Matthieu Quinquis:
A numerical study of subduction zone dynamics using linear viscous to thermo-mechanical model setups including (de)hydration processes

Report of the supervisor

Matthieu Quinquis started his PhD studies in 2008 as a member of the Marie-Curie Research Training Network which was focused on multidisciplinary research of subduction-related processes and education of PhD students. This network, interlinking several geophysical laboratories with complementary fields of expertise, provided the students with a broad view of mantle processes and gave them the opportunity to gain valuable skills in different branches of geophysics. Matthieu was a member of the Trondheim laboratory which was associated with the Norwegian Geological Survey and supervised by Susanne Buiter. Since this institution was not authorized to confer academic degrees, Matthieu was enrolled as a student at the Charles University in Prague, which was the other node in the network dealing with numerical modeling of subduction, and I became his official supervisor. Susanne Buiter remained Matthieu's daily supervisor and it is to her credit that we can now read his thesis. The official activities of the c2c network ended in January 2011 when Matthieu's PhD project was still far from being completed. In the years that followed Matthieu received only limited financial support (mostly thanks to Susanne) and it took him another three years to finish his work.

In his thesis Matthieu Quinquis deals with complex numerical modeling of subducting slabs. This type of work requires a numerical program which allows all ingredients of the complex physical model to be included and which must be properly tested against other numerical tools. Matthieu − who had studied geology and had acquired only limited experience with numerical modeling − decided not to develop his own code but rather to use one of existing numerical tools available in the scientific community. He started with *Underworld* but later switched to *Sulec*, a new code developed by Susanne Buiter and Susan Ellis. With this code he carried out a number of useful numerical tests and benchmarks, some of which have already been published. Typically, benchmarking is very time-consuming and not really rewarding, because only some of the results are worth publishing. Matthieu spent a lot of time testing different model setups and comparing their outputs, and although this work did not enrich our knowledge on the state of subducting slabs substantially, I find it very important for the community of subduction modelers. The thesis contains a lot of useful tests and examples which can be used for benchmarking other codes in future and which well illustrate the relative importance of individual model ingredients. The text is well organized, clearly written and the numerical examples are carefully described which makes the results easy to access.

Matthieu Quinquis proved that he is able to independently solve complex scientific problems and present the results of his work in the form of a concise written text. That is why I strongly recommend the work to be accepted as the Ph.D. thesis.

November 1, 2014 *doc. RNDr. Ondřej Čadek, CSc.*