Maximum outer-bank velocity reduction for vane-dike fields installed in channel bends

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Abstract. Hydraulic conditions associated with channel bends in meandering rivers include secondary, helical currents and increased erosion at the streambank on the outer channel. Such outer-bank erosion may result in undesired plan-form migration of the stream course, placing valuable land holdings or infrastructure in jeopardy. A type of instream transverse rock structure, the vane dike, has been installed in field scenarios to mitigate problematic hydraulics associated with meandering river bends. Flows around vanes and similar structures have been modeled extensively in the past, both physically and numerically; yet, guidelines for the installation of vane dikes in series optimizing key state parameters are still unrealized and application of previous results are generally site specific. Emphasizing the stabilization of the upper reaches of the Rio Grande River near Cochiti Dam, two scaled channel bends were physically modeled with installed vane-dike fields. Structure plan form angle, spacing, and length were altered between testing configurations and comprehensive data collection was performed. The reduction of the outer-bank velocity magnitude was quantified and non-dimensionalized for each tested vane-dike configuration. An approach predicting the outer-bank velocity reduction was developed for collected laboratory data which approximates vane-dike field velocities for both channel bends with a coefficient of determination of 0.841.