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The use of isotopic age for improved groundwater assessment and management: recent IAEA initiatives

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Groundwater provides more than half of the world's freshwater supply and fossil groundwater sustains a significant portion of the current food production by irrigated agriculture, as well as contributes to baseflow of rivers. In spite of the importance of groundwater, a number of fundamental aspects of aquifer hydrogeology, including recharge, groundwater-surface water interactions, and the extent and distribution of fossil groundwater remain poorly characterized in most countries. Aquifer assessments at regional or national scales can be conducted more effectively and rapidly by using groundwater isotope signatures and ages, but a lack of easy access to analytical facilities and discordant ages estimated from multiple isotope tracers have been two of the important impediments in the wider use of age dating for groundwater investigations. We have recently established a noble gas facility at the IAEA to increase the availability of groundwater ages and have demonstrated the use of tritium-helium isotope pair in a shallow aquifer and river baseflow in Austria for characterizing groundwater residence time. Carbon-14 data collected prior to the advent of accelerator mass spectrometry is subject to large uncertainties because of potentially large contamination with atmospheric carbon dioxide during ampling. Using field and laboratory experiments, we demonstrate that carbon-14 values as much as 10 pMC in the Nubian Aquifer can be attributed to contamination during sampling. In this presentation, we will discuss recent IAEA initiatives for a wider application of tritium-helium-3, carbon-14 and krypton-81 for groundwater dating and to increase the availability of comprehensive, national assessments of water resources.