

Quantifying and monitoring vulnerability of Amazon-influenced mangrove coasts. Case study from French Guiana

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Abstract

Sustainable management of mangroves coasts depends on our ability to assess vulnerability of mangroves coasts to oceanic processes, climate change or anthropogenic activities. This challenging work requires quantitative baselines to monitor and predict changes in coastal landforms and impacts on human infrastructures. The case of French Guiana mangroves is specific. In this French department, coasts are relatively preserved from any polluting industry. However, as part of the longest muddy coast of the world, originating from the Amazon sediment dispersal system, the mangrove coasts are exposed to the shifting of giant mud banks from southeast towards northwest, causing an extreme variability of its shoreline. Such regional hydro-sedimentary system generates, all along the Guianese coast, a succession of erosion and accretion phases that control the extent and physiognomy of mangroves. Surprisingly, coastal-fringed mangroves, mainly composed of *Avicennia germinans* trees, seem to regenerate rapidly after an erosion phase, as soon as the following mud deposit is consolidated.

This original context yielded us to attempt to build a spatiotemporal index of coastal vulnerability based on the remote-sensing monitoring over 60 years of mangroves landscape changes. As a preliminary approach, we combined distance measurements of mangrove shorelines in both across-shore (current situation) and along shore (future situation) directions to calculate a vulnerability index. Results suggest that the northern part of the French Guiana coast seem more vulnerable than the southern part; probably because shore-faced mud banks become more elongated along-shore and confine mangrove colonization to their upper fringe part. These findings led us to make hypotheses on the *Avicennia* mangroves functioning. To learn from the past, explain the actual risk and predict vulnerability for next years, the necessity to develop regional strategies based on remote-sensing observations of changes occurring in mangrove coasts is finally explained and discussed. This work is supported by the INFOLITTORAL-1 project.

Keywords

mangrove forest, coastal instability, vulnerability index, remote sensing, muddy Amazon coast