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Jury Member Report – Doctor of Philosophy thesis.

Name of Candidate: Daniel Wamriew

PhD Program: Petroleum Engineering

Title of Thesis: Location and source mechanisms of induced seismic events

Supervisor: Professor Dmitri Koroteev
Co-supervisor: Professor Roman Pevzner, Curtin University

Name of the Reviewer: Dr. Ardiansyah Koeshidayatullah

I confirm the absence of any conflict of interest	**Date: 09-09-2022**

The purpose of this report is to obtain an independent review from the members of PhD defense Jury before the thesis defense. The members of PhD defense Jury are asked to submit signed copy of the report at least 30 days prior the thesis defense. The Reviewers are asked to bring a copy of the completed report to the thesis defense and to discuss the contents of each report with each other before the thesis defense.

If the reviewers have any queries about the thesis which they wish to raise in advance, please contact the Chair of the Jury.

Reviewer's Report

Reviewers report should contain the following items:

- Brief evaluation of the thesis quality and overall structure of the dissertation.
- The relevance of the topic of dissertation work to its actual content
- The relevance of the methods used in the dissertation
- The scientific significance of the results obtained and their compliance with the international level and current state of the art
- The relevance of the obtained results to applications (if applicable)
- The quality of publications

The summary of issues to be addressed before/during the thesis defense

I truly appreciate the opportunity to review Mr. Daniel Wamriew's Ph.D. thesis titled: **"Location and source mechanisms of induced seismic events."** I have reviewed the thesis thoroughly, and it brings me great pleasure to read such a well-structured and -written Ph.D. thesis by Mr. Daniel. Furthermore, the thesis is written with an acceptable level of English proficiency. In his thesis, he leveraged deep neural networks, specifically Convolutional Neural Networks, to

1. create synthetic microseismic data,
2. locate and detect microseismic events in offline and real-time,
3. update velocity model, and
4. determine the source mechanisms of microseismic events via full moment tensor inversion.

Overall, the thesis provides good coverage of different background information and theories on microseismic and deep learning. In this thesis, Mr. Daniel combined traditional and novel approaches, including seismic forward modeling, inversion, and deep learning to study microseismic events. Furthermore, I commend the information and case studies on integrating Fiber-optic Distributed Acoustic Sensing (DAS) and deep learning because this is still a frontier technology in microseismic event detection.

Throughout his Ph.D., Mr. Daniel managed to publish three reputed internationally peer-reviewed journals and two conference proceedings from his Ph.D., which is an outstanding achievement and shows the quality of his work. All the publications are timely and should be of interest to a broader geoscience community. As deep learning is a rapidly growing technology, it is expected that the method used is not always the most updated or state-of-the-art. This issue is rightly pointed out in his future recommendation, where it mentioned that the application of physics-informed neural networks might further improve the performance and accuracy of microseismic event detections and the explainability of the model. In general, I am satisfied with the quality of the Ph.D. thesis and look forward to discussing the work in more detail during his Ph.D. defense.

Provisional Recommendation

☒ *I recommend that the candidate should defend the thesis by means of a formal thesis defense*

☐ *I recommend that the candidate should defend the thesis by means of a formal thesis defense only after appropriate changes would be introduced in candidate's thesis according to the recommendations of the present report*

☐ *The thesis is not acceptable and I recommend that the candidate be exempt from the formal thesis defense*