Shallow groundwater dynamics in the root zone of a cypress wetland

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The hydrology of the root zone in a forested wetland is being studied as part of a larger investigation of the hydrologic controls on wetland tree growth. Previous studies have shown that bald cypress trees (*Taxodium distichum*) undergo accelerated growth during years of high precipitation, including trees growing in saturated sediments where water should not be a growth-limiting factor. The primary cause of growth may be a precipitation induced influx of nutrients into the wetland or alteration of root-zone chemistry that enhances nutrient uptake.

The work is being conducted in Sky Lake in the Delta north of Belzoni, Mississippi. Sky Lake is an oxbow lake surrounded by a cypress dominated wetland. Outflow is ephemeral, and occasional backflow from the Yazoo River results in fluctuations in lake level in excess of 4 m creating the potential for seasonal reversals in shallow groundwater flow. A series of nested piezometers are employed to measure spatial and temporal trends in bulk chemistry, oxygen isotopic composition, and hydraulic gradient in the upper 3 m of sediment. The potential for differentiating lake and regional groundwater sources in the root zone is enhanced by seasonal changes in the chemistry and isotopic composition of the lake water. During the summer the lake level falls below the outlet resulting in evaporative concentration of dissolved solids and isotopic enrichment of ^{18}O. During the previous winter, the $\delta^{18}O$ of lake water was similar to mean precipitation (near -5‰ VSMOW), but rose above 3‰ in the summer.

Preliminary results indicate that the shallow flow system is complex. During the previous year, the lake level remained higher than the hydraulic head in all the deeper piezometers, but the vertical gradient within the top 3 m of sediment partially reversed on multiple occasions. Several partial reversals in the horizontal gradient have also been observed. The partial reversals suggest that pockets of higher permeability exist within the sediment with variable connection with the surface. Observed changes have correlated more with lake level than with precipitation. Significant changes in the chemistry and isotopic composition of piezometer samples have been observed, but thus far without a clear indication of the source or transit time of the water present. Slug tests and tritium analyses are planned to help determine sources and travel times.