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Multiple resolution dispersion tomography of Earth, Europe, and the Mediterranean

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We invert surface wave dispersion data for global and regional velocity structure with a multi-resolution linearized inversion scheme, deriving a 3-dimensional model of shear wave velocity. We account for the non-linear effects of strong lateral crustal heterogeneities by generating sensitivity kernels for each pixel of a 2°x2° starting model including Crust 2.0. We complement a high-quality database of global teleseismic phase velocity observations by adding a much denser coverage of high-quality data in and around the Mediterranean Basin and central and southern Europe including data from MidSEA (van der Lee et al., 2001), SDSNet (Baer et al., 2000), Tomo-CH (Fry et al., 2005), and GRSN (Hanka and Henger, 1992) stations. The resulting improvement in data coverage and unprecedented commensurate improvement in tomographic resolution yield a more stable image of regional heterogeneities in S-velocity, with the possibility of mapping variations in radial anisotropy at the regional scale. We are also capable of resolving more finely the long and intermediate wavelength structures that elucidate currently debated geodynamic processes occurring as a result of the convergence of the African and Eurasian plates. Our multiple-resolution parameterization consists of a relatively fine grid of splines over the Mediterranean-southern European region and a coarser grid elsewhere. By including the global dispersion database in our inversion, we account for heterogeneities outside the high-resolution region and decrease the chance of erroneously mapping these external features into the high-resolution region. By implementing multiple resolution parameterizations, correcting a-priori for strong, local crustal heterogeneities, and including previously unused data from densely sampled regions, we provide a velocity model for Europe and the Mediterranean with unprecedented resolution, and we are progressing toward the ultimate goal of merging local, regional, and global tomography. Our work contributes to a multi-disciplinary effort aimed at establishing a new reference model for

the region with a multitude of scientifically and socially relevant applications.