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Optical characterisation and quantification of DOM in streams of the Bavarian Forest during hydrological extreme events

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For understanding the fate and transformation behaviour of dissolved organic matter (DOM) in freshwater systems high temporal resolution studies over a long time period are needed. Wet chemistry measurements though very accurate are time consuming and expensive and hence frequent and cheap DOC monitoring solutions are requested. A new approach is an in-situ method taking advantage of the chromophoric part of DOM, the CDOM. CDOM is particularly proven useful to this process because the absorption of blue and ultraviolet light can be assessed with sensitive and accurate measuring equipment.

Since November 2011 we have been developing new sensor principles and are working to optimize existing approaches. The aim is to develop an online method to determine and characterise DOM measured as DOC using fluorescence and absorption spectroscopy.

An extensive set of samples from a forested catchment area in the Bavarian Forest National Park has been analysed for DOC via wet chemistry on the one hand and with fluorescence (excitation wavelength at 370 nm and emission wavelength at 460 nm) and absorption spectroscopy (from 190 to 750 nm) on the other hand. Spectral data were taken in situ every 15 minutes and samples for DOC were taken daily over a whole circle of the year, with additionally DOC sampling every two hours in hydrological extreme events. During snow melt in spring DOC concentrations increased from a background of 3.2 mg/L to 6.5 mg/L, due to leaching OF organic material from soil. The same phenomenon was observed time shifted after heavy rain events in summer with DOC concentrations up to 16.6 mg/L. Furthermore the samples were analysed for fluorescence via Excitation-Emission-Matrix Spectroscopy (EEMS) with excitation wavelengths from 240 to 450 nm and emission wavelengths from 215 to 620 nm. The obtained data were used to generate a spectral fingerprint and identify the optimal combinations of excitation and detection wavelengths especially for waters with a low content of DOC in general but a high percentage of humic substances.