

# Boundary-Layer Structure in Houston's Urban and Rural Areas during the TexAQS II Campaign

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# Overview

## 1. Introduction and background

## 2. Instrument platforms

- Radiosonde Profiles (weather balloons) measure stability
- Doppler SODARs to measure winds
- Micrometeorological Towers to measure turbulence
- Tethersondes to measure high-resolution profiles

## 3. Preliminary Results

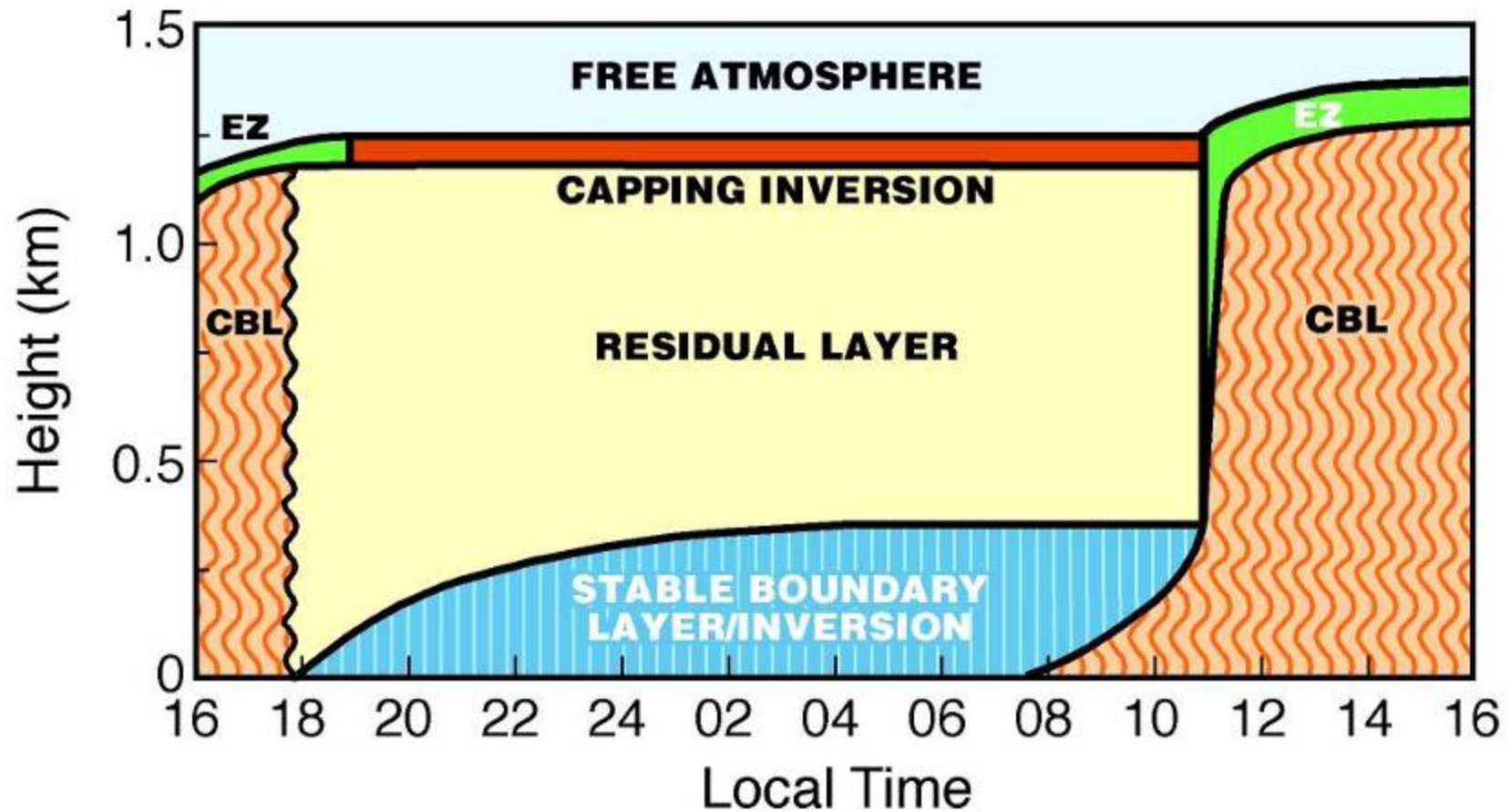
An aerial photograph of a rural landscape. The foreground is a large, flat field with sparse, dry-looking vegetation. A road or canal runs diagonally from the middle ground towards the right side of the frame. In the background, there is a dense line of trees and some distant structures under a clear blue sky.

## Purpose

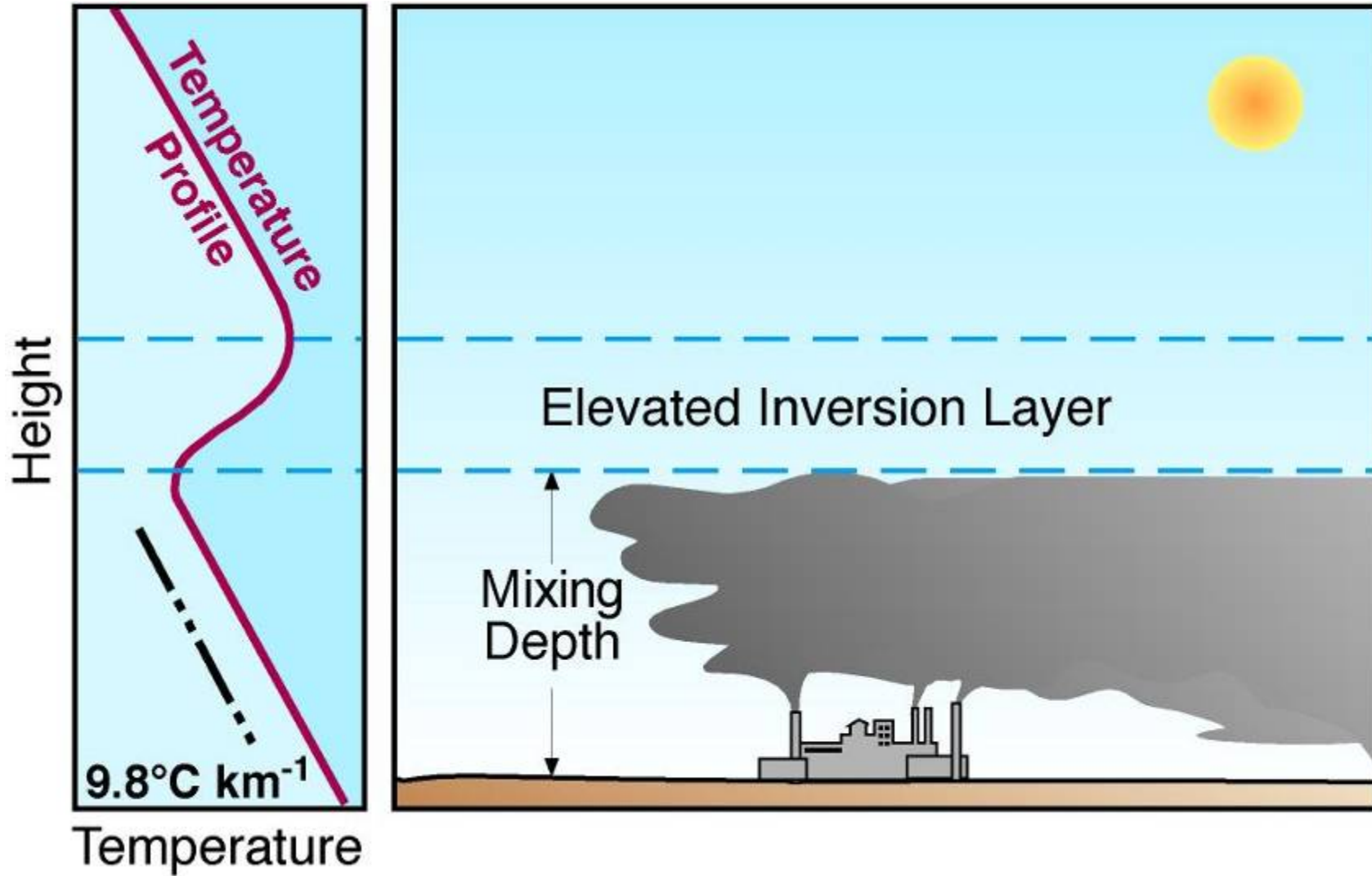
- 1. Purpose of measurements is to support the TexAQS II Field Campaign**
- 2. TexAQS II is focused on understanding air quality in eastern Texas with emphasis on regional scales.**
- 3 A number of participants involved.**

# Planetary Boundary Layer

The layer of air influenced by surface friction is called the **planetary boundary layer (PBL)**.



# Pollutants in the Atmospheric Boundary Layer



# Urban Boundary Layers?







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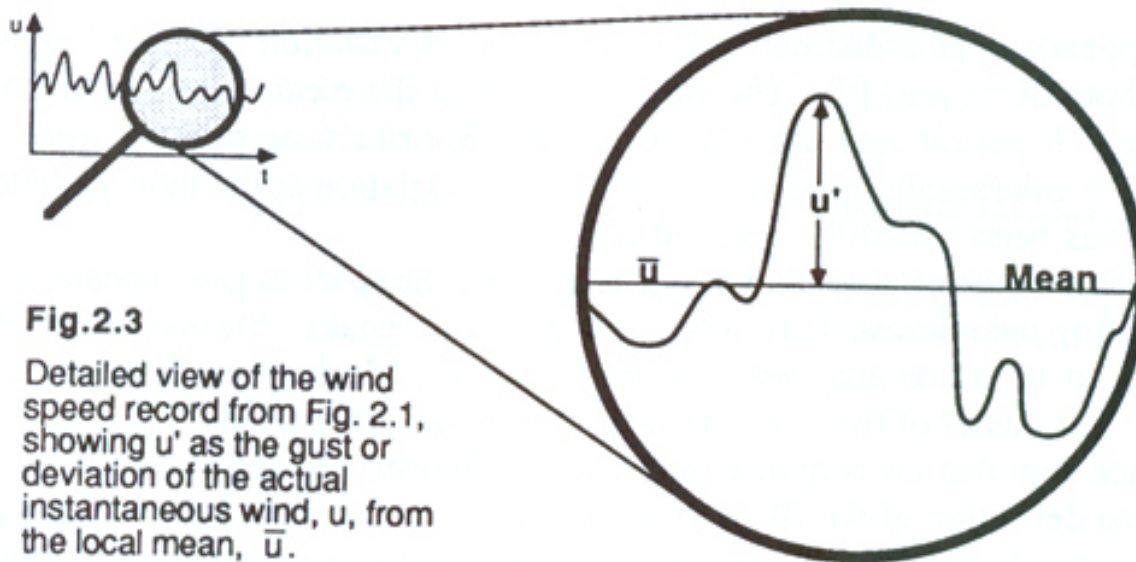


## Background: definitions

### What is turbulence?

- Simply defined as perturbation from the mean.

$$u = (\bar{u} + u')$$



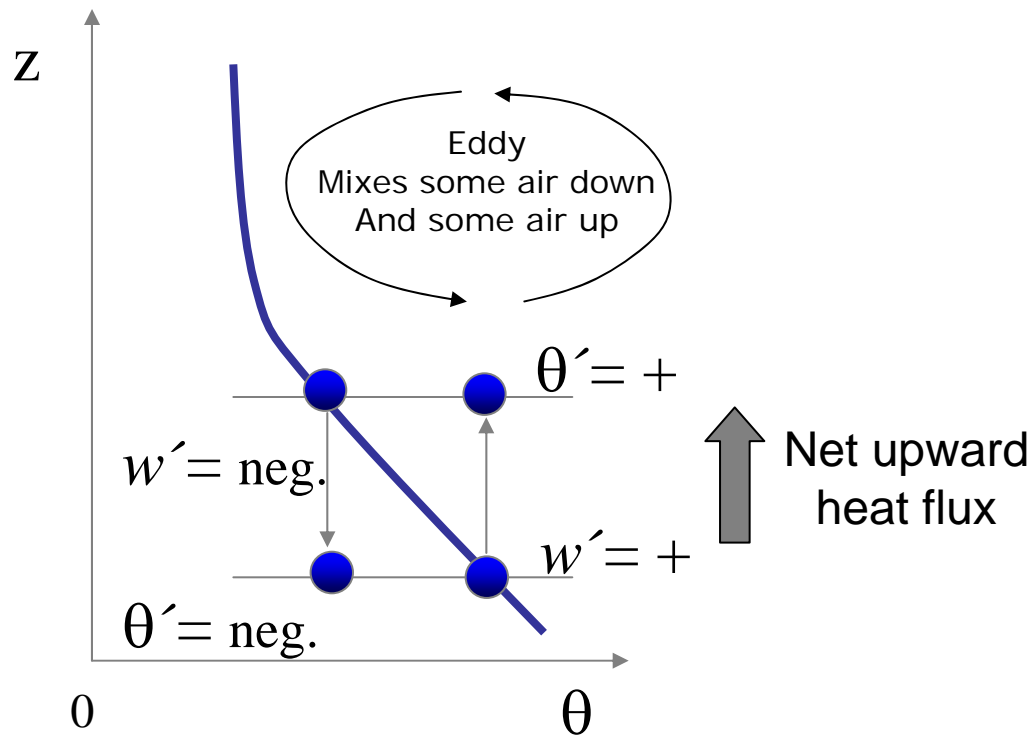
**Fig.2.3**

Detailed view of the wind speed record from Fig. 2.1, showing  $u'$  as the gust or deviation of the actual instantaneous wind,  $u$ , from the local mean,  $\bar{u}$ .

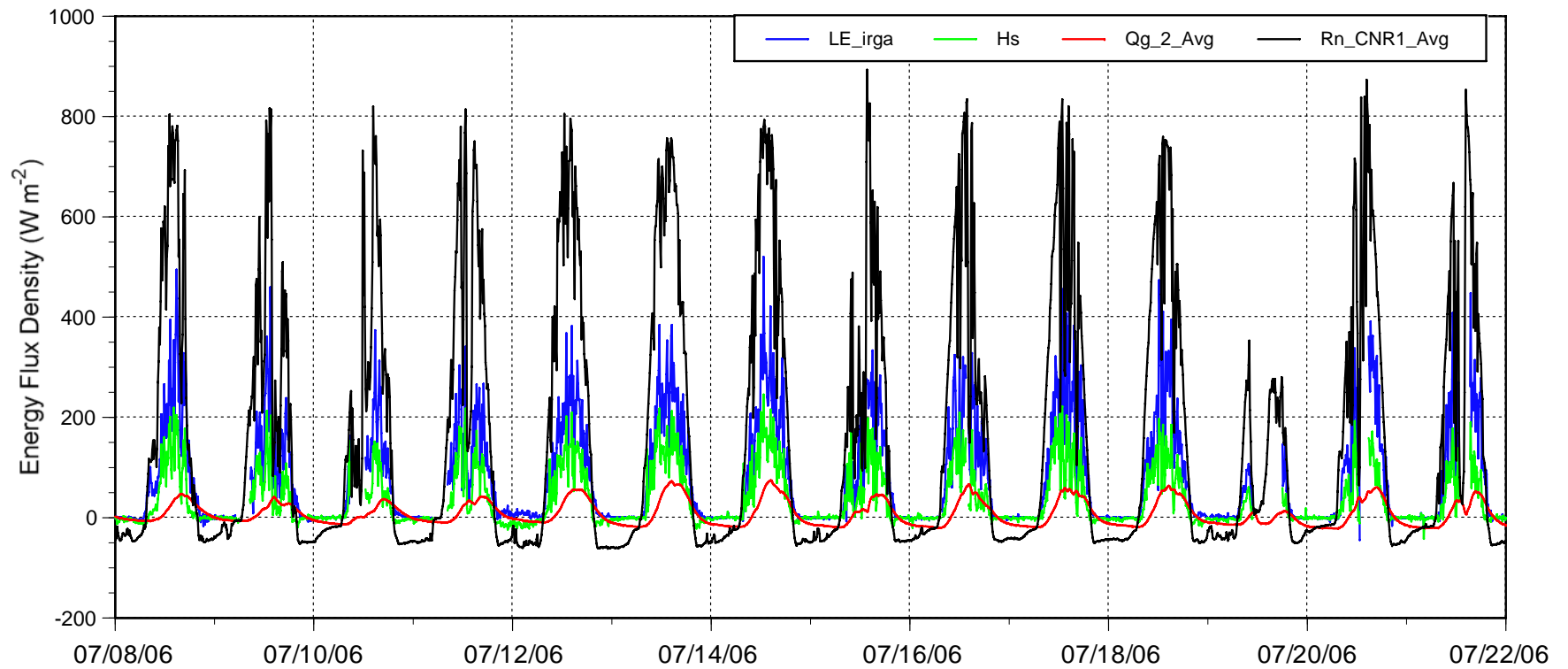
# Turbulent Flux?

- Transport of a quantity by eddies or swirls.
- The covariance of a velocity component and any quantity.

$$\text{cov}(w\theta) = \frac{1}{N} \sum_{i=0}^{N-1} (W - \bar{W}) \cdot (\theta - \bar{\theta}) = \frac{1}{N} \sum_{i=1}^N w'_i \theta'_i = \overline{w'\theta'}$$

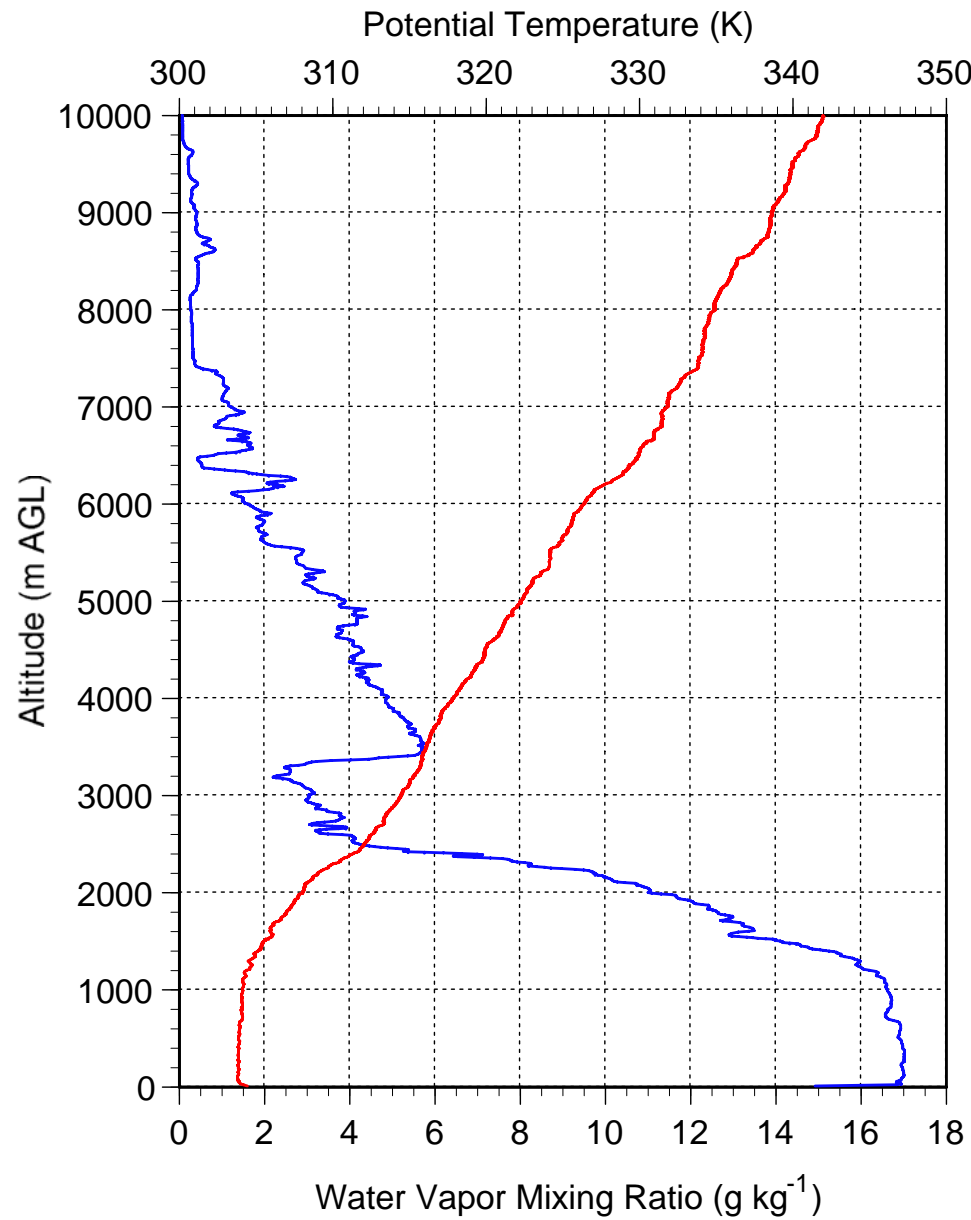


## Turbulent Heat Fluxes from Tower at UH Coastal Center (10 min Ave of Covariances)

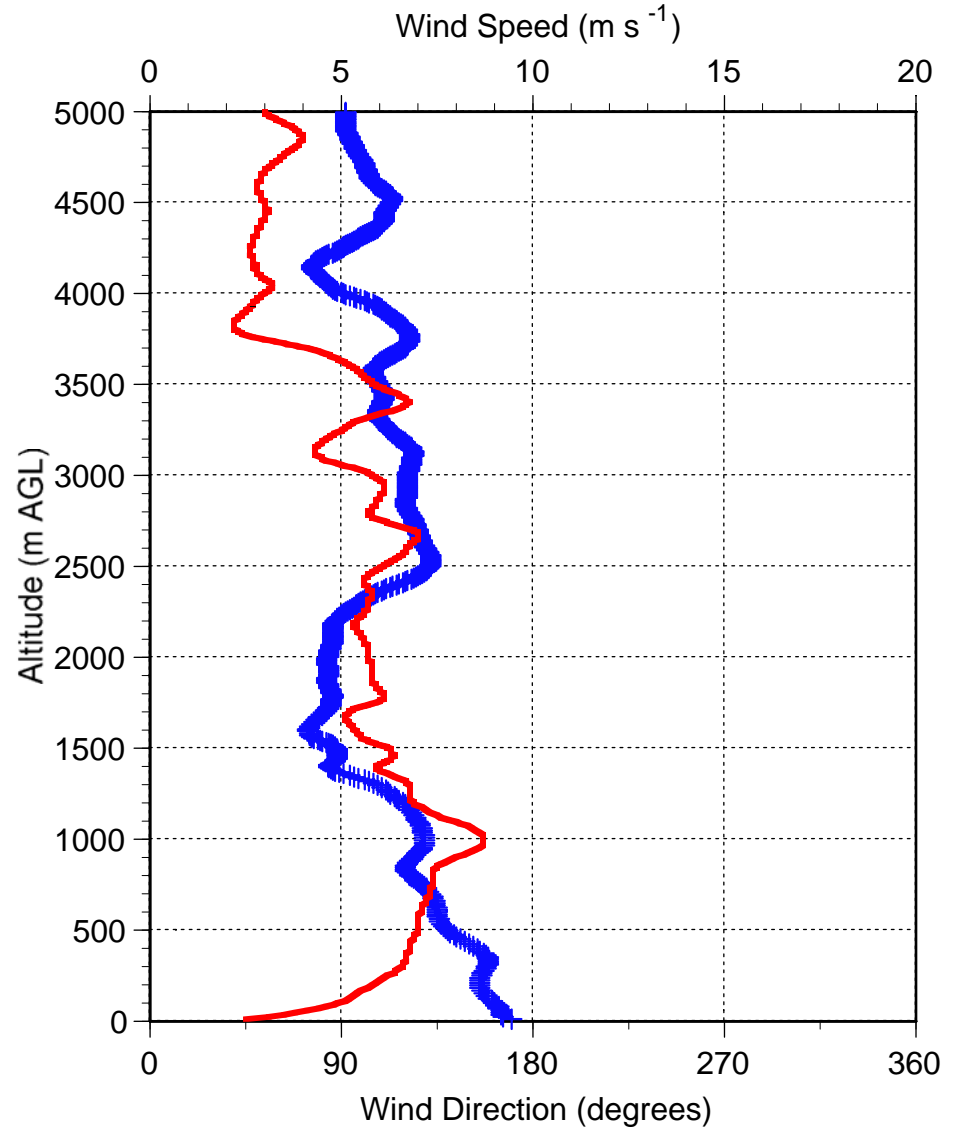
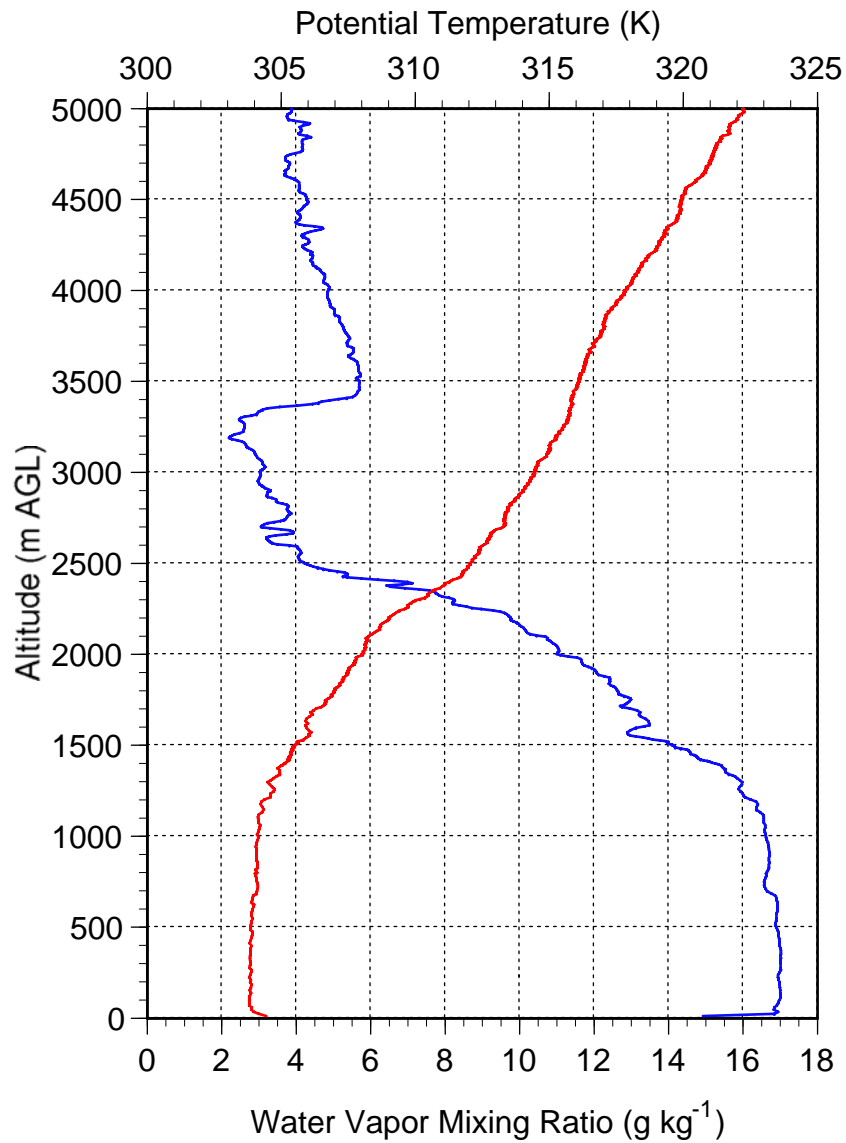


Surface Energy Balance:  $Q^* = Q_H + Q_L + Q_G$

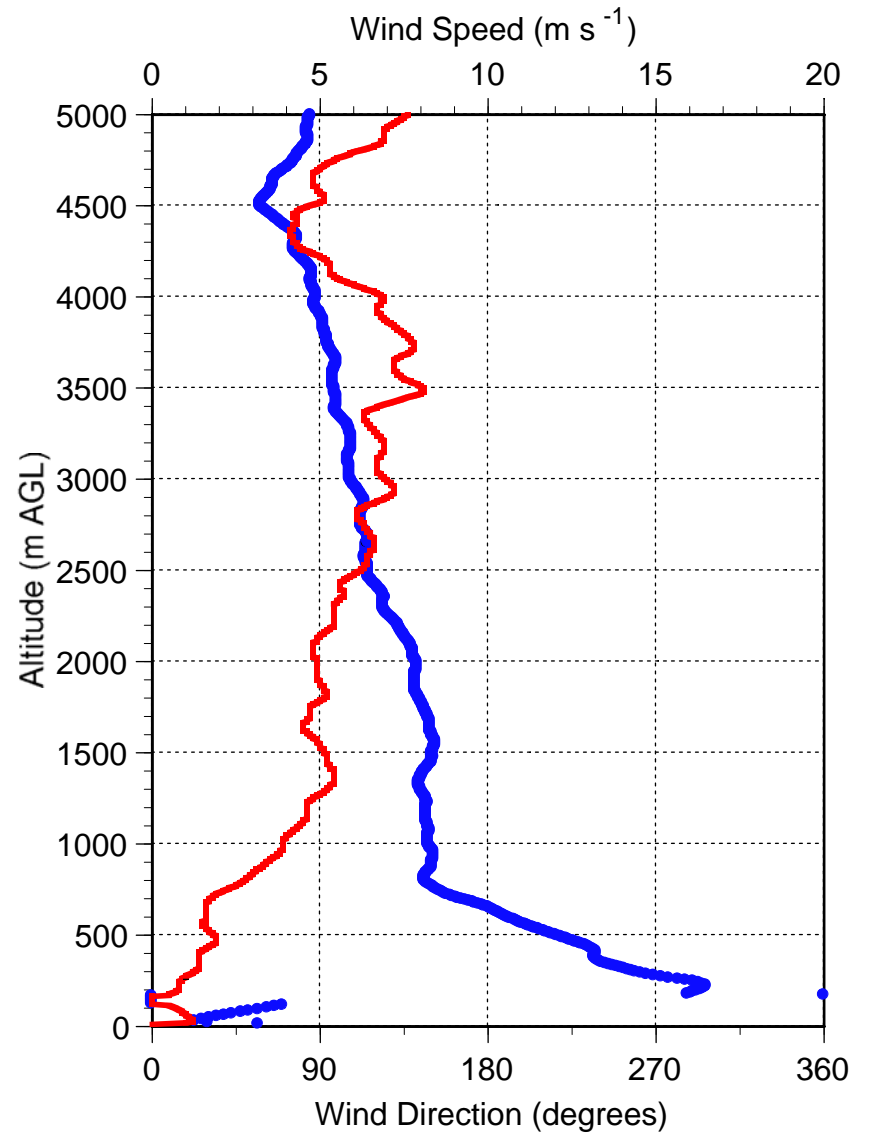
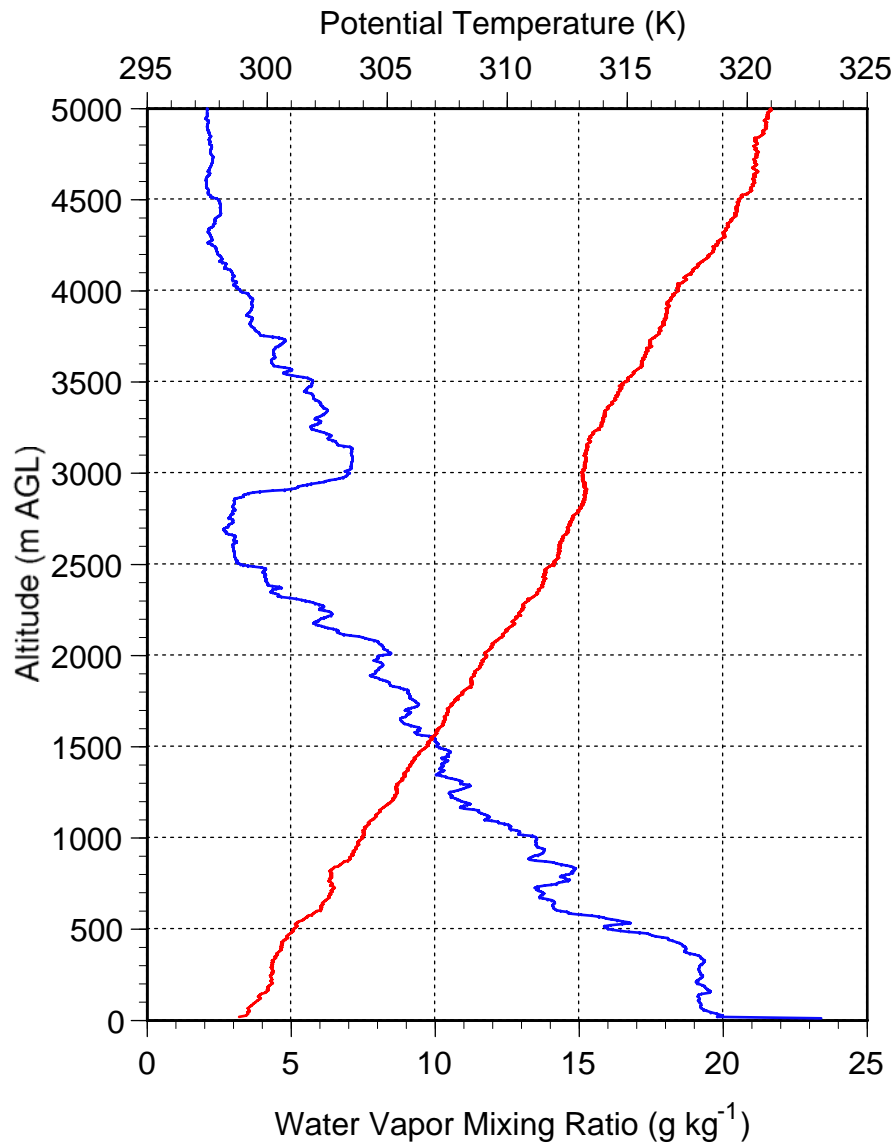
# 5 August 2006 00Z (6 PM) University of Houston Sounding



# 5 August 2006 Evening (6 PM) University of Houston Sounding

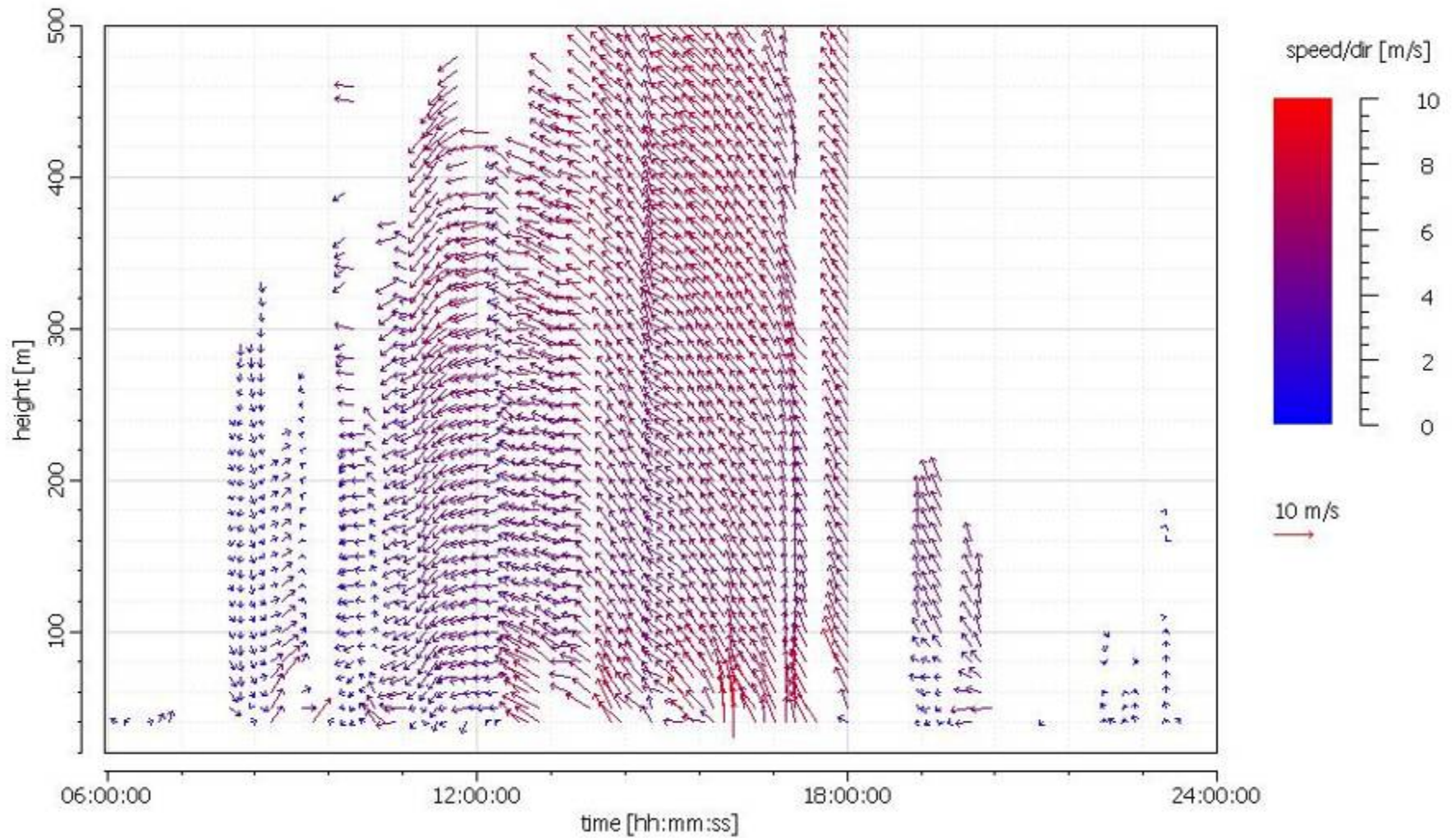


# 5 August 2006 Morning (6 AM) University of Houston Sounding

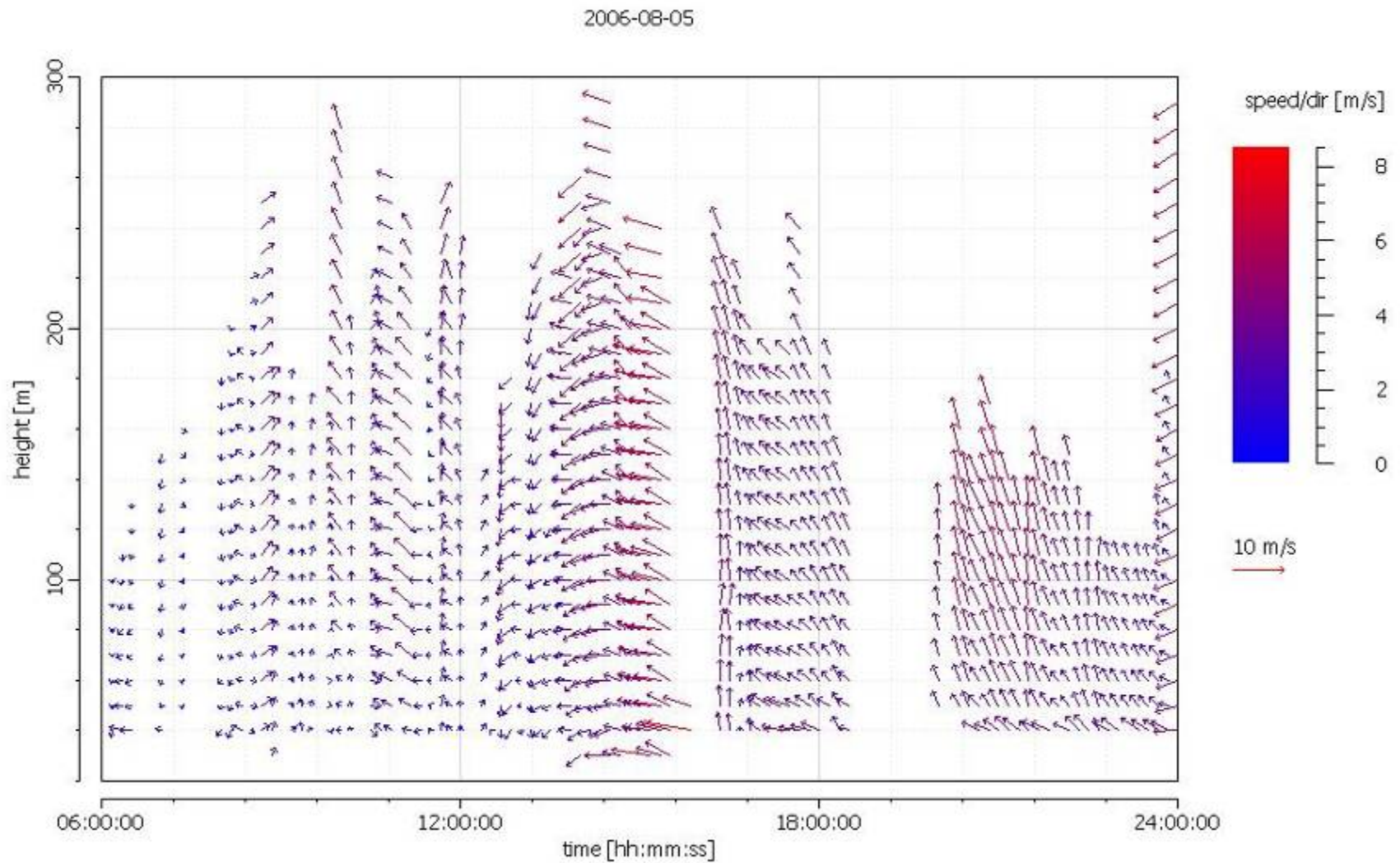


# SODAR Profiles La Marque, TX--UHCC

2006-08-05



# SODAR Profiles from UH Main Campus



## Summary

- **Measurement platforms have been established**
- **Preliminary analyses show instruments are performing as expected**
- **Data show boundary layer structure**
- **TexAQS II starts on August 15.**