Three-dimensional Electrical Resistivity Imaging of Duzce Fault, Turkey by Magnetotellurics

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Abstract:
Wideband (320 – 0.0005 Hz) magnetotellurics (MT) data were collected at 24 sites forming two north-south aligned profiles on both sides of the 1999 Duzce earthquake's epicenter (Mw=7.2) which occurred on the western part of the North Anatolian Fault Zone in Turkey. The two profile's data were utilized to develop three-dimensional (3D) resistivity models where the earthquake's rupture velocity differed significantly to the east and west of the epicenter. Dimensionality of the magnetotellurics data were investigated by Groom and Bailey decomposition and phase tensor analysis. These techniques showed clear marks for three-dimensionality. The three-dimensional (3D) electrical resistivity models for sixteen frequencies between 100 Hz and 0.001 Hz were developed where data space modeling technique was used to provide faster computation due to smaller number of parameters. A mesh of 40 x 50 x 50 (including 7 air layers) extending to a depth of 30 km was constructed for inversions. During the inversions Black Sea was included in the models to minimize the "ocean effect". The modeling results defined (I) a high resistivity region towards the east of the epicenter where earlier studies suggested faster rupture velocity, asperities and widespread aftershock distribution; (II) a highly conductive zone close to the hypocenter of the main shock; (III) a north dipping fault which agrees well with seismological and geodetic results.