1) Traction and faults

Assume that the horizontal components of the 2-D stress tensor are

$$\boldsymbol{\tau} = \begin{bmatrix} \tau_{xx} & \tau_{xy} \\ \tau_{yx} & \tau_{yy} \end{bmatrix} = \begin{bmatrix} -30 & -20 \\ -20 & -40 \end{bmatrix} \text{ MPa}$$

(a) Compute the normal and shear stresses on a fault that strikes 10° east of north.

(b) Compute the principal stresses, and give the azimuths (in degrees east of north) of the maximum and minimum compressional stress axes.

2) The stress at the core-mantle boundary is 135 GPa. What is the hight of a 1m^2 x granite body (density 2500 kg/m^3) assuming constant acceleration that produces such stress value?

3) Find values for the PREM model in Shearer or in the internet:

Using values from the PREM model (Appendix A), compute values for the bulk modulus on both sides of (a) the core–mantle boundary (CMB) and (b) the inner-core boundary (ICB). Express your answers in pascals.

4) Is it possible to have spherical symmetry for S wave propagating away from a point source? Under what conditions could an explosive source generate shear waves?

5) Show that, if

$$\mathbf{u} = \nabla\Phi + \nabla \times \boldsymbol{\Psi} = \mathbf{P} + \mathbf{S}$$

then

$$\Phi = A\exp\left[\mathbf{k} \bullet \mathbf{x} - \omega t\right] \quad \text{and} \quad \mathbf{S} = \mathbf{B}\exp\left[\mathbf{k} \bullet \mathbf{x} - \omega t\right]$$

leads to longitudinal and transversal waves, respectively. Note that **B**, **k**, and **x** are vectors *A* is a scalar amplitude.