

# **The Fine Structure of the Entrainment Interfacial Layer and the Role of Wind Shear on Entrainment Mixing**

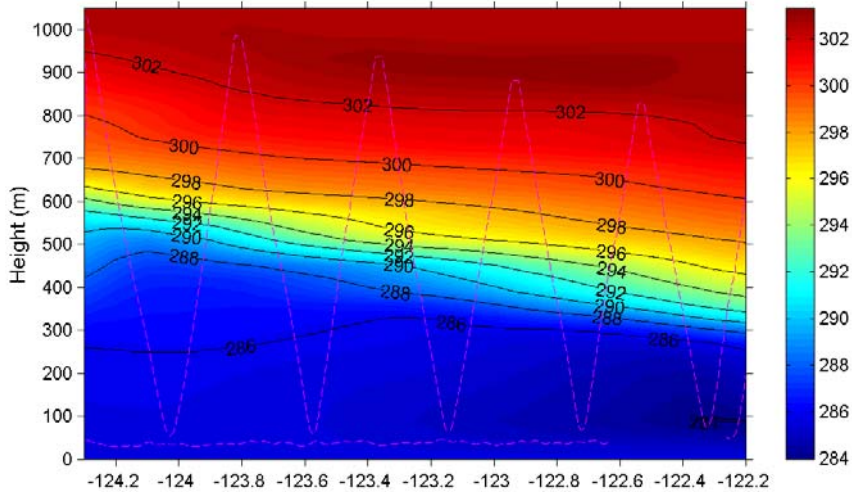
Q. Wang

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# Variations of the Costal Cloud-topped Boundary Layer --- Observations from DECS (1999)

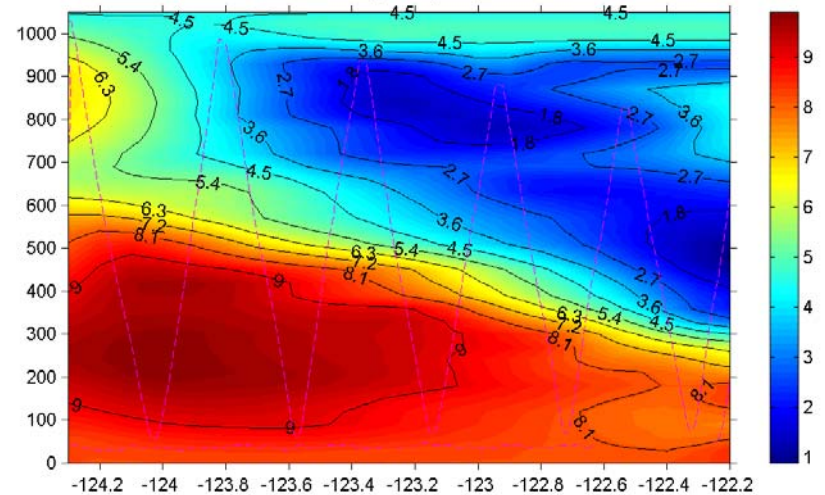
DECS 09/07/1999

$\Theta_v$  (K)



DECS 09/07/1999

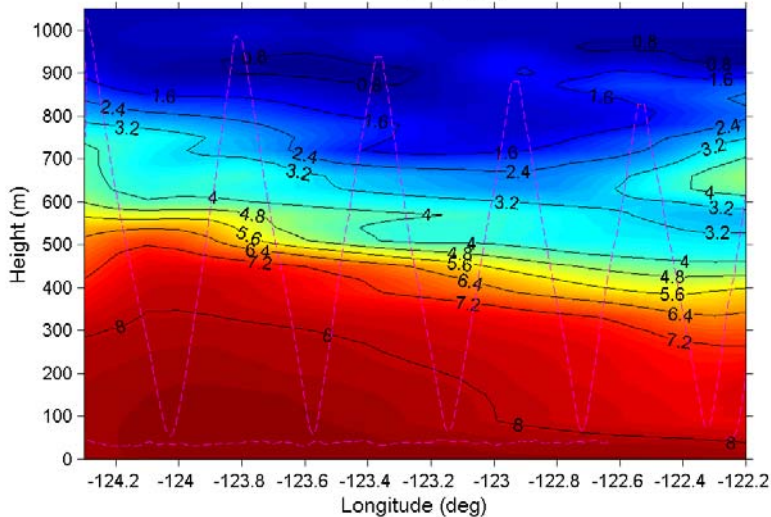
Wind speed ( $\text{ms}^{-1}$ )



From: (36.70N, 122.13W) To: (36.70N, 124.36W)

Start: 15:39:29UTC End: 17:38:20UTC

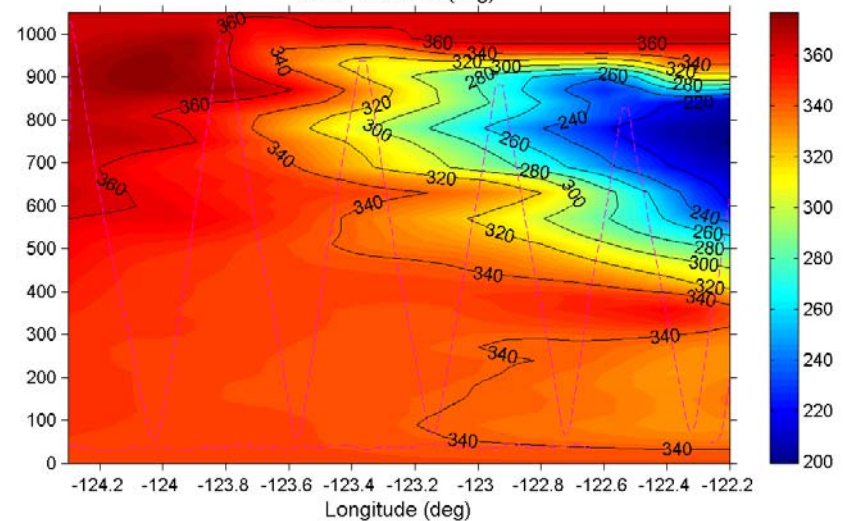
Water vapor ( $\text{g kg}^{-1}$ )



From: (36.70N, 122.13W) To: (36.70N, 124.36W)

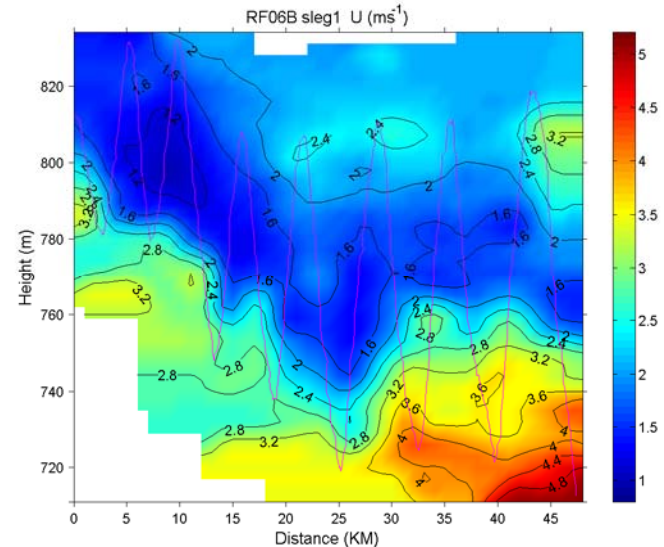
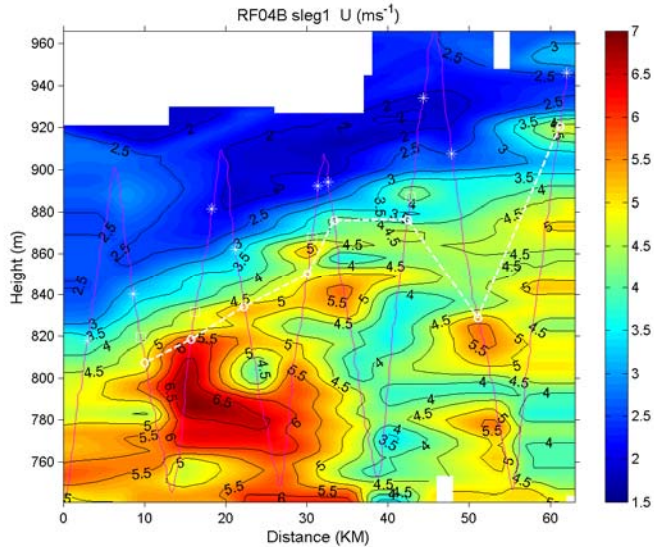
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Wind direction (deg)

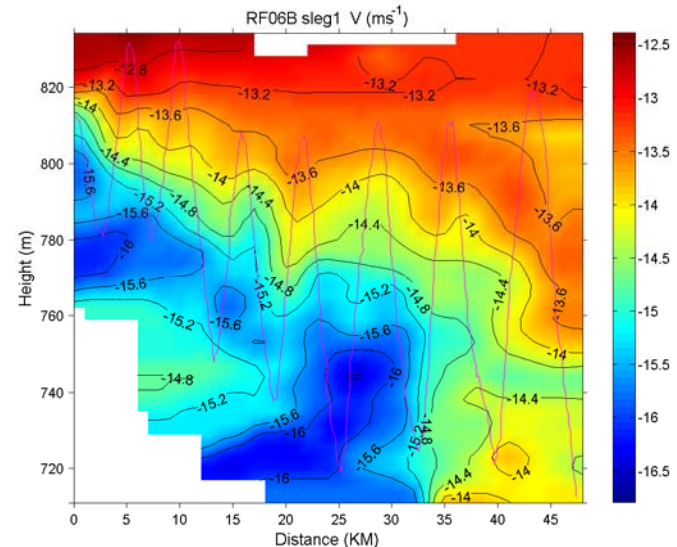
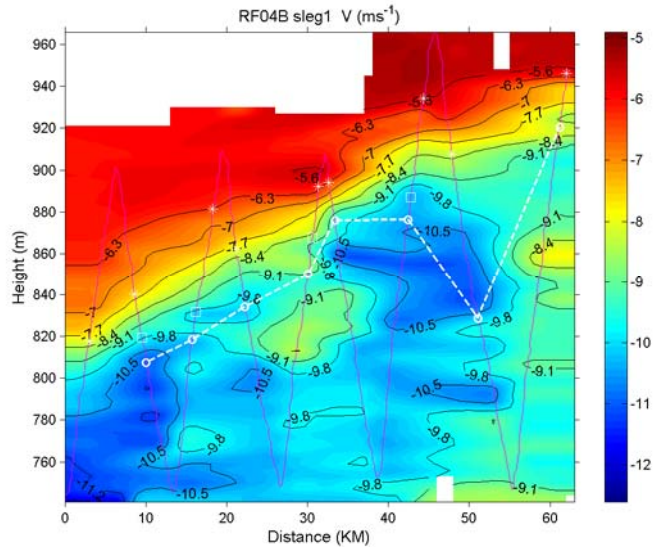


# Variations of the Coastal Cloud-topped Boundary Layer --- Observations from FIRE (1987)

Flt 4

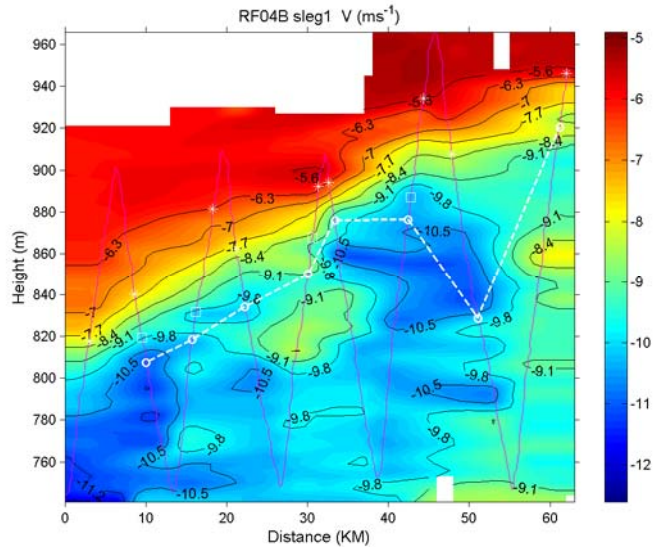
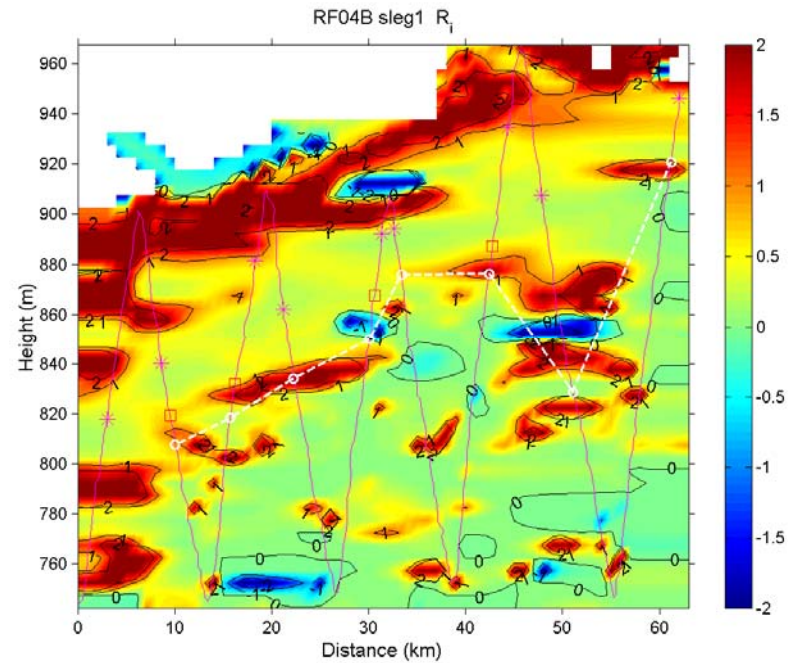
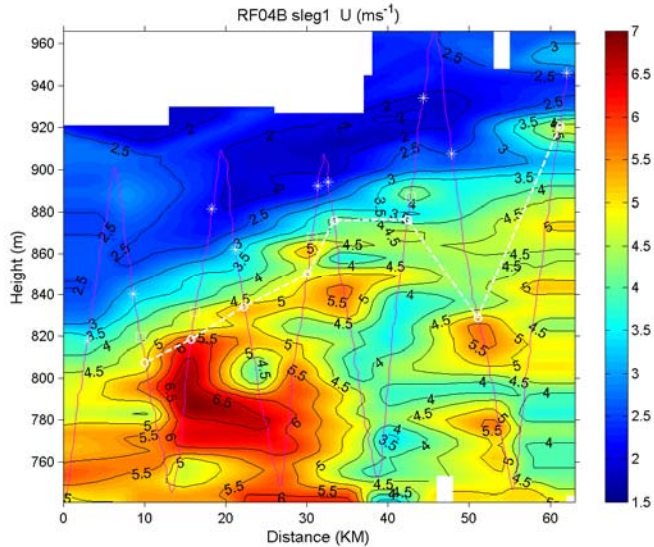


Flt 6



# Variations of the Costal Cloud-topped Boundary Layer --- Observations from FIRE (1987)

Flt 4



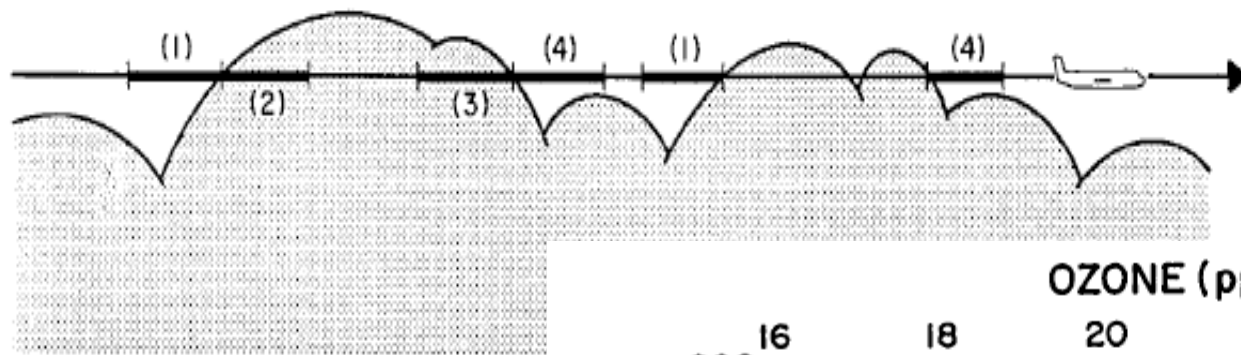


Figure 1. Schematic diagram showing the used in the composited profiles.

**Traditional view of cloud top structure: (Lenschow et al. 2000)**

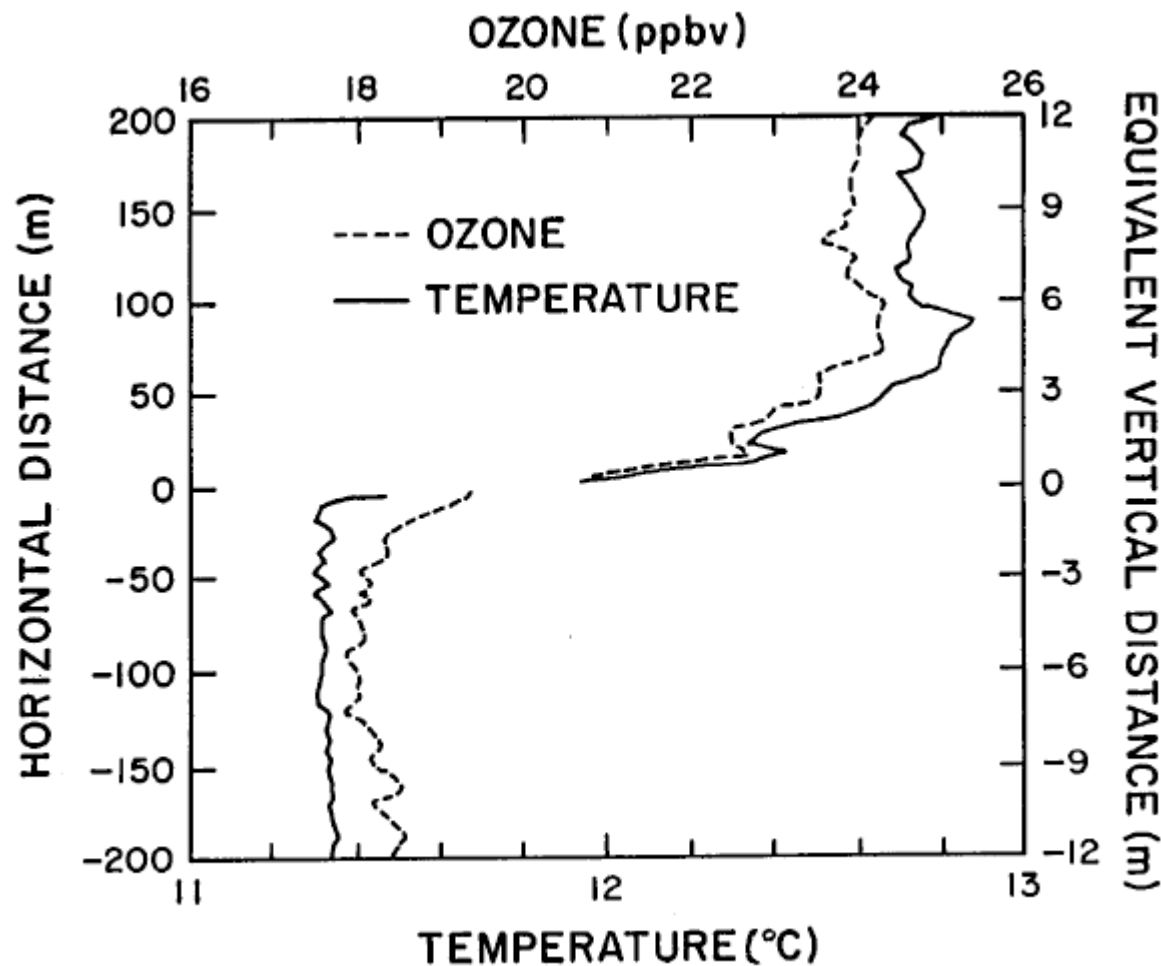
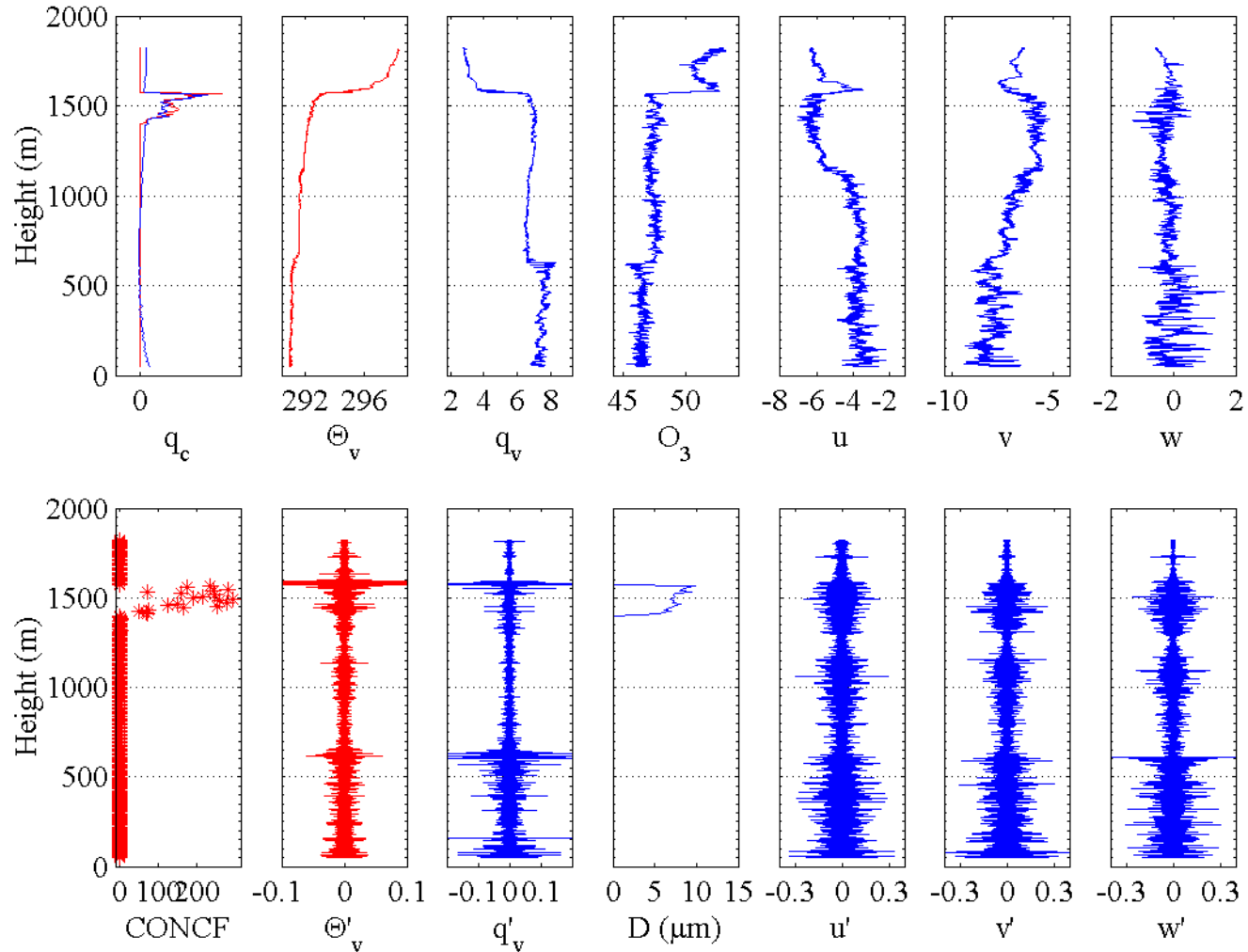


Figure 6. Same as Figure 5, for temperature and ozone.

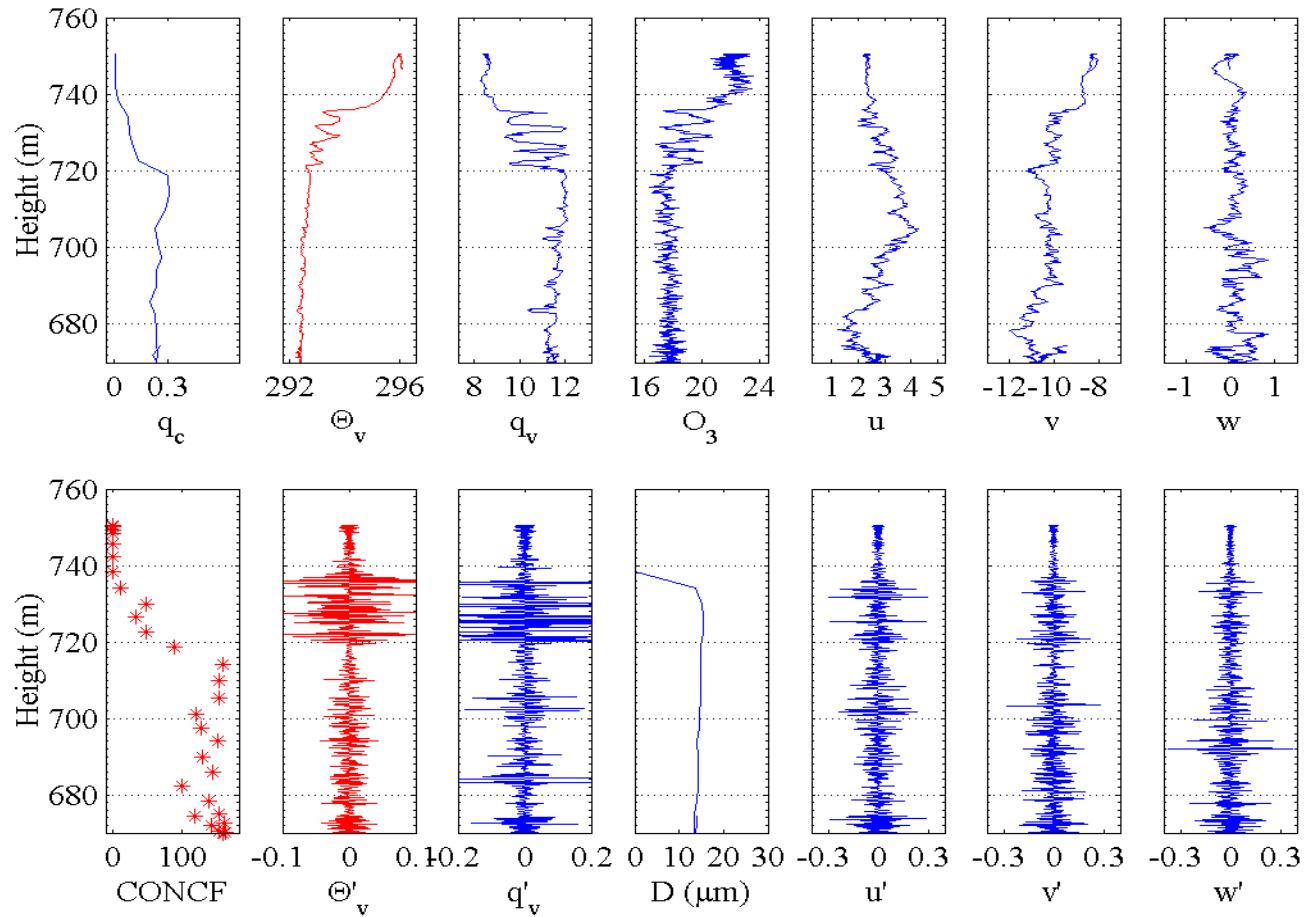
# Observed Vertical Variation from Aircraft Sounding (ASTEX)

## The traditional view



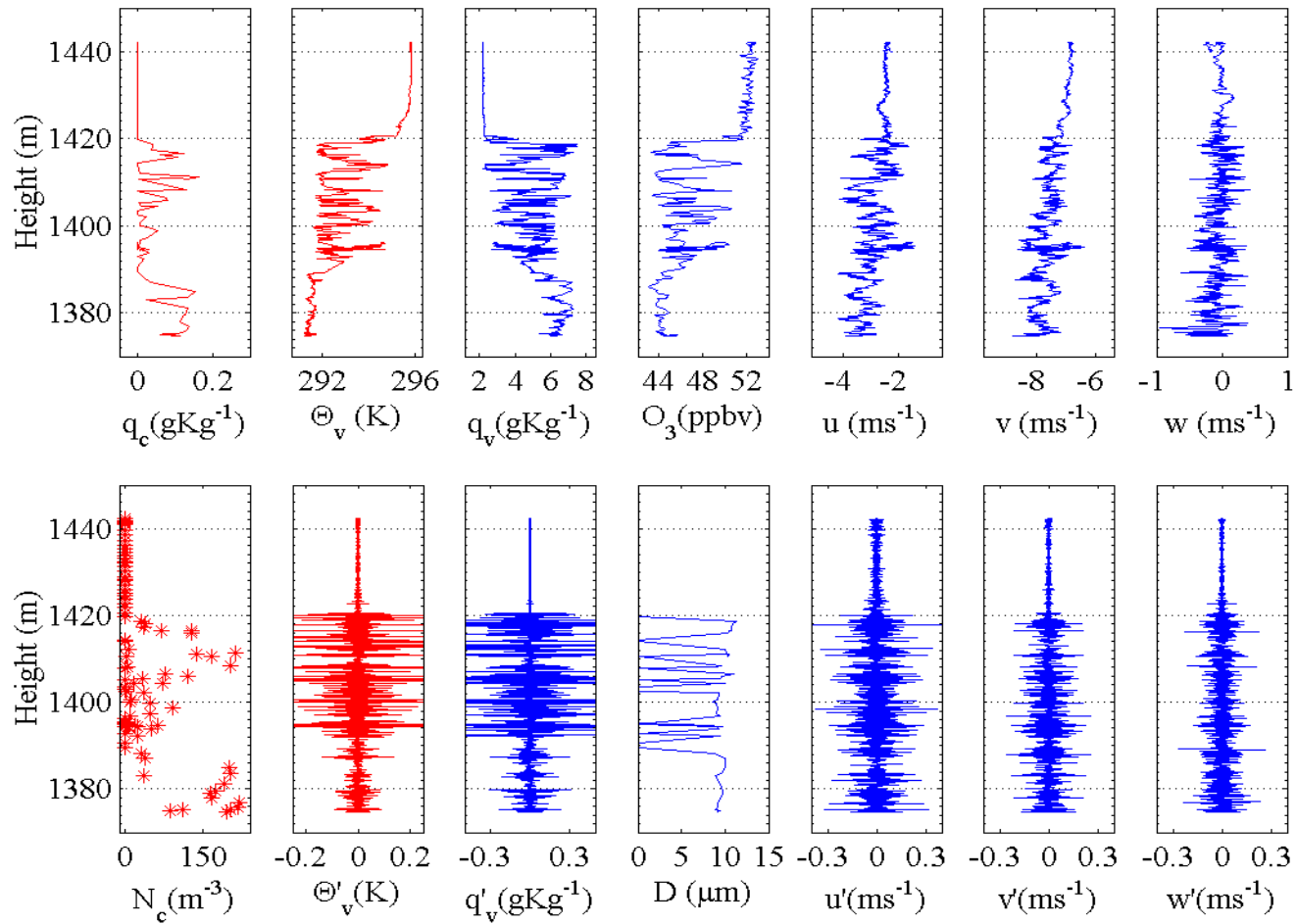
# Observed Vertical Variation from Aircraft Sounding

## The not-so-traditional view



# Observed Vertical Variation from Aircraft Sounding

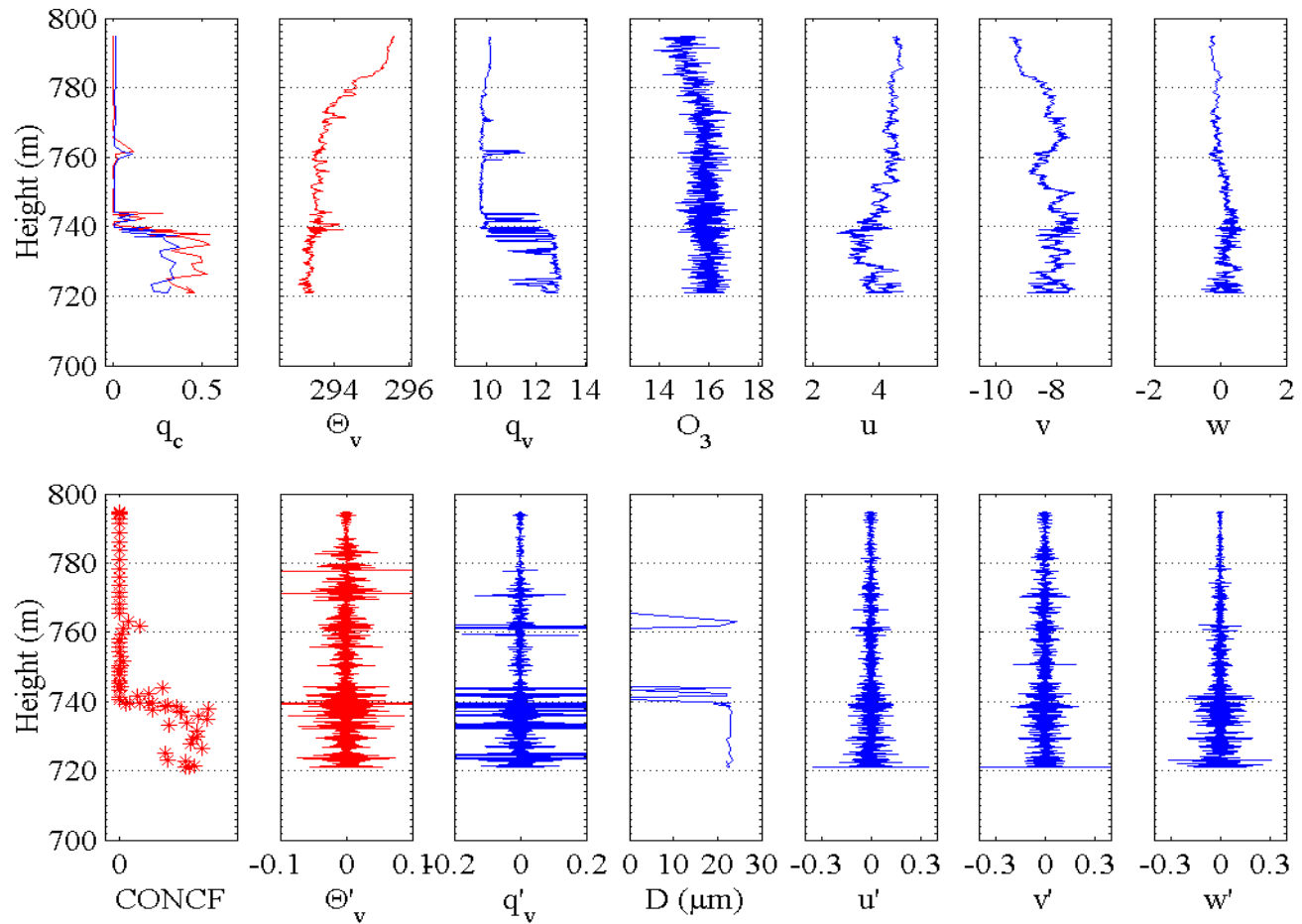
## The not-so-traditional view



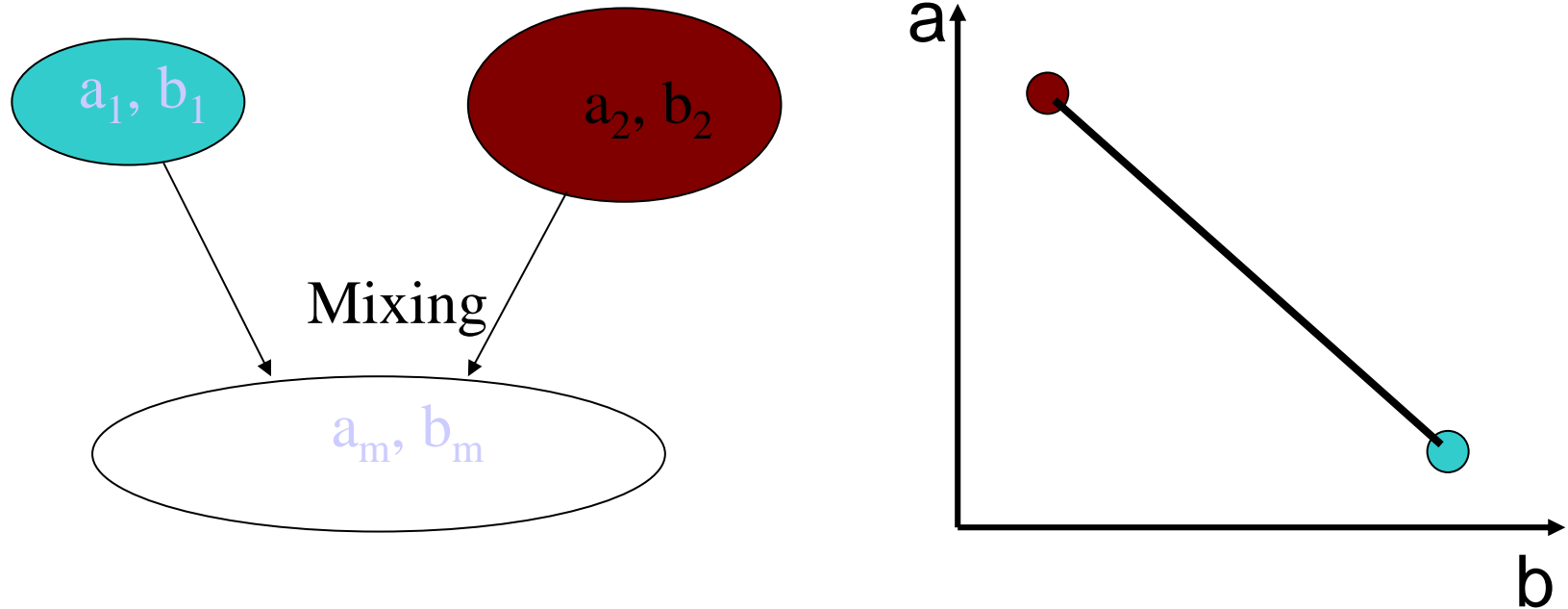


# Observed Vertical Variation from Aircraft Sounding

## The not-so-traditional view



# Mixing-line Analysis For the Interfacial Layer

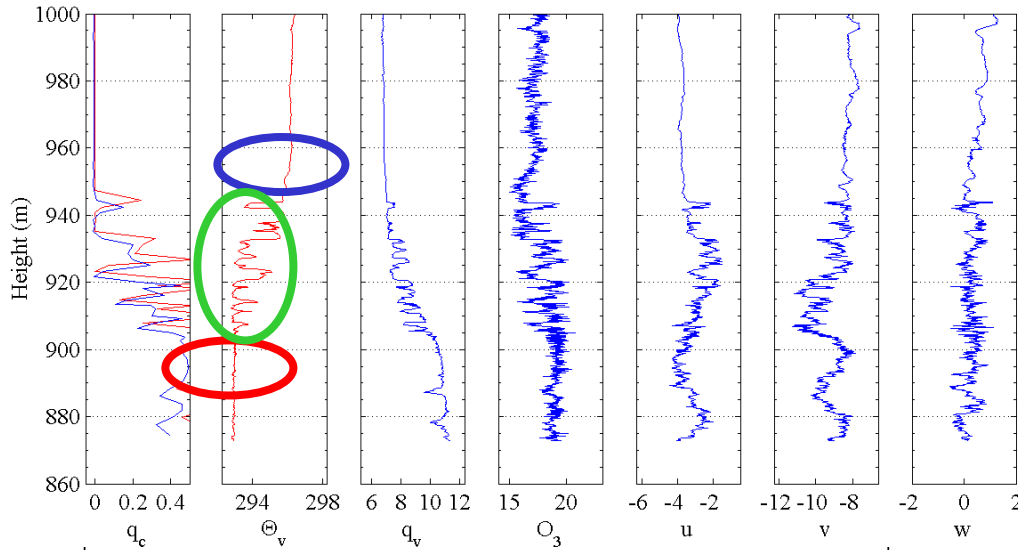


- $a$  and  $b$  are conserved in the mixing process.

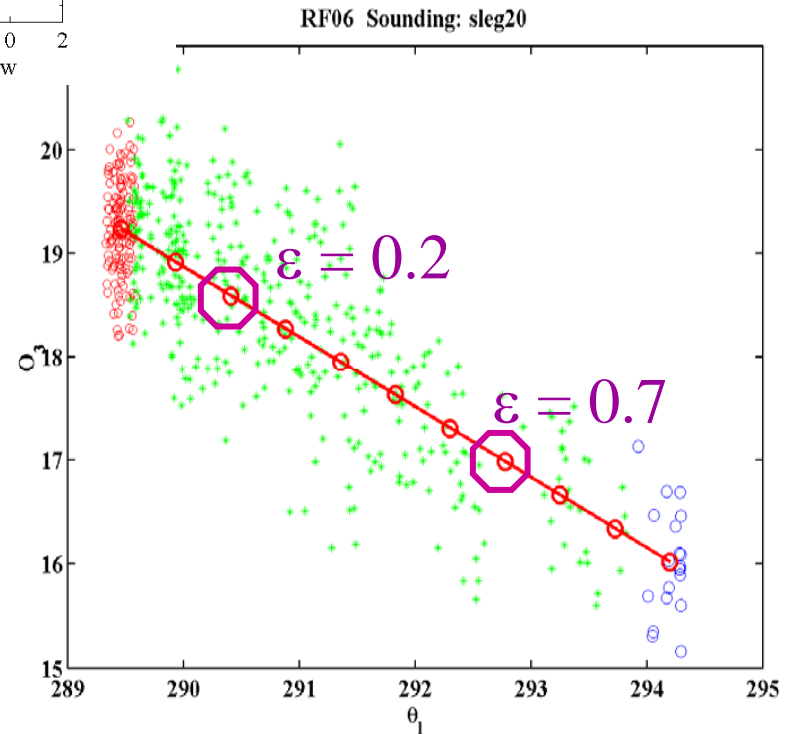
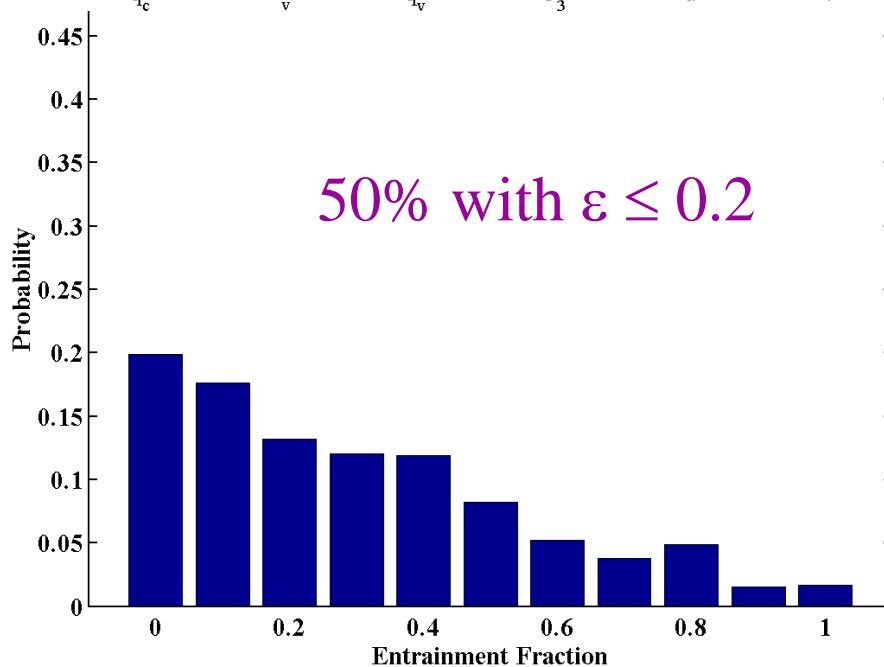
What is the interfacial layer composed of?

# Mixing Line Analyses

RF06 Sounding sleg20

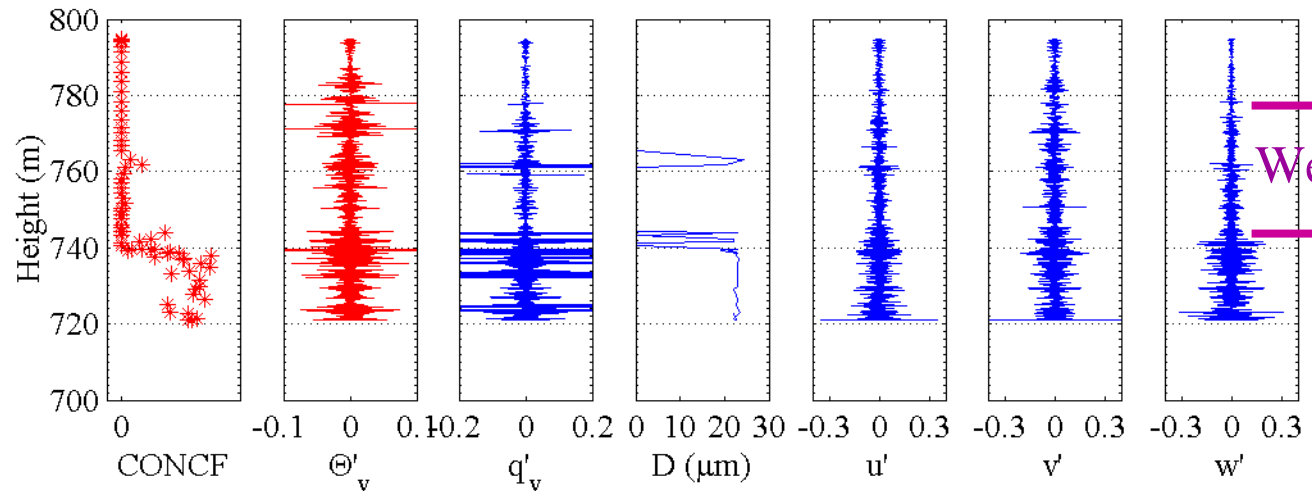
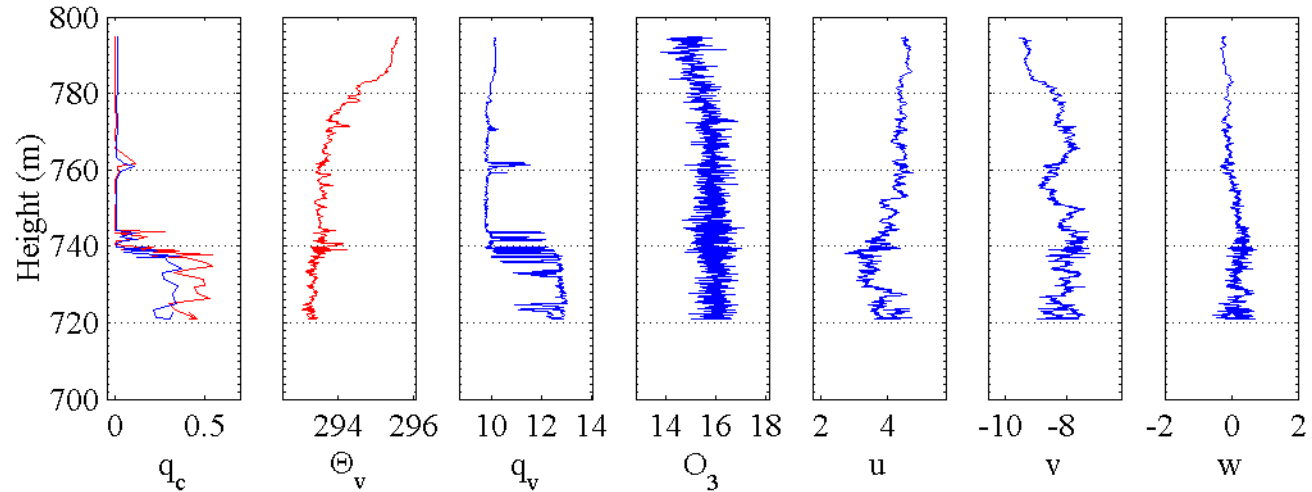


**Assumptions:**  
Horizontal homogeneity  
except in the interfacial  
layer



# Turbulence in the Interfacial Layer

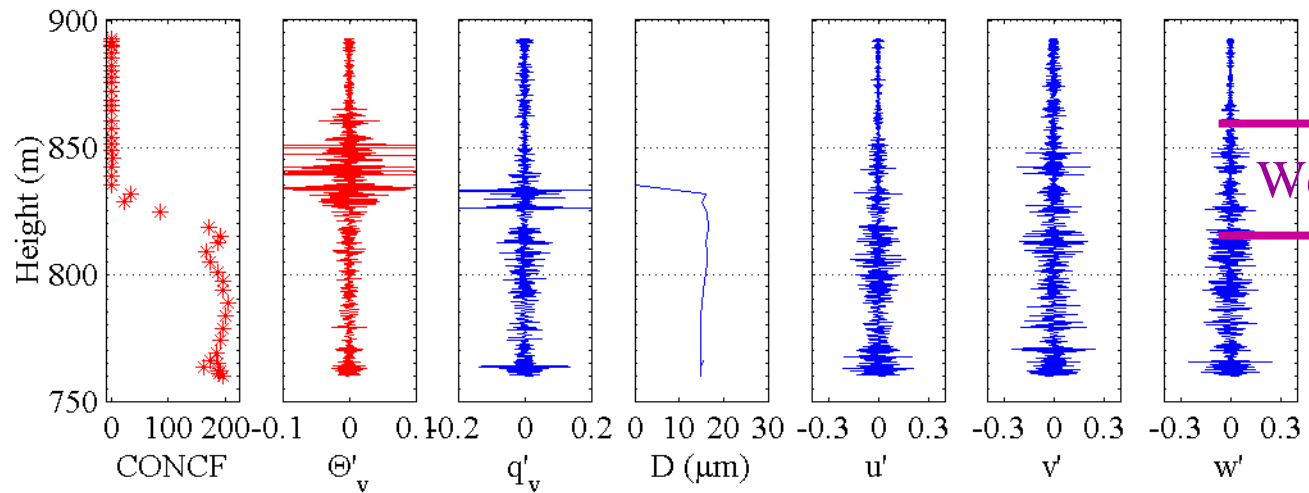
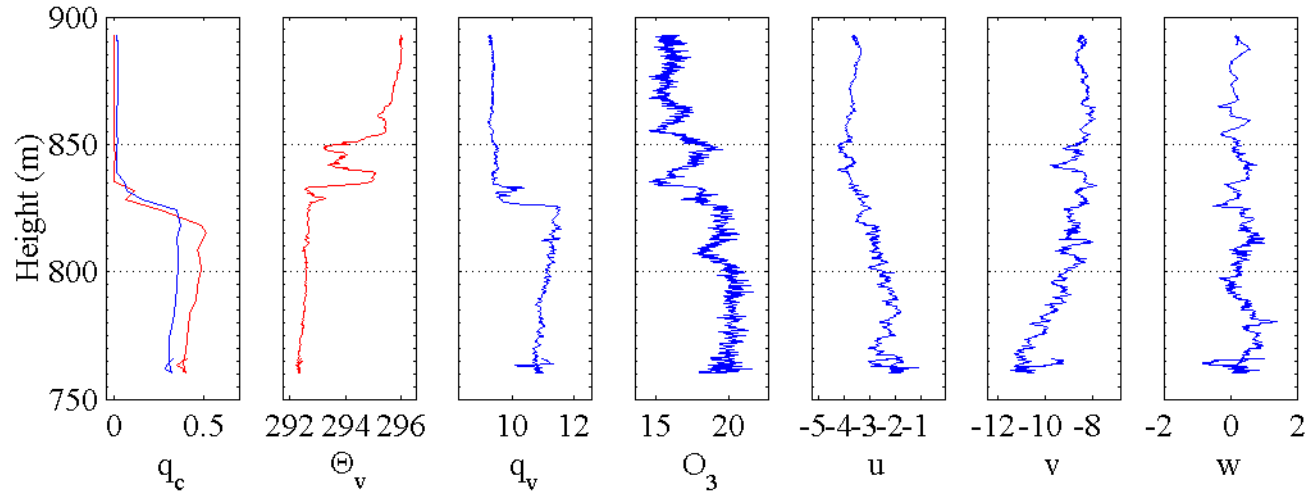
RF05 Sounding sleg12



Weak turb layer

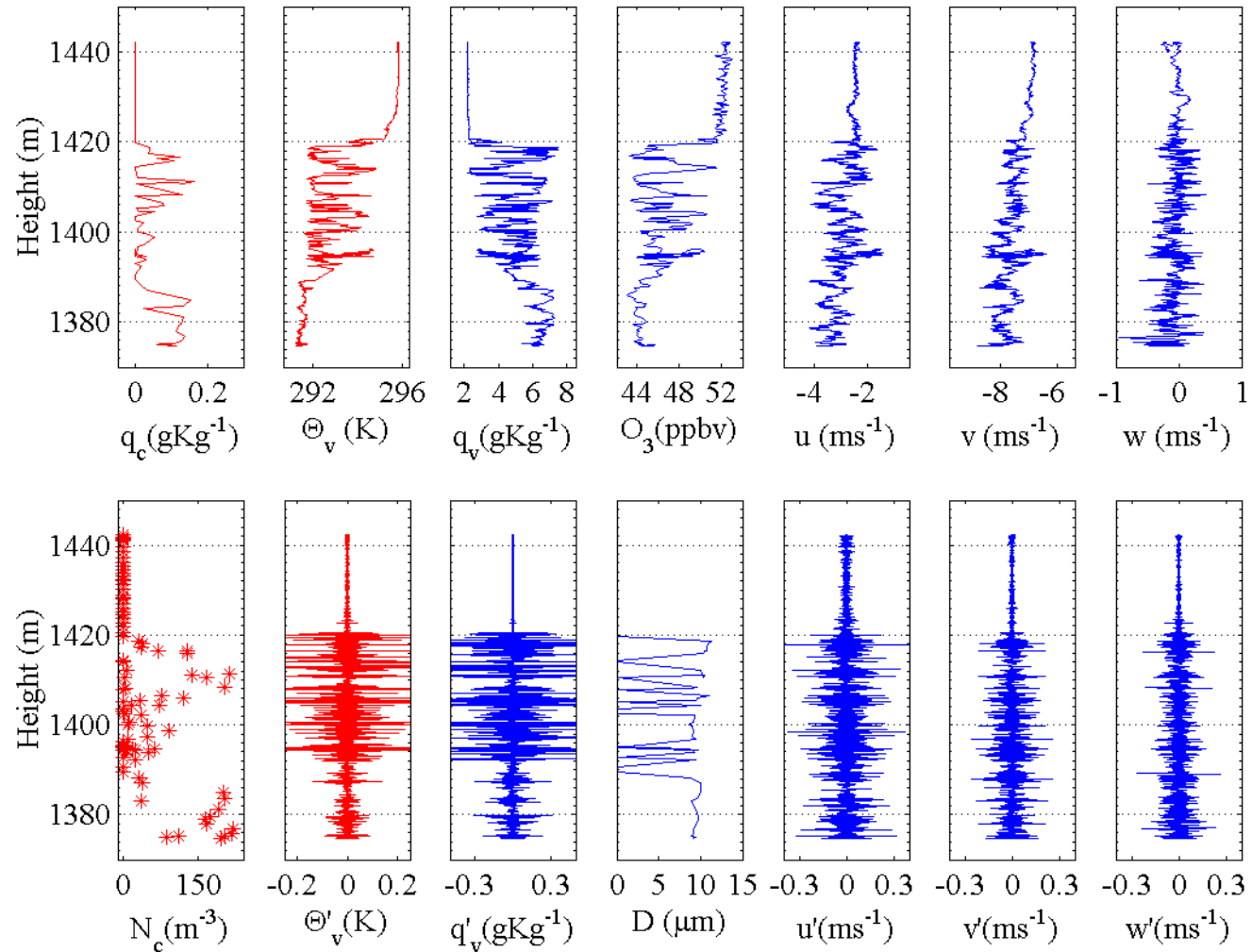
# Turbulence in the Interfacial Layer

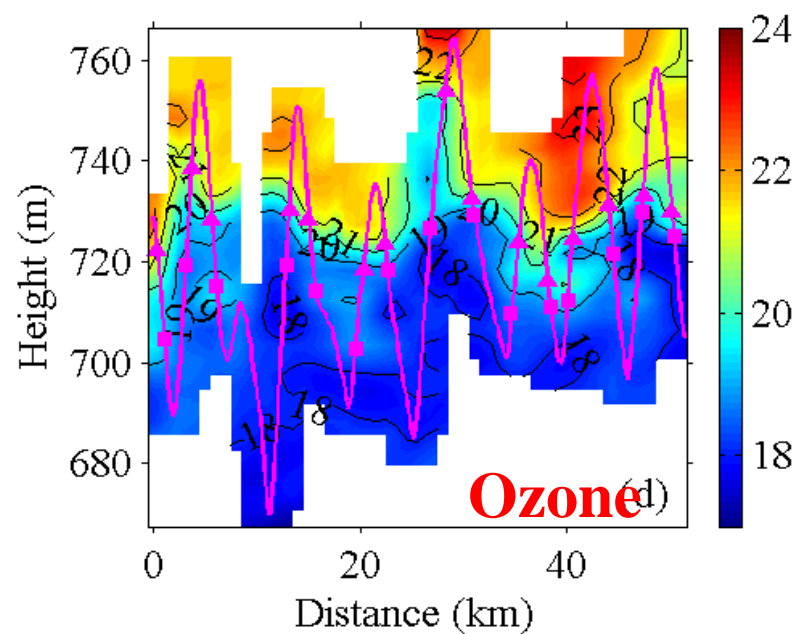
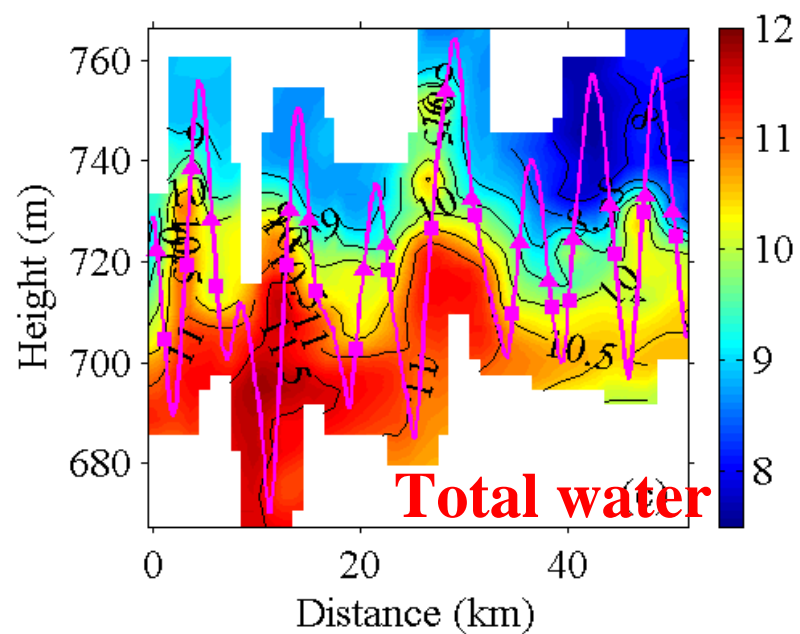
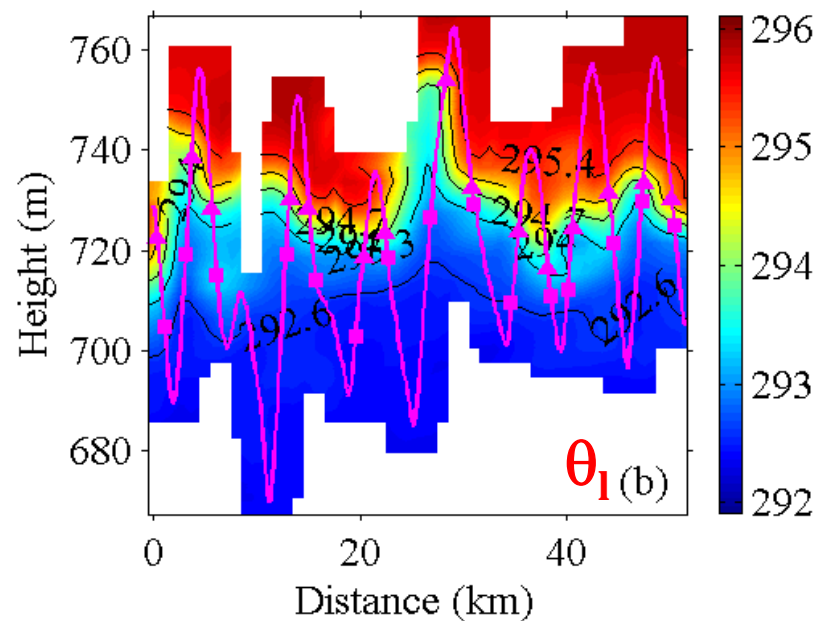
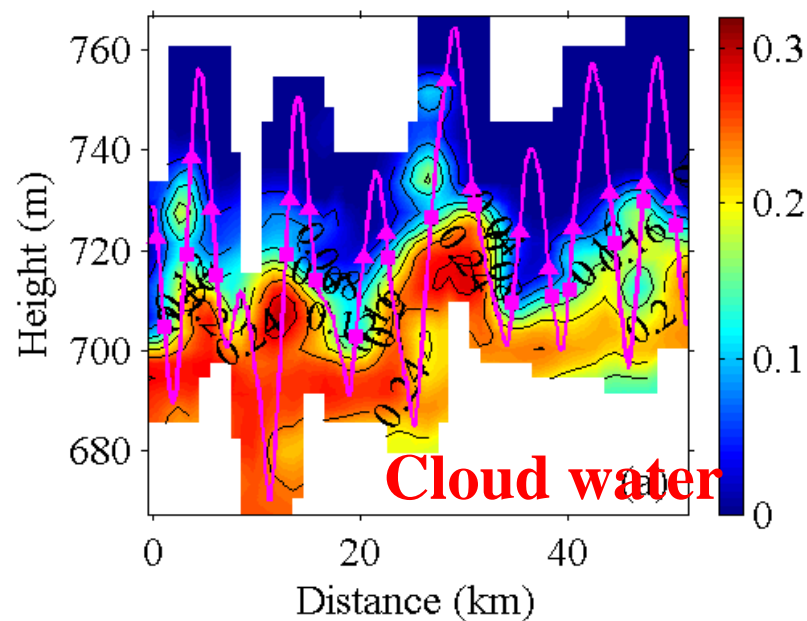
RF06 Sounding sleg27



# Turbulence in the Interfacial Layer

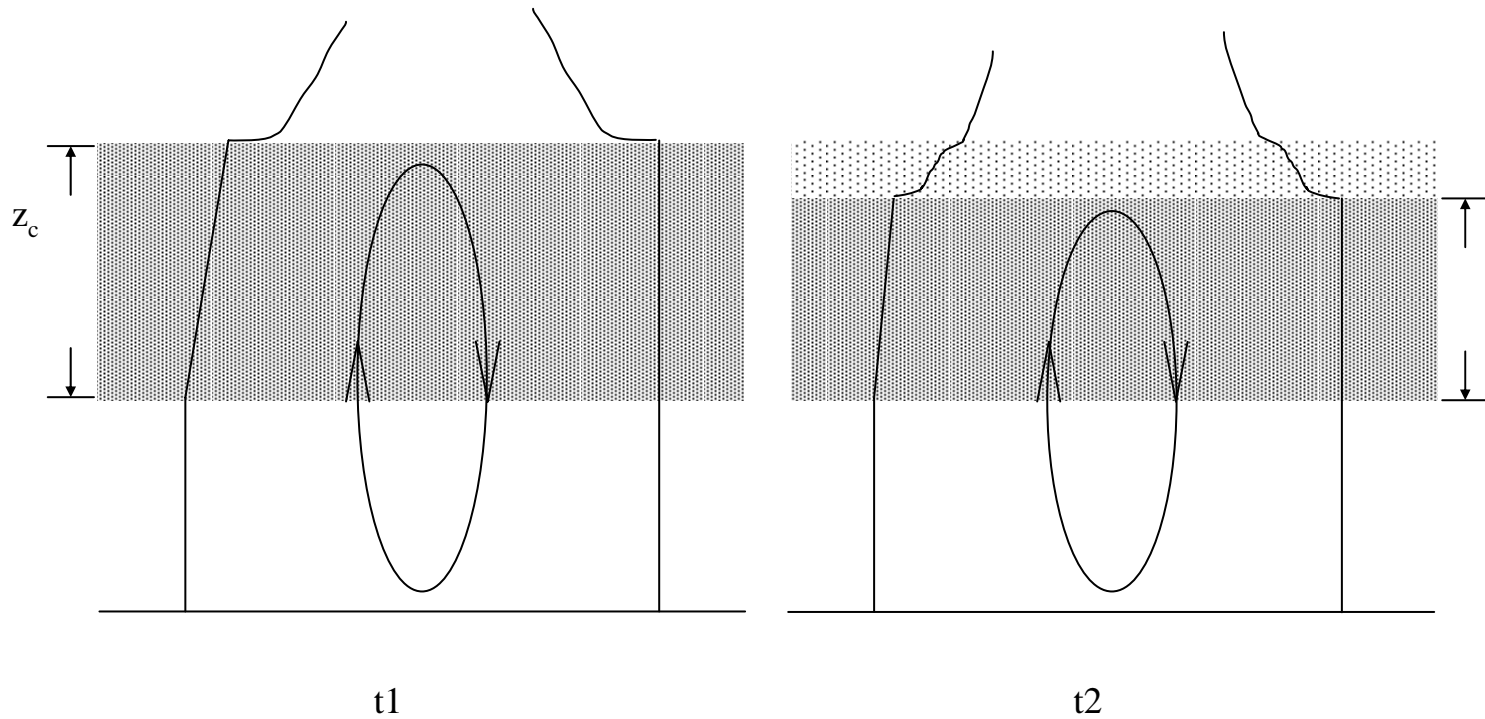
RF01 Sounding sleg8





# Hypothesis

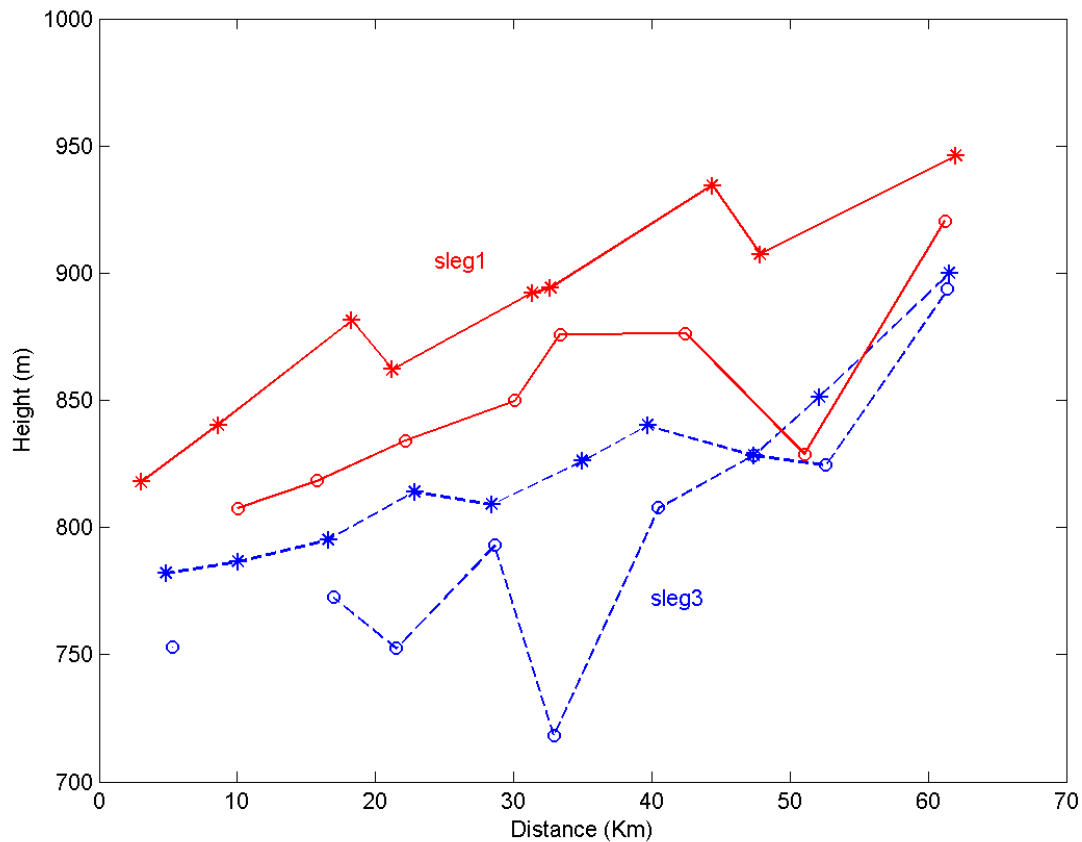
Entrainment drying of the upper cloud layer:





# NPS Focus in POST

How does the wind shear at the cloud-top change the entrainment physics in the stratocumulus-topped boundary layer?



# Optimal Flight Pattern for Shear Entrainment Study

- 1) Combined deep and shallow sawtooth slant path soundings to capture: a) the entire BL vertical structure; b) the variation of the mean and perturbation in the entrainment zone.
- 2) Horizontal legs through the entrainment zone.

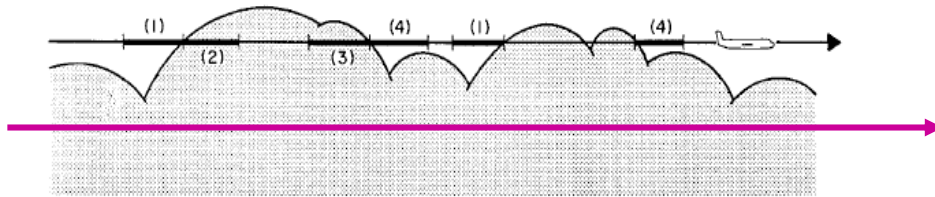
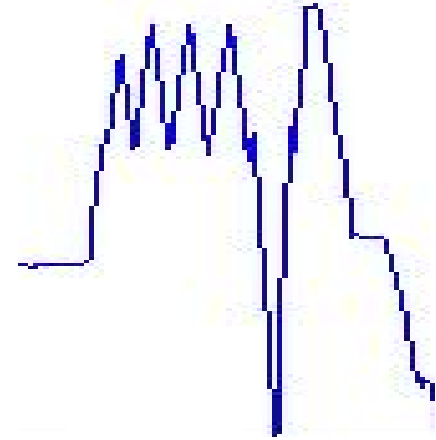


Figure 1. Schematic diagram showing the categories of segments referenced to cloud top that are used in the composited profiles.



- 3) Slow slant path ascent/descend through the BL: attempt to get turbulent statistics in case there are not enough time for stacks of horizontal legs.
- 4) Horizontal legs at the solid cloud top (red line) to capture in-cloud turbulence and entrainment events