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Abstract title: Experimental and numerical assessment of transient stream–aquifer exchange during disconnection

Understanding the state of connection processes of stream–aquifer systems is of great interest for water resources management, particularly in semi-arid regions and where groundwater is extracted in the vicinity of a river bank. Here we present a combined experimental–numerical study to explain physical processes involved in disconnected stream–aquifer systems. A stream–aquifer sand box was built to measure the infiltration rate through the stream bed during aquifer drainage. The pressures in the saturated zone of the aquifer and the infiltration rate were measured in order to quantify the fluid flow in this system. The transient transitional stage between connected and disconnected flow regimes, which was obtained experimentally, is characterised by a maximum infiltration rate across the stream bed before a decrease towards a constant value. This behaviour is analysed by means of transient numerical simulations using relevant hydrodynamic parameters. The importance of the drainage kinematics and unsaturated zone parameters for the temporal variation of the infiltration rate is demonstrated. The possible occurrence of a maximum infiltration rate value during the transitional stage is characterised into a general view of the stream–aquifer disconnection with direct implications for pumping near a stream.