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Triggering cascades and statistical properties of aftershocks

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With a general statistical procedure for identifying aftershocks, we investigate their statistics for a high-resolution earthquake catalog covering Southern California. By comparing our results with those from other definitions of aftershocks, we discover that many features depend on how one defines aftershocks. The differences in the results include the temporal variation in the rate of aftershocks and the spatial distribution of aftershocks at large distances. We also discuss why the mean aftershock distance is not a good descriptor of the seismic process. Nevertheless, other features are robust, suggesting that they truly characterize aftershock sequences. These include the p-values in the Omori-Utsu law for large main shocks, Båth's law, the productivity law with an exponent smaller than the b-value in the Gutenberg-Richter law, and the identification of the most likely distance of aftershocks from the main shock with the rupture length. Moreover, we find that the exponent p in the Omori-Utsu law does not vary significantly with main shock magnitude.