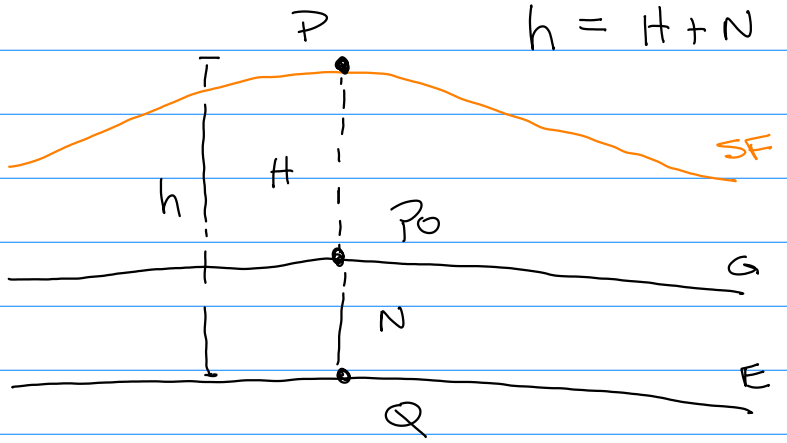
Classical gravity anomalies

gravity anomaly

$$\Delta g_P = g_0 - \gamma_Q$$



Free-air anomaly Δg_P^{FA}

approximations

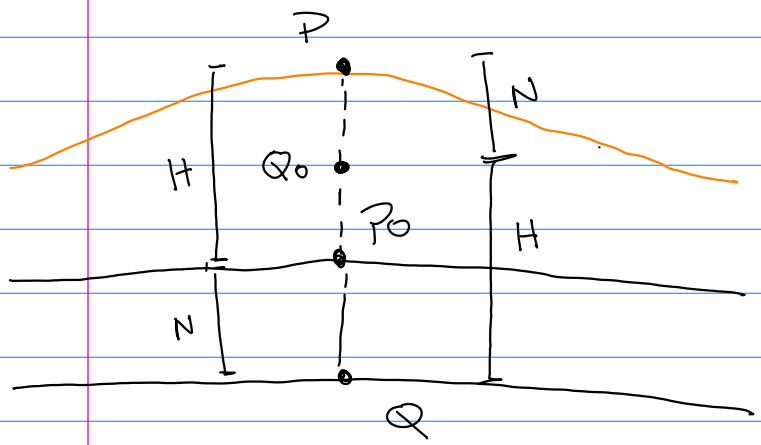
$$g_P \approx g_0 + \frac{\partial g}{\partial H} H$$

$$\frac{\partial g}{\partial H} \approx \frac{\partial \gamma}{\partial h} \approx -0{,}3086 \text{ mGal/m}$$

$$\Delta g_P^{FA} = g_0 - \gamma_Q$$

$$\approx \left(g_P - \frac{\partial \gamma}{\partial h} H\right) - \gamma_Q$$

$$\approx g_P - \underbrace{\left(\gamma_Q + \frac{\partial \gamma}{\partial h} H\right)}_{\approx \gamma_{Q_0}}$$



$$\gamma_P \approx \gamma_Q + \frac{\partial \gamma}{\partial h} h$$

$$\delta g_P = g_P - \gamma_P$$

$$\approx g_P - \left(\gamma_Q + \frac{\partial \gamma}{\partial h} h\right)$$

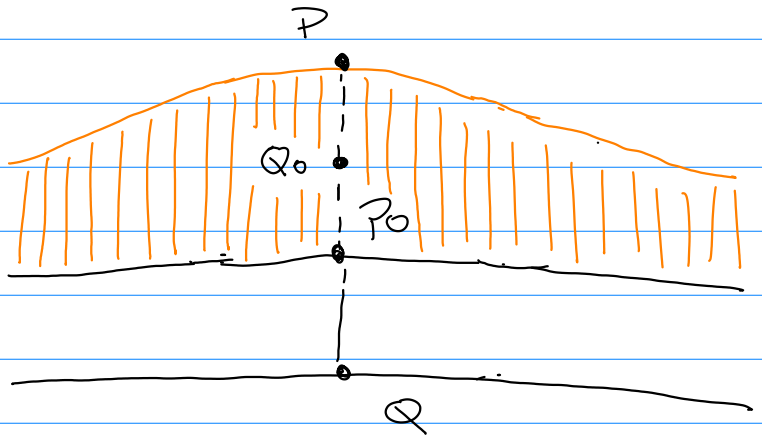
$$\delta g_P - \Delta g_P^{FA} \approx -\frac{\partial \gamma}{\partial h} \underbrace{(h - H)}_{N}$$

Bouguer anomaly Δg_P^B

approximations

$$g_P \simeq g_0 + \frac{\partial g}{\partial H} H + g_P^t$$

$$\frac{\partial g}{\partial H} \simeq \frac{\partial \gamma}{\partial h}$$

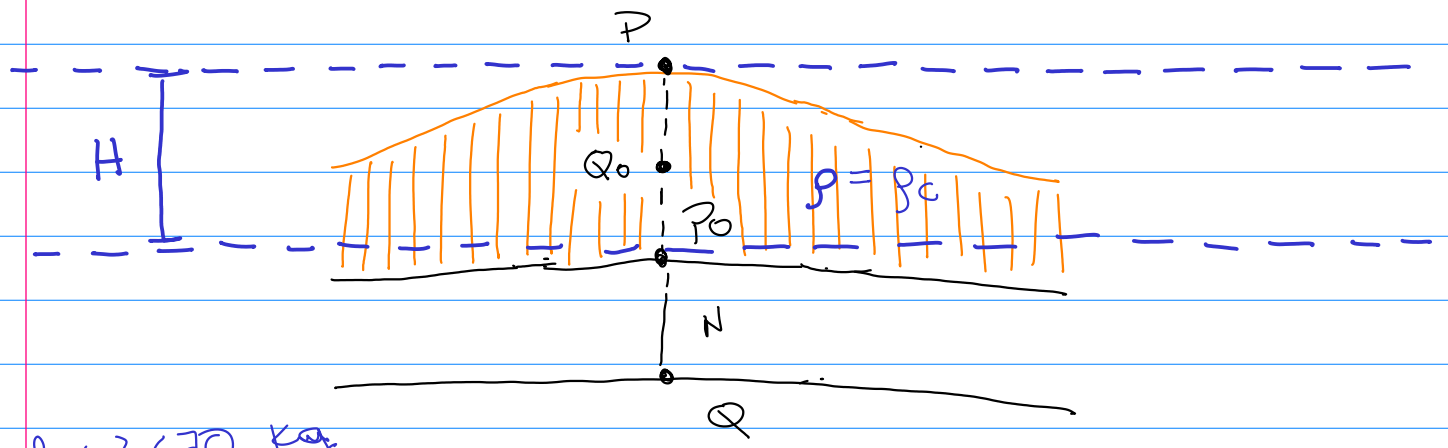


$$\Delta g_P^B = g_0 - \gamma_Q$$

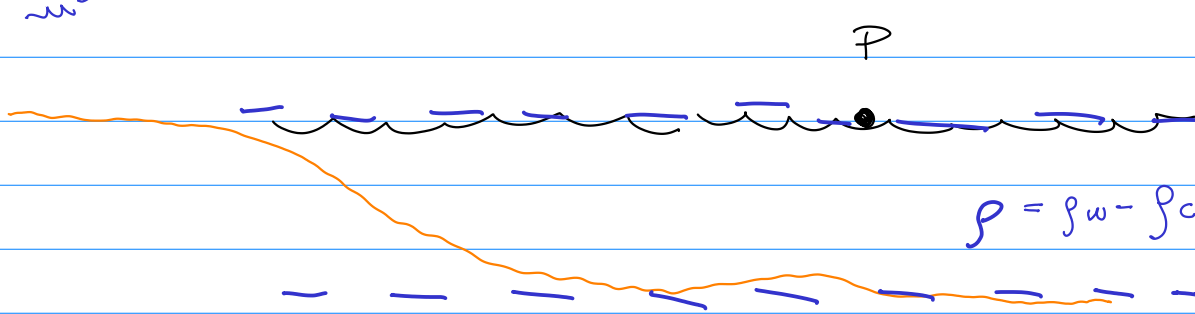
$$\simeq \left(g_P - \frac{\partial \gamma}{\partial h} H - g_P^t \right) - \gamma_Q$$

$$\simeq g_P - \left(\gamma_Q + \frac{\partial \gamma}{\partial h} H \right) - g_P^t$$

$g_P^t \simeq 10^{-5} \times 2\pi G \rho H$ (BOUGUER plate)



$\rho_c = 2670 \frac{kg}{m^3}$



$$\delta g_P^B \approx g_P - \left(\gamma_Q + \frac{\partial \gamma}{\partial h} h\right) - 2\pi G \rho h$$

$$\delta g_P^B - A g_P^B \approx -\frac{\partial \gamma}{\partial h} N - 2\pi G \rho N$$

$$\approx \left(-\frac{\partial \gamma}{\partial h} - 2\pi G \rho\right) N$$

geophysical indirect effect
(Hinze, et al, 2005)

Recommended papers:

Hinze, W. J., C. Aiken, J. Brozena, B. Coakley, D. Dater, G. Flanagan, R. Forsberg, T. Hildenbrand, G. R. Keller, J. Kellogg, R. Kucks, X. Li, A. Mainville, R. Morin, M. Pilkington, D. Plouff, D. Ravat, D. Roman, J. Urrutia-Fucugauchi, M. Véronneau, M. Webring, and D. Winester, 2005, New standards for reducing gravity data: The north american gravity database: Geophysics, 70, J25–J32. doi: 10.1190/1.1988183

Hackney, R. I., and W. E. Featherstone, 2003, Geodetic versus geophysical perspectives of the gravity anomaly: Geophysical Journal International, 154, 35–43. doi: 10.1046/j.1365-246X.2003.01941.x

Li, X., and H.-J. Götze, 2001, Ellipsoid, geoid, gravity, geodesy, and geophysics: Geophysics, 66, 1660–1668. doi: 10.1190/1.1487109

LaFehr, T. R., 1991, An exact solution for the gravity curvature (Bullard B) correction: Geophysics, 56, 1179–1184. doi: 10.1190/1.1443138