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The 12-13 January 2011 lava fountain of Mt. Etna volcano: total mass and grain-size evaluation of the fallout deposit

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South-East Crater (SEC) of Mt Etna, Italy, is renowned for its sequences of paroxysms, otherwise called episodic eruptions, which produced more than 150 events since 1998. Each episode typically gives rise to eruption columns and fallout deposits over distances of up to several tens of km from the vent. The last sequence consisted of twenty-five lava fountains occurred between 12 January 2011 and 24 April 2012. The 2011-12 sequence began from a pit-vent located on the eastern flank of the cone; with time, the intense and recurrent paroxysmal activity was able to build a new cone above the SEC, renamed New South-East Crater. The first episode was preceded by the resumption of Strombolian activity on 11 January 2011; late in the afternoon of 12 January, the increasing of explosion intensity and frequency led to the formation of powerful magma jets and a dense eruption column which moved toward SSW. The paroxysmal activity lasted about 1 hour and half; afterward it almost abruptly stopped early on 13 January, thus causing also the end of the eruption plume.
Based on prevalent winds blowing in the Etnean area, most of the fallout deposits from Etna disperse their tephra fallout eastward toward the Valle del Bove depression, difficulty accessible in the upper part, then reaching the Ionian Sea. These peculiar conditions usually prevent direct observation of the deposit within 5 km from and 15 km beyond the eruptive vent. The 12-13 January lava fountain fallout, conversely, was dispersed over the South of Etna, exceeding the southern coastline of Sicily and thus giving the chance to map, sample and describe for more than 100 km the tephra fallout, passing from a black scoria deposit to ash deposit (90 % of which formed by sideromelane particles). In particular, the proximal deposit (up to 5 km of distance from SEC) was composed of a continuous to almost continuous tephra blanket containing decimetric-sized scoriae to coarse lapilli, while the most distal sites were covered by highly scattered ash particles (a few grams per square meter), with mode from -4 phi (at 1 km from the vent) to 3 phi (at 103 km). Here we present results of total mass (TM) and total grain-size (TGS) of the 12-13 January fallout deposit arising by the application of different methodologies and strategies. In particular, four different methods were applied for estimating the TM: Pyle (1989), Fierstein and Nathenson (1992), Power Law (Bonadonna and Houghton, 2005) and Weibull Distribution (Bonadonna and Costa, 2012), obtaining a mean value of 1 x 108 kg. Furthermore, we considered different sectors of the deposit and evaluated TM for one or more sectors. The obtained results were hence compared each other and with the values obtained by the TM estimations using all the collected samples with different methods. A similar strategy was also applied to evaluate the TGS using the Voronoi method (Bonadonna and Houghton, 2005), that we found peaked at -3 phi. The study of the 12-13 January 2011 shows a unique opportunity for understanding the representativity of the samples collected over a fallout deposit erupted during the most common paroxysmal activity from Etna, and verifying the validity of the used methods in approximating the TM and TGS.