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New insights on the apparent background seismicity biased by undetected earthquakes

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The purpose of this work is to provide a new theoretical treatment of the impact of unobserved seismicity within the framework of triggering models. Specifically, by analyzing the branching structure of an ETAS model, we deepen some issues regarding the bias produced by unobserved seismicity (below the detection/completeness magnitude threshold) on estimation of branching ratio and of background seismic rate. We complete our theoretical treatment with some empirical studies on simulated catalogues. Unlike results obtained by recent studies, we find that, by taking into account the level of detection of present networks, the ETAS model is usually able to recognize the real background seismic rate. This finding opens a new perspective to establish a correlation between the spatio-temporal evolution of background seismicity occurrence and the underlined physical processes, as tectonic loading, fluid intrusion or magma motion.