9/8/20

Froude number

$$\frac{Dw}{Dt} = g\frac{\Delta\theta}{\theta} \quad (= B)$$

$$\int \frac{Dw}{Dt}\,dz = \int g\frac{\Delta\theta}{\theta}\,dz$$

$$\frac{Dz}{Dt} = w \qquad \int_0^H w\,dw = \int_0^H g\frac{\Delta\theta}{\theta}\,dz$$

if $w(z=0)=0$,

$N^2 = \frac{g}{\theta}\frac{\partial\theta}{\partial z} \sim \frac{g}{\theta}\frac{\Delta\theta}{H}$

$$\frac{1}{2}w\Big|_H^2 \sim \underbrace{g\frac{\Delta\theta}{\theta}H}_{N^2H} \sim \text{KE needed to lift air parcel up to } H$$

$\frac{1}{2}U^2 \sim$ KE of wind

$F_r \equiv$ Froude number (also related to phase speed of shallow water gravity wave — later!)

$$F_r^2 = \frac{U^2}{N^2H^2} \sim \frac{\text{KE of air}}{\text{KE} \leftarrow \text{PE by lifting stable air up to } H}$$

(KE of air: needed to lift air up to H)

KE → PE as air rises over mtn. (consider gravity waves later)

- low F_r ⇒ blocking (not enough KE to make it over mtn)
- high F_r ⇒ flow goes over mtn (enough KE to make it over mtn)