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Analyses of Spring Dynamics with the Application of Stable Isotopes: Preliminary Results of Case Study in River Radovna Valley (NW Slovenia)

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River Radovna valley is situated in the north-eastern part of Slovenia (Southern Alps). River starts to flow from several diffuse springs flowing out from the fluvioglacial sediments. Their recharge area is positioned in high mountains consisting of karstified limestones. It is 17 km long, almost entirely groundwater flow dominated river where several visible and invisible inflows from karstified limestone are presented.
Appearances of karstic springs are related to the contact between Quaternary sediments filling the valley and carbonate rocks forming slopes of the valley. Discharge of the springs is very variable with high fluctuation and heavily related to snow melting period. During low flow period some of the springs dry up.
For better understanding of spring and river dynamics systematic monitoring of water chemistry and stable isotopes of hydrogen, oxygen and dissolved inorganic carbon was carried out during the years 2005 and 2008. Sampling was performed on 18 springs and along the river. Isotopic composition of dissolved inorganic carbon is changing between -5‰ and -14‰İsotopic composition of hydrogen and oxygen varies between -53‰ and -83‰ and between -7.0‰ and -11.8‰ respectively. Changes in isotopic composition are highly seasonally dependent. Mean residence time for springs was estimated between 0.5 and 1.5 years and was determined with piston-flow model with approach for relating amplitude attenuation to residence time and taking into account the long-term variations of isotopic composition of precipitation in Ljubljana.
The longest residence time (1.5 years) of all investigated springs was determined for river Radovna spring and is related to the intergranular aquifer in the recharge area. The rest of downstream springs have shorter residence times, between 0.5 in 1 year and are mainly springs with outflow from fissured limestone rock in the recharge area. Results also confirm the hypothesis that the highest lying springs have the highest recharge area.