Geophysical Research Abstracts
Vol. 18, EGU2016-4595, 2016
EGU General Assembly 2016

Source detection by chemical and isotopic means - the Lower Jordan River

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During the past several decades the volume of freshwater carried by the Lower Jordan River (LJR) has been reduced by 90% due to damming of its main tributaries, leaving a mixed flow of polluted and brackish to saline water from anthropogenic and partly known geogenic sources. Since the river represents the highly secured border between Jordan, Israel and the West Bank, neither systematic nor long-term measurements were conducted in it. Only vague knowledge exists about the amount and composition of natural contributors and no knowledge concerning their temporal dynamics. However, since the river water is intensely used for irrigation along its course and represents the major source of water to the Dead Sea, the spatio-temporal variation of water discharge and chemistry are required for water resource assessment in the Lower Jordan Valley and the Dead Sea.

To monitor the temporal variations of water discharge and hydrochemistry, an automatic sampler, including water level and EC sensors with real time transmission were installed at the Baptism site, a few kilometers upstream of the delta. Major ions are analyzed on a daily basis, while stable isotopes of sulfate (δ^{34}S, δ^{18}O), nitrate (δ^{15}N, δ^{18}O) and water (δ^{2}H, δ^{18}O) are analyzed on an event basis. A general inverse correlation between EC and water level was found although extreme high conductivity values relate to flood events during the wet period. Due to the high-resolution monitoring, a series of flood events could be observed, some having unusually high saline water. Results from Cl/Br, Na/Cl, Mg/Ca, δ^{34}S allow separation and identification of sources: (i) the dissolution of evaporite minerals, abundant in the surrounding geological strata, (ii) sewage and (iii) brine springs.

The continuous monitoring is an essential tool for understanding long-term processes and changes in such a dynamic system, and is crucial for identifying rarely occurring extreme flow events. However, a single sampling location is not sufficient for locating the sources responsible for the changes in water composition over time.