Evaluating Water, Sediment, and Nutrient Transport Rates and Accumulation Patterns in Alluvial Ridge Basins Between the Abandoned River Channels (Resacas) of the Rio Grande Delta

PI: Tian Dong
University of Texas, Rio Grande Valley
Award #: DE-SC0024550

River deltas are vital ecosystems and social centers in coastal regions. However, deltas face climate change threats and human activities today, leading to land loss. River deltas distribute sediment and build land near the coast by abruptly shifting course through channel avulsion. Within a delta, much of the area is occupied by alluvial ridge (AR) basins, depressions formed by relict channels from past avulsions. How materials, like sediment and organic carbon, accumulate in AR basins remains less understood. Moreover, climate change and natural disasters disproportionately affect under-served communities, especially those of the Rio Grande Delta (RGD) in south Texas. The RGD region contains seven major relict channels of the Rio Grande, known locally as *Resacas*. Despite experiencing frequent flooding, the patterns of water and sediment transport in the AR basins of the RGD remain unclear. This project aims to study the processes of mass accumulation in deltaic AR basins by combining field observations, remote sensing data, and numerical modeling. The research will determine the connectivity of the channel network and the direction of water flow within the AR basins. The topography of the channel network will be analyzed via flow routing using digital elevation models. Instruments will be deployed to measure water and sediment transport rates in three AR basins, representing a range of natural and human conditions. Sediment core samples will be collected for radiocarbon age dating to determine sediment and nutrient accumulation rates over long periods. The field data will be combined with numerical models to simulate material transport and accumulation patterns under different scenarios, providing insights into the impact of climate change on the RGD and its communities. This project will be the first comprehensive study of mass accumulation rates and patterns in the RGD, the second-largest river delta in North America. Furthermore, it aims to provide valuable data to the under-served community, enabling them to understand delta inundation patterns for better policymaking and engineering practices. The results of this research will also help to validate the transport rate and direction of the E3SM-Land model.