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# Dependence of the Omori p-value on mainshock magnitude in rate-and-state friction models

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Recently, it has been shown that stress heterogeneities are able to explain aftershock activity, especially those observed in stress shadows such as within the mainshock rupture. Here we will show that the same model predicts an increasing aftershock density and an increasing Omori p-value for increasing mainshock magnitudes as a result of scale-invariant slip on faults. We find that both predictions are in good agreement with recent observations. However, even for large mainshock magnitudes, these rate-and-state friction models cannot account for p-values larger than 1 which is not in agreement with observations where p-values above one are frequently found. We show that in the case of bimodal stress distributions, which might be expected for crack-like earthquake ruptures, larger p-values can be explained by local stress unloading due to the aftershocks. In a mean field approach, the stress unloading would not affect the p-value, however, the non-linearity of the state-evolution leads to values $p>1$ if localized stress changes are considered.