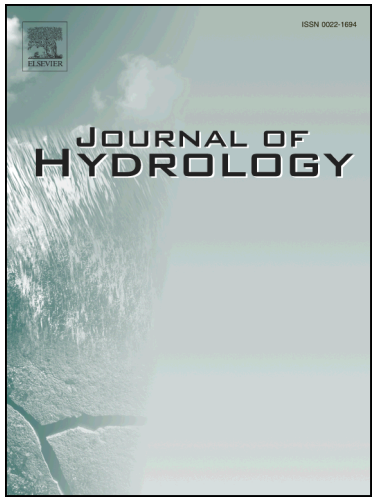

Research papers

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Impact of storm tides and inundation frequency on water table salinity and vegetation on a juvenile barrier island

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Abstract

Freshwater lenses are generally of major interest for drinking water supply in coastal environments. Knowledge of the interrelations between ground surface elevation, sea level, inundation frequency, groundwater salinity and vegetation is also vital to understand coastal ecosystem functioning. This study provides an integrated analysis of these parameters at a barrier island in the North Sea that is currently developing under highly dynamic processes, but remains largely unaffected by humans. This study is particularly relevant in view of predicted sea-level rise and increasing storm frequencies, as the analysis of groundwater salinities at the water table, water level data and ground surface elevation reveal the pronounced influence of storm tides and inundation frequency on the water table salinity at the eastern part of the barrier island Spiekeroog, the so-called 'Ostplate', located off the northwest coast of Germany. The shallow freshwater is restricted to the elevated dune areas and shows spatial and temporal variations, depending on the time passed since the last storm tide. The water table salinities depend on inundation frequencies, whereby more than three flooding events in the year prior to sampling led to brackish water table salinities. Inundation frequency and water table salinity are both largely a function of ground surface elevation, and the dependence of water table salinity on the ground surface elevation can be quantified with an exponential function. Combining this function with digital elevation models enables the extrapolation and reconstruction of present and past water table salinity