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Surface water and groundwater interactions in coastal wetlands

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Salt marshes are an important wetland system in the upper intertidal zone, interfacing the land and coastal water. Dominated by salt-tolerant plants, these wetlands provide essential eco-environmental services for maintaining coastal biodiversity. They also act as sediment traps and help stabilize the coastline. While they play an active role in moderating greenhouse gas emissions, these wetlands have become increasingly vulnerable to the impact of global climate change. Salt marshes are a complex hydrological system characterized by strong, dynamic interactions between surface water and groundwater, which underpin the wetland's eco-functionality. Bordered with coastal water, the marsh system undergoes cycles of inundation and exposure driven by the tide. This leads to dynamic, complex pore-water flow and solute transport in the marsh soil. Pore-water circulations occur at different spatial and temporal scales with strong link to the marsh topography. These circulations control solute transport between the marsh soil and the tidal creek, and ultimately affect the overall nutrient exchange between the marsh and coastal water. The pore-water flows also dictate the soil aeration conditions, which in turn affect marsh plant growth. This talk presents results and findings from recent numerical and experimental studies, focusing on the pore-water flow behaviour in the marsh soil under the influence of tides and density-gradients.