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Groundwater resources of the urban area of Niamey – Characterization and localization of anthropogenic pollutants

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Niamey, the capital of Niger, is located on the banks of the Niger River, which constitutes the main drinking water resource of the city. In 1985, during the decades of the Sahel droughts, a complete cessation of the Niger River flow led to a well drilling program to mitigate the effects of the droughts and to reduce the high dependency on surface water. Today, groundwater resources in the urban area are endangered by the widespread practice of sewage disposal and collection via soak pits and septic tanks. Furthermore, the impacts of industrial activities and diffuse solid waste disposal on the groundwater resources are unknown due to the lack of a problem-orientated groundwater monitoring network.

Since 2013, the AGES project (Appui à la Gestion des eaux souterraines) of the German Federal Institute for Geosciences and Natural Resources (BGR) supports local authorities with the implementation of a groundwater monitoring network in Niamey under the financing of the German Federal Ministry of Cooperation and Development. The groundwater levels and the hydrochemistry were monitored in 34 observation points covering the three different aquifers and the main surface waters in the urban area. Based on the collected data, a groundwater contour map was created and combined with distribution maps showing the main pollutants found in the aquifer system.

The results point out a widespread nitrate and nitrite contamination in all three aquifers. Furthermore, local release events of lead, cadmium and nickel with concentrations exceeding the WHO guideline values for drinking water could be observed. A high vulnerability of the aquifer system to surface pollution is indicated by the groundwater contours and hydrographs showing that most of the urban area is located within a groundwater recharge zone and that all aquifers react within 12 hours to rainfall events. Both, hydrochemical and hydraulic conditions of the aquifer system suggest that production wells for a drinking water supply of the city should be located outside the urban area.