

Analysis on morphodynamics of bed forms and fluvial erosion in the lower Orinoco river

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The Orinoco River is the third largest flow-discharge-river in the world with an average water flow of 37,600 m³s⁻¹. Due to the presence of the Guyana shield on the right bank, the lower reach of the Orinoco presents a plan form characterized by alternance of contraction and expansion zones (Laraque et al., 2013). Typical 1-1.5 km width narrow reaches are followed by 7-8 km wide reaches. A complex pattern of bed aggradation and degradation processes takes place during the hydrological cycle. The relationship between flow velocity and morphodynamic of sand waves and bars in an expansion/contraction channel is very important to understand the processes that control the evolution of rivers. Considerable research efforts has recently been directed towards the understanding of fluvial processes associated with geomorphology and hydrologic conditions with the river width, which are explained through the mechanics of formation and evolution of sand waves and bars. Repeated surveys by an acoustic Doppler current profiler (ADCP) were carried out in a channel (in expansion) in the Orinoco River, specifically over a central island near to Ciudad Bolivar Town, close to the navigation channel, dominated by sand waves and bars. For this purpose, temporal series of bathymetric cartography obtained by ADCP profiles combined with DGPS measurements (with dual-frequency), were used to recover the local displacement of bed forms in this island. The methodology is based on correlation techniques applied on bathymetries with a day of difference and the COSI-Corr software (Leprince et al., 2007). The principal aims of this analysis were: (1) to understand the mechanics of formation and evolution of sand waves and bars at this section and (2) to quantify the volume of a fluvial island with dunes, applying correlation techniques on a temporal series of bathymetric data. This required a sampling with transects during the months of May and November, 2016. Each bathymetric transect was measured twice, with a day of difference and on the same trajectory obtained by a GPS receptor. During the fieldwork on November 13, 2016 was possible to obtain bathymetric transects and ADCP profiles simultaneously. The spatial analysis of ADCP data shows that a strategy of repeated surveys and flow field interpolation has the potential to simplify the acquisition of temporal series of bathymetries in slightly deep sections (~16m) with various flow conditions. Additionally, the application of correlation techniques provides the measurement of local displacements between temporal series of bathymetric models, as well as the understanding of the kinematic of bed sand dunes.