

**ESE 134: Cloud and Boundary Layer Dynamics** (due April 23):

[Problems adapted from Stull (1988).]

**1. Turbulence kinetic energy (TKE) budget.**

- (a) Which term(s), if any, represent the production of TKE
  - i. in a stratocumulus topped boundary layer?
  - ii. in a cumulus topped boundary layer with light trade winds?
- (b) Which terms are loss terms in the TKE budget, and why?
- (c) Which terms redistribute TKE, without producing or destroying it?
- (d) Define (i) free convection and (ii) forced convection, and discuss how their TKE budgets differ.

**2. Thermodynamics.**

- (a) Under which circumstances is the virtual potential temperature  $\theta_v$  conserved during adiabatic ascent of air, and when is it not conserved?