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Regional and local seismic anisotropy through shear-wave splitting from wide-angle seismic data

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We present a working scheme to image the spatial extent of shear-wave splitting parameters in the crust from wide-angle seismic data. A first step consists in the obtaining of radial- and transverse-component seismic reflectivity sections by implementing pre-stack depth migration from an S-wave velocity crustal model determined by conventional interpretation of picked intra-crustal seismic events. Next, we compute time delays between split shear waves and polarizations of the fast split shear wave by minimizing the transverse-component seismic energy from the previous reflectivity sections. The time delay and polarization in each layer are inferred using a layer-stripping method. Finally, we estimate the average of the splitting parameters along the whole profile or tectonic blocks crossed by the wide-angle seismic sounding. Thus, the averaged time delay and polarization are viewed as the effects caused by regional anisotropy, whereas the residual values of the splitting parameters are supposed to be due to local anisotropy. The working method permits the construction of multi-layer anisotropy images, which in turn allow discuss the intra-layer coupling/decoupling or deformation. As a study case based on real data, we have utilized a set of three-component seismic data acquired by a controlled source experiment carried out in the southeastern region of China. The results demonstrate that the averaged polarizations and time delays are consistent with the direction and strength of the stress field, respectively, as well as the lateral variations of polarization and time delay due to local anisotropy match the spatial distribution of surface faults crossed by the wide-angle seismic profile.