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SINUOSITY CHANGES AROUND AN ARTIFICIAL CONSTRICTION IN A MEANDERING RIVER: THE BERMEJO RIVER CASE (ARGENTINA)

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ABSTRACT

The Bermejo River is a tropical stream flowing from the Andean Mountains to the Paraguay River through the plains of the South American's Chaco. Near Lavalle Port (25º 40' lat. S and 60º 10' long. W), its channel has a meandering pattern with slopes in the order of 20 cm/km, a mean bankfull width of 240 m, and fine-to-very fine sand bed. Mean discharges for low and flood stages are ca. 60 m^3/sec and 1200 m^3/sec, respectively. Due to its large sediment transport the Bermejo has the most intense morphodynamics of the Argentinian plain rivers, and is one of the lowland alluvial streams with more specific solid discharges in the world. The suspended sediment concentration for flood stages at Lavalle Port averages 15,000 ppm. The channel stability in a 65 km-long valley reach around Lavalle Port was studied by means of historical cartography analysis (maps, satellite images and air photographs) and geomorphic field work. The geo-corrected positions of the Bermejo channel axis were sketched for 8 years starting from 1945, via low scaled data (1:100,000); five additional records of a 10 km-long reach scaled at 1:50,000 were also considered. All the meander shift types were identified in the studied reaches, i.e., meander expansion and translation, bend rotation, changes to compound meanders, and neck and chute cut-offs. Moreover, reactivation of abandoned meanders was also observed. These river shifts prompted variations of the channel length between 111 to 131 km (sinuosity, P: 1.71 to 2.02) during the last 60 years, with mean maximum rates of meander migration of ca. 600 m/year. Major channel displacements near 950 m/year, were related to cut-off phenomena. The morphologic result is a recent belt of meander-axis shifts with mean width of 1900 m. The bridge of the National Road 95 near Lavalle Port was constructed between 1968 and 1976 with lateral embankments in a (cut-off formed) straight reach of the river. The original bridge span of 285 m was recently widened to 400 m, because of the damages caused by the channel shiftings at the upstream reach. The straight reach downstream the bridge remained stable after its construction with a length of ca. 4 km. This length increased suddenly to 8 km during the eighties, when the maximum recorded floods occurred. Since that period the length of the reach remains without major changes. The opposite river behavior observed at both sides of the bridge could be related with a disequilibrium in the sediment supply during both the flood and low stages. The artificial constriction apparently acted like a dam during the high water levels promoting sedimentation upstream of the bridge, and channelized bed-lowering downstream. During low water stages, the upper reach slope would exceed the limit necessary to convey the water and sediment input and meandrification processes became the mechanism to decrease the energy excess.

Key words**:** river sinuosity – local constriction – meander shift – Bermejo River