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A first look at the ground motion characteristics unveiled by accelerometric data: the case of Campi Flegrei area (Italy)

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Campi Flegrei is a volcanic region in Southern Italy of great interest for volcanic risk due to the presence of a potentially dangerous caldera collapse structure in a very densely populated area. In historical times, the Campi Flegrei area experienced explosive eruptions (the most recent – the Monte Nuovo eruption, 1538 CE), and in recent times (from 1969 to 1972 and from 1982 to 1984) critical seismic activity and bradyseism crises. Since 2020 the increase of seismicity related with the acceleration of ground uplift is a matter of the scientific and civil protection debate, given the vulnerability of the urban settlements under the effect of the volcanic phenomena. The recent bradyseism crisis climaxed in September 2023, with a high number of seismic events per month (1000 events per month) and a maximum magnitude (Md) of 4.2— the strongest event recorded in the last forty years. In general, predicting attenuation law in volcanic areas poses a significant challenge due to the limited availability of strong motion records, the predominance of lower magnitude events, and the distinct characteristics of waveforms compared to tectonic earthquakes. Moreover, additional challenges arise from the potential anisotropic behavior of the area, which could lead to high seismic impact for specific directions of seismic wave propagation. This makes it difficult to establish predictive models for ground motion, hindering the development of reliable risk scenarios and the effective implementation of civil protection measures. Since September 2023, the Civil Protection Department started improving the station coverage of the accelerometric network (RAN, Rete Accelerometrica Nazionale) by installing 3 new seismic stations along coastal areas and around Pisciarelli locality. The accelerometric data, recorded from the 18th of September 2018 to the 4th of October 2023 by 12 accelerometric stations of the RAN, fill a gap of information and represent an important contribution in adding new constraints to ground motion characterization. Specifically, we analyzed 3771 three-component records whose 186 exhibit a magnitude exceeding 3.5. We derived the engineering interest parameters (e.g., Peak Ground Acceleration, PGA; Peak Ground Velocity, PGV; Housner Intensities, HI; Arias Intensities, AI; significant duration, Td; Spectral accelerations) and compared them with the available ground motion prediction equations defined in the tectonic and volcanic

areas in Italy and abroad. For the two events >= 3.8 we perform a comprehensive analysis. Our results unveil a trend similar to that predicted in the ground motion prediction equations in the near field but with a steeper attenuation recorded beyond approximately 5 km of distance. Furthermore, a relevant result is the existence of elevated peaks in PGA (Peak Ground Acceleration) at considerable distances also for low magnitude values underscoring the potential existence of preferential directions in propagation. These findings are crucial for understanding the region's seismic impact and enhancing risk assessment and civil protection strategies in this densely populated volcanic area.