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Analysis on Morphodynamics and Evolution of Bed Forms in the Orinoco River

S. Yepez[1], B. Castellanos[2], F. Christophoul[1], C. Gualtieri[3], J.L. Lopez[2] and A. Laraque[1]

[1] GET, UMR CNRS / IRD / UPS – UMR 5563 du CNRS, UMR234 de l'IRD, 31400 Toulouse, France.
santiago.yepez@get.omp.eu, frederic.christophoul@get.omp.eu, alain.laraque@ird.fr,
[2] IMF - UCV Instituto de Mecánica de Fluidos, Caracas 1041-A, Venezuela. author2@unitn.it
bartoloraf@gmail.com, lopezjoseluis7@gmail.com
[3] University of Napoli Federico II, 80138 Napoli, Italy
carlo.gualtieri@unina.it

1. Introduction

The Orinoco River is the third largest flow-discharge-river in the world with an average water flow of 37,600 m^3s^{-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 (Figure 1). 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 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 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).

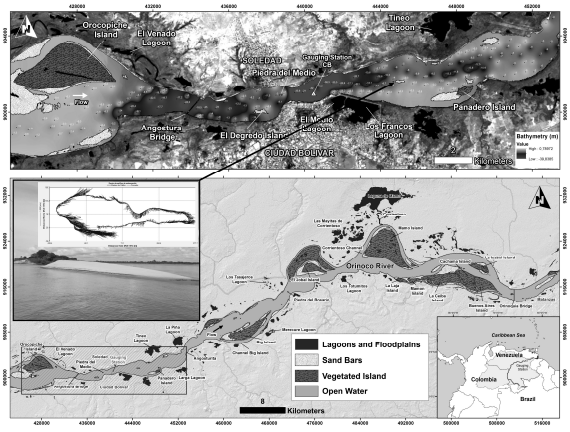

Figure 1. Study area in the Orinoco River

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 analyze the kinematic of these bed forms. 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.

2. Conclusions

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.

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