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Seismic anisotropy analysis in the Alps: contribution of permanent stations to AlpArray temporary network

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Investigating the structure and deformation pattern at depth below the Alps is best tackled with the help of permanent seismic stations with long recording periods. Seismic anisotropy analysis of core-refracted shear waves (SKS) is a standard technique that provides a wealth of information on active and/or fossil deformation, shedding light on the geodynamic activity of the study region. SKS waves are sensitive to the broad upper mantle anisotropy, providing an average measurement of deformation beneath each station. The Alpine Orogen is a complex geodynamic region and a more heterogeneous anisotropy distribution is expected, such as multiple layers with different anisotropic properties or dip angles. Their combined effect would result in an apparent SKS splitting variation with event azimuth. Unfortunately, due to the unequal global distribution of earthquakes and often short recording time periods, data are only available in narrow azimuthal ranges, biasing interpretations. Mapping lateral and vertical variations of seismic anisotropy requires a good azimuthal coverage and the long time window recordings of permanent stations can significantly improve this deficit.
In western and central Alps, where the analysis of AlpArray data is work in progress (v. Petrescu L. et al., paper submitted to session GD7.2), a deep complex structure is expected. To reinforce the discussion on the results obtained by previous and current anisotropy studies, we started analysing SKS data recorded by permanent stations with very long time window data availability, such as the TUE MedNet station, active since 2002. SKS splitting measurements of the TUE station show significant variation of the anisotropy direction as a function of the back-azimuth, which is a diagnostic for complex anisotropy. To investigate the distribution anisotropy at depth, we use the SplitRacer software to fit a variety of theoretical anisotropy models to the observed variation, ranging from two layers of anisotropy to ten layers with a fixed delay time. This kind of analysis, allowed by the large number of teleseisms recorded in more than 15 years, is applied to other permanent stations belonging to the Italian National Network with similar recording data periods.