Isotopic Groundwater Ages to Assess a Water Budget for the Sustainable Groundwater Management Act (SGMA) in Butte County, California

N. GRIMM[1], A. VISSER[2], J.E. MORAN[1]

[1]Dept. of Earth and Environ. Sci., California St. Univ. East Bay, Hayward, CA 94542, USA (*correspondence: ngrimm@horizon.csueastbay.edu)

[2] Nuclear and Chemical Science Division, Lawrence Livermore National Laboratory, Livermore, CA 94551 USA

In California nearly 40% of potable water is sourced from groundwater, significantly increasing during drought years. Historically there have been no regulations managing groundwater with long-term overdraft as a result. The Sustainable Groundwater Management Act (SGMA) aims to balance groundwater basin budgets to ensure water security during future droughts. The goal of this study is to use isotopic signatures in groundwater to improve the Butte Basin Groundwater Model by calibrating groundwater residence times and recharge rates. The stable isotopes of water (δ^2H and $\delta^{18}O$) indicate the recharge source, as local precipitation is isotopically heavier than recharge from snowmelt and stream water from higher elevations. Recharge temperatures are determined from noble gas concentrations in the groundwater. Groundwater with a subsurface residence time of less than 70 years is dated using the ^3H-^3He method, and estimates of longer residence times are based on radiogenic ^4He concentrations. This study utilizes nested depth-specific monitoring wells, where incremental groundwater ages allow for the determination of recharge rates, along with mixed ages determined at long-screened production wells. Recharge rates, residence times, and aquifer storage capacity estimated from geologic data are combined to determine the amount of groundwater discharge tolerable for a sustainable water resource management plan. Discharge includes natural losses to streams and extraction for anthropogenic uses. The apparent isotopic groundwater ages from this study will be compared to residence times from the California Department of Water Resources' Integrated Water Flow Model (IWFM) that is calibrated using groundwater elevation. This will allow for the evaluation of the Butte Model's reliability for sustainable management of the Butte County Groundwater Basin.