

Tidal and Seasonal Variations of Soil and Water Properties in a Brazilian Mangrove Ecosystem

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Abstract

This study focused on the tidal and seasonal variations of soil and water properties in a mangrove ecosystem in the northern part of Pará (Brazil). Furo do Chato, one of the main tidal creeks in the Rio Caeté estuary system, is surrounded by mangrove forest. Neap and spring tide have amplitudes of 3.4 m and 4.1 m, respectively. The mangrove forest is only inundated during spring flood tides which occur two to three days before and after full and new moon. The average monthly rainfall during rainy season is 300 mm and during dry season only 40 mm. Considering evaporation, evapotranspiration, runoff and river discharge yields a net freshwater input into the estuary of 190 m³/s during rainy season and a net loss of 2 m³/s during the dry season. The groundwater level, recorded in wells at various depth, depended on sediment characteristics, tidal stage and season. The difference in fresh water supply during dry and rainy season governs, to a large extent, the hydrochemistry of the tidal creek Furo do Chato, pore- and groundwater. The creek- and porewater salinity was much higher during the dry season as compared to the rainy season. The concentration of dissolved organic carbon during the rainy season was elevated in the creek-, ground- and porewater, relative to the dry season. Nitrogen, orthophosphate and silicate values were variable and significant trends were not evident. Water level responses to tidal forcing were only observed below the top 2 m. These observations suggest that during tidal inundation there is little hydraulic response through the low permeability clay loam and silty clay, whereas the observed head changes in the underlying horizon is due to the high permeability of the sandy loam layer. However, observation suggest that in the top 2 m vertical water flow along roots and through animal burrows form a significant pathway for tidal flow. Within the mangrove forest two different soil types could be distinguished. Friable, grayish brown, sandy substrate with abundant mottles on one side and black, watersaturated mud on the other side. The later soil type was mainly found in natural depressions whereas the sandy substrate sites were located on the creek bank. In spite of a rather large variance between and within samples from the two different sediment types a few generalizations are possible: (1) the average salinity in the soil-water extract of two different soil types were significantly higher during dry season as compared to the rainy season and (2) all nutrient concentrations measured in the soil-water extract were elevated with respect to the nutrient concentration in porewater and creekwater.