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Physical properties of Southern Africa lithosphere: Comparison of seismic and electrical parameters

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Generally seismic velocity is primarily a function of bulk properties of the media and electrical resistivity is usually primarily a function of the properties of a minor phase in the rock (low order partial melt, presence of conducting irons, oxides, etc.), so one might not expect the two to correlate.

Modelling and inversion of continental and regional seismic data for southern Africa yield a variety of compressional and shear velocity models. These models differ in the data used, either surface waves or body waves, and in the techniques applied. Magnetotelluric (MT) data from SAMTEX (Southern African Magnetotelluric Experiment) yield models and images of the electrical resistivity of the lithospheric mantle of Southern Africa.

Comparisons at various depths of slices from a new high-resolution (1.5 deg) seismic model, derived from surface wave inversion of events along continental paths, and new electrical images, including the data from Phase IV of SAMTEX, reveal correlations at both large and small scales. The existence of these correlations, which can be defined quantitatively by a linear regression between log(resistivity) and velocity, indicates that the two are functions of the same parameters, namely temperature, physical state, magnesium number, and composition. This suggests that joint inversion would be worthwhile, where the two datasets should be inverted directly for petrophysical parameters.