

Testing the stability of LLSVPs using the full adjoint method for mantle circulation models

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Analysis of seismic tomography reveals two large low shear-velocity provinces (LLSVPs) near the core-mantle boundary. Mantle circulation models can generate similar structures to those seen by seismic tomography, and efforts have been made to understand how these structures have evolved through time. These models solve the equations for the conservation of mass, energy and momentum together with a surface boundary condition that assimilates surface plate motion history and an initial condition for the internal structure some time in the past. Since the initial condition is unknown for the Earth, our models inherently contain some error. There is however, an abundance of data available to us from observations from seismic tomography. By employing the full adjoint method for mantle convection we can constrain the unknown mantle flow back in time using the data available to us, providing better estimates of the internal state of the mantle earlier in geological history.

With our forward-adjoint mantle model, together with a 200Myr plate motion history model and a global seismic tomography model, we will investigate how varying the mantle's parameters effects the stability and evolution of these structures over recent Earth history.