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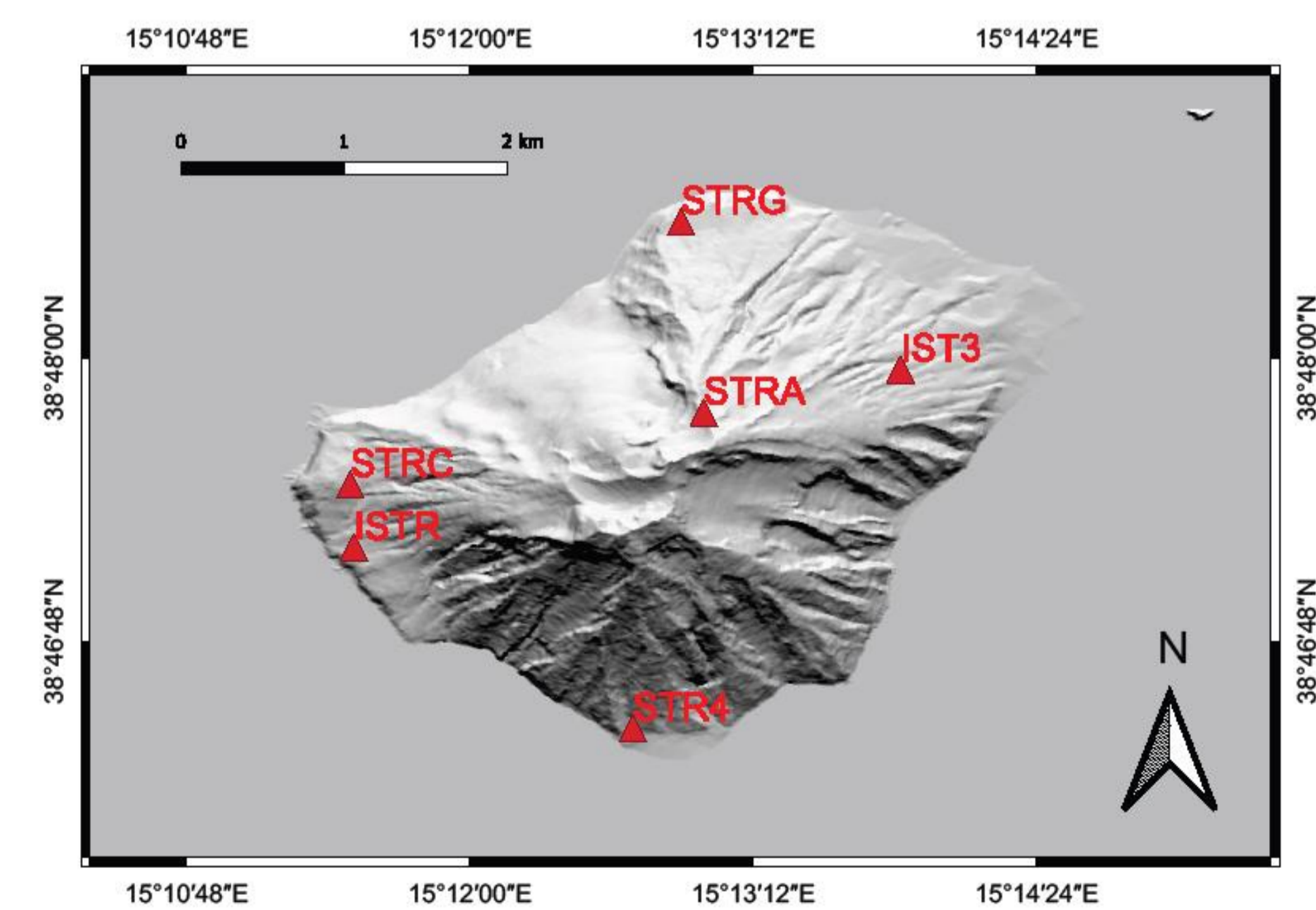
ABSTRACT

The collection of a significant catalog of seismo-volcanic data involves the selection of relevant parts of raw signals, that can be automatized by using the Short-Term over Long-Term Average (STA/LTA) method [1]. Since it is parametric, the common approach to the choice is the adoption of literature-suggested parameters. To overcome these limitations, we propose a methodology for the automatic selection of STA/LTA parameters able to optimize the extraction of local events from a seismo-volcanic raw signal.

The parameters are found by a grid search over an index named Quality-Numerosity Index (QNI) that measures the accordance in the automatic cuts and the consequent quantity of triggered seismo-volcanic events with the ones suggested by a human expert. The method was applied in the volcano domain, for the specific application of Explosion Quakes (EQs) signals extraction in Stromboli Volcano. Experiments have been conducted selecting a subset of the dataset as training where to search for the best parameters, which were subsequently adopted in a test set.

The results demonstrate that the selected parameters improve significantly the quality of the extraction when compared to those extracted by adopting the parameters indicated in the literature.

ORIGIN OF THE DATA

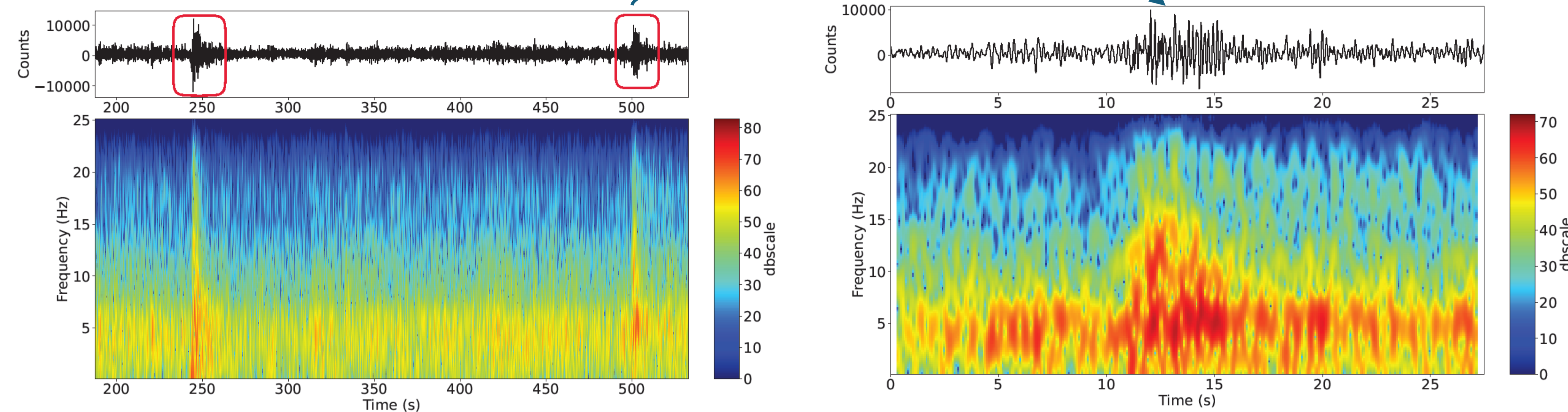


Seismic permanent network of Istituto Nazionale di Geofisica e Vulcanologia on Stromboli. Data comes from STRA seismic station (the one in the center of the image); the time range selected for the analysis is from 01 June 2019 until 14 June 2019, before the double paroxysm of the Stromboli volcano.

ACKNOWLEDGEMENTS  
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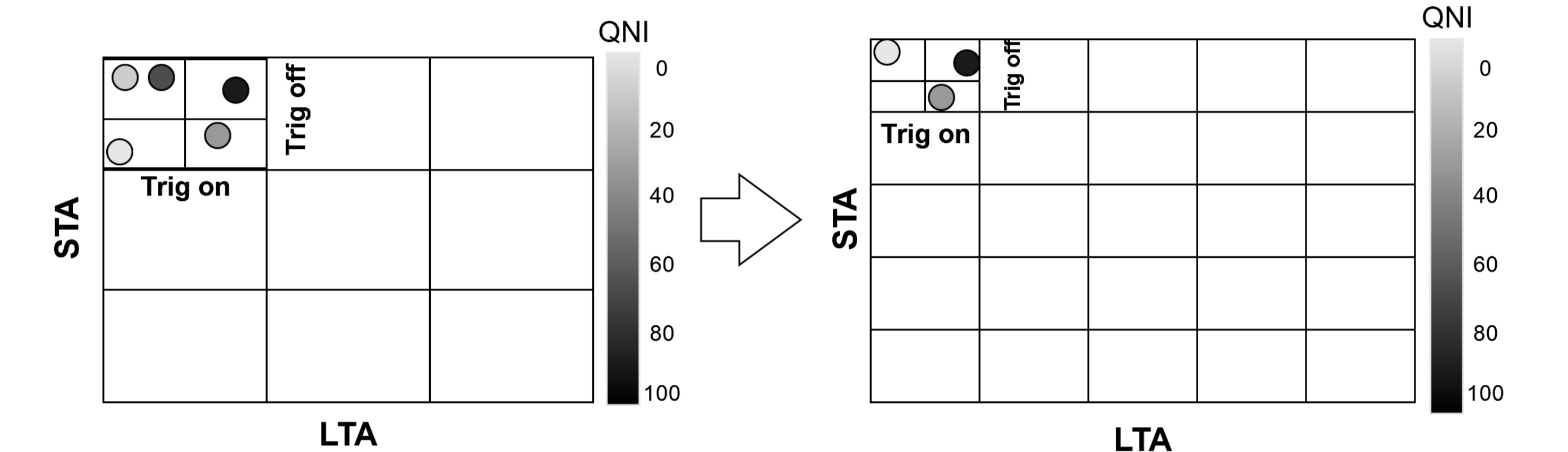
REFERENCES  
[1] Allen, R.V., 1978. Automatic earthquake recognition and timing from single traces. Bulletin of the Seismological Society of America 68, 1521-1532  
[2] Earle, P.S., Shearer, P.M., 1994. Characterization of global seismograms using an automatic-picking algorithm. Bulletin of the Seismological Society of America 84, 366-376.

EXAMPLE OF DATA



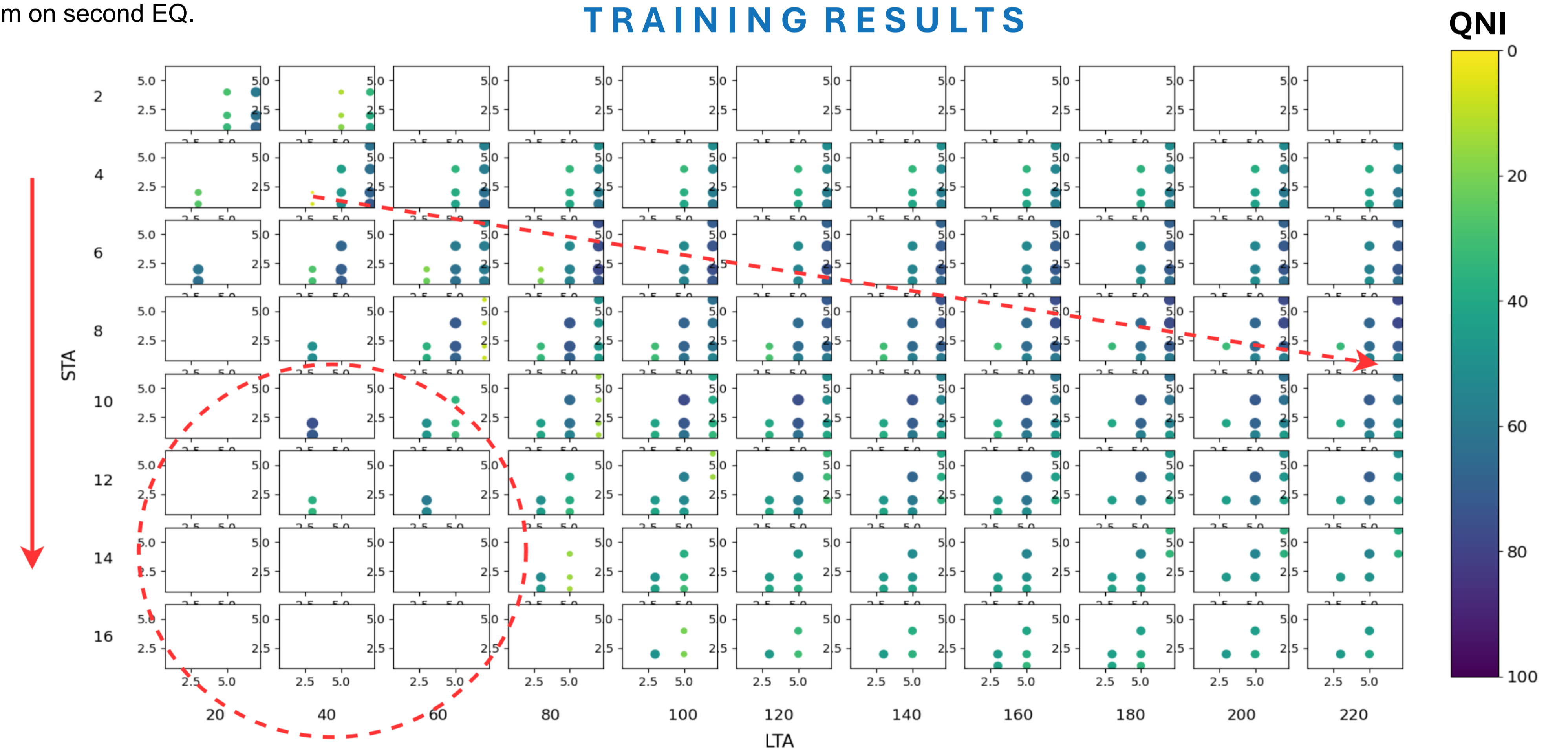
Typical example case of Explosion Quakes on seismo-volcanic signal. On the left, Multiple EQs from Stromboli Volcano's signal. On the right, Zoom on second EQ.

GRID-SEARCH TECHNIQUE FOR QNI VALUES



Once QNI values are obtained, they are shown on a grid by colored circles, performing a grid-search. The darker the colour of the circle, the higher the value is. The expansion of the grid depends on the number of combinations of the quadruples: STA, LTA, Trigger On, Trigger Off.

TRAINING RESULTS



Grid-search exploration for STA windows (rows) and LTA windows (columns), represented by the red rows. Both STA and LTA windows are expressed in seconds. Trigger on / off thresholds, respectively in abscissa and ordinate, are shown in every cell of the matrix. The red circle shows a region where most of the QNI values are 0. Red dashed line underlines a trend in the distribution of highest QNI values.

RESULTS

	Num. EQs (QNI) Training quadruple	(QNI) Literature quadruple
First 4 days (train data)	743 extracted	6s 80s 7 2 1s 10s 7 2
Days 5-8	395	0.65
Days 6-9	425	0.64
...	...	...
Last 4 days (11-14)	170	0.5

We extracted the Training quadruple: 6s, 80s, 7 and 2 from Training results.

Regarding the Literature quadruple, we have chosen the values for STA and LTA as: 1s, 10s respectively; referring to the study from [2]. For simplicity, we have left Trigger on and Trigger off unchanged.

The QNI values are reported after an experiment with the associated days has performed with the corresponding quadruple.

We can see that the QNI values follows a trend: as the number of the EQs decrease, the more the QNI values also decrease. The results show that on average our training quadruple produced a QNI 0.24 higher than the literature quadruple.

METHOD

