Supporting Information for

Landslides caught on seismic networks and satellite radars

Andrea Manconi[1,2], Alessandro C. Mondini[3], and the ALPARRAY Working Group

[1] Department of Earth Sciences, Engineering Geology, ETH Zurich, Switzerland

[2] now at CERC, WSL Institute for Snow and Avalanche Research SLF, Switzerland

[3] National Research Council, Istituto di Ricerca per la Protezione Idrogeologica, Perugia, Italy

Correspondence to: Andrea Manconi (andrea.manconi@slf.ch)

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Introduction

This file provides additional figures and tables supporting the data analysis and the results presented in the main text.

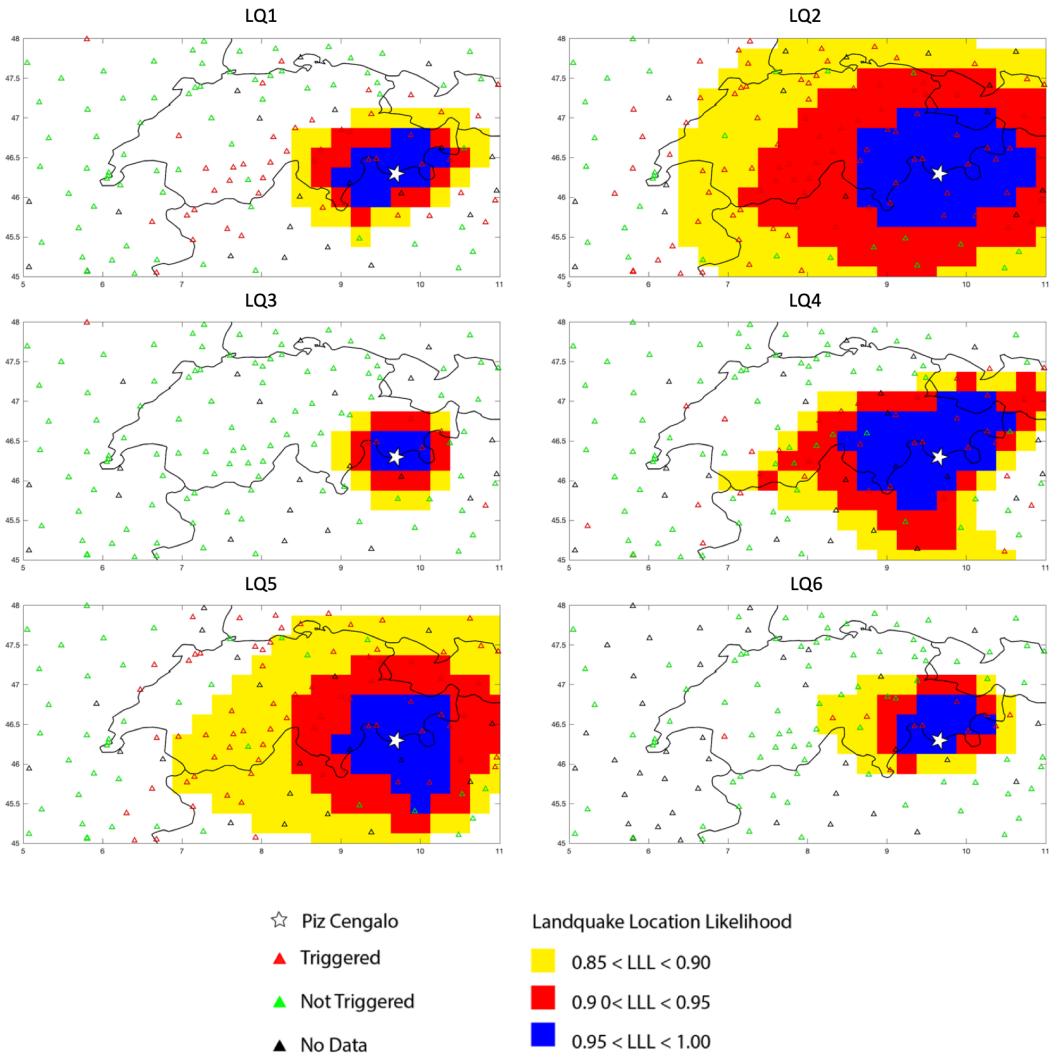

Figure S1. Landquake Location Likelihood (LLL) functions for all the events occurred in the Piz Cengalo area between August and October, 2017 and analyzed in this work (see table 1 in the main text for the details)

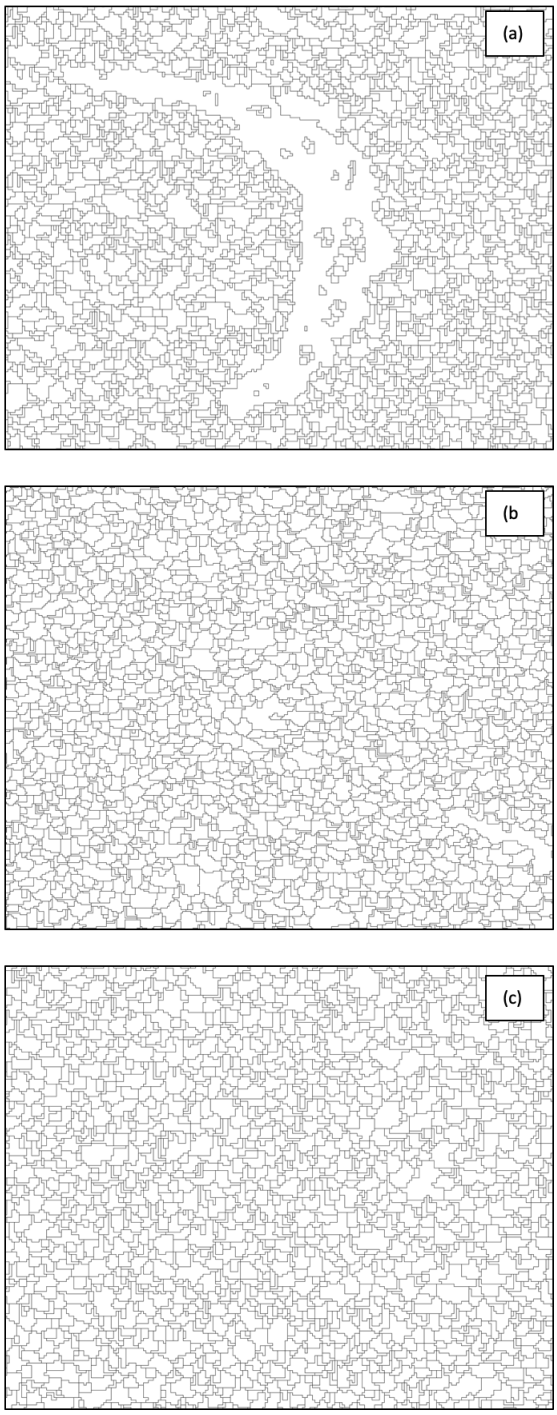

Figure S2. Output of the segmentation step, zoom over the main area of interest around the Piz Cengalo massif. While for LQ1-LQ4 (a) event the largest segment related to the Landquake sequence is relatively easy to identify, a unique solution for LQ5 (b) and LQ6 (c) is difficult to constrain. See also the box plots in Figure S3.

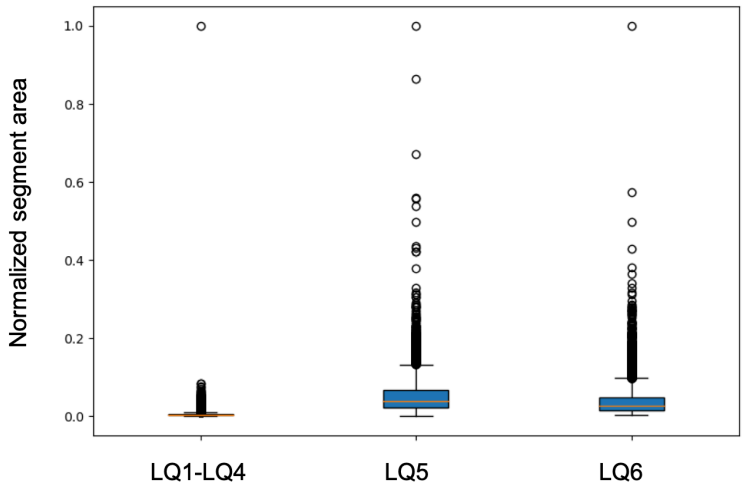

Figure S3. Box plots showing the normalized distribution of segment areas provided by the segmentation step over the entire area of analysis. While the difference between the largest segment identified for the LQ1-LQ4 event and the rest of the segments is remarkable, the LQ5 and LQ6 events are difficult to univocally constrain.

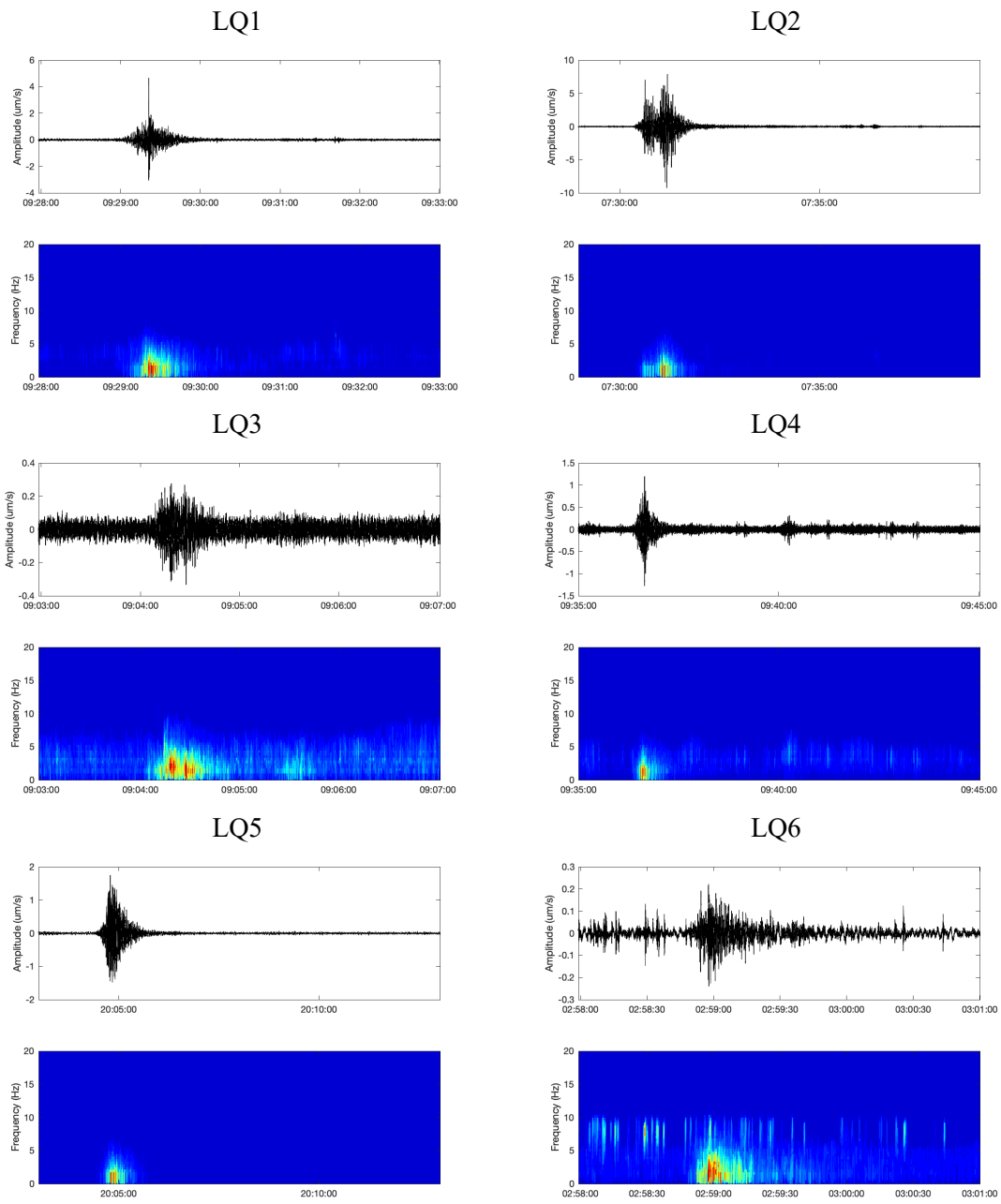

Figure S4. Waveforms and spectrograms of the six landquakes (L1-L6) identified as related to the Piz Cengalo rock avalanche sequence at the seismic station CH-BERNI. Waveforms are filtered (Butterworth) between 0.5 and 25 Hz. Dominant frequencies for all landquake events are between 1 and 5 Hz.

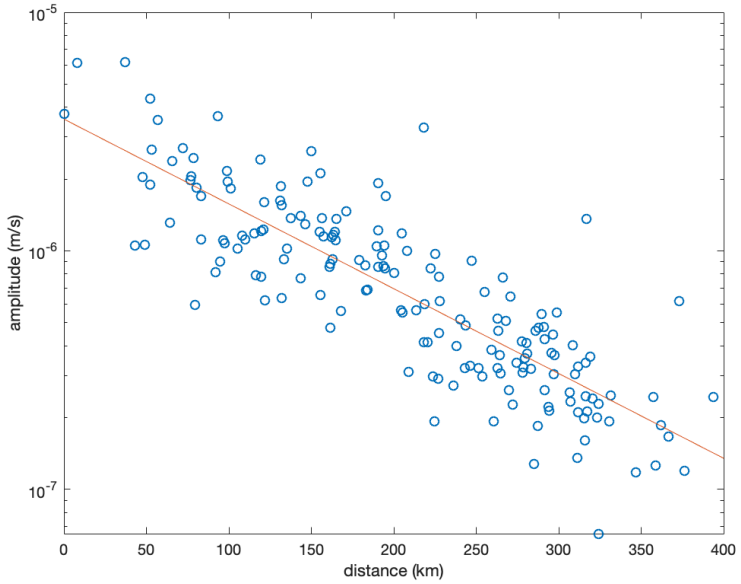

Figure S5. Relationship between Amplitude and Distance for the Piz Cengalo main event (LQ2) by considering AlpArray stations in a radius of 400 km from the landquake occurrence. The log of amplitude follows a linear decay with distance.

Parameter	Value	Notes
STA	10	STA time window in seconds
LTA	60	LTA time window in seconds
Tr_ON	2.5	Event triggers "ON" with STA/LTA ratio > Tr_ON
Tr_OFF	1.15	Event triggers "OFF" when STA/LTA ratio < Tr_OFF
D	20	Trigger must be on at least “D” seconds
pre_trigger_seconds	0	Pre-trigger padding
post_trigger_seconds	0	Post-trigger padding
LTA_mode	frozen	LTA stops updating when trigger is "ON".

Table S1. STA/LTA detector parameters used for the identification of events in the seismic traces of the AlpArray network. We used the GISMO software tool provided at https://github.com/geoscience-community-codes/GISMO

Pre-event image	Post-event image	LQ event(s)
S1B-20170821	S1A-20170827	LQ1-LQ4
S1B-20170914	S1A-20170920	LQ5
S1B-20171008	S1A-20171014	LQ6

Table S2. Sentinel-1 radar imagery used in this study. Ascending orbit T015A. The results shown for the LQ1-LQ are independent on the polarization considered, while for LQ5 and LQ6 the VH polarization provides the best solution.