

## Western Water and Power Solution Bulletin

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### CHANNEL MIGRATION MODEL PREDICTS MEANDERING OF RIVERS

*Simulation of channel meander assists in sand/gravel point bar formation and riparian corridor analyses*

#### What Is The Problem?

The migration of river channels across their floodplains and the periodic erosion of terrace banks are natural processes. These processes become especially important to people living in or near the floodplain or to organizations planning or maintaining infrastructure within or along the edge of the floodplain. Natural rates of channel migration can be accelerated, reduced or negated by human disturbance. For example, the clearing of native floodplain vegetation can accelerate the rate of channel migration, whereas the placement of rip rap or other bank protection can limit or even prevent channel migration.

Simulation of channel meandering is necessary to provide information for endangered species related habitat analyses, other instream and riparian habitat evaluations, and to predict the effect of flood flow pulses on the downstream environment.

#### What Is The Solution?

Reclamation has developed a numerical channel migration model (SRH-Meander) for predicting the future river channel alignment of meandering rivers. The model simulates river bank erosion and resulting channel migration as a function of the channel radius of curvature, stream discharge, river channel dimensions, sediment transport capacity, and bank material properties. It assumes sediment input from bank erosion is on average balanced by sediment deposition through sand and gravel point bar accretion.

#### What Are The Benefits Of This Solution?

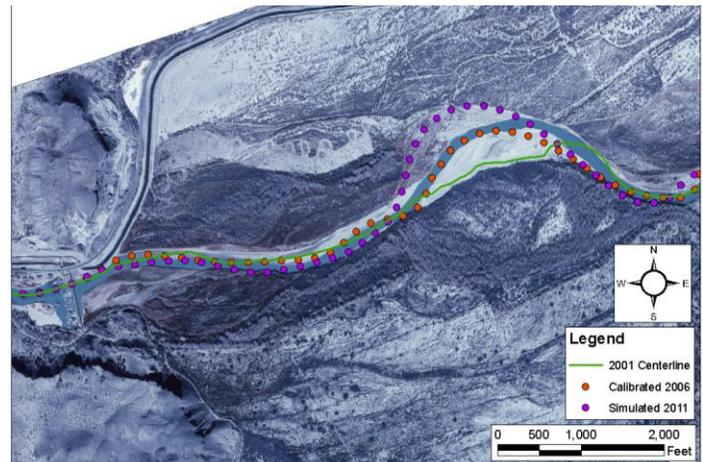
Most of the existing river simulation models measure vertical sediment deposition and erosion of the stream bed while neglecting horizontal meandering. Such models cannot simulate bank erosion on the outside of bends and the formation of point bars on the inside of channel bends.

SRH-Meander can simulate the migration of tens of miles of river channel over a period of decades using daily or hourly variations in flow. Each model simulation can be completed in a period of minutes so that a wide range of hydrologic conditions can be individually simulated and compared.

For example, the model can be used as a planning tool to evaluate the effects of alternate patterns of water releases downstream from dams and alternative land management practices. By varying the annual peak river flows, the rate and extent of channel migration can be evaluated. Also, the effects of removing bank protection along selected reaches to promote channel migration can be studied.

#### Where Have We Applied This Solution?

SRH-Meander has been applied to the Rio Grande and Sacramento Rivers. On the Rio Grande, we used SRH-Meander to estimate future locations where bank erosion may damage levees. The model was calibrated to the recent historical channel migration and then used to predict future locations of bank erosion. The model has also been applied to the Sacramento River to assess the impact of flow alterations on future channel migration. We are using the model to identify where channel migration will create new areas for cottonwood establishment.



2006 aerial photograph with initial Rio Grande section channel alignment, calibrated alignment and predicted 2011 alignment

#### Future Development Plans

Additional research is needed to develop and implement criteria for the occurrence of meander-bend cutoffs. Future versions of the model could track the age of floodplain and terrace vegetation over time. As the model simulates the creation of point bars along the inside curves of meander bends, the model could also simulate the growth of vegetation on these point bars.

#### More Information

<http://www.usbr.gov/pmts/sediment/model/srh1d/meander/index.html>

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#### Collaborators

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