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Abstract Book

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suggest that small earthquakes generate stronger ground motion than large earthquakes in the frequency range of around 1 Hz. These observations indicate differences in the rupture mechanism of large and small earthquakes. We explore the mechanism of earthquakes by means of numerical models and propose characteristic dynamic models for practical application to strong ground-motion prediction. The characteristic models consist of asperity and surrounding background areas for surface (large) and subsurface (small) earthquakes. These models show that surface earthquakes are characterized by a large area of negative stress drop surrounding the asperities, while sub-surface earthquakes present positive or zero stress drop. The source scaling of seismic moments and rupture area derived from the asperity models is consistent with empirical models if the sub-surface earthquakes follow self-similar scaling and surface earthquakes break this self-similarity. We apply the proposed characteristic asperity models to simulate near-source ground motion, and we find that hypocenter location below the asperity can produce strong directivity of the slip velocity function toward the free-surface. That effect, in addition to a reduced fault area and low fracture energy during rupture may be significant in enhancing high-frequency ground motion. On the other hand, large earthquakes are characterized by shallow hypocenter (upper part of asperity), large fracture energy on the asperities and enhanced energy absorption due to large areas of negative stress drop in the background area. The existence of negative stress drop can be a manifestation of large area of damage zone off-fault where energy is dissipated. These characteristics of large earthquakes inhibit severe directivity effects on the slip velocity function directly toward the free-surface reducing the high-frequency ground motion.

SC-D 1-I: 2-D and 3-D Crustal Models of Europe

Wednesday 13:30 - 15:00 – Room 7+8

P AND S SEISMIC VELOCITIES BENEATH THE ITALIAN PENINSULA FROM LOCAL EARTHQUAKE TOMOGRAPHY – ID 1828

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We investigate the P and S waves velocity structures and the Vp/Vs ratio beneath the Italian peninsula down to 100 km depth by seismic travel time tomography. Our aim is not only to define and confirm the gross structural framework of the crust and of the upper mantle, which is somewhat already known, but, in particular, to provide more details either on the shape of the complex subduction that acts on the peninsula either on the transition zones between continental and oceanic crusts. The experiment is based on data published by the International Seismological Centre (ISC). More than 60.000 P phase readings and about 25.000 S phase readings for the period 1997-2005, as recorded by various seismic networks around the italian peninsula, have been inverted employing SIMULPS, the well constrained and worldwide adopted tomographic code. The joining of an adequate dataset and the introduction of some alternative strategies in the travel time tomographic routine (grid designing, ray tracing of the forward problem, appropriate data selection) results in a fair cross-firing all over the large inverting area and partly ensures ray sampling also for deeper layers. Although results are partly biased by the uneven resolution of the tomographic images and by the varying maximum resolved depth, we discuss the structural framework of the most debated areas of the peninsula as they appear from our Vp and Vs 3D inversion. In particular, a very shallow Moho is evident in the Ligurian Sea; a gentle subduction is visible under the western Alps; in the eastern Alps, an opposite dip direction of high-velocity mantle material would suggest that an Adriatic moho subducting under an European one should be further discussed. Finally, the slab of the Calabrian arc is confirmed as very steep in the Tyrrhenian Sea.

3-D SHEAR VELOCITY MODEL OF THE UPPER MANTLE BENEATH THE AEGEAN SEA (GREECE) – ID 1822

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The purpose of this work is to obtain a 3-D shear velocity model of the upper mantle beneath the Aegean. In a previous work, averaged phase velocities of fundamental mode Rayleigh wave were determined along 36 interstation profiles across the Aegean in the period range 10-100 s. Phase velocities were further inverted to produce 1-D path average shear velocity models. The interpolation of these models yielded a 3-D image of wavespeed lateral variations throughout the Aegean area. However, due to the irregular distribution of ray paths in the region and the limited dataset, simple interpolation could not provide stable results for the large-scale lateral velocity variations, or constraints on the resolution of the model. This dataset is combined in a continuous regionalization tomographic scheme, to derive a smooth model of lateral shear velocity variations and a qualitative estimation of the model constraint as a function of geographical position. The observations reveal significant velocity variation between continental Greece (low velocities) and the Aegean Sea (high velocities). A low velocity zone is observed beneath the North Aegean Trough. In South Aegean high velocities indicate the subducted African lithosphere beneath the Aegean. Low velocity zones are associated with regions of high extensional strain rates, recent volcanism and high heat flow. These observations suggest a hot or perhaps partially molten upper mantle and/or distributed deformation of the upper mantle beneath this region, probably related with the slab roll-back that has accompanied back-arc extension. ACKNOWLEDGMENTS The present study was funded through the program EPEAEK II in the framework of the project “Pythagoras - Support of University Research Groups” with 75% from European Social Funds and 25% from National Funds”, contract No. 70/3/7306.

QLG TOMOGRAPHY IN BRITAIN – ID 1740

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Lateral variations in Lg-wave propagation in and around mainland Britain have been investigated using short period recordings from the UK Seismic Network. The dataset consists of 30 crustal earthquakes (2.7-4.7 ML) recorded in the distance range 170-600 km giving a total of 510 ray paths. The study area is generally well sampled with the exception of northernmost Scotland and southeast England. The regional average Lg quality factor, QLg, was estimated between 0.5 and 7.0 Hz. The result indicates that attenuation in mainland Britain is similar to levels observed in France and provides valuable information for ground motion simulation in the UK. The lateral variation in QLg was solved as a mixed-determined inverse tomography problem following the methodology of Ottemöller et al. (2002). Tomographic inversions were conducted individually for 23 frequencies in the range 0.5-7.0 Hz. The spatial resolution obtained was around 100 km in areas with good data coverage. Lower than average QLg values were obtained for the collision zone associated with the closure of Iapetus, which lies between the Highland Boundary Fault and a major shear zone in northern England. Low QLg values were also obtained for the Anglo-Brabant Massif region whereas the older Welsh Massif appears to be characterised by high QLg. The results point towards similar attenuation north and south of the Great Glen Fault in Scotland and the Variscan Front in southern England but these areas are not well resolved.