Multiscale spatio-temporal analysis of seismicity: application to the 2016-2017 seismic sequence in Central Italy

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The estimation of the spatial and temporal variations of the b-value of the Gutenberg-Richter law is of great importance in different seismological applications. However, its estimate is strongly dependent upon the selected spatial and/or temporal scale due to the heterogeneous distribution of the seismicity.

For this reason, we propose a novel multiscale approach 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 estimation 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.

The b-value has shown relevant spatial and temporal variations during the 2016-2017 seismic sequence in Central Italy (more than 90.000 earthquakes), especially around the mainshocks: Amatrice Mw=6.0 on August 24th 2016, Ussita Mw=5.9 on October 26th, Norcia Mw=6.5 on October 30th and Capitignano Mw=5.5 on January 18th 2017. In particular we observed a marked drop of the b-value after the Amatrice and Capitignano mainshocks. Furthermore, we detected spatial and temporal spots of high b-value, possibly associated with fluid-driven swarms.