Geophysical and geochemical data reveal large-scale subterranean estuaries along west Florida coastal region

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The flow and discharge of meteoric groundwater beyond the coastline through offshore extensions of terrestrial aquifers is now recognized as an important process that affects both the coastal and global ocean. However, material transported via this mechanism does not enter the marine realm unaltered. The ubiquitous presence of complex subsurface mixing zones (the so-called subterranean estuaries) are still poorly undestood. To date, many of the subterranean estuaries studied have been spatially narrow, with the transition between fresh and saline groundwater occurring on the scale of 10s of meters. A few larger-scale mixing zones (100s to 1000s of meters) have aslo been documented. Geophysical and geochemical investigations conducted along several regions along west Florida coastal region, including the Everglades National Park and Tampa region, reveal large-scale mixing zones. For example, continuous resistivity profiling (CRP) suggests less saline water extends as much as 2-km offshore from the mainland Pinellas County shoreline near the Tampa Bay region. Two-year salinity time series observations in select marine wells indicate that the salinity of offshore groundwater to depths of 2.5 m is relatively stable. Similarly, data from the Shark River Slough region of the Everglades National Park highlights the diffuse nature of mixing in this region. Mixing based on salinity and other geochemical data as well as CRP suggests the mixing zone is on the order of 10 km. The influence of these large-scale mixing zones on the geochemistry of the discharging water (terrestrial meteoric or marine surface water) is discussed for these two examples from west Florida coastal region. Further understanding and comparisons are required between narrow, relatively sharp interface type subterranean estuaries and broader, more diffuse mixing zones as each will inevitably respond differently to climatic, land-use, and sea-level changes.