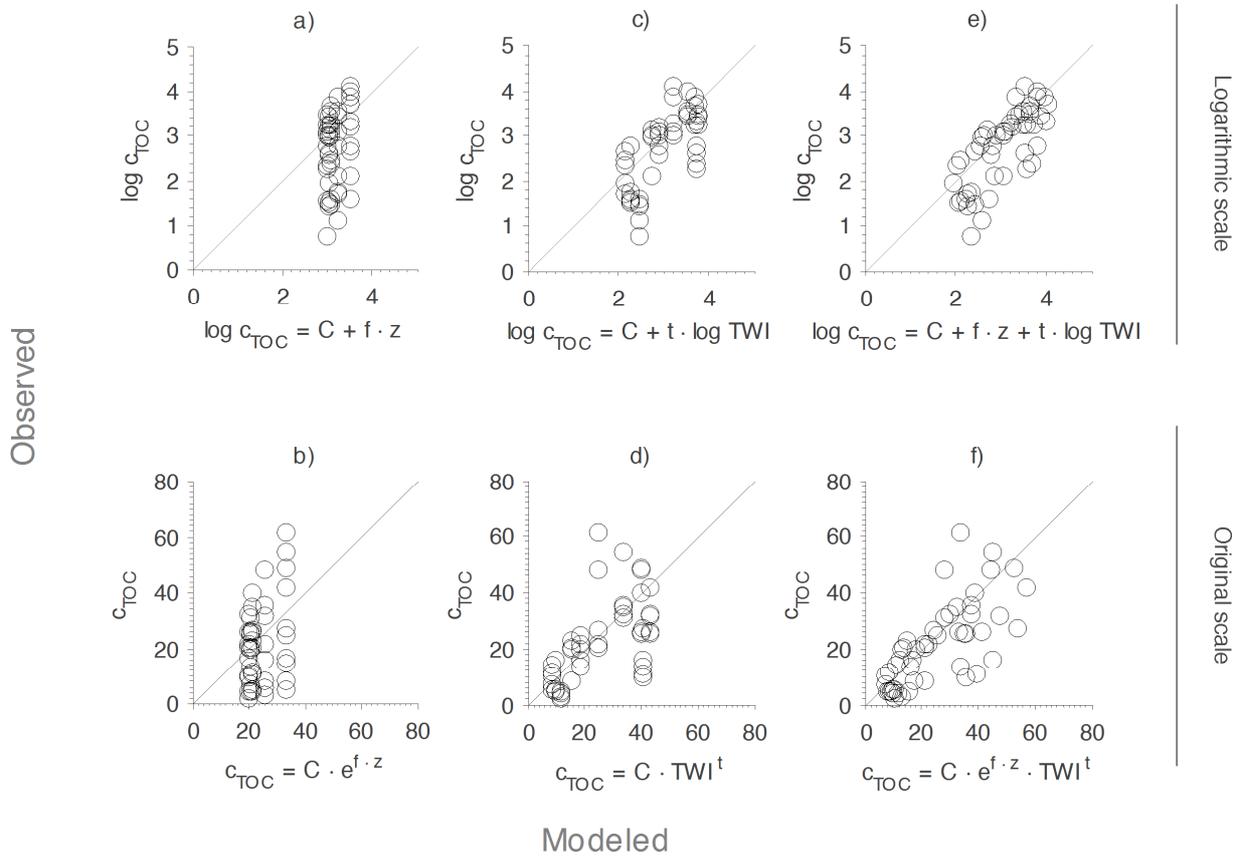


**Figure 5:** Ranges of average TOC profile concentrations  $c_{TOC}$  (a), flow-weighted profile concentrations  $c_{TOC q}$  (b) and specific TOC export rates  $l_{TOC}$  (c) and the specific discharge  $q$  (d) at the time of 9 individual sampling occasions (6 in 2008 and 3 in 2009). For each campaign the ranges of TOC-related variables (left y-axis) are illustrated by box plots (contoured by light-shaded lines) and site-specific values (short, dark-shaded horizontal lines). Site specific values from organic till sites are additionally highlighted by asterisks and dots respectively at both ends of the corresponding horizontal lines.

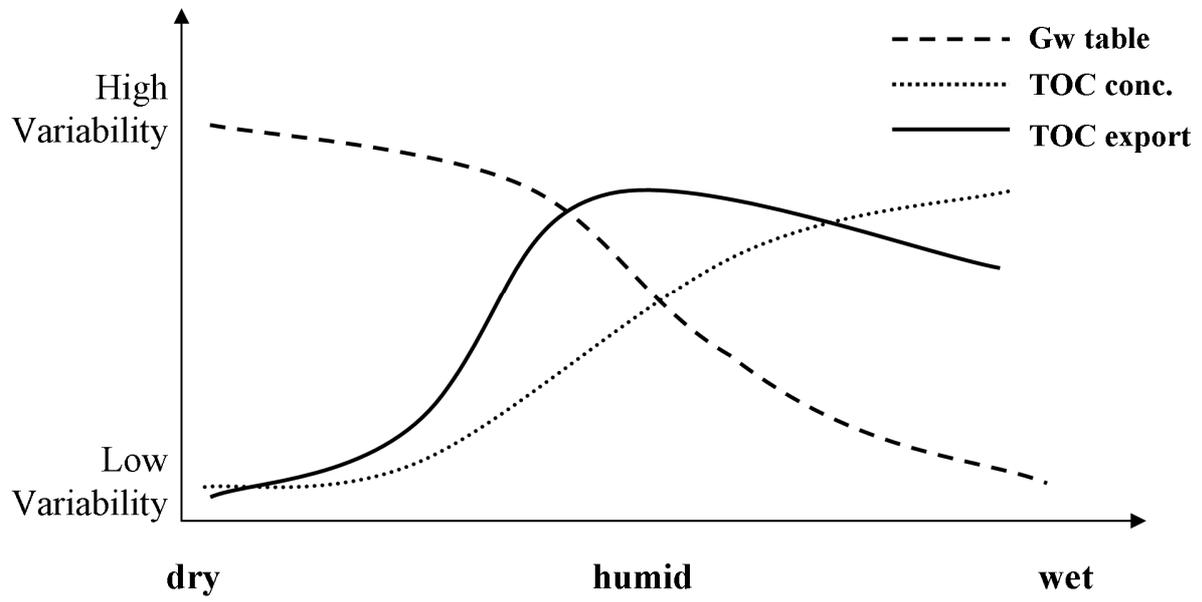


**Figure 6:** Links between median groundwater positions  $z_{GW}$ , median flow-weighted TOC profile concentrations ( $c_{TOC,q}$ ) and the topographic wetness index (TWI). In the left plot (a) median flow-weighted  $c_{TOC,q}$  values (from 9 sampling occasions in 2008-2009) are plotted against median  $z_{GW}$  values. The middle plot (b) compares median  $z_{GW}$  values against the TWI whereas the right plot (c) compares median  $c_{TOC,q}$  values against the TWI. Vertical error bars show the 10<sup>th</sup> and 90<sup>th</sup> percentile groundwater positions (b) respectively the potential range of flow-weighted TOC concentrations (a and c) assuming average profile concentrations (solid lines) or changing profile concentrations (dotted lines). Circles represent sites located in the till parts and triangles represent sites located in the sedimentary part of the catchment. Organic sites are colored black, mineral sites are white and mineral-organic sites are grey. Site numbers are plotted next to the circles and triangles. Only site numbers are shown and “R” prefixes used in the text (preceding the site digits) were omitted for better readability.

## TOC regression models



**Figure 7:** Modeled versus predicted average TOC concentrations (empty circles) for 10 riparian monitoring sites and 5 different depths (15, 30, 45, 60 and 75 cm below the surface) in the till part of the catchment. In the upper row log-transformed TOC concentrations are shown. Three regression models for TOC were tested using depth (first column), TWI (middle column) as well as using both depth and TWI as predictors (right column).



**Figure 8:** Temporal variability as function of riparian zone wetness for different quantities (schematic figure).