EGU23-16438, updated on 23 Mar 2023
https://doi.org/10.5194/egusphere-egu23-16438
EGU General Assembly 2023

Earthquake Detection and Location in the Cameroon Temporary Network Data Using Deep Learning

Luis Carvalho[1], Hamzeh Mohammadigheymasi[2], Paul Crocker[3], Nasrin Tavakolizadeh[4], Yahya Moradichaleshtori[5], and Rui Fernandes[2]

[1]Instituto de Telecomunicações and Colaboratório para as Geociências, University of Beira Interior, Covilhã, Portugal
[2]Instituto Dom Luiz and University of Beira Interior, Covilhã, Portugal
[3]Instituto de Telecomunicações and Department of Computer Sciences, University of Beira Interior, Covilhã, Portugal
[4]Department of Computer Sciences, University of Beira Interior, Covilhã,Portugal
[5]Institute of Geophysics, university of Tehran, Iran

A temporary seismic network consisting of 32 broadband seismic sensors was installed in Cameroon between March 2005 and December 2006 to study the seismic structure of the crust and upper mantle beneath the Cameroon Volcanic Line (CVL). This study aims to re-evaluate the seismicity in this period by processing this database and calculating an updated crustal velocity model for the region incorporating the acquired earthquake bulletin.

The earthquake detection and location procedure applies hybrid deep learning (DL) and phase validation methods. We use an integrated workflow composed of Earthquake Transformer (EqT) and Siamese Earthquake Transformer (S-EqT) for initial earthquake detection and phase picking. Then, PickNet is used as a phase refinement step, and REAL for earthquake association and rough location. A set of thresholding parameters for earthquake detection and P- and S-picking equal to 0.2 and 0.07 are adjusted, respectively. By combining a set of 33282 P and 29251 S-picked phases associated with 743 earthquakes with $1.3 \leq ML \leq 4.6$, we implement a joint inversion for estimating an updated 1D crustal velocity model. The obtained mode comprises thicknesses of 8, 12, 14, 20, and 30km, from the surface to a depth of 45km, with Vp = 6.1, 6.4, 6.6, 7.6, 8.25, and 8.5km/s, respectively. The newly detected events are primarily concentrated in three main clusters, 1) the east flank of Mount Cameroon, 2) an area between Mount Cameroon and Bioko Island, and 3) southern Bioko Island. The compiled catalog for this time interval is 1.7 times larger than the already reported catalog for this data set. Finally, we present a 3D time-lapsed animation of the detected earthquake sequences.

Acknowledgements: The authors would like to thank the support of the Instituto de Telecomunicações. This work is funded by FCT/MCTES through national funds and, when applicable co-funded EU funds under the project UIDB/50008/2020.