DECADAL-SCALE DYNAMICS OF AN AMAZONIAN MANGROVE CAUSED BY CLIMATE AND SEA LEVEL CHANGES: INFERENCES FROM SPATIAL-TEMPORAL ANALYSIS AND DIGITAL ELEVATION MODELS

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ABSTRACT: Sea level rise and climate change are major forces driving wetland dynamics. The northern Brazilian coast has one of the largest continuous mangrove areas on Earth, with the mangroves from the Bragança Peninsula, in eastern Amazonia, being the most representative ones. These mangroves have migrated into higher tidal flats over the last years. We analyzed spatial-temporal changes of vegetation units adapted to different physical-chemical conditions along the Bragança Peninsula in order to decipher possible causes responsible for such recent mangrove dynamics. The investigation was based on time series analysis of a 33-year (1984-2017) data base consisting of satellite and drone images. These data were combined with digital elevation models based on topographical data obtained by photogrammetry, theodolite and hydrotopographic devices. During this time frame, mangroves invaded 2.7 km^2 of inner tidal flats, which is compatible with a rise in relative sea level (RSL) and with a rainfall decreasing. Such topography-dependent dynamic suggests that an increased frequency of tidal inundation decreased porewater salinity and caused mangroves to expand into topographically higher grounds. However, the study area contains small basins, that are less affected by tidal inundation, and *Avicennia* trees are dying in these locations due to increased porewater salinity, probably caused by a decreased rainfall. We propose that climate and RSL are responsible for driving the death of mangroves in the study area, and their migration into topographically highest tidal flats. Considering the hypothesis of a RSL rise of 5 mm/yr under stable rainfall, or a RSL rise of 3 mm/yr accompanied by decreased rainfall, it is projected that mangrove areas will expand by 2.93 or 1.35 km^2, respectively, by the end of this century. The mangrove expansion rates have decreased from 0.136 km^2/yr to 0.081 km^2/yr, with projection of 0.036 km^2/yr (2017-2100). It is caused by the steeper topographic gradients nowadays occupied by herbaceous and Terra Firme vegetation and the effects of decrease trend of rainfall rates in the central depression. The combination of time series analysis based on satellite and drone images associated with photogrammetry techniques, based on interpolated dense points cloud and ground control topographic data, proved to be an efficient and innovative process for monitoring and evaluating the impacts of global changes on coastal wetlands.

KEYWORDS: MANGROVE; SEA LEVEL; DIGITAL ELEVATION MODEL