

# Tethered Balloon Observations in a Pre-montane Wet Forest



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## 1. Introduction

This poster presents vertical profiles of the atmospheric boundary layer in a pre-montane wet forest in central Costa Rica as it entered the wet season of 2011. Profiles of atmospheric variables, CO<sub>2</sub>, and particle counts were taken during the six-week (Jun 12 - Jul 24) experiment. The ultimate goal of the project was to determine atmosphere-canopy layer interactions and their potential impact on convective cloud development.



## 2. Instrumentation

### Radiosonde

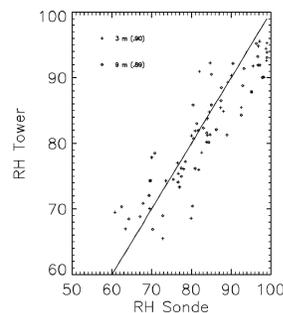
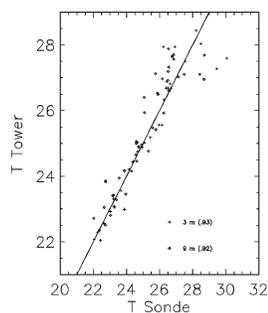
- Temperature (T), relative humidity (RH), and pressure
- 100 m line, values from 0.5 ms<sup>-1</sup> descent

### LI-COR

- CO<sub>2</sub> and water vapor
- 60 s averages every 25 ft

### Particle counts

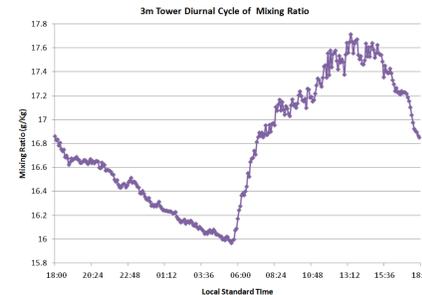
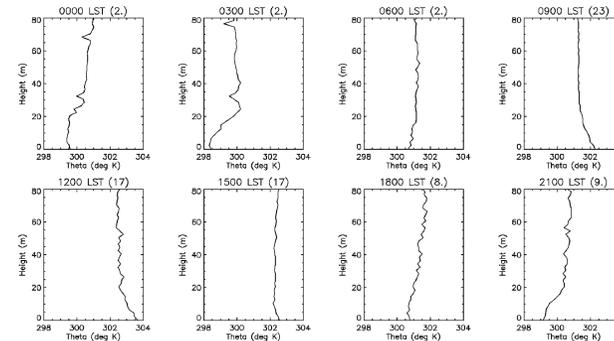
- 0.3-10 μm
- 10 s averaged samples



- Comparisons with 5-min tower values show that the sonde T and RH were well calibrated

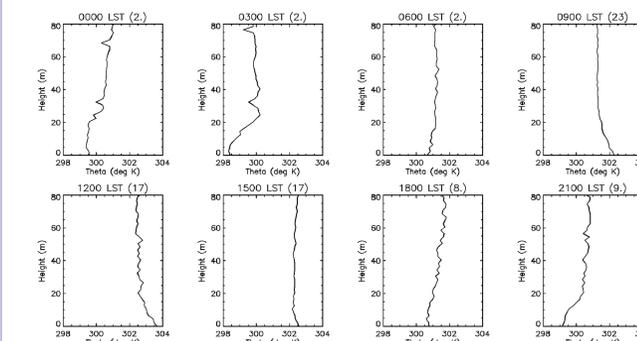
## 3. Diurnal Cycle of Humidity

- Water vapor mixing ratios are well-mixed above 20 m, but show distinct diurnal variations below 20 m
- Low-level humidity increases from sunrise to mid afternoon signify possible transpiration feedback from the forest



- Tower confirms a sharp near-surface increase in humidity from 6 am to 2 pm
- Distinctly different diurnal trend compared to cycle over Amazonian pasture land [Betts et al., 2002]

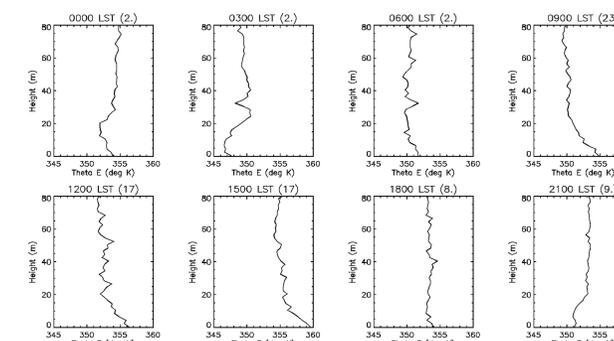
## 4. Diurnal Cycle of Temperature



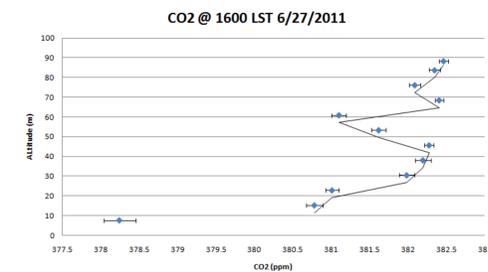
- Potential temperature,  $\theta$ , indicates nocturnal inversions deepening to 30 m by 3 am and increasing instability during the day with the strongest mixing at 3 pm

## 5. Diurnal Cycle of Stability

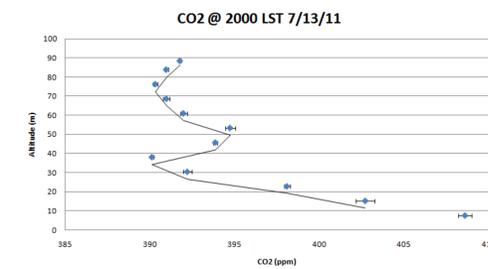
- Equivalent potential temperature,  $\theta_E$ , shows a potentially unstable boundary layer from 9 am to 3 pm
- $\theta_E$  is isothermal later than  $\theta$  due to decreasing humidity



## 6. Atmospheric Carbon Dioxide

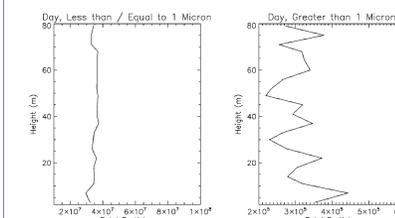


- During daytime, relative CO<sub>2</sub> minima below 20 m and near 55 m may indicate canopy transpiration



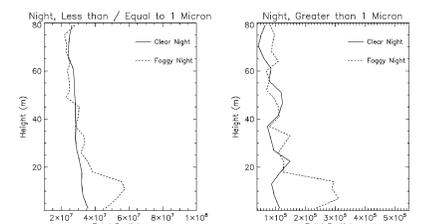
- At night, relative maxima occur near the same levels potentially indicating respiration

## 7. Particle Counts



- During the day particles are well-mixed throughout the boundary layer

- On clear nights particles are well-mixed except when fog layer is present



## 8. Future Work

With a longer line (e.g., 300-500 m), the tethered sonde would be significantly higher than the canopy helping to determine if the feedback around 60 m is truly an atmosphere-forest interaction. A mechanical winch would allow for this longer line and provide a consistent rate of ascent and descent. The LI-COR carbon dioxide experiment shows promise in finding a feedback at canopy height and more launches would paint a clearer picture. More particle count measurements will help elucidate fog layer properties.

### Acknowledgements

Don Conlee and SOAP for setting up the tetheredsonde  
All of the Costa Rica REU groups for data sets