MAJDA – SAM ~~STECHMANN~~ Stechmann Mentor 7/15/08
NCAR-Lectures

Problem #1 (~~LARGE~~) Multi-Scale Equations

from Lecture #2 – Low Froude # – WTG

A) Assuming rigid lid and no-slip bdy conditions,

Solve the Large Scale Eqns

$$(\vec{u}_h)_t = -\nabla_x p + F_{\vec{u}}$$

$$p_z = \theta$$

~~$\frac{\partial}{\partial t}$~~

$$\frac{\partial \theta}{\partial t} + w = F_\theta$$

$$\text{div}\, \vec{u}_h + w_z = 0$$

Hint: Use vertical eigenfunctions; What are gravity/vortical modes?

B) Assume the small scale fluctuations are

2½ dimensional, i.e. $\vec{u}_h' = (u'(x,t), v'(x,t))$

~~w'~~ and set-up and solve the ~~w~~ small scale mean flow equations from lecture #2

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Problem #2 (Lecture #3 WTG and $F_R = O(\varepsilon)$)

A) Repeat derivation and equations from Lecture #3 with general anelastic $\rho_0(z)$, $N^2(z)$

B) Classify all Large Scale Flow Solns at Leading Order with $\textcircled{H} \equiv 0$ and get Eqns

Hint: 1) Generalized Shear Flows: $(\vec{x}_h = (x_h, y_h)$

$$\vec{u}_h = (u(z),\ v(z, x_h, t))$$

2) Barotropic Flows without z dependence

Problem #3 (Sam Stechmann / Yulong Xing mentors)

Compare 3-D fully WTG & $F_R = O(\varepsilon)$ from Lecture #3 with prescribed $v(z)$ and 3-D small-scale plane wave solutions with special solutions from Problem #1 A) in Low Froude #, WTG regime.

Future: Numerics for 3-D Asymptotic eqns. with variable