



Hydrological exchange characteristics between Danube (New- and Old Danube) and groundwater East of Vienna: Conclusions from environmental isotope records

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The Danube is the second largest river in Europe. The catchment area at Vienna (Upper Danube Basin) is about 103 000 km². The mean annual flow rate is around 1900 m³/s, with a seasonal variation typical of alpine rivers (a minimum of 1300 m³/s in November and a maximum of 2700 m³/s in July).

To increase flood storage capacity the New Danube canal have been constructed from 1972 -1980 and the Danube Island has been created between the New Danube and the Danube to offer recreational opportunities in Vienna. The New Danube, a bypass channel parallel to the Danube, is approximately 20 kilometers long and an average of 200 meters wide. With exception of extreme flood periods the New Danube channel is primarily fed by groundwater.

To improve the connectivity between the Danube and their old cut off branches the Old Danube was the first tributary to be reconnected after 1980 and it became the heart of the network in terms of both surface and ground water flow regimes contributing about 0.5 m³/s surface water into the old branches of the river Danube in the Lobau-UNESCO Biosphere Reserve. The Lobau floodplain ensemble includes still waters and riparian forests remaining after river regulation in the late 19th century. The Lobau is separated from the river by a levee, but passage of seepage water is uninterrupted and floods flow in and out through a small opening in the levee at the downstream end of the area.

In 2006-2007 groundwater and surface water from the eastern side of the river Danube (Marchfeld and Lobau) as well as from the New Danube channel, the Old Danube and the other old branches (Großenzersdorfer branch) were sampled four times a year and analyzed for the environmental isotopes oxygen-18 and hydrogen-2.

The New Danube channel water shows a constant $\delta^{18}\text{O}$ - enrichment (- 10.4 ‰) compared to mean Danube values (-11.1 ‰) indicating that at least 20 % of groundwater is constantly admixed from the Danube island or from the eastern bank of the river Danube. The Old Danube water is further enriched during the summer by evaporation changing the $\delta^{18}\text{O}/\text{H}_2\text{O}$ -signals from -9.8/-73 ‰ in April to -6.8/-57 ‰ in August-September. These waters with enriched $\delta^{18}\text{O}$ -signal are transported into the old branches below and overall into the Lobau- and Marchfeld-groundwater up to 20 km East of the Danube till this groundwater mixes in the Marchfeld with groundwaters coming from the NW.

$\Delta^{18}\text{O}$ and $\delta^{2}\text{H}$ -measurements of surface- and groundwater as well as waters from groundwater dependent ecosystems can help to quantify and evaluate water balances in context with traditional hydrological methods.