



## Multiscale spatio-temporal determination of the b-value

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The estimation of the spatial and temporal variations of the Gutenberg-Richter b-value is of great importance in different seismological applications. One of the problems affecting its estimation is the heterogeneous distribution of the seismicity which makes its estimate strongly dependent upon the selected spatial and/or temporal scale. This is especially important in volcanoes where dense clusters of earthquakes often overlap the background seismicity. Proposed solutions for estimating temporal variations of the b-value include considering equally spaced time intervals or variable intervals having an equal number of earthquakes. Similar approaches have been proposed to image the spatial variations of this parameter as well. We propose a novel multiscale approach, based on the method of Ogata and Katsura (1993), allowing a consistent estimation of the b-value regardless of the considered spatial and/or temporal scales. Our method, named MUST-B (MULTiscale Spatial and Temporal characterization of the B-value), basically consists in computing estimates of the b-value at multiple temporal and spatial scales, extracting for a give spatio-temporal point a statistical estimator of the value, as well as an indication of the characteristic spatio-temporal scale. This approach includes also a consistent estimation of the completeness magnitude ( $M_c$ ) and of the uncertainties over both b and  $M_c$ . We applied this method to example datasets for volcanic (Long Valley Caldera) and tectonic (Central Italy) areas as well as for induced seismicity zones and an example application at global scale.