WWe have our PDE sets

- $\frac{d}{dt}(u, v, w) = \frac{d\vec{v}}{dt}$ Newton
- Some $\frac{d}{dt}$ (density for gravity to work on)
- continuity enforcement (a pressure eqn)

Hydrostatic $\{$ "Primitive Eqs"
Nonhyd $\{$ anelastic eqs — $P_0(z \text{ only})$ & $\rho' \sim T'$ in buoyancy

"Soundproof" $\{$ Boussinesq eqs — $\rho_0 = \text{const.}$

$\frac{\partial \rho}{\partial t} = \frac{\partial}{\partial t}\left(\frac{P}{RT}\right)$

$\frac{\rho_0 = \text{const.}}{\text{simplest}}$ $\exists \not\exists$ same $\}$

What are "solutions" to PDE's?
Fields in 4D space-time   that "obey"
2D   the PDES

Without fussing at analytic solutions (intractable),
categorize types of solutions

- transient "weather"

$\frac{\partial}{\partial t}$ term is leading order

vs.
diagnostic
steady or quasi-steady
"stationary"
balanced (for forces)

what timescale separates these?
- a day for geostrophy
- residence time for $KE = \dfrac{[KE]}{\text{friction loss rate}}$
"about a week"

- linearized vs. nonlinear

amplitude of disturbance or
perturbations is so small that
they are amplitude-independent

perturbation winds
don't importantly
advect perturbation quantities

• <u>Forced</u> vs <u>free</u> solutions
    ⇓   ⇓
RHS terms   "solutions to the homogeneous
                  diff eq^n