Geophysical Research Abstracts
Vol. 16, EGU2014-14843, 2014
EGU General Assembly 2014

Fluid dynamics, sediment transport and turbulent mixing at large confluences of the Amazon River

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The Clim-Amazon Project aims to study temporal sedimentary records to understand the mechanisms involved in climate and geodynamic changes and the processes involved in dissolved and suspended load evolution of the Amazon River basin from the Miocene to present. The knowledge of the present Amazon River sediment discharge and of its variability is fundamental since it can be linked to the on-going climatic and erosion processes at the regional scale. Understanding the relationships between these processes will be helpful to better interpret the observations of the past sedimentation rates. Within this general objective the aim of this study is to investigate the complex fluid dynamics, sediment transport and water quality processes occurring at the large confluences in the Amazon River, through a combination of theoretical, experimental (field) and numerical research.

In the last decades a wide body of theoretical, experimental, and field research has emerged on the fluvial dynamics of river confluences, which are integral and ubiquitous features of river networks. Through this research substantial advances have been made into understanding the hydrodynamics and morphodynamics of river confluences which will be outlined here. However, to date most experimental studies have focused either on laboratory confluences or on small to medium sized natural confluences, whereas an extremely limited number of investigations about the confluences on large rivers. Presently little is understood about how river confluence hydrodynamics may vary with the size of the river, especially in the largest rivers. The Amazon River is the largest river in the World, with approximately 15,000 sub-branches joining the Amazon River within the Amazon Basin including some of the largest confluences on Earth. A study region containing three of the larger confluences between Manacapuru and Itacoatiara will be used as part of this study, with the primary focus being the confluence of the Rio Negro and Rio Solimões.

The primary objective of this study is to develop a conceptual model for flow dynamics and sediment transport about such large confluences through analysis of field data, to assist with general objectives of the Clim-Amazon Project and improve general understanding of large confluence dynamics. While another objective is to apply CFD methods based on field measurements to improve the understanding of the dynamical processes that determine water quality parameters and sediment transport, mixing and accumulation at the confluences of large rivers such as the Amazon River. Therefore the main focus of this presentation will be the proposed field methodology for collecting hydrodynamic, sediment transport, water quality and bathymetric data about these large confluences within the study region of the Amazon River. As well as how the data collected during these field measurements will be analysed and used to develop conceptual and numerical models of such large confluences.