ESC3332 Global Dynamics WEEK 4

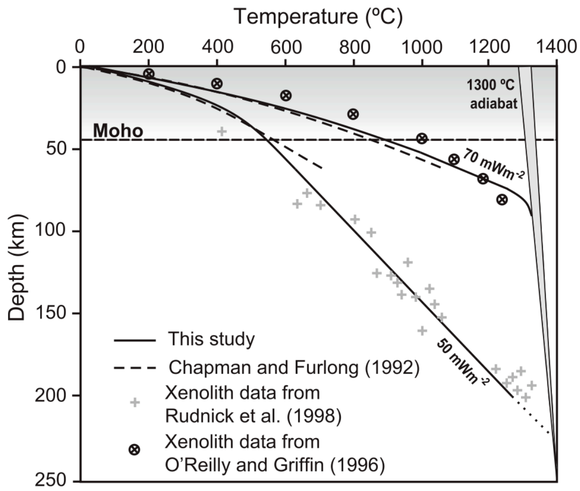
Using the script from the previous Pracs build the Yield Strength Envelope of the Oceanic and Continental Lithospheres.
Use the Plastic flow law (Byerlee):

$\sigma = \sigma_0 + \mu P$

where σ_0 = 50 MPa, μ = 0.6, and P = ρ_0 **g** y (as in the previous Pracs).
Use the creep law for the Olivine and Crustal rocks end members Wet Quartzite to Maryland Diabase and strain rates of 10^{-15} s^{-1}
(Refer to the additional slides in the Practical Material folder on Moodle for the values or the Lecture)

$$\dot{\epsilon} = A\sigma^n exp(-\frac{Q}{RT})$$

NOTE: This is to be rewritten in the stress explicit form.
Reproduce two Oceanic lithospheres (for a young and old one) and a "cold" and "warm" continental geotherms. Use a homogeneous continental crust of 30 km.



Answer the following questions:

1) What is the depth of the Plastic – Creep Transition in the Oceanic lithospheres?
2) What is the depth of the Plastic – Creep Transition in the Continental lithospheres?
3) Different continental geotherms and crustal compositions predict different deformation styles, discuss the overall lithosphere deformation according the end members below. These are, in general, the Jelly Sandwich (a) and the Crème Brulée (b). In the Jelly Sandwich the largest strength is in the upper crust and lithospheric mantle, deforming under plastic regime (faulting or mylonitic shear zones) while a weak layer in between is under creep, decoupling the layers. In the Crème Brulée most of the strength is in a top layer, while the lithospheric mantle is weak. Faulting and shearing occurs in the top layer, which is under plastic conditions, the mantle accommodates deformation by viscous dislocation creep.