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Synthetic Earthquake Statistics From Physical Fault Models for the Lower Rhine Embayment

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As of today, seismic risk and hazard estimates mostly use pure empirical, stochastic models of earthquake fault systems tuned specifically to the vulnerable areas of interest. Although such models allow for reasonable risk estimates they fail to provide a link between the observed seismicity and the underlying physical processes. Solving a state-of-the-art fully dynamic description set of all relevant physical processes related to earthquake fault systems is likely not useful since it comes with a large number of degrees of freedom, poor constraints on its model parameters and a huge computational effort. Here, quasi-static and quasi-dynamic physical fault simulators provide a compromise between physical completeness and computational affordability and aim at providing a link between basic physical concepts and statistics of seismicity. Within the framework of quasi-static and quasi-dynamic earthquake simulators we investigate a model of the Lower Rhine Embayment (LRE) that is based upon seismological and geological data. We present and discuss statistics of the spatio-temporal behavior of generated synthetic earthquake catalogs with respect to simplification (e.g. simple two-fault cases) as well as to complication (e.g. hidden faults, geometric complexity, heterogeneities of constitutive parameters).