



Underworld, developed by Monash University, is a geodynamics modelling framework for long-term geophysics research codes. Underworld is based on StGermain - VPAC's core computational mechanics technology, utilises a Lagrangian particle-in-cell finite element scheme, and visualised using gLucifer.

<<< Underworld Modelling of Subduction Zones

Underworld allows for development of model to accurately predict subduction zone shapes around the globe

A recent study by researchers at The Australian National University (ANU) and Monash University used both computational and laboratory models to simulate the detailed dynamics of subduction zones deep within the Earth's crust. The new computational model, developed by the researchers using the Underworld framework, provides a more sophisticated view of subduction involving time/space evolution of subduction zones.

Subduction is the process where denser and older oceanic crust is recycled back into the Earth's mantle. As the crust is recycled, it also pulls the accompanying plate and provides part of the driving force for plate tectonics.

Subduction zones are limited in lateral extent and have a three-dimensional geometry that evolves over time. Previous models of subduction, however, treated subduction zones as either finite in trench-parallel extent (two-dimensional) or finite in width but fixed in space, thereby forcing modellers to place artificial limits on the processes. These previous models did not allow geophysicists to gain full insight into the process of subduction, which in reality varies in time and 3D space.

The new model generated by researchers at ANU and Monash University, simulates the subduction process as a 3D variable slab that changes as the subduction geometries change and as the slab encounters different forces during subduction.

The experiments were run using the Underworld framework on VPAC's Supercomputing clusters. Underworld provides several important features allowing the development of such models: a suite of rheological laws (the laws governing how the subducting slabs of rock respond to applied forces); the capacity for high-resolution 3D simulations; fast, scalable solvers (in particular the multigrid method); and efficient parallelism. The combined high-resolution and complex nature of these models prevents them from being run on conventional desktop hardware. VPAC's Supercomputing clusters provided ample resources for this purpose.

Further Information

Schellart, W.P. J. Freeman, D.R. Stegman, L. Moresi and D. May, Evolution and diversity of subduction zones controlled by slab width. *Nature* 446, 308-311, doi:10.1038/nature05615, 2007
Underworld is under development as part of the AuScope nation-wide Geosciences infrastructure program.

For further information regarding Underworld or VPAC's Supercomputing Facility, please email geophysics@vpac.org or call +61 3 9925 4645.