

Flow of river water into a Karstic limestone aquifer. 1. Tracing the young fraction in groundwater mixtures in the Upper Floridan Aquifer near Valdosta, Georgia.

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Abstract

The quality of water in the Upper Floridan aquifer near Valdosta, Georgia is affected locally by discharge of Withlacoochee River water through sinkholes in the river bed. Data on transient tracers and other dissolved substances, including Cl^{a} , ^3H , tritogenic helium-3 (^3He), chlorofluorocarbons (CFC-11, CFC-12, CFC-113), organic C (DOC), O_2 (DO), H_2S , CH_4 , $\hat{\text{I}}'^{18}\text{O}$, $\hat{\text{I}}'\text{D}$, and ^{14}C were investigated as tracers of Withlacoochee River water in the Upper Floridan aquifer. The concentrations of all tracers were affected by dilution and mixing. Dissolved Cl^{a} , $\hat{\text{I}}'^{18}\text{O}$, $\hat{\text{I}}'\text{D}$, CFC-12, and the quantity ($^3\text{H}+^3\text{He}$) are stable in water from the Upper Floridan aquifer, whereas DOC, DO, H_2S , CH_4 , ^{14}C , CFC-11, and CFC-113 are affected by dilution and mixing.

CFC-11, and CFC-113 are affected by microbial degradation and other geochemical processes occurring within the aquifer. Groundwater mixing fractions were determined by using dissolved $\text{Cl}^{\delta^{35}}$ and $\delta^{18}\text{O}$ data, recognizing 3 end-member water types in the groundwater mixtures: (1) Withlacoochee River water ($\delta^{18}\text{O} = -2.5 \pm 0.3 \text{‰}$, $\text{Cl}^{\delta^{35}} = 12.2 \pm 2 \text{ mg/l}$), (2) regional infiltration water ($\delta^{18}\text{O} = -4.2 \pm 0.1 \text{‰}$, $\text{Cl}^{\delta^{35}} = 2.3 \pm 0.1 \text{ mg/l}$), and (3) regional paleowater resident in the Upper Floridan aquifer ($\delta^{18}\text{O} = -3.4 \pm 0.1 \text{‰}$, $\text{Cl}^{\delta^{35}} = 2.6 \pm 0.1 \text{ mg/l}$) (uncertainties are $\pm 1\sigma$). Error simulation procedures were used to define uncertainties in mixing fractions. Fractions of river water in groundwater range from 0 to 72% and average 10%. The influence of river-water discharge on the quality of water in the Upper Floridan aquifer was traced from the sinkhole area on the Withlacoochee River 25 km SE in the direction of regional groundwater flow. Infiltration of water is most significant to the N and NW of Valdosta, but becomes negligible to the S and SE in the direction of general thickening of post-Eocene confining beds overlying the Upper Floridan aquifer.



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