



## **Depth-specific groundwater age determination on the island of Langeoog reveals climate archive and spatially variable recharge**

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Depth-specific sampling of groundwater, followed by geochemical and stable isotope analysis, as well as groundwater age determination using the tritium-helium method, was performed on the freshwater lens of the island of Langeoog, Germany. The obtained age stratification shows marked spatial differences in recharge rates, which can be related to the type of land use. Recharge at the dune tops is significantly lower than in the dune valleys, due to the high water repellency of the dry sand. Dune valleys can contribute up to four times more recharge per unit of area than other areas. The development of housing in such areas can thus significantly decrease the recharge of fresh groundwater.

The fresh groundwater samples show markedly heavier stable water isotope values with decreasing depths. This is obviously a reflection of a change of the climatic conditions during the time of recharge. The freshwater column thus preserves a climate archive. Using age data obtained from tritium-helium dating, this pattern was successfully matched to actually measured climate records for the last century which indicate an increase of the temperature during the last 100 and especially the last 30 years.