Review #1

Line 20: we added "Digital Surface Model (DSM)" as suggested by Review

Line 73: we added sentences as suggested by reviewer due to the multidisciplinary monitoring approaches. " Multidisciplinary monitoring approaches have been used in different MVs in the world; more recently at Lusi Mud Volcano during and after the 2006 eruption. The last few years of activity have been characterized by periodic short-lived eruptive bursts. In May and October 2011, it was documented the activity with high-resolution time-lapse photography, open-path FTIR, and thermal infrared imagery (Vanderkluysen et al., 2014). Different geochemical surveys have been carried in 2006 by Sciarra et al., 2016, monitoring the soil gas concentration (222Rn, CO_2, CH_4) in the Sidoarjo district (Eastern Java Island, Indonesia).

Linea 85: we have replaced "provoking" with "causing" as suggested by Review.

Linea 88: we have replaced "repose" with "dormancy" as suggested by Review.

Line 94: space "of drone".

Line 102 to 107: we rewrote the sentences as suggested "Santa Barbara and Aragona MVs areas are located in the central and south-west sector of the Sicily Region respectively, inside the Caltanissetta Basin (locations in Fig. 1). These two areas, consisting of Late Miocene to Pleistocene accretionary prism, have been formed simultaneously with the Tyrrhenian Sea opening, during the convergence between the African and Eurasian plates in the Neogene-Quaternary (Catalano et al., 2000b), reaching a deposit thickness of the order of some km".

Line 119, Figure 2: we added A and B and standardized the font size.

Lines 163-165: we combined the 2 sentences "A general uplift of the area around the mud volcano, together with the presence of variable fractures with horizontal and vertical rejections were observed (DRPC report, 2008). During the period just before the paroxysmal event, from December 2007 to August 2008, Cigna et al., (2012) recorded up to 3–5 cm of progressive movements accumulating in the direction towards the satellite with the Satellite-based synthetic aperture radar interferometry method".

Line 178: we added references and rewrote the sentence as follow "The paroxysmal event lasted several minutes and was anticipated by a telluric event (Madonia et al., 2011) occurred a few hours before in the whole Terrapelata area and, contemporaneously, in the neighbouring area of St. Anna. According to Madonia et al., 2011, in august 2008, 5 earthquakes occurred with magnitudes ranging from 1.7 to 2.4 in the radius of 10-55 km form the sites"

Line 189: we changed the sentence as suggested, "The activity of the Maccalube of Aragona, according to Greek, Roman and Arab historical evidences, have occurred at least for 2,500 years".

Line 245: we added the sentence "It could be lethal to human life if breathed in high concentrations, It is a toxic, corrosive, irritant and colorless gas with the characteristic unpleasant smell of rotten eggs. It can cause chronic diseases of the respiratory organs through prolonged exposure even at very low concentrations; at concentrations of 200-250 ppm it can cause pulmonary edema and risk of death, while at 1,000 ppm it is immediately lethal (NIOSH, 1981)"

Line 278, Figure 4: we added A and B.

Line 288: we have replaced "at first" with "starting" as suggested by Review.

Line 289: we have replaced "With the aim" with "By using" as suggested by Review.

Line 293, Figure 5: we added A and B.

Lines 297-298: we rewrote the sentence "Secondly, through the elaboration in ArcGis 10.5, we created from each emission points checked in 2017, different omni-directional buffer circumferences, considering an increase in distance of + 30% respect to the greatest historical distance reached, due to the creation of the safety limits in both areas. For the hazard assessment, we elaborated 117 and 165 buffer circumferences with a radius of 180 m and 195 m at Santa Barbara and at Aragona respectively (Fig.6a and b).

Line 304 Figure 6: we added A and B.

Line 342 Figure 7: we added A and B.

Line 412: we moved the sentence at line 255 as suggested.

Review #2 – comment 1

Thanks to Giovanni Martinelli for constructive comments to our paper. We are glad for the important suggestions to the work.

1) We accepted the change of Title in: *The mud volcanoes at Santa Barbara and Aragona (Sicily, Italy): A contribution to risk assessment.*

2) *In Mellors et al., 2007, a complete catalogue for Azerbaijan mud volcano eruption has been used. The average number of eruptions per year (3.2) in the Azerbaijan catalog has remained fairly constant since 1950. For an alternate estimate of catalog completeness, they used the eruption time-of-occurrence information. They found 25 (out of 116) eruptions since 1965 have the time of eruption recorded, concluding that 4.2 eruptions per year is an upper bound on the average number of eruptions per year. Given the uncertainties, an average of 3.2 ± 1 eruptions per year seems reasonable. In our paper we have only 4 hystorical paroxysm events at Santa Barbara and only one occurred in recent time (2008). It's evident that a big gap of data occurred from 1823 to 2008.*

   For the Aragona site, the main historical events reported in our paper are 2 (1777 and 1936) and 7 (from 1998 to 2020). As for Santa Barbara, the catalogue of Aragona mud volcano paroxysms could be incomplete and different data gaps are present, mainly in the historical time. Intensity of the paroxysm events in both study areas are not very clear (we have, indirectly, only the height of the mud column). There is no intensity or magnitude of the events.

   To apply the Guttemberg-richter, within some limitations, and display them in graphs similar to Fig.5 (Kijko, 2011) or to Fig.8 in Youngs RR, Coppersmith KJ (1985), we should have a robust database consisting of at least a few hundred paroxysmal events and the size of each individual event should be well estimated. For these reasons, we cannot apply the approach that kindly Prof. Giovanni Martinelli suggested to us. We would thank him for the possible future strategies that shared with us and that will find in the next future.

   We agree with Prof. Giovanni Martinelli to continue the investigation on seismic approach to the mud volcanism study areas. In a next future, some stations will be implemented in order to collect data in

near real time mode, transmitting them to the operative monitoring room of the Palermo INGV. Our final goal is to understand properly the two mud volcanic system areas, with a multidisciplinary approach, both geochemical and geophysical.

3) Thanks for the comment. We translated it by native English mother language translator.

Review #2 – comment 2

Dear Editor,

The comment of Giovanni Martinelli is certainly correct. The availability of a complete paroxysmal events catalogue for the mud volcanism in Italy could be appropriate in order to perform a frequency occurrence analysis similar to method proposed by Mellors et al., 2007. For these reasons, we added in our conclusions a sentence reporting these aspects (Line 476).

According to Mellors et al., 2007, the most active volcano in the Azerbaijan region is Lokbatan, which has erupted 22 times since 1810. The time between eruptions is erratic, ranging between **2 and 27 years**. Similarly, another active volcano, Dashgil, has been active **every 6 to 37 years** in historic time […].

For the Macalube of Aragona, there is no certain knowledge on the average occurrence of the paroxysmal events due to the intrinsic incompleteness and fragmentation of historical data. However, the indication of a certain constancy of behavior seems to emerge both from what has been observed from 1998 to today, and from the fact that this recurrence well agrees with the estimates made by Fazello in 1579, who reported an event **every 5 years**. In recent times, from 1998 to 2020, the time intervals between events ranges **from 13 to 84 months**.

Our paper does not focuses on the Italian mud volcanoes, but we concentrated our analysis only on two of them located in southern Italy (Sicily) and we did not concentrate on their eruptive frequency.

Our work investigates all the available historical information in order to constrain the hazardous phenomena that could occur during a paroxysmal event, their common features and the distance reached by the erupted products former events in both areas. Our final goal was the construction, for the first time, of the possible hazard scenarios related to paroxysmal events for both the study areas in order to better define the correct risk mitigation measurements.