



Evidences for higher nocturnal seismic activity at the Mt. Vesuvius

Nicola Scafetta & Adriano Mazarella

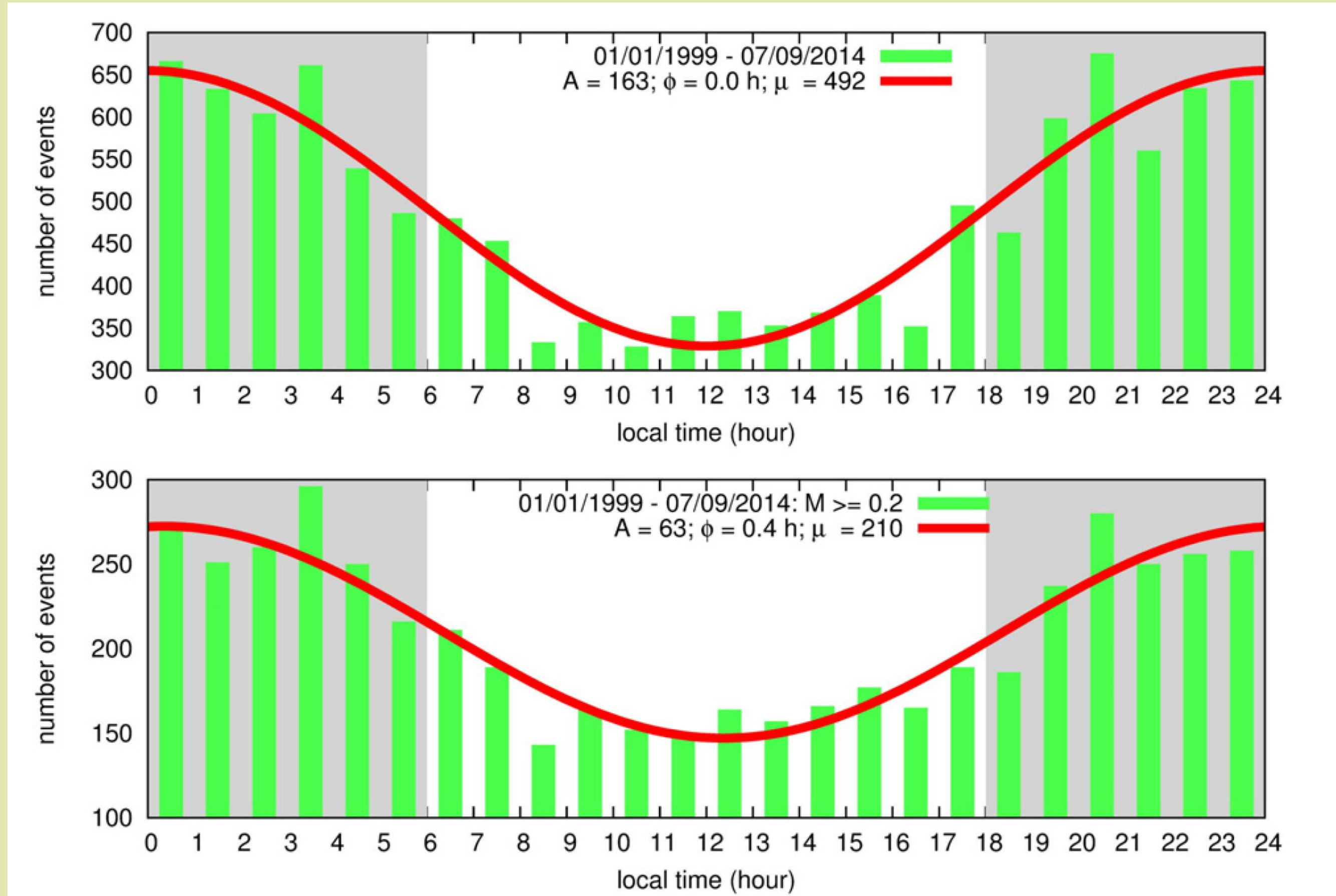
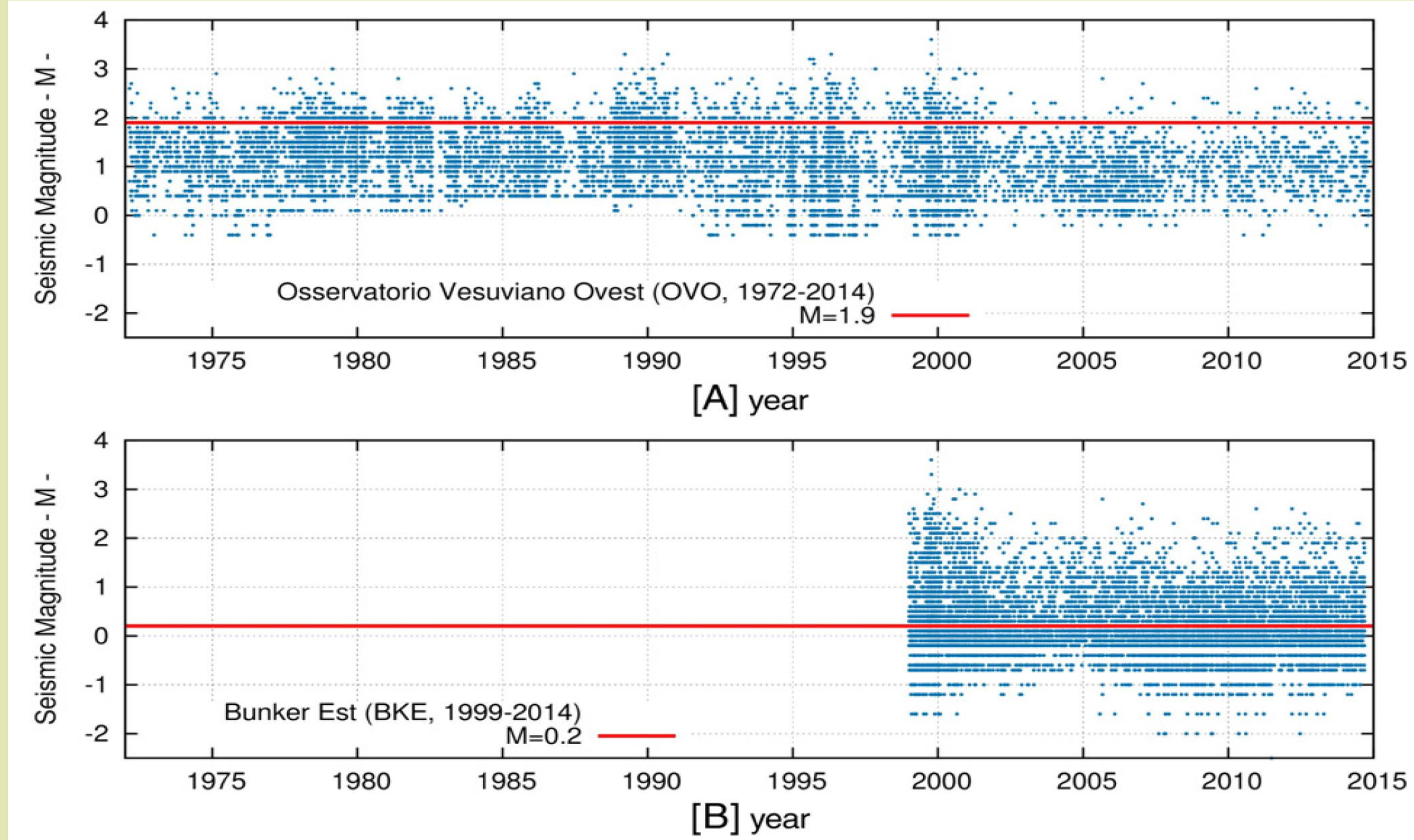
Department of Earth, Environmental and Resources Science, University of Napoli Federico II, Napoli, Italy

(nicola.scafetta@unina.it)

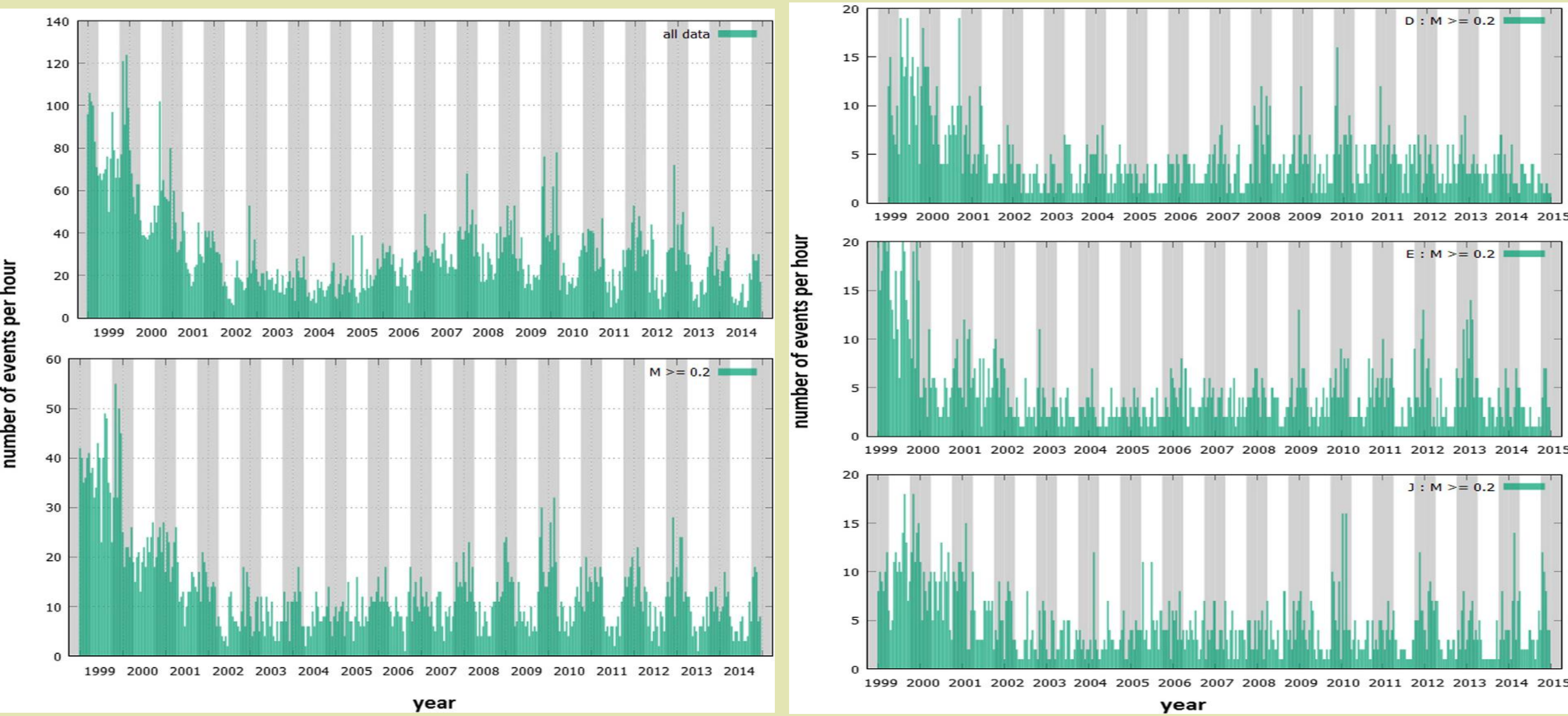
ABSTRACT

We analyze hourly seismic data measured at the Osservatorio Vesuviano Ovest (OVO, 1972–2014) and at the Bunker Est (BKE, 1999–2014) stations on the Mt. Vesuvius. The OVO record is complete for seismic events with magnitude $M \geq 1.9$. We demonstrate that before 1996 this record presents a daily oscillation that nearly vanishes afterwards. To determine whether a daily oscillation exists in the seismic activity of the Mt. Vesuvius, we use the higher quality BKE record that is complete for seismic events with magnitude $M \geq 0.2$. We demonstrate that BKE confirms that the seismic activity at the Mt. Vesuvius is higher during nighttime than during daytime. The amplitude of the daily oscillation is enhanced during summer and damped during winter. We speculate possible links with the cooling/warming diurnal cycle of the volcanic edifice, with external geomagnetic field and with magnetostriction, which stress the rocks. We find that the amplitude of the seismic daily cycle changes in time and has been increasing since 2008. Finally, we propose a seismic activity index to monitor the 24-hour oscillation that could be used to complement other methodologies currently adopted to determine the seismic status of the volcano to prevent the relative hazard.

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[1] The seismic events recorded at the Osservatorio Vesuviano Ovest (OVO, 1972–2014) and [B] at the Bunker Est (BKE, 1999–2014) stations on the Mt. Vesuvius.
[2] [A] Hourly histogram of the seismic data measured at the BKE Vesuvius station from 1999 to 2014. [B] Subset containing only events with magnitude $M \geq 0.2$ for which the catalog is complete. The gray shadow refers to the nighttime.

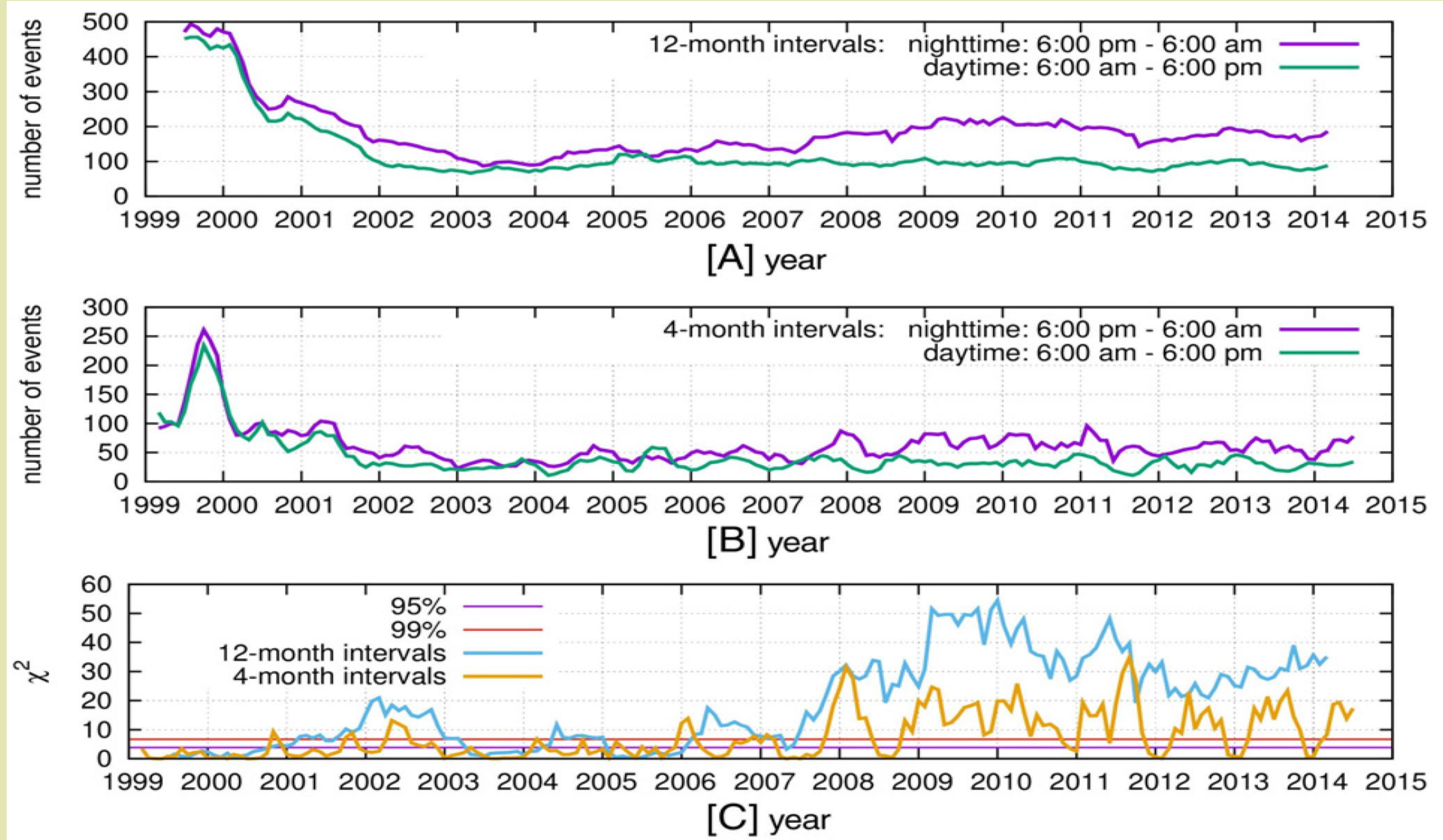


Seasonal cycle computed starting from the catalog containing 5035 earthquakes with magnitude $M \geq 0.2$ and relative to 1/1/1999–7/9/2014 interval.

Number earthquakes	Lloyds season	Amplitude	vpe	Phase (°)	Max of occurrence (h)	Hourly mean	A/vpe (confidence level)
1622	D (J,F,N,D)	25.3	3.7	95.4	23.6	5.6	6.8 (>99%)
1714	E (M,A,S,O)	38.0	4.5	81.2	0.6	5.9	8.4 (>99%)
1699	J (M,J,J,A)	27.3	4.7	81.3	0.6	5.9	8.9 (>99%)

Seasonal cycle computed starting from the catalog containing 1655 earthquakes with magnitude $M \geq 0.2$ and relative to 8/11/2008–7/9/2014 interval.

Number earthquakes	Lloyds season	Amplitude	vpe	Phase (°)	Max of occurrence (h)	Hourly mean	A/vpe (confidence level)
565	D (J,F,N,D)	32.9	6.5	94.3	23.7	2.0	5.1 (>99%)
557	E (M,A,S,O)	65.7	10.5	84.4	0.4	1.9	6.3 (>99%)
533	J (M,J,J,A)	62.7	9.9	74.8	1.0	1.9	6.3 (>99%)



[3] [A] Sequence of 24-hour histogram of the seismic data measured at the BKE Vesuvius station for each year from 1999 to 2014. [B] Subset containing only events with magnitude $M \geq 0.2$ for which the catalog is complete.
[4] [A] Sequence of 24-hour histogram of the seismic data measured at the BKE Vesuvius station for each year from 1999 to 2014 for the winter D months. [B] and [C] like [A] for the equinoxes (E) and summer (J) months.
[5] [A] Number of BKE seismic events for $M \geq 0.2$ occurred during nighttime (6:00pm–6:00 amLT) and during daytime (6:00pm–6:00 amLT) for 12-month intervals. [B] As in [A] for 4-month intervals. The 12-month and 4-month intervals move by 1-month step. [C] χ^2 curves relative to each interval in the two cases against the 95% and 99% confidence levels.