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Numerical simulations of a sequence of bars in a large-amplitude meandering channel

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Morphodynamic patterns in large-amplitude meandering channels have been investigated experimentally, mainly for configurations presenting two forced bars per meander bends [1]. Nevertheless, curved channels with three or more bars per bend have been poorly studied.
Theoretically, the development of a sequence of alternate riffles and pools in the downstream direction in a bend can bed due to (i) an overshoot response to a first riffle-pool unit in the bend; (ii) a forcing effect of the curved planform; or (iii) in response to an instability of the flow throughout the curved planform [2, 3]. For this case, pools and riffles do not occur successively on opposite sides of the channel as is observed in straight configurations. Instead, bars present a "shingled" appearance, with the same sense of curvature.
In this work, the Telemac-Mascaret modelling system [4] is used to simulate the origin, short-term and long-term development of a sequence of bars in large-amplitude meanders with fixed boundaries, based on an experiment research conducted in symmetric sine-generated meanders channel of large-amplitude by Whiting and Dietrich [2, 3].
Numerical simulations based on the solution of the full 3D Navier-Stokes equations, previously averaged in the sense of Reynolds, coupled to a morphodynamics model are performed and compared with experimental data from Whiting and Dietrich [2, 3] and results obtained with a depth-averaged 2-D model with appropriate parameterizations of relevant 3-D effects.

[1] Kinoshita, R., An investigation of channel deformation in the Ishikari River (in Japanese), report, Bur. of Resour., Dep. of Sci. and Technology, 174pp., Tokyo, 1961.
[2] Whiting, P. J., and W. E. Dietrich, Experimental studies of bed topography and flow patterns in large-amplitude meanders, 1 Observations, Water Res. Res., vol. 29, No. 11, Page 3605-3614, Nov. 1993.
[3] Whiting, P. J., and W. E. Dietrich, Experimental studies of bed topography and flow patterns in large-amplitude meanders, 2 Mechanisms, Water Res. Res., vol. 29, No. 11, Page 3615-3622, Nov. 1993.
[4] www.opentelemac.org