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# Cultural noise and the night-day asymmetry of the seismic activity recorded at the Bunker-East (BKE) Vesuvian Station

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## Abstract

Mazzarella and Scafetta (2016) showed that the seismic activity recorded at the Bunker-East (BKE) Vesuvian station from 1999 to 2014 suggests a higher nocturnal seismic activity. However, this station is located at about 50 m from the main road to the volcano's crater and since 2009 its seismograms also record a significant diurnal cultural noise due mostly to tourist tours to Mt. Vesuvius. Herein, we investigate whether the different seismic frequency between day and night times could be an artifact of the peculiar cultural noise that affects this station mostly from 9:00 am to 5:00 pm from spring to fall. This time-distributed cultural noise should evidently reduce the possibility to detect low magnitude earthquakes during those hours but not high magnitude events. Using hourly distributions referring to different magnitude thresholds from  $M = 0.2$  to  $M = 2.0$ , the Gutenberg–Richter magnitude-frequency diagram applied to the day and night-time sub-catalogs and Montecarlo statistical modeling, we demonstrate that the day-night asymmetry persists despite an evident disruption induced by cultural noise during day-hours. In particular, for the period 1999-2017, and for earthquakes with  $M \geq 2$  we found a Gutenberg–Richter exponent  $b = 1.66 \pm 0.07$  for the night-time events and  $b = 2.06 \pm 0.07$  for day-time events. Moreover, we repeat the analysis also for an older BKE catalog covering the period from 1992 to 2000 when cultural noise was not present. The analysis confirms a higher seismic nocturnal activity that is also characterized by a smaller Gutenberg–Richter exponent  $b$  for  $M \geq 2$  earthquakes relative to the day-time activity. Thus, the found night-day seismic asymmetric behavior is likely due to a real physical feature affecting Mt. Vesuvius.

Keywords: Mt. Vesuvius; Seismic Activity; Cultural noise; Diurnal oscillation

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