project title: Addressing the replication problem in science

project subtitle: Using the open source ASPECT code to replicate computational geodynamics studies of the last 30 years.

Department: Earth Sciences
Research group: Mantle dynamics & theoretical geophysics
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Project description

The field of computational geodynamics was born in the 80's with the advent of powerful computers and their widespread availability in universities. This lead to hundreds of published studies in the 90's, all based on somewhat primitive codes which have all long been gone/abandoned. Up to the 2000's there was no version control tool and no online repository for codes, data, input files, results… At the same time papers published in the 2010's still did not follow basic archival procedures and relied on non-open source codes.

Fortunately the community is moving away from this workflow by massively adopting truly open source codes, developed by its users, fully tested, and following a review process carried out by highly trained scientists (applied mathematicians and geophysicists alike). On of these tools, of which I am a user/developer since 2014 is the ASPECT code (https://aspect-documentation.readthedocs.io/en/latest/).

In light of all this, I propose to:
1) carry out an inventory of the published computational geodynamics literature and organise it by theme (oceanic subduction, rifting, mantle convection, etc …). A great deal of this work has been carried out by myself (https://cedrict.github.io/literature_topics.html).
2) identify within each theme a dozen or so of landmark papers (based on absolute and yearly citation counts)
3) scrutinise these studies and assess whether they contain enough documentation to warrant a replication attempt.
4) use the ASPECT code as a platform to try to replicate these studies. If successful, incorporate the corresponding input file to the code base as a so-called cookbook (https://aspect-documentation.readthedocs.io/en/latest/user/cookbooks/index.html) . If not, document the reasons for failure and draw conclusions.

Job requirements

The assistant should have followed the Solid Earth track of the Msc program. Knowledge of continuum mechanics, rheology, geodynamics and computational science is essential.