Geophysical Research Abstracts
Vol. 21, EGU2019-6026, 2019
EGU General Assembly 2019
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Contrasting beach morphodynamics in the mud-dominated setting of the Guianas coast: the role of context and river influence

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The 1500 km-long Guianas coast, South America, is characterized by both large-scale muddy sedimentation and exposure to waves from the Atlantic. Mud supplied by the Amazon River is organized into large banks that migrate along the coast under the influence of waves and currents, separated by 'inter-bank' zones. The wave regime is distinctly seasonal. 'Bank' zones completely dissipate the wave energy transmitted shoreward, whereas inter-bank zones are commonly characterized by a relatively mud-free shoreface and by sandy/shelly beaches and cheniers that dissipate wave energy. In addition to their role in coastal protection, these deposits assure recreational and ecological functions and services, notably by providing nesting sites for marine turtles. Although the migration of mud banks along the coast entails shifting 'bank' and inter-bank zones, large estuaries can significantly influence beach morphodynamics, not only by liquefying mud, thus limiting muddy coastal sedimentation during bank phases, but also through the 'hydraulic-groyne' effect of strong outflowing river jets on waves. In order to gauge the influence of this river-jet effect on beach morphodynamics, topographic surveys were conducted on two beaches, Kourou and Yalimapo, the latter located 120 km westward, adjacent to the east bank of a large river estuary (Maroni River). Aerial photographs from May 2017 to November 2018 were used to carry out photogrammetric Structure-from-Motion analysis, based on 8 surveys for Yalimapo and 6 for Kourou at a bi-seasonal frequence. Comparison of digital elevation models highlights overall erosion of the berm line on both beaches, with erosion rates up to 1.5m in 18 mouth, and morphological modifications associated with slope changes and scarp formation that reflect morphodynamic transitions within the reflective-dissipative continuum. This net annual erosion is superimposed, however, on important seasonal variability with periods of limited erosion or accretion. Notwithstanding larger waves in the rainy season, Yalimapo beach accreted because the strong Maroni River discharge acts as a relatively efficient 'hydraulic groyne' that limits wave influence. Kourou beach, on the other hand, was dominated by 'normal' erosion during the high wave-energy rainy season. These differences highlight the importance of river jets and local context in influencing the susceptibility of beaches to erosion on the mud-dominated coast of the Guianas.