Hydrology plays an important role in intertidal salt marshes, which are among the most productive ecosystems on Earth. For example, drought has been linked to acute marsh dieback (AMD). Surface water/groundwater interactions also drive significant export of dissolved constituents from coastal aquifers to the coastal ocean. The purpose of this study was to understand the hydrogeology of a pristine salt marsh system to determine the relationship between drought and AMD on a marsh island and to quantify rates of submarine groundwater discharge (SGD) from the marsh. An additional goal was to determine the impact of groundwater flow on spatial and temporal variations in porewater radium activity because, although radium isotopes serve as key tracers for SGD in coastal systems, the groundwater endmember for these tracers has been difficult to determine. To meet these goals, a field and modeling study was conducted on a marsh island at North Inlet, SC.

Measurements of pore pressure, temperature, and salinity were made in piezometers, and nutrients and salinity were measured in the top 1m of the marsh using passive diffusion samplers. Concurrent measurements of Ra, salinity, temperature, pH, and redox potential were measured in porewater and surface water samples along with measurements of bulk sediment $^{226}$Ra and $^{228}$Ra activity. Finally, a groundwater flow model was calibrated using both the hydraulic head dataset and the radium measurements. Results indicate that 1) periods of extended marsh surface exposure during low mean water level may lead to a rapid increase in shallow porewater salinity; 2) discharge is inversely related to daily tidal variations and seasonal variations in MWL; 3) discharge from the marsh was concentrated in a confined sand aquifer that underlies a surficial
mud; 4) temporal changes in groundwater discharge provided the only statistically quantifiable control over porewater $^{224}$Ra and $^{223}$Ra activity; 5) spatial variations in groundwater flow, sediment grain size, and permeability resulted in lateral and vertical differences in porewater Ra activity; and 6) a groundwater flow model calibrated to both hydraulic head and Ra measurements provided discharge estimates comparable to those of a prior radium-based discharge study conducted at North Inlet.