Inversion and Imaging for the Solid Earth

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Abstract

All knowledge of the interior of the Earth is based on indirect inference. Even apparently simple tasks such as the location of seismic events are actually highly non-linear inverse problems with data inputs of various types and quality. Many problems involve either data dependency on multiple classes of parameters or many different sources of data associated with the same description of an Earth model. The result is that there has been a strong independent tradition of innovation in geophysical inverse problems, since conventional tools do not directly translate to the problems at hand.

A major problem is the description of the 3-dimensional interior structure of the Earth using observations of seismograms at the Earth's surface, which can rapidly lead to large numbers of parameter and data inputs. The dominant structure depends on radius and so progress has been made by developing reference models for the average radial structure of the seismic wavespeed in the Earth and then seeking the 3-D variations about this state. I will illustrate the successes and problems associated with the generation of such reference models and the current state of imaging for 3-D structure.