Coupled vs. Decoupled Boundary Layers in VOCALS-REx

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Two decoupling criteria

Profiles: $\Delta q = q_t (<0.25z_i) - q_t (0.75-1z_i) > 0.5 \text{ g kg}^{-1}$

Coupled

Decoupled

Subcld legs: $\Delta z_b = \text{Leg-mean lidar } z_b - \text{LCL} > 100 \text{ m}$
Decoupling correlates with well-mixed cloud thickness

...as does drizzle, but causality unclear.
Bretherton and Wyant (1997) suggested stronger latent heat fluxes should promote decoupling – not seen in our results.
Decoupling not correlated with inversion jumps

• Lock (2009) and others have suggested high values of
  \[ \kappa = 1 + c_p \Delta \theta / L \Delta q_t \]
  induce strong entrainment and Sc cloud breakup.
  Strong entrainment might also favor decoupling.

• Use REx C-130 profiles to calculate jumps/decoupling, adjacent
  subcloud legs to calculate cloud fraction.

• \( \kappa > 0.4 \) often (but not always) goes with broken cloud.
• For \( \kappa < 0.5 \) there is no obvious correlation of \( \kappa \) and decoupling.
• POC and non-POC distributions overlap