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Non-linear body wave teleseismic tomography across the Zagros collision zone

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Upper-mantle structure under the Zagros Mountain Belt, in southwest Iran which is a result from the collision of the Arabian and Central Iran continental blocks, is studied using non-linear high resolution teleseismic P-phase tomography. Observed relative arrival-time residuals from 50 teleseismic earthquakes recorded by a temporary array (including 66 broadband and short-period stations), are inverted to delineate the structure of the upper mantle. The seismic stations were employed in a rectangular array (two-and-a-half dimension) along 620 km long and by about 80 km wide strip plus a few seismographs off the array from November 2000 to April 2001. In order to reduce possible complications associated with possible significant three-dimensionality in the Earth structure, it was considered desirable to concentrate on events where the ray path was aligned with the axis of the array ($\pm 47^{\circ}$). Distinct lithospheric blocks and transitions are resolved in the inversion. Two inverse methods (singular value decomposition and a quadratic programming method) were implemented in order to investigate whether or not the lithospheric blocks and major transitions in the inversion are required by the data or are artefacts of the inversion. The inversion results show a general discontinuous decrease of the velocity from south to north across the Zagros Mountain Belt. The existence of a major lateral change in P-velocity of several percent to depth 200 km more or less directly below the Zagros Mountain Belt is a common structure resolved in all the inversions carried out. The transition coincides with the Main Zagros Thrust (MZT) at the surface. According to the results, in the Zagros region, southern part of the array, more than 400 km of continental lithosphere is recognized in the model. Below the central part of the array (31° -32° N), where ray

coverage is best, the data reveals a large region of relatively high velocity at depths of about 200-400 km that appear to be an apparent slab-like structure dipping gently towards the northeast. Abrupt lateral P-velocity changes (maximum 5 per cent) are seen at both the southern and northern sides of the Zagros Mountain Belt down to at least 500 km below the array.