Estimating the vulnerability of karst springs to microbial contamination based on numerical flow modelling

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Abstract An approach is presented to develop an indicator for the vulnerability of karst springs to faecal contamination. The indicator is expressed as the Dynamic Vulnerability Index (DVI) and determined by the ratio of conduit to diffuse flow contributions to spring discharge. DVI is calculated based on a numerical model simulating karst water flow. The performance of DVI to estimate the risk of faecal spring water contamination was tested at a karst spring in northwest Switzerland. Five recharge events were sampled at the spring, and analysed for faecal indicators (FI). The comparison of DVI with FI showed that maximum DVI values correlate with maximum FI levels by trend in this study. In addition, DVI was capable of giving an early warning of elevated FI levels in four of the five analysed events. It is concluded that DVI holds promise for the assessment of microbial pollution risks of karst springs.

Key words karst hydrogeology; groundwater vulnerability; faecal indicators; numerical modelling