GFD I

Frierson

Lecture 4: 1-11-17

Last time…

- Convective instability
  - Convective instablity criteria for atmos and ocean:

$$\frac{\partial \rho_\theta}{\partial z} > 0 \qquad \text{(ocean)}$$

$$\frac{\partial \theta}{\partial z} < 0 \qquad \text{(atmosphere)}$$

Last time…

- Static stability:
  - If stable, parcels oscillate up and down w/ frequency

$$N = \left(-\frac{g}{\rho_\theta} \frac{\partial \rho_\theta}{\partial z} \right)^{(1/2)}$$ (ocean)

$$N = \left(\frac{g}{\theta} \frac{\partial \theta}{\partial z} \right)^{(1/2)}$$ (atmos)

Moisture

- New variable: equivalent potential temperature

$$\theta_e = \theta \; exp\left(\frac{L_v q}{c_p T}\right)$$

- If parcel is saturated, $\frac{\partial \theta_e}{\partial z}$ determines stability.
- θ_e is conserved whether saturated or not!

A few other moisture definitions

- Clausius-Clapeyron equation for saturation vapor pressure:

$$e_s = e_{s0}\ exp\left(-\frac{L_v}{R_v}(\frac{1}{T}-\frac{1}{T_0})\right)$$

R_V=461.5 *J/kg/K*
e_{s0}=611 *Pa* if T_0=273.16 *K*
L_V=2.5e6 *J/kg*

- Specific humidity equation: $q = \epsilon\frac{e}{p}$

ϵ =0.62 = ratio of mass of water vapor to dry air

Today

- Sound waves
- Incompressibility
- Advection-diffusion