Review Solid Earth EGUSPHERE (https://doi.org/10.5194/egusphere-2023-806)

A New Seismicity Catalogue of the Eastern Alps Using the Temporary Swath-D Network

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The paper from Jan Hofman et al. focuses on the development of a new semi-automatic methodology for the creation of a consistent seismic catalog in the Eastern Alps, as part of the Swath-D project. The method involves both manual and automatic procedures, as well as the GPU usage to fasten up the process. This application aimed at precise arrival pick detections for P and S phases, thus producing improved absolute seismic locations. I found the paper well written in English, with room for improvements mainly for the methodological sections. I also appreciate the authors shifting most of the methods in the Appendices for a clearer view of the main goals. Eventually, I recommend the publication of this work after revisions.

Main General Comments:

- To meet the FAIR publications criteria, the authors should provide the final catalog with at all the needed metadata to replicate their results. The codes used in the study should be also distributed in one or more open access repository (i.e. GitHub, GitLab, Zenodo) at authors discretion. I think that especially for methodological paper, this latter point is a must.

- In my opinion, the magnitude calculation and catalog completeness definition are a bit incomplete. First, the author should provide a clear value for the completeness consistently throughout the manuscript: the symbol ~ should not be used (i.e. P1-L3 / P9-L222/ P16-L311). Second, how is the completeness calculated? With which method? Is one or more statistical approaches involved? Finally -and most important- why not pursue a much more consistent strategy of reassessing the event local magnitude based on S-wave amplitude? Having already extracted the amplitude windows during the cross-correlation and repicking stages, it should be straightforward to apply a standard ML attenuation function and the catalog would highly benefit from it in terms of consistency and robustness, not to mention for the discussions section. One could then plot the master events initial magnitude against the recalculated one to validate a linear fit trend. I would recommend these calculations and to better validate the catalog completeness, although I leave the decision to the authors.

- Still talking about magnitudes…citing appendix A4: "*Event magnitudes for detected events are computed relative to the magnitudes in the publicly available event catalogues, based on peak S-wave amplitude ratios. For each station, peak S-wave amplitudes are determined for all events with known magnitudes recorded by the station".* In the follow up equation, though, I see the least-square fit based on master

event station magnitudes. I think this assumption could lead to biases. Indeed, the master events extracted from national bulletins are obtained with different local magnitude scales parametrization. Please provide some reasoning for your decision and try to expand the discussion in the Appendix A4.

- I would try stress a bit more the discussion over the improvement with the authors GPU support solution. Did the authors tried to benchmark their approach with other methods? Or even compare it with the serialization or standard parallelization approach? Some absolute and quantitative number would be nice to have for the reader.

- Another important yet underexplained part of the methodology is the anthropogenic / natural seismic event definition (and therefore filtering). P2-L56 *"We identify these anthropogenic signals based on their typical temporal signatures and confirm their origins using satellite images."*. Is it really based only on temporal signatures? How where the satellite images compared? The authors should provide an example of anthropogenic event detection and filtering to complement Figure 5. This stage is as important as a good picking refinement, and I think it should deserve more space in the manuscript. Did the authors adopted any criteria to stay on a more conservative scenario (i.e., losing more seismic events compared to risking having anthropogenic noise labeled as seismic events)?

- I think the author could provide an additional figure (in the supplementary) showing the x-y-z-ot uncertainty distributions of the final catalog events, to validate the average errors declaration.

Additional comments:

Fig.1:

- A differentiation with marker type (i.e., square or circles) is helpful to discern between the permanent and temporary stations. Please group them accordingly.
- Please provide a useful web page or reference for "Stamen Design" (package/tool) in the legend and therefore in the reference-list.
- The number 198 (P2-L48) correctly sum up the stations number listed in the legend. The authors, though, also mention that the SWATH-D is composed by 151 stations (P2-L32). In the figure's legend is written 147. Please double check the numbers and correct accordingly both in captions and in text.
- The Z3 and ZS temporary network listing and their respective citations are missing in the figure's caption. Please add them.
- In my opinion, displaying the fault systems is a bit off the figure's scope, as the main aim is to describe the station network. The authors correctly display and describe the fault system in Fig.4 and Fig.8, and therefore I would suggest the authors to remove them from this figure.
- I think it would be nice for the reader and for the completeness of the manuscript to provide a figure in the supplementary material with the initial

seismicity geometry (the one from the agencies bulletin) in different colors. Possibly, sided with the merged seismicity. I strongly recommend such a figure.

Fig.2: Is there a reasoning why the authors use different colors (blue / gray) and occasionally grouping in gray box? In the manuscript, the method part is divided in 3 main blocks, I would recommend the authors to follow that flow consistently in the figure as well.

Fig.4:

- Please provide a useful web page or reference for “Stamen Design” (package/tool) in the legend and therefore in the reference-list.
- Please provide the reference for the vectorial shapefile / grid file of Schmid 2004 faults geometry.
- The authors should also display the classic longitude and latitude section profiles displaying the final seismicity at depths.
- Please add the station marker (empty triangle) to the legend.

Fig.5:

- The y scale for the “Day of the Weeks” panels (left sides) and “Hour of day” panels (right-side) should be equal for a clearer comparison.
- Please add an example of anthropogenic event detection and filtering.

Fig.6:

- Remove the bracket around relative.
- Would be nice to have a and *b* value listed separately and not in the equation-style in the legend.

Fig.8: I like the color differentiation (in map) for the projected earthquakes in each panel!

- Please remove the fault polarity from the straight-slip faults. The authors should either plot the geological dynamic *on each* fault front (that would also be a nice addition to help the discussion) or remove this information completely. This comment is valid for Fig.4 as well.
- A magnitude scale legend is missing on the map, please add it.

Fig.A4: Y axis label(s) missing.

Fig.A9: The map should have lon/lat measurements and a magnitude scale legend.

Additional comments:

- As a general comment, is there even an Appendix B? Otherwise, one could remove the Appendix nomenclature and leave the standard “Supplementary Information” one. In any case, I would change the naming of the appendix figures from Figure A1, A2 … to Figure F1, F2 etc. to avoid misunderstanding with the text blocks also named A*.
- P2-L51 GPU acronym should be fully extended 2 lines before.

- P2-L54: … The extended set of P and S arrival times **are** then …
- P10-L23: Lower magnitude of completeness (not higher)
- In the reference list, Käestle et al. (2021) is misplaced (P30-L473). Should be placed after Kästle et al. (2020).
- The authors should think of merging section 2 and 3 in a more suitable “Data & Methods”. Section 2 is too short in my opinion to stand alone, plus it is not really detached in terms of contents from section 3.