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Assessment of regional groundwater flow patterns by geochemical tracers in the Middle Drâa Basin (South Morocco)

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This work is carried out within the framework of the IMPETUS project which is part of the German research program GLOWA. It is aiming at the hydrological cycle as determining process for water availability under the pressure of climatic change. IMPETUS follows a multidisciplinary approach to the efficient management of water resources in West Africa. In this context, two catchments are investigated, the Ouémé-River in Benin and the Wadi Drâa in Morocco.

These hydrogeological studies focus the arid to hyper-arid Middle Drâa Basin, where population, infrastructure and husbandry are concentrated in oases mainly along the Wadi Drâa. Sampling of groundwater, surface and rain water provide data on the major ion composition and the stable isotopic signature (δ18O, δ2H). Hydrochemical and isotopic techniques are applied to identify and quantify groundwater flow patterns of different time slices.

Groundwater composition has been analysed against the background of the geochemical composition of the aquifers, the climatic conditions and the regional hydraulic settings. Groundwater evolution along main pathways has been assessed by reactive tracers (e.g. SO42+), specific ratios (e.g. Ca2+/Mg2+) and saturation indices. Conservative tracers (e.g. Cl-) are detected to estimate mixing fractions of distinct groundwater compartments. In respect to this, the return flow from irrigation by both surface

and groundwater has a special impact on groundwater composition.

In order to verify the resulting conceptual model of groundwater flow numerically, the software PHREEQC and a mixing cell model is used.

Taking into account recurrent drought periods and global climatic change in combination with population dynamics, the above mentioned arrangement of techniques is used to assess the regional groundwater sustainability in the rarely gauged Middle Drâa Basin.