Joint analysis of seismic and magnetotelluric data

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Quantitative analysis of collocated seismic velocity tomography and electromagnetic experiments is developed to elucidate the structure of the deep extension of the Nagamachi-Rifu fault, northeastern Japan. P and S wave seismic velocities obtained from a dense seismic network are examined and a ratio of spatial variation in P and S wave velocities dlnVs/dlnVp is chosen as a proxy for the influence of pore geometry. The analysis shows that the deep extension of the Nagamachi-Rifu fault reveals the dlnVs/dlnVp values exceeded 1.1. Such large values of dlnVs/dlnVp cannot correspond to equilibrium pore geometry, at which the interfacial energy is at a minimum, and indicate regions with non-equilibrium state where non-isotropic stress prevents the equilibrium pore geometry to be achieved. To specify a fine distribution of porosity and connectivity of micropore in the region, we carry out the joint analysis of the seismic velocities with the electrical resistivity data obtained by the magnetotelluric survey crossing the Nagamachi-Rifu fault. It is shown that the region at 10-17 km depths at about 20-40 km to the northwest from the hypocenter of the M5.0 earthquake occurred in 1998 exposes the highest connectivity among the adjacent areas, suggesting a strong deformation process.