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Multi-sampling points dye tracing in karstic rivers as a tool for hydrodynamic characterization

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This project aims at providing a critical review on actual tracing methods and testing potential efficiency of multi-points dye tracing specifically in karstic configurations.

Dye tracing is widely used as a tool for hydrodynamic characterization, from stream scale to basin-wide scale. Its purpose and methodology are well-defined, while not being limited to their current state.

Single point dye tracing using automatic field fluorometers is considered reliable, probably due to their straightforward application and ease of implementation. The spatial arrangement of injection and sampling point(s) is usually entirely depending on local stream configuration and access. Sampling is mostly arranged considering on-field conditions and equipment instalment difficulties, assuming a homogeneous distribution of tracer concentration along the transversal stream section at the sampling location. However, most users are probably aware of the potential bias in case of non-homogeneous dye distribution, which can mislead interpretation (in recovery rate calculation for example). The implementation of multi-points tracing is usually not considered by lack of equipment and/or funding.

This research aims at providing an insight on multi-points dye tracing, its efficiency regarding stream hydrodynamic assessment, and on larger scale, on basin-wide hydrodynamic in karstic regions. We propose a critical review on single-point tracing based on various dye tracing experiments in various karstic sites in Wallonia, Belgium. Two major configurations will be considered using a set of 15 Fluo-Green fluorometers: transversal multi-points and along-stream multi-points. Transversal multi-points dye tracing will be performed by placing fluorometers along local transversal stream section(s) at a fixed interval while injecting at various distances from the section. Along-stream multi-points dye tracing will be performed by placing fluorometers upstream and downstream strategic cave segments such as sumps or other supposedly heterogeneous segments of karstic stream, while injecting upstream at various distances. Both methodologies will be performed on multiple sites.

Collected data will be analysed by aiming at highlighting any transversal dye distribution heterogeneity in each site (for transversal multi-points), which would potentially allow to critically review widely used single-point tracing, and by comparing dye concentration at each strategic points (for along-stream multi-points) to assess potential efficiency of multi-points tracing in karstic hydrodynamic characterization.