Rising concentrations of dissolved organic carbon (DOC) in inland waters are observed and investigated intensely in the last decades. The development of adaptive measures requires the forecasting of DOC-exports from catchments. Since DOC is exported from river catchments along hydrological pathways it is evident that the investigation of runoff generation, retention and travel times along flow paths are important to quantify DOC-loads and to develop a forecast model.

To gain comprehensive insights in runoff formation and DOC export in a small forested catchment in the Bavarian Forest National Park we apply a nested multi-tracer approach, combining experimental and analytical methods with the aim to develop a hydrological forecast model which is able to reproduce the dominant mobilization- and export processes of DOC in forested mountain catchments. The use of multiple tracers combines different approaches to determine source areas, flow paths and retention times of runoff water in catchments. Stable isotopes (d2H, d18O) are suitable as natural tracers to estimate contributions from precipitation to stream discharge. With the additional use of geochemical tracers (e.g. DOC, SiO2) contributions from groundwater and the organic and mineral soil horizons can be estimated. Combined with a nested approach these analyses can be conducted on different spatial scales, enabling the development of scalable prognostic models of runoff formation in catchments.

To complement the limited information from historic data sets we instrumented two hill transects to observe lateral contributions from hill slopes and to investigate potential preferential flow paths. Water samples from stream-, soil-, ground- and precipitation water were collected during two flood events and analysed for stable isotopes and chemical compositions. To support the nested approach, the sampling sites were chosen at strategical sites within the catchment, including the instrumented hill transects and the stream network from the creek to the catchment outlet.

Preliminary results of stable isotope analysis show, that after dry periods nearly no event water seems to contribute to runoff formation, whereas after wet periods the proportions can be up to 40 %. A strongly delayed reaction of the groundwater was observed which suggests that deep groundwater is not contributing to stream flow, but a possible mobilization of pre-event water in the riparian zone was observed as a response to precipitation events.

A likely major source of DOC is in the organic soil horizons due to storage and degradation of
organic material. This is supported by higher DOC-concentrations in the soil water from these horizons. In how far residence times, precipitation intensities and flow paths activation from different source areas influence concentration peaks of DOC in the stream will be analysed in the next steps.

The results of the recent field campaign help to identify the dominant processes of runoff generation and DOC mobilization on different temporal and spatial scales and for different antecedent system states. The data and insights gained from the field campaign will be used to develop and calibrate process models for hypothesis testing and further analyses to eventually develop a forecast model for DOC mobilization.