1 Acoustic flux equations

$$\widetilde{D}_t\overline{P'u'_r} = -\nabla_r\overline{P'u''_ru'_r} - \overline{P'u'_r}\partial_r\overline{u}_r + \overline{u'_ru''_r}\partial_r\overline{P} + \Gamma_1\overline{u'_rPd} + (\Gamma_3-1)\overline{u'_r\rho\varepsilon_{nuc}} + \overline{P'u''_rd''} - \overline{P'G^M_r/\rho} - \overline{P'\partial_rP/\rho} + \mathcal{N}_{fpr} \tag{1}$$

$$\widetilde{D}_t\overline{P'u'_\theta} = -\nabla_r\overline{P'u''_ru'_\theta} - \overline{P'u'_r}\partial_r\overline{u}_\theta + \overline{u'_\theta u''_r}\partial_r\overline{P} + \Gamma_1\overline{u'_\theta Pd} + (\Gamma_3-1)\overline{u'_\theta\rho\varepsilon_{nuc}} + \overline{P'u''_\theta d''} - \overline{P'G^M_\theta/\rho} - (1/r)\overline{P'\partial_\theta P/\rho} + \mathcal{N}_{fp\theta} \tag{2}$$

$$\widetilde{D}_t\overline{P'u'_\phi} = -\nabla_r\overline{P'u''_ru'_\phi} - \overline{P'u'_r}\partial_r\overline{u}_\phi + \overline{u'_\phi u''_r}\partial_r\overline{P} + \Gamma_1\overline{u'_\phi Pd} + (\Gamma_3-1)\overline{u'_\phi\rho\varepsilon_{nuc}} + \overline{P'u''_\phi d''} - \overline{P'G^M_\phi/\rho} - (1/r)\overline{P'\partial_\phi P/\rho\sin\theta} + \mathcal{N}_{fp\phi} \tag{3}$$

2 Dilatation flux equations

$$\overline{u''_rd''} \sim \frac{\widetilde{R}_{rr}\ \overline{g}_r}{\Gamma_1\ \overline{P}} \tag{4}$$

$$\overline{u''_\theta d''} \sim \frac{\widetilde{R}_{\theta r}\ \overline{g}_r}{\Gamma_1\ \overline{P}} \quad \text{hypothesis, still needs to be validated} \tag{5}$$

$$\overline{u''_\phi d''} \sim \frac{\widetilde{R}_{\phi r}\ \overline{g}_r}{\Gamma_1\ \overline{P}} \quad \text{hypothesis, still needs to be validated} \tag{6}$$

$$\tag{7}$$

Using defintions of the dilatation and Reynolds stresses, the 3 equations of 3 unknowns $(u''_r, u''_\theta, u''_\phi)$ can be written as

$$\overline{u''_r\nabla_ru''_r} + \overline{u''_r\nabla_\theta u''_\theta} + \overline{u''_r\nabla_\phi u''_\phi} \sim \frac{\overline{\rho u''_ru''_r}\ \overline{g}_r}{\Gamma_1\ \overline{P}} \tag{8}$$

$$\overline{u''_\theta\nabla_ru''_r} + \overline{u''_\theta\nabla_\theta u''_\theta} + \overline{u''_\theta\nabla_\phi u''_\phi} \sim \frac{\overline{\rho u''_\theta u''_r}\ \overline{g}_r}{\Gamma_1\ \overline{P}} \quad \text{hypothesis, still needs to be validated} \tag{9}$$

$$\overline{u''_\phi\nabla_ru''_r} + \overline{u''_\phi\nabla_\theta u''_\theta} + \overline{u''_\phi\nabla_\phi u''_\phi} \sim \frac{\overline{\rho u''_\phi u''_r}\ \overline{g}_r}{\Gamma_1\ \overline{P}} \quad \text{hypothesis, still needs to be validated} \tag{10}$$

These equations should give us full turbulence field in convection zone in hydrostatic equilibrium **HOW CAN WE SOLVE THEM?**