



Using environmental tracers to assess groundwater resources in reclamation areas of Egypt

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In Egypt, many new agricultural areas outside the overpopulated Nile Valley and Delta are being developed. Such so-called reclamation areas depend almost exclusively on groundwater, raising the crucial issue of the future availability and quality of this resource. To provide the basis for an assessment, we investigated the origin and rate of groundwater recharge in reclamation areas near the southwestern Nile Delta. Several environmental tracer methods (SF_6 , ^3H - ^3He , ^{14}C) were used to date the groundwater, whereas noble gases and stable isotopes were applied to study its origin.

The stable isotopes show that the groundwater is derived from the Nile River. The change of the river's isotopic composition in response to the construction of the Aswan High Dam allows a clear distinction between groundwater that infiltrated before and after 1970. Only wells close to surface water features (river branches, canals) reflect the modern Nile water composition. These wells are also the only ones that can be dated by SF_6 and ^3H - ^3He , yielding ages of up to 25 years. Further away from the surface water, the groundwater residence time exceeds 50 years, and ^{14}C data indicate ages of up to a few thousand years. Noble gas temperatures are consistent with recharge under modern climate conditions.

The data show that the regional aquifers are recharged from the surface water, thus the groundwater resource is in principle renewable. However, the recharge rate is low and current pumping already has negative impacts on water levels and salinity. By linking tracer data with hydrogeological and hydrochemical information, we aim to establish a reliable basis for a sustainable water resource management.