Geophysical Research Abstracts
Vol. 19, EGU2017-9406, 2017
EGU General Assembly 2017

On the role of flood wave celerity-discharge relationship and its applications on hydrological studies

Ayan Fleischmann, Walter Collischonn, Pedro Jardim, Aline Meyer, and Rodrigo Paiva
Institute of Hydraulic Research, Federal University of Rio Grande do Sul, Porto Alegre, Brazil (rodrigo.paiva@ufrgs.br)

The non-linear relationship between flood wave celerity (C) and discharge (Q) plays an important role on defining how flood waves are routed through the river network. The behavior of this curve is driven by cross section geometry, which leads to increasing celerity with discharge in rivers without floodplains. In reaches with floodplain storage, C may decrease after bankfull Q. Thus, in a set of studies we investigate the effects of C x Q relationships on the basin hydrological response. (i) We studied these curves for several Brazilian river reaches, and analyzed to which extent they are related to river channel geometry and other characteristics (e.g., slope, width, drainage area and sinuosity). (ii) It is shown through empirical, analytical and numerical experiments how C x Q relation affects hydrograph skewness, and how the decreasing relationship existent in rivers with important floodplain storage leads to negatively skewed hydrographs, such as in the Amazon and Pantanal regions, which could be used to infer important floodplain processes (e.g., presence of overbank flow wetlands, which feature negatively skewed hydrographs or interfluvial wetlands not directly connected to rivers). (iii) Finally, we found that it is possible to use these concepts to calibrate the effective bathymetry of a hydrodynamic model by fitting the C x Q relationship using SCE-UA optimization method. Our results show how important it is to investigate the non-linear hydraulic processes occurring throughout river basins to understand the overall hydrological response, and propose new frameworks to assist such studies, including the evaluation of hydrograph skewness and estimation of hydraulic geometry.