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Process-Based Stochastic Modeling of Meandering Channelized Reservoirs

Processes leading to fluvial sedimentation are highly discontinuous both in time and space, with the result that fluvial strata often show a great heterogeneity of facies. Now, most stochastic models only try to reproduce this spatial heterogeneity without considering sedimentary processes. Yet, fully process-based models often lack the flexibility of their stochastic counterparts. We propose to combine both approaches to model meandering channelized reservoirs limiting the number of key parameters to keep the approach operational. Rules of floodplain evolution are derived from river mechanics and data describing dominant floodplain processes. The model is then able to represent such features as point-bars, overbank deposits, crevasse-splays, and avulsions, each deposit being genetically linked with its neighbors. Once the effects of the parameters of the model are understood, some are considered to be stochastic processes with specific spatial and temporal structure: several realizations can then be produced. Some temporal trends can also be imposed to simulate periods of incision, varying accommodation space or hydraulic conditions, frequent or rare overbank flooding… The influence of these parameters is observed through morphological changes of the whole system. Finally, channel migration is given a stochastic component through the erodibility of the riverbanks, which is used to constrain the location of the simulated deposits. Realistic 3-D representations of fluvial deposits are obtained, enabling detailed reservoir characterization. Current work is now focusing on accurate well conditioning.