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Patterns of seismic anisotropy and mantle flow around convergent margins: predictions from 3D geodynamic modelling, comparison with observations and implications for the interpretation of seismic tomographies (Arne Richter Award Lecture for OYS)

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Seismic anisotropy generated by strain-induced lattice/crystal preferred orientation (LPO/CPO) of intrinsically anisotropic minerals is commonly used to study flow in the mantle and its relations with plate motions.
In this contribution, I will present results from 3D petrological-thermomechanical models of subduction/collisional settings, where the strain-induced LPO of polycrystalline aggregates of the upper and mid mantle is computed. Overall, medium to strong fabrics develop in the upper and uppermost lower mantle around the convergent margin, with distinctive patterns that are related to the margin dynamic history.
The full elastic tensors obtained from each polycrystalline aggregate is then used to carry out several seismological synthetic experiments. In particular:
1) seismogram synthetics of teleseismic waves propagating sub-vertically were computed to estimate SKS splitting patterns that are mostly controlled by the anisotropy in the upper mantle. Results are compared with observations from different subduction and collisional settings, yielding a strong constrain on the recent dynamics of these convergent margins.
2) synthetic seismic tomographies were produced using realistic ray path distributions around convergent margins, showing how the interpretation of seismic anomalies could potentially be biased by the presence of seismic anisotropy and a non-uniform seismic ray coverage.