Geophysical Research Abstracts
Vol. 17, EGU2015-4226, 2015
EGU General Assembly 2015

An interdisciplinary approach to constructing models of the lithosphere and asthenosphere of Antarctica

Anya Reading (1,2), Jacqueline Halpin (3,2), Matthew Cracknell (4,2)

(1) School of Physical Sciences, University of Tasmania, Hobart, Australia (anya.reading@utas.edu.au), (2) Institute for Marine and Antarctic Studies, University of Tasmania, Hobart, Australia, (3) School of Physical Sciences, University of Tasmania, Hobart, Australia (jacqueline.halpin@utas.edu.au), (4) School of Physical Sciences, University of Tasmania, Hobart, Australia (matthew.cracknell@utas.edu.au)

In this contribution, we aim to draw on the wealth of information that now exists across several Earth Sciences disciplines and relates to the structure of the lithosphere and asthenosphere of Antarctica. Geological terranes that are well constrained in continents that were neighbours of Antarctica prior to the break-up of Gondwana (South America, Africa, India and Australia) are represented in three dimensions. Extrapolation into the interior of Antarctica is constrained by extensive remote sensing and geophysical datasets. We also incorporate direct information on the Antarctic continent which has substantially improved in both quality and coverage following extensive field programs of several nations in association with the 2007-2008 International Polar Year. Where several contrasting models remain possible, we construct multiple models that allow such alternatives to be readily compared.

The models that we construct are of an appropriate resolution for continent scale rheological and seismological simulations. They consist of spatial coordinates including depth, material property values, and also metadata which provide for nominal uncertainty estimates and provenance information for the model values. This approach enables a variety of information to be included in a single model, and well and less-well constrained parts of the model to be handled with rigor. The combination of multiple models, and model uncertainty metadata, into model suites is a liberating one. We maximise the inclusion of information across the disciplines of geoscience such that inaccurate, insufficient and inconsistent data may be evaluated.

Applications of the new models include large-scale ice sheet modelling, including glacial isostatic adjustment studies. They can also be applied to sensitivity testing with respect to new instrumental deployments in Antarctica such as large scale passive seismic experiments. As the international community progresses from reconnaissance studies to understanding the more detailed implications of lithospheric and asthenospheric heterogeneity, in the continent beneath Antarctica, such simulations have two-fold potential. Firstly, in illuminating the relationship between observable and inferable physical properties. Secondly, in optimising the locations of future deployments for the purpose of distinguishing between candidate deep Earth structures. Model suites will be made available for the use of the research community in interoperable data formats.