

GPlates and GPML: Open software and standards for linking data to geodynamic models on the APAC grid

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Abstract

Unravelling the evolution of planet Earth as well as resource exploration depend on our ability to link many different types of observations and models to each other in a plate kinematic context. However, no common tool is available to track the time history of geological and geophysical data broken up into plates, or to simultaneously display models for mantle dynamics in a plate tectonic framework. To overcome this obstacle to synthesizing and modelling Earth processes, we are developing a plate kinematic/geodynamic information model, the GPlates Markup Language (GPML), and GPlates software to create a universal standard for plate reconstructions, linked to both commonly used data bases and geodynamic models. GPlates/GPML combines well designed tools for data integration and visualization with a powerful mathematical backend that allows researchers to easily acquire, investigate, manipulate and distribute plate tectonic data and link them to geodynamic models. We focus on two examples of linking kinematic data to models: (1) modelling the current and paleostress field of the Australian continent via automatic optimization using Abaqus and Nimrod, based on a combination of continental and oceanic geophysical and geological data and (2) combining a relative and absolute plate motion model with a regional plate tectonic data base to restore the geometry and velocities of plates through time for linking to a 3D mantle convection model.

Keywords: plate tectonics; information model, continental paleostress, mantle convection