Characterization of Submarine Groundwater Discharge along a 130 km Stretch of the Udupi Coastline, Southwestern India.

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Submarine Groundwater Discharge (SGD) is estimated to contribute 6-12% of the total freshwater discharge into the ocean, with solute fluxes two to three times higher. Despite its significance, less than 1% of the global coastline has been measured for SGD. In this study, we conducted a comprehensive two-year investigation of SGD along a 130km stretch of the Udupi district coastline in southwestern India. We employed a range of proxies, including groundwater, hydraulic gradient, porewater, and seawater parameters, to conduct measurements at every kilometre along the coast. Our research identified twelve potential SGD sites, characterized by the electrical conductivity of groundwater and porewater. The results revealed a variable SGD flow to the Arabian Sea, with some areas exhibiting consistent SGD flow throughout the year, while others showed cessation of groundwater flow shortly after the monsoon season. Seepage meter measurements were taken at five selected sites, revealing the dynamics of fresh and recirculated SGD at the seepage face. We observed a shorter recirculation near the upper saline plume, with flushing occurring within minutes to two hours post-high tide. The discharge of SGD is influenced by various factors, including inland hydraulic gradients, tidal fluctuations, and the presence of extensive coastal deposits. Our findings underscore the importance of such investigations worldwide to accurately quantify SGD and inform proactive coastal ecosystem conservation strategies, particularly in the context of escalating climate change and human activities.