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Do all riparian areas behave the same? On the mechanistic role of saturated area dynamics in hydrological responses.

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The spatio-temporal dynamics of saturated areas in riparian zones and their location within a catchment are major controls on the hydrological connectivity between hillslopes and the stream network. Moreover, they are known to largely influence quantitative and qualitative stream water characteristics. Documenting the expansion and contraction of saturated areas in riparian zones – as well as their subsequent connectivity to the stream – bears the potential for significantly improving our mechanistic understanding of the spatially and temporal variability of streamflow generation processes.
In this contribution, we used ground-based thermal infrared (TIR) imagery for characterising saturated area dynamics in riparian zones. Unlike other techniques (i.e. manual mapping, vegetation mapping, topographic indices), TIR observations of saturated areas allow to directly visualize saturated area dynamics at unprecedented spatial and temporal resolution. We employed the TIR imagery technique in the Weierbach catchment (0.45 km2), a small slate, forested catchment in the Grand Duchy of Luxembourg. We monitored the spatio-temporal dynamics of nine different riparian saturated areas with a handheld thermal infrared camera, collecting panoramic images at a (bi)-weekly frequency over a period of two years. We extracted the percentages of saturated pixels (i.e. pixels corresponding to saturated surfaces in each riparian area) from the panoramas in order to generate time series of surface saturation. Precipitation, stream discharge, groundwater levels and soil moisture time series were also recorded.
Our preliminary results suggest that there are differences in surface saturation dynamics of different riparian areas (i.e. some areas wet up or dry down faster than others) and in their relationship with hydrometric metrics. For example, we determined a good relationship (tested with Spearman correlation) between surface saturation and stream discharge for almost all investigated riparian areas when considering periods of low and intermediate discharge (i.e. discharge lower or equal to 10 l/s). This relationship weakens for some of the areas in periods of higher discharge (i.e. discharge higher than 10 l/s), suggesting a potential hysteretic relationship between discharge and saturation.