Supervisor's review of doctoral project

The role of rheology and water in the deformation of subducting slabs

by RNDr. Jakub Pokorný

I have known Jakub since 2017, when he started to work on his diploma thesis under my supervision. During his master project he familiarized himself with the problem of subduction modeling using software SEPRAN and he decided to continue on that subject also during his PhD studies.

His PhD research was part of a project of Czech Science Foundation focused on a detailed description of the decoupling of plates during subduction; mainly on the nonlinear rheology and water content of crustal and mantle rocks. Project involved serious code development, because water transportation was not explicitly included in SEPRAN at the beginning of Jakub's project. Code development was primarily carried out by prof. Arie van den Berg, our collaborator from Utrecht University while Jakub was involved in testing of the code and his main task were applications – both in parametric studies and in case studies in natural subduction zones. He spent two months at Utrecht University which gave him opportunity to get familiar with the emerging code and also establish cooperation with other colleagues at the Department of Earth Sciences. Code development was slower and more difficult than originally anticipated and the focus of Jakub's project in the first years was thus shifted more in the direction of subduction models without explicit water transportation and detailed understanding of 'dry' rheology effects. A brief parametric study of the effects of water on the crustal rheology was nontheless finalised and concludes the thesis.

Jakub is a highly motivated student with a deep interest in learning new things. He was always keen on attending further lessons and broaden his scope. His strong point is also his geological background, rare at our department, which is ideal in combination with expertise in numerical modeling. Despite the challenges he had to face – first the covid pandemic that paralyzed university life and especially international exchange, and later also his family commitments – Jakub managed to finalize his thesis succesfully. He is a first author of the parametric study of the effects of dry crustal rheology and of the case study of the stress evolution in Tonga slab (chapters 3 and 4 of the thesis). Further, during his visit at Utrecht University he established collaboration with a PhD student Eric van der Wiel and his supervisor prof. van Hinsbergen, focused on the explanation of rapid plate velocity oscillations recently revealed by tectonic reconstructions. This cooperation resulted in the third publication (chapter 5 of the thesis). Personally, I highly value this publication, as this was the most independent one, carried out primarilly by the two PhD students (both contributed equally). They received significant help in the writing phase, mainly from prof. van Hinsbergen, but the design of the subduction models was almost exclusively by Jakub and the iterpretations were perfomed by him and Eric.

With all that said, I am very happy to conclude that I believe that Jakub have proven his ability to carry out independent research and that I support awarding him with PhD degree.

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