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Flow mixing at the World's largest river confluence

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River confluences form key nodes within all fluvial networks and points of significant, and non-linear, changes in flow discharge, sediment grain size and bed morphology. It is generally acknowledged that the hydrodynamics and morphodynamics within the confluence zone are influenced by the junction planform, the momentum flux ratio between the merging streams, and the level of concordance between channel beds at the confluence entrance. Recent work has also identified the role of density differences between the confluent flows as potentially exerting a significant influence on fluid mixing. Perhaps the most well-known example, which has attracted considerable recent study, is at the world's largest river confluence - the Rio Solimões and Rio Negro (the Encontro das Águas), near Manaus, in the Amazonian basin.

This paper sheds new light on the patterns of mixing at the Encontro das Águas as revealed by combined multibeam echo sounder (MBES) and acoustic Doppler current profiling (aDcp) surveys. The MBES survey reveals that the scour and bed morphology at this confluence, that can be up to c. 80m deep, is dominated by the presence of Cretaceous bedrock and that the mobile bedload sediment from the Rio Solimões is confined to a narrow zone of transport. The suspended sediment plume from the Rio Solimões interacts with the bedrock, which can comprise subaqueous roughness up to 20m in height, and is consequently diverted both laterally and vertically by this topography. The aDcp surveys reveal the nature of this topographic interaction and suggest that the routing of sediment-laden fluid within the junction, and the patterns of upwelling on the flow surface, are significantly influenced by these flow-bedrock interactions. Details of the topography and these fluid dynamic interactions will be presented, together with an analysis of satellite imagery that links the longevity of the location of some of the upwellings to the presence of bedrock roughness.