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Multiparametric study of Mt. Etna activity during 2010-2012: evidences from quantitative comparison of geophysical and geochemical time series

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During 2011-2012, Mt. Etna volcano was characterised by intense eruptive activity fed by a pit-crater formed between 2007-2009 on the Eastern flank of the South-East Crater (SEC). Activity consisted on 25 episodes of vigorous and short-temporal lava fountaining, which gradually made a new cone named New South-East Crater (NSEC). The eruptive sequences developed by three cycles of lava fountains of (Jan-May 2011; Jul-Nov 2011; Jan-Apr 2012), producing a total products emission of ∼50 x 106 m3 and the formation of a volcanic cone 190 m above the pre-cone surface in only 51 h of lava fountaining activity. In this study, we get insight into the volcano dynamics sequences over the 2010-2012 through a multi-parametric approach based on a quantitative comparison between seismic and gas geochemical time series. For this purpose, we use the Randomised Cross Correlation technique to compare temporal changes of volcanic tremor amplitude at EBEL station with CO_2 soil-flux by the EtnaGas network and summit bulk SO_2 flux remotely observed by the FLAME network. In detail, we filtered the vertical component of the seismic signals recorded by EBEL station in different frequency bands, computed the corresponding RMS time series and comparing the results with the CO_2 and SO_2 flux records for the same time interval. Comparisons between the time series revealed significant relationships between volcanic tremor features and degassing-eruptive activity in terms of gas emission rates. Comparable trends and the computed time-lags helped reconstruct the dynamics of the volcano in the considered period, particularly as regards the alternation between degassing and eruption stages.