**Review of PhD Thesis „*Influence of velocity model uncertainty in earthquake source inversions*" by RNDr. Miroslav Halló**

Miroslav Halló started his PhD project in 2014 under my supervision at the Department of Geophysics, Faculty of Mathematics and Physics, Charles University in Prague. Before that he conducted his Master studies at the Masaryk University in Brno, Department of Geological Sciences, in cooperation with the Institute of Physics of the Earth. He also underwent a 6-month internship at University of Bergen. After defending his Master thesis on "Geometry of the seismo-active structure in western Bohemia", he worked in a private geophysical service company Seismik Ltd. as a key developer of codes for analyses of microseismicity. Therefore, Miroslav had already been quite experienced when he started his PhD studies. Miroslav started his PhD studies in parallel with his job in Seismik. After quitting the job his work intensity on the PhD topic increased dramatically.

At the very beginning, Miroslav expressed his interest in source analysis of larger earthquakes. At that time the department's seismological group discussed the influence of velocity model inaccuracy on inferred earthquake parameters, which is a typically neglected issue in practical source inversions despite being understood as the major source of uncertainty of the source parameters. We have, therefore, decided to address this point in the Miroslav's Thesis. The idea was not to formulate the source (i.e. centroid and slip) inversions formally correctly, because such an approach would be too complex, hardly applicable in practice. Instead, the aim was to develop an approximate yet simple to implement approach for considering the velocity model uncertainty.

After introducing such a new approach using the so-called approximate covariance functions (ACF), Miroslav demonstrated its capabilities on simple examples of Bayesian moment tensor inversions. During his stay at the Disaster Prevention Research Institute, Kyoto University, in 2017, under the supervision of prof. Kimiyuki Asano, Miroslav applied the approach to the 2016 Kumamoto damaging earthquake sequence in Kyushu. For this application Miroslav learnt Python and implemented the ACFs in Isola-ObsPy code written by Jiří Vackář. The application to the Kumamoto earthquakes helped to understand the seismotectonic context of this seismic sequence. The methodology and its application resulted in two publications of which Miroslav is the first author. It is worth mentioning that the methodological paper already has 12 citations.

As a next step Miroslav has developed a new Bayesian slip inversion. He managed to code and test it in just about 6 months, although such task could be a PhD project itself. Miroslav learnt FORTRAN and Parallel Tempering approach to Monte Carlo Markov Chain inversions, utilizing the code by prof. M. Sambridge. The method introduction and its application to the mainshock of the 2016 Kumamoto sequence form the last part of the Miroslav's Thesis. A related paper is currently under preparation.

During the past four years Miroslav has demonstrated his strong programming skills and proficiency in seismic data processing. In particular, I was impressed by his careful and efficient approach to software coding. Miroslav is also very good at preparing and giving nice

and clear presentations. During his studies he has improved the writing skills, where he needed some help when preparing the first paper, while eventually he wrote his PhD Thesis almost without any of my interference. Miroslav has also gained experience in funding management as he got a 3-year project from the Grant Agency of the Charles University. Finally, I have to point out that his strong involvement and enthusiasm has been demonstrated by the fact that after submitting the Thesis, Miroslav himself started analyses of the newly emerged earthquake sequence between Osaka and Kyoto. In just a few days after the main event he suggested a vital hypothesis of a complex fault model of the sequence mainshock, which he is further corroborating by studying the whole sequence (in collaboration with prof. Asano).

To conclude, I am convinced that Miroslav is a very promising young researcher deserving the PhD title, and I wish him good luck in his future scientific career.


Prague, August 2018                                  doc. RNDr. František Gallovič, Ph.D.