

Subduction zones dynamics and structure from coupled geodynamic and seismological modelling

Manuele Faccenda

Universita' di Padova, Dipartimento di Geoscienze, Padova, Italy (manuele.faccenda@unipd.it)

The present-day structure of subduction settings is mainly determined by means of seismological methods. The interpretation of seismological data (e.g., isotropic and anisotropic velocity anomalies) is however non-unique, as different processes occurring simultaneously at subduction zones can be invoked to explain the observations. A further complication arises when regional tomographic seismic models ignore seismic anisotropy, in which case apparent seismic anomalies due to non-uniform sampling of anisotropic areas will appear.

In order to decrease the uncertainties related to the interpretation of seismological observations, geodynamic modelling can be exploited to reproduce the micro and macro scale dynamics and structure of subduction settings, yielding a valuable first-order approximation of the rock isotropic and anisotropic elastic properties. The model output can be subsequently tested against observations by performing seismological synthetics (e.g., SKS splitting, travel-time tomography, receiver functions, azimuthal and radial anisotropy). When the misfit between the modelled and measured seismic parameters is low, the geodynamic model likely provides a good approximation of the recent dynamics and present-day structure of the subduction setting. Such a model can then be used to give a more robust and thermomechanically-based interpretation of the observables and/or further improve the seismological model by providing a-priori information for subsequent inversions.

The methodology is still in its infancy, but we envisage that future developments could substantially improve seismological models and, overall, our understanding of complex subduction settings.