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Estimating the hydrodynamic and morphodynamic characteristics using Entropy theory at the confluence of Negro and Solimões Rivers

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When two mega rivers merge the mixing of two flows results in a highly complex three-dimensional flow structure in an area known as the confluence hydrodynamic zone. In the confluence zone, substantial changes occur to the hydrodynamic and morphodynamic features which are of significant interest for researchers. The confluence of the Negro and Solimões Rivers, as one of the largest river junctions on Earth, is the study area of the present research. During the EU-funded Project “Clim-Amazon” (2011-2015), velocity data were collected using an ADCP vessel operating under high and low flow conditions in different locations at that confluence (Gualtieri et al., 2019). By applying the Entropy theory developed by Chiu (1988) for natural channels and simplified by Moramarco et al. (2014), the two-dimensional velocity distribution, as well as depth-averaged velocity, were calculated at the different transects along the confluence zone, using only the surface velocities observation. The estimated data yielded 6.6% and 6.9% error percentage for the discharge data related to high and low flow conditions, respectively, and 8.4% and 8.3% error percentage for the velocity data related to high and low flow conditions, respectively. Regardless of the flow condition, these preliminary results also suggest the potential points at the confluence zone for the maximum local scouring. The findings of the current research highlighted the potential of Entropy theory to estimate the flow characteristics at the large river’s confluence, just starting from the measure of surface velocities. This is of considerable interest for monitoring high flows using no-contact technology, when ADCP or other contact equipment cannot be used for the safety of operators and risks for equipment loss.

Keywords: Amazon River, Negro/Solimões Confluence, Entropy Theory, Velocity Distribution, Local Scouring

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