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Testing the tectonic significance of sinuosity changes- The Maas river in the Roer Valley Rift System

Ronald Van Balen and Cornelis Kasse

Earth Sciences, Vrije Universiteit, Earth Sciences, Climate change and landscape dynamics, Amsterdam, Netherlands (ronald.van.balen@falw.vu.nl)

Faults can affect the meandering pattern of a river in two ways: 1) by inducing differences in bedrock and bank lithology via the lithology of the subsurface (passive mechanism), 2) by changing the fluvial gradient through active fault displacement (active mechanism). The last mechanism is of special interest since the identification of active faults may help the assessment of earthquake hazards. However, few studies have addressed this topic. The meandering Maas river in the Roer Valley Rift System crosses active faults, for which independent geologic, geomorphic, geodetic, and seismic constraints are available, providing an excellent case study. At a large-scale the Maas can be subdivided in to four zones of different sinuosity. The boundaries of three of the four zones coincide with important faults in the subsurface. However, the sinuosities in the zones are not in agreement with the displacements of the faults, nor the tilting of the fault-bounded blocks. Since discharge changes and variations in bedload grainsize can als be discarded as possible causes, we conclude that the meandering pattern changes are caused by a combination of bedrock changes and changes in valley gradients caused by ongoing incision. At the scale of individual loops faults been identified which do have an impact on sinuosity. One previously unknown active fault has been identified. However, some active faults have no impact. We hypothesize that this is caused by the limited lifetime of fault-affected loops (tens to hundreds of years following a faulting event), just like other meander loops. In addition, they are in competition with the vertical response to faulting of the river, i.e. incision and aggradation.