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Mantle structure and dynamics beneath the Western Mediterranean constrained by seismic anisotropy and global flow models

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The western Eurasian-African plate margin hosts a complex subduction system adjacent to the Atlantic lithosphere to the west and the west African craton to the south. New seismological and geodynamic studies of the Alboran domain of the western Mediterranean are helping constrain the regional dynamics and mantle anisotropic structure. We examine shear-wave splitting delay times and fast polarization directions using SKS phases recorded by a temporary broadband array in Morocco and southern Spain. We use events in 2009-2010 with magnitude greater than 6.0 for earthquakes between 85-135 degrees. In co-located sites, initial results substantiate published work, but new measurements in Morocco across the Atlas show an approximately 90 degree rotation in azimuth and reduced delay-times. This shift occurs south of the spine of the High Atlas. We hypothesize that the change in fast polarization direction is perhaps due to the existence of a shallow lithosphere-asthenosphere boundary beneath the Atlas and the mantle flow associated with it, in interaction with the cratonic root toward the south. In order to test this hypothesis, we compute high resolution, global mantle flow models adapted to the regional mantle structure. A series of different rheological models and scenarios based on global and regional tomographic images are used to evaluate the observed seismic anisotropy from new SKS splitting results. This approach allows for study of different upper mantle structure in affecting regional tectonic force transmission and the implications of long-term plate boundary evolution.