Geophysical Research Abstracts, Vol. 7, 06276, 2005
SRef-ID: 1607-7962/gra/EGU05-A-06276

Petrophysical Structure of the lithosphere asthenosphere system above the subducted slab in Central Andes from local-source tomography

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About 50000 P and S arrival times and 25000 values of t* recorded at seismic arrays operated in the Central Andes between 20°S and 25°S have been used for locating more than 1500 deep and crustal earthquakes and creating 3D P, S velocity and Qp models. The study volume in the reference model is subdivided into three domains: slab, continental crust, and mantle wedge defined from available a-priori information. A separate inversion for Qp has been performed using the ray paths and source locations in the final velocity model. Using the relations from mineral physics we have performed also a simultaneous inversion of P, S and Qp data resulted in calculating distributions of temperature and water content in the mantle wedge and P-, S-velocity anomalies and Qp anomalies in the crust. This model shows essentially 3D structure in the lithosphere and asthenosphere. P- and S- velocities in the crust beneath the forearc and main volcanic arc are strongly correlated suggesting presence of large variations of temperature, water content and degree of partial melting also within the crust. Water content in the mantle wedge is systematically the highest in the forearc and beneath the magmatic arc. Between 21 and 23°S the volcanic arc is associated with relatively low temperatures 1000-1200 °C in the mantle wedge in agreement with its low volcanic activity, while temperatures are above 1200°C in the mantle beneath the arc between 23 and 25 °S, where recent magmatic activity is higher. However the highest temperature (over 1300°C) is imaged in the back arc mantle beneath the Tuzgle volcanic field, where it is associated with relatively low water content. Low temperature anomalies further to the east are likely associated with the underthrusting of the cold Brazilian shield lithosphere and delamination of the mantle lithosphere of the adjacent back arc, which have the similar shapes as predicted in numerical modeling.