Question B: How do the structure and dynamics of the planetary boundary layer and lower troposphere affect ozone and aerosol concentrations in Houston, Dallas, and eastern Texas?

A Case Study of Vertical Ozone Distribution above the University of Houston: August 31-September 2, 2006

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– University of Houston

Gary Morris
– Valparaiso University

Overview - Methods

- **“Normal” Days:**

- Radiosondes launched twice/day at 7AM & 7PM.

- Ozonesondes launched once/day at 1300 CDT.

- **Intensive Days:**

- Radiosondes launched at 1AM, 5AM, 7AM, 10AM, 1PM, 4PM, 7PM, 10PM.

- Ozonesondes launched at 7AM & 1PM

Overview - Methods

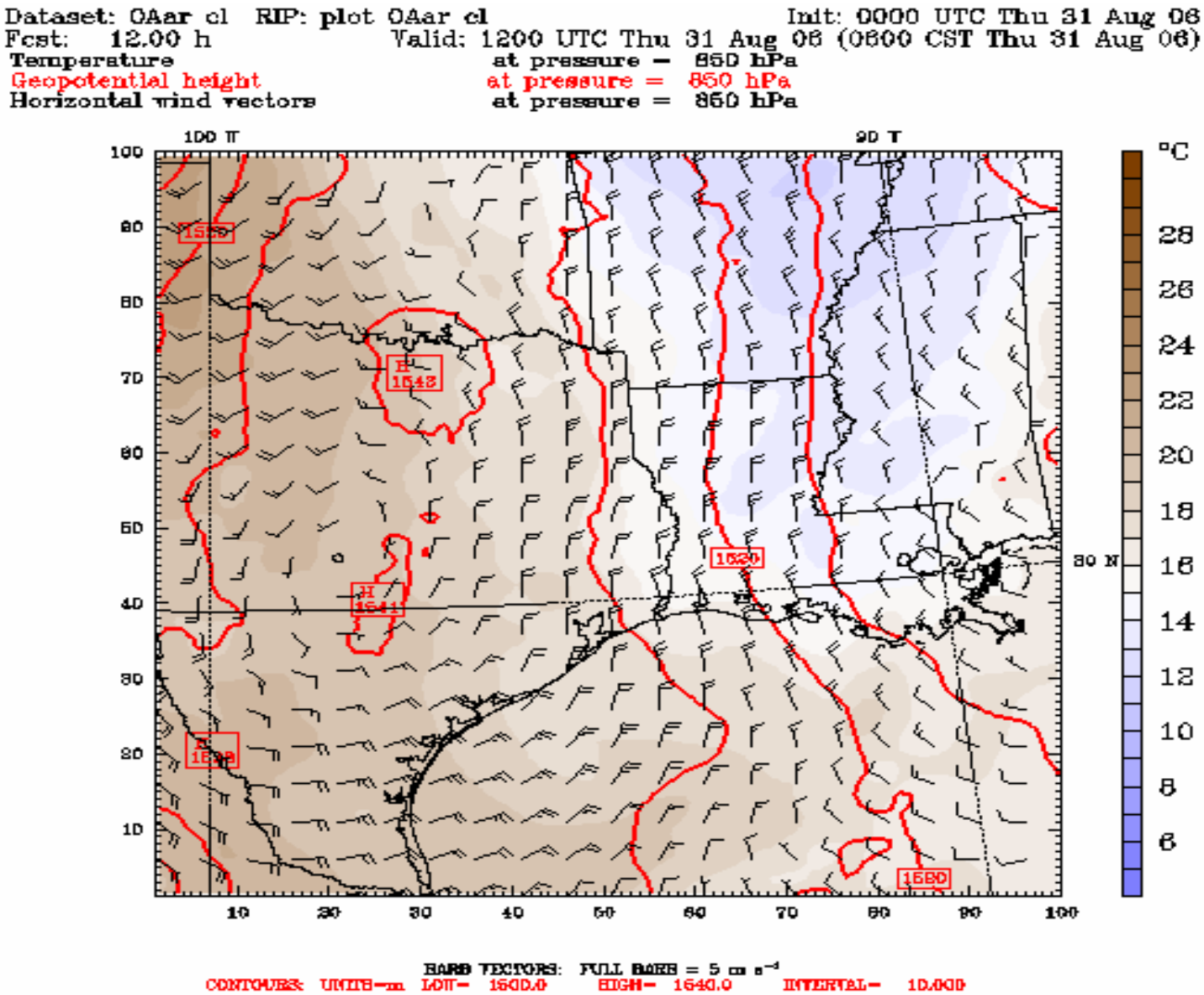
- Vaisala RS92 GPS Radiosondes (UH), and Ozonesondes (Univ Valparaiso) launched from the University of Houston.

- Radiosondes:
  - Temperature, Pressure, Humidity, Wind Speed/Direction using GPS

- Ozonesondes:
  - same as radiosonde including ozone mixing ratio

Ozonesonde

8-31-06



Dataset: OAar cl RIP: plot OAar cl
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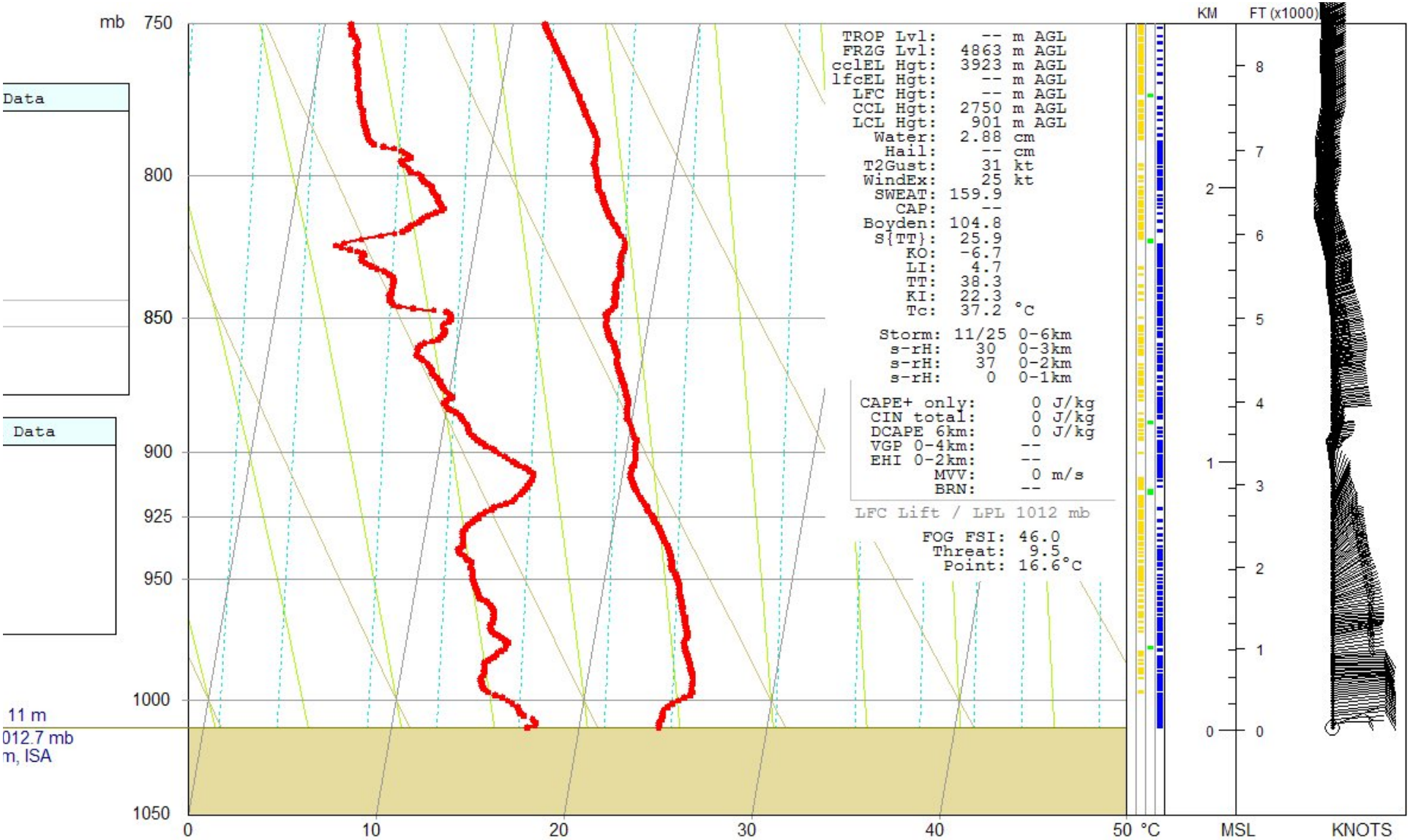
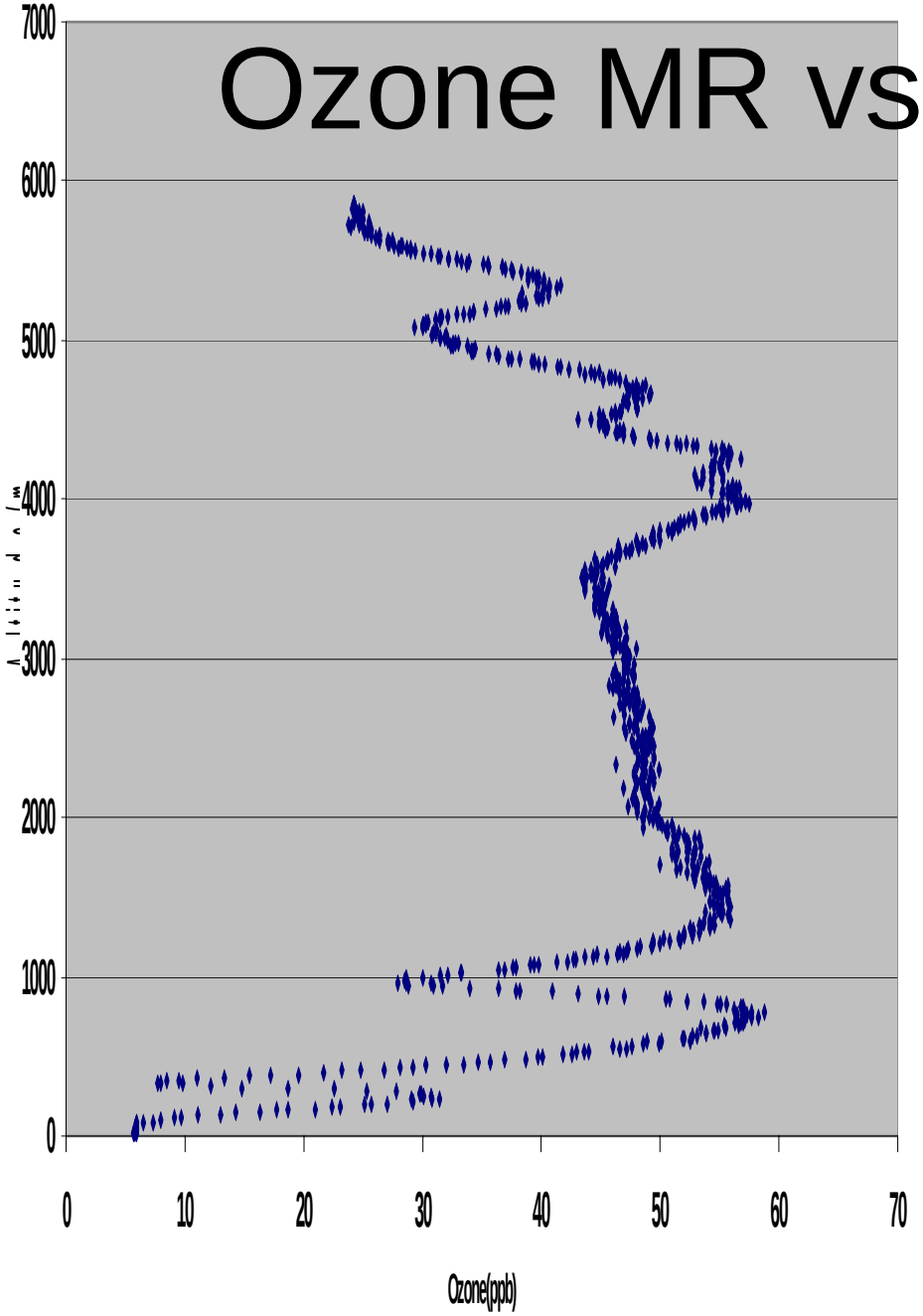
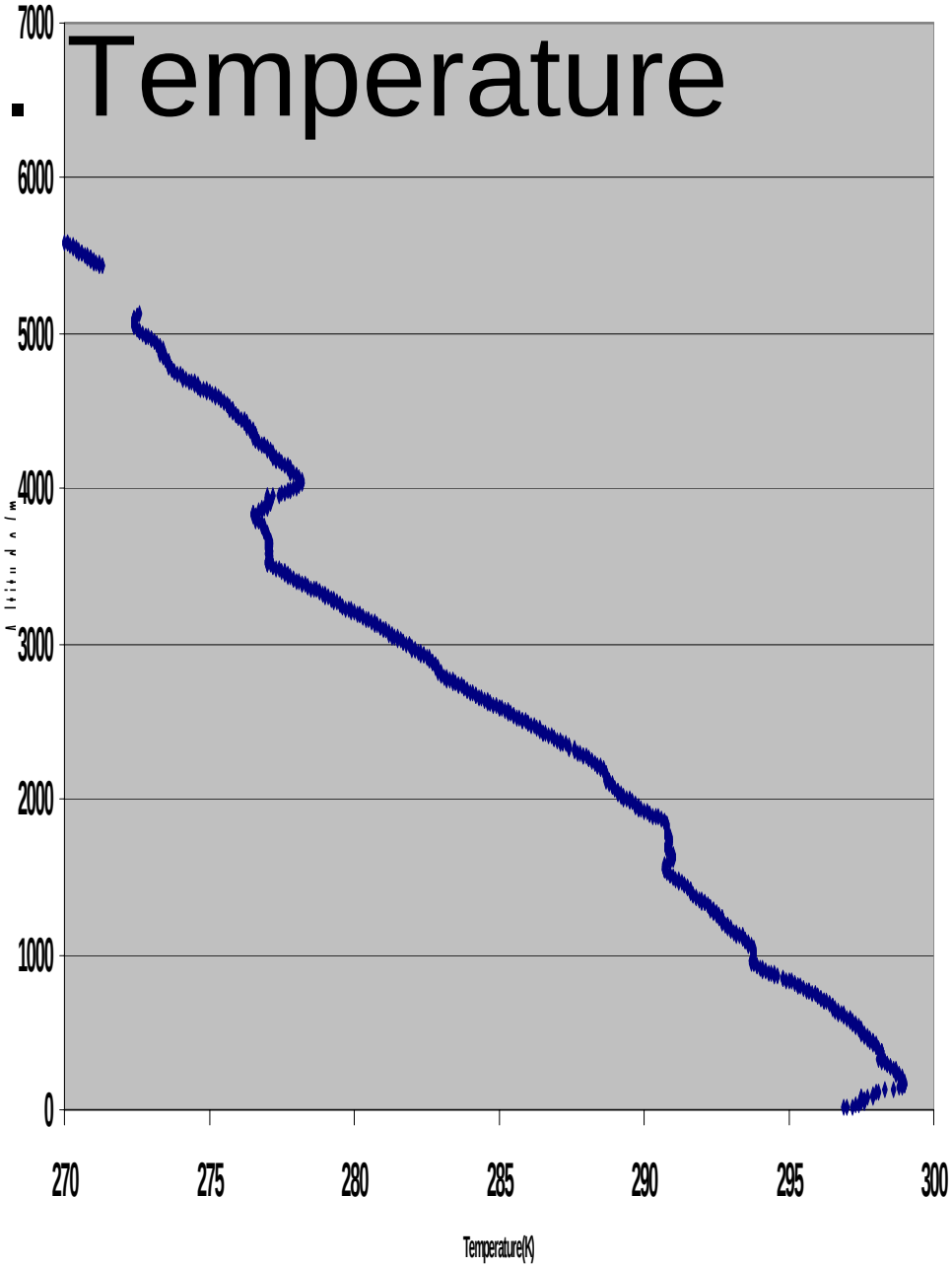
Valid: 1200 UTC Thu 31 Aug 06 (0600 CST Thu 31 Aug 06)
Temperature at pressure = 850 hPa
Geopotential height at pressure = 850 hPa
Horizontal wind vectors at pressure = 850 hPa
100 W
90 W
30 N
°C
28
26
24
22
20
18
16
14
12
10
8
6
BARB VECTORS: FULL BARB = 5 m s⁻¹
CONTOURS: UNITS=m LOW= 1500.0 HIGH= 1540.0 INTERVAL= 10.000

0700 8-31 Close-up

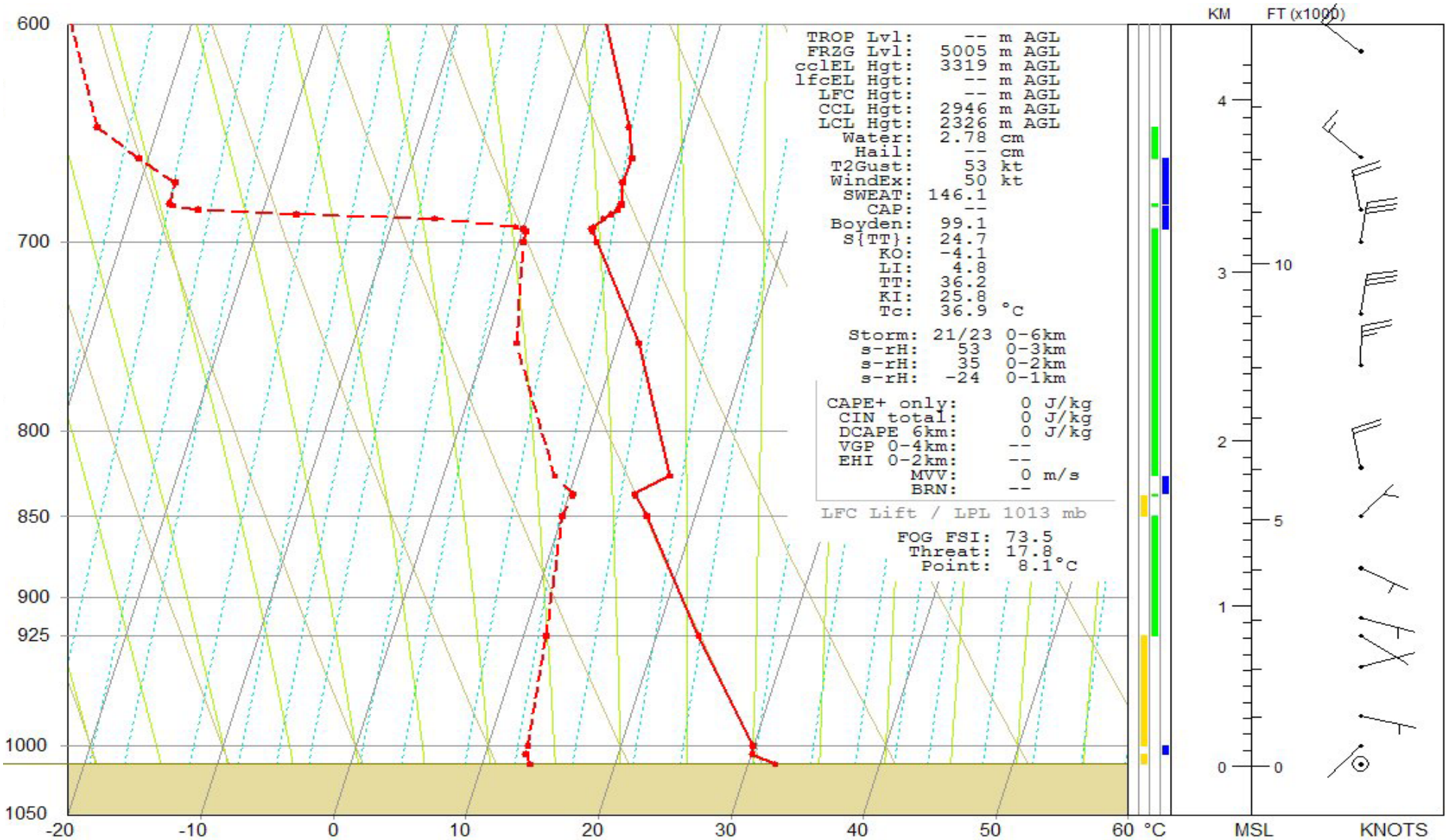


Ozone MR vs. Temperature

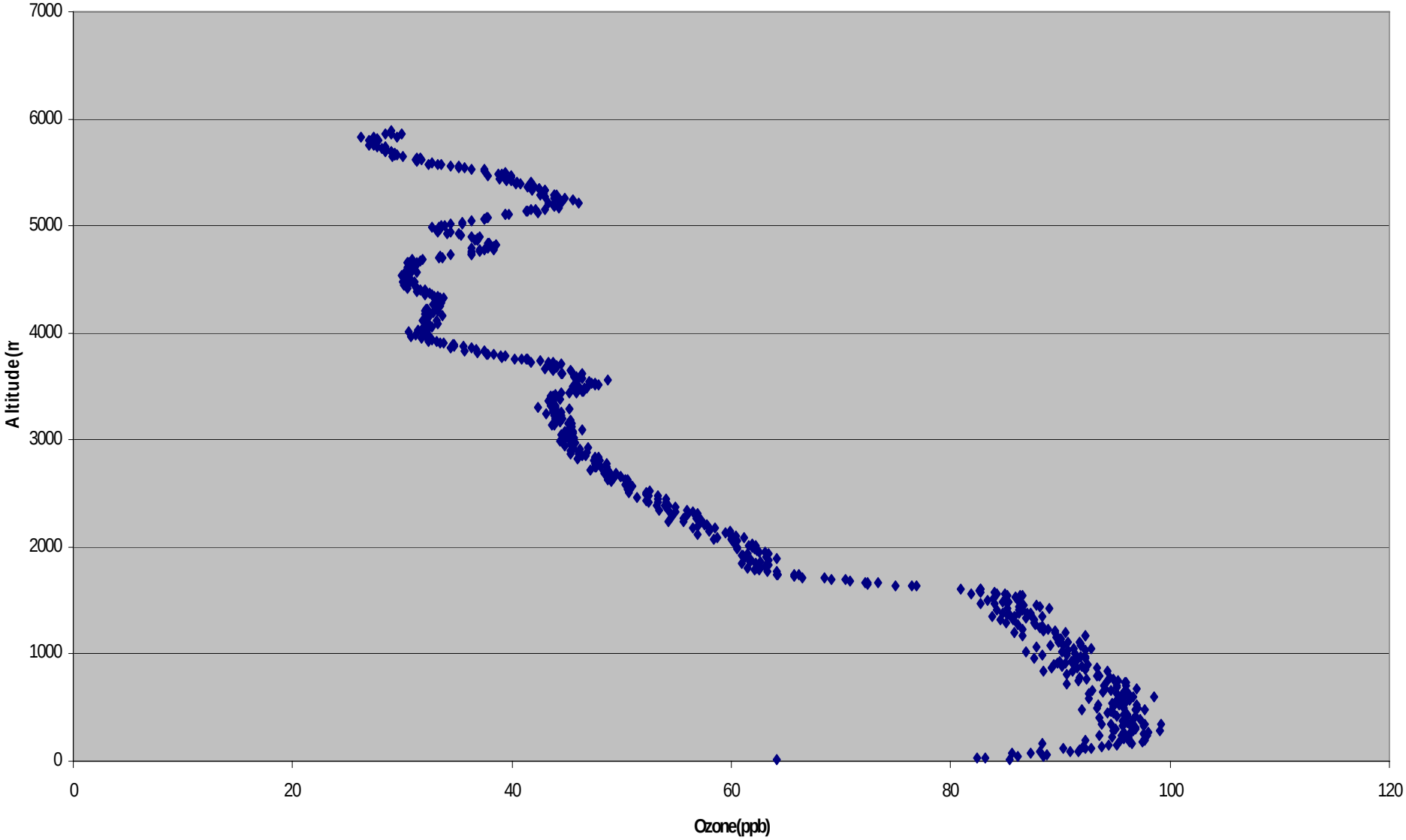




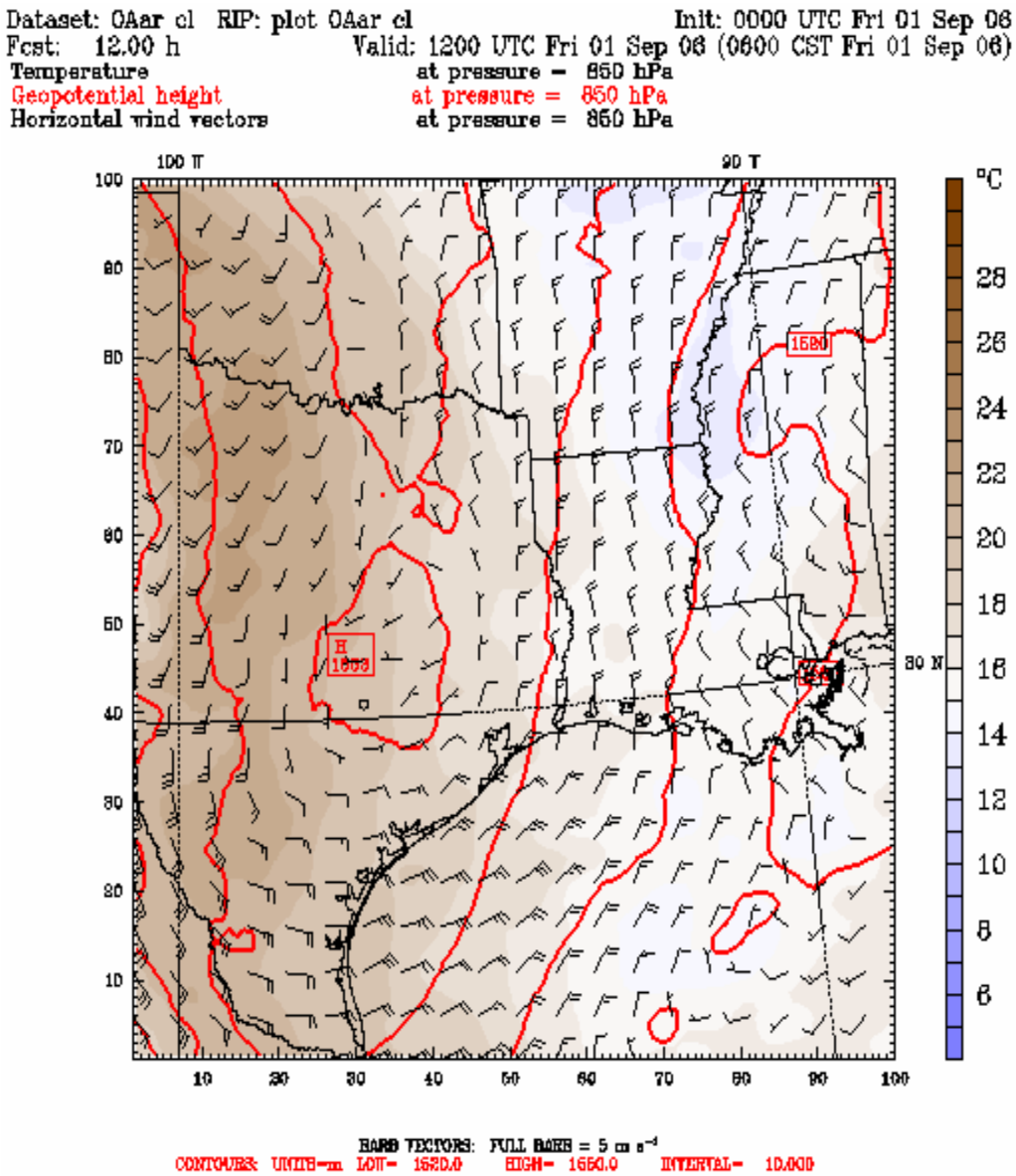
8-31 1300 sounding



8-31 1300 Ozone Profile



9-1-06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Fcst: 12.00 h
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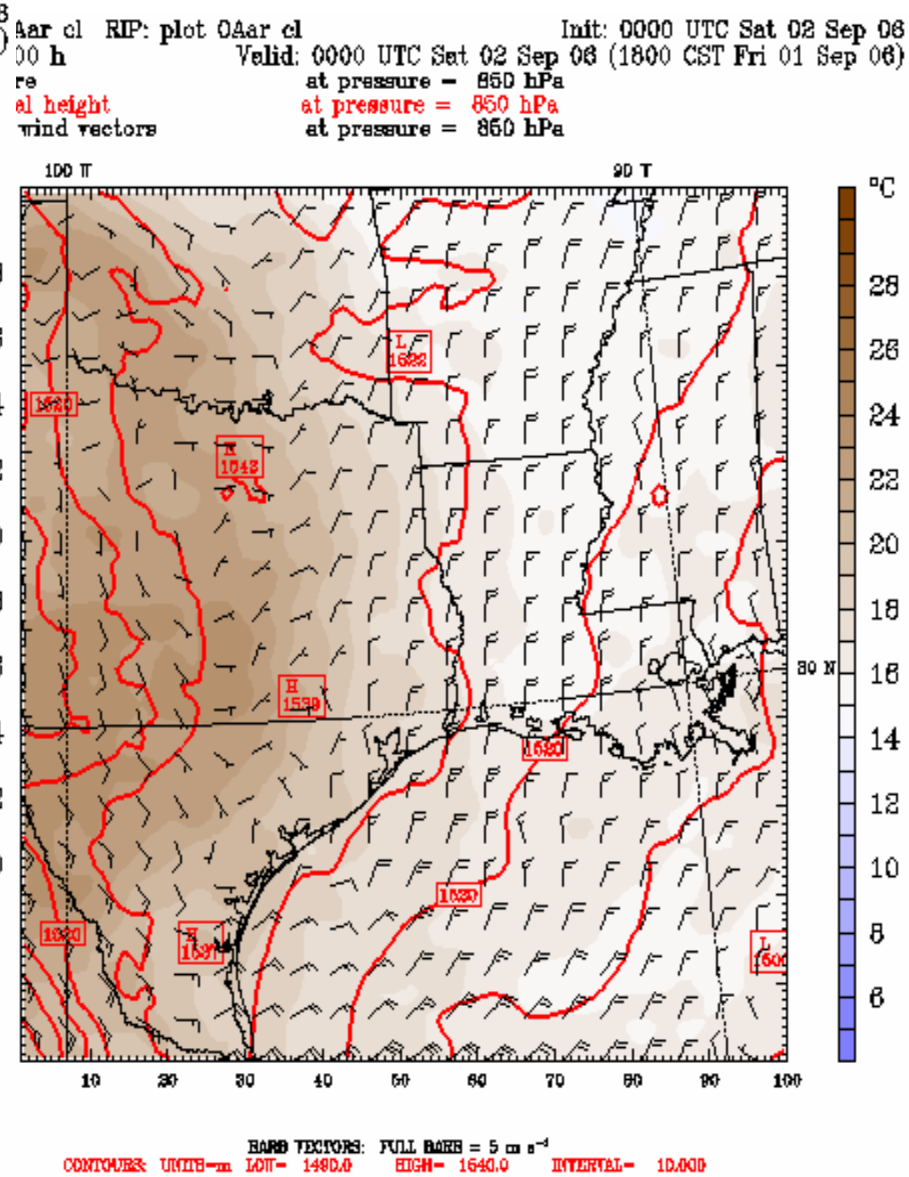
Temperature at pressure = 850 hPa
Geopotential height at pressure = 850 hPa
Horizontal wind vectors at pressure = 850 hPa
°C
BARB VECTORS: FULL BARB = 5 m s⁻¹
CONTOURS: UNITS=m LOW= 1520.0 HIGH= 1650.0 INTERVAL= 10.000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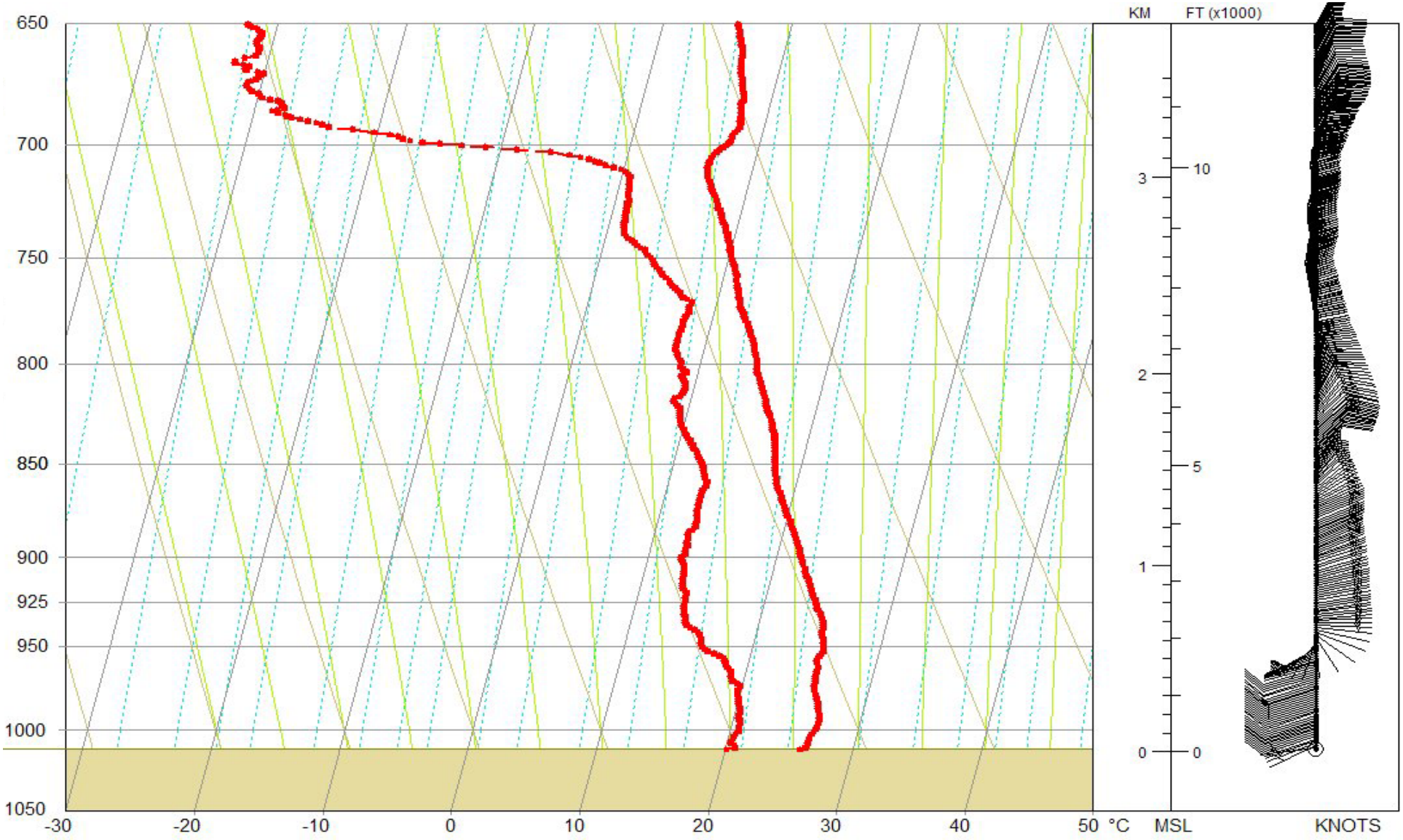
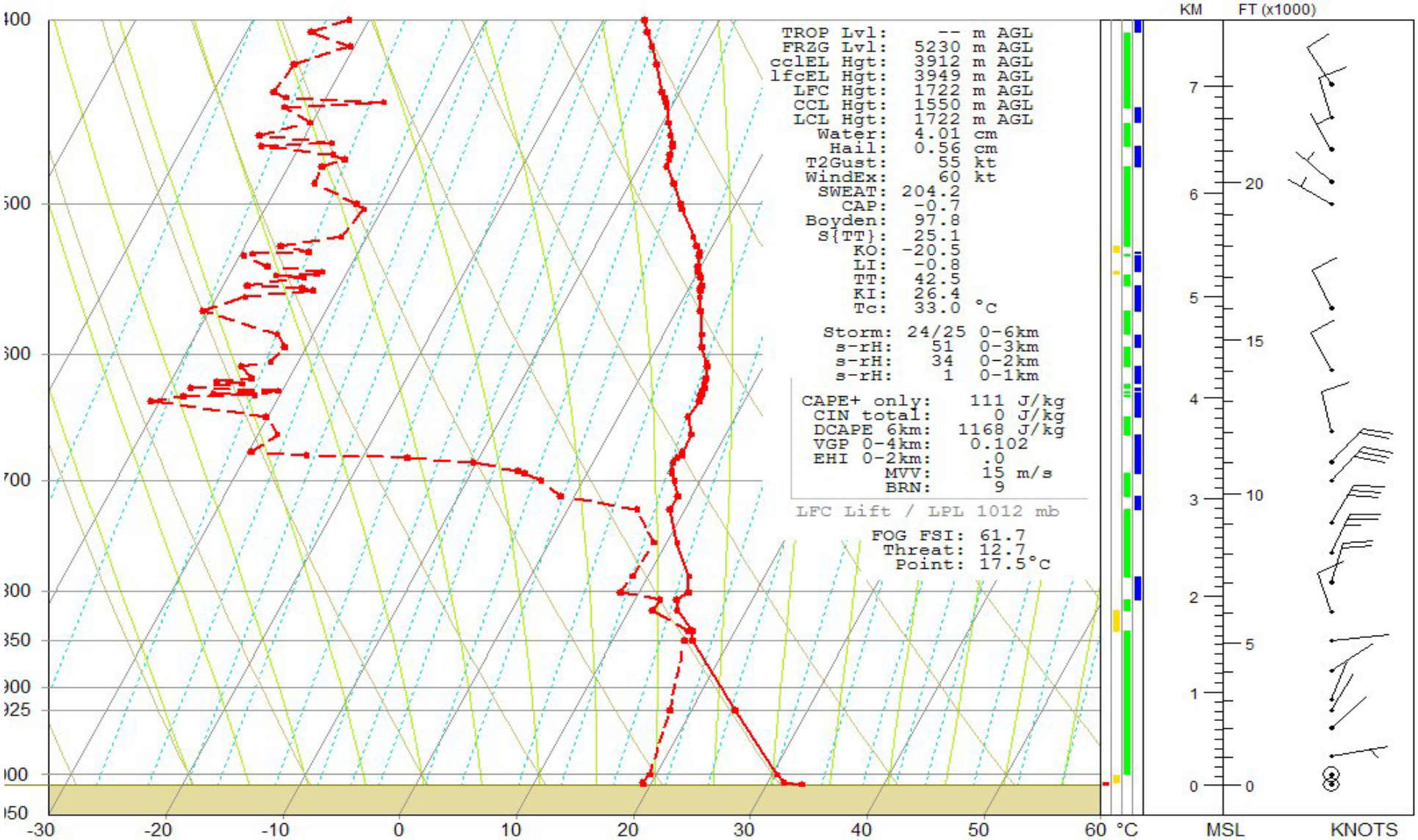
at pressure = 850 hPa
at pressure = 850 hPa
at pressure = 850 hPa
°C
BARB VECTORS: FULL BARB = 5 m s⁻¹
CONTOURS: UNITS=m LOW= 1490.0 HIGH= 1640.0 INTERVAL= 10.000

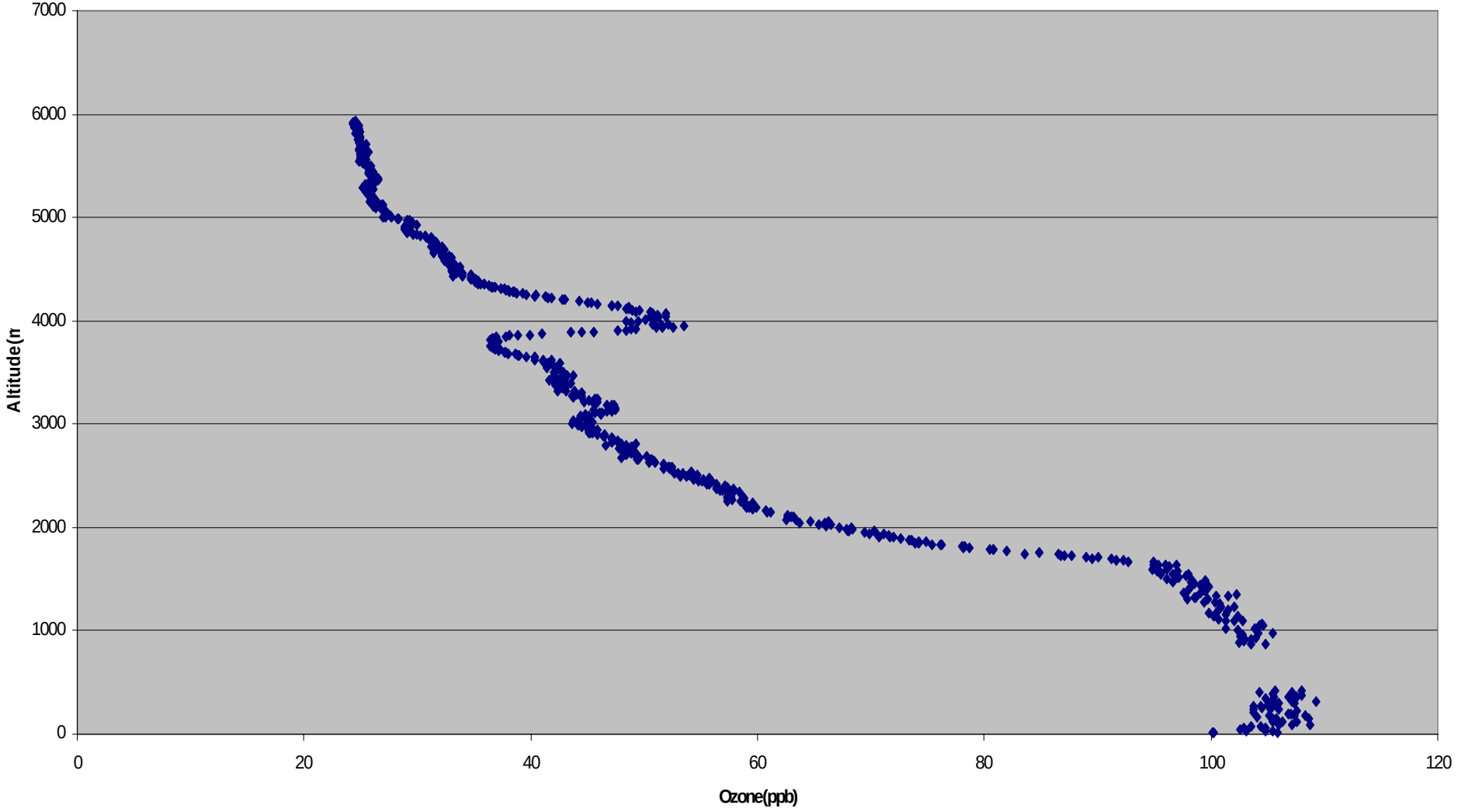
9-1 0500 Sounding



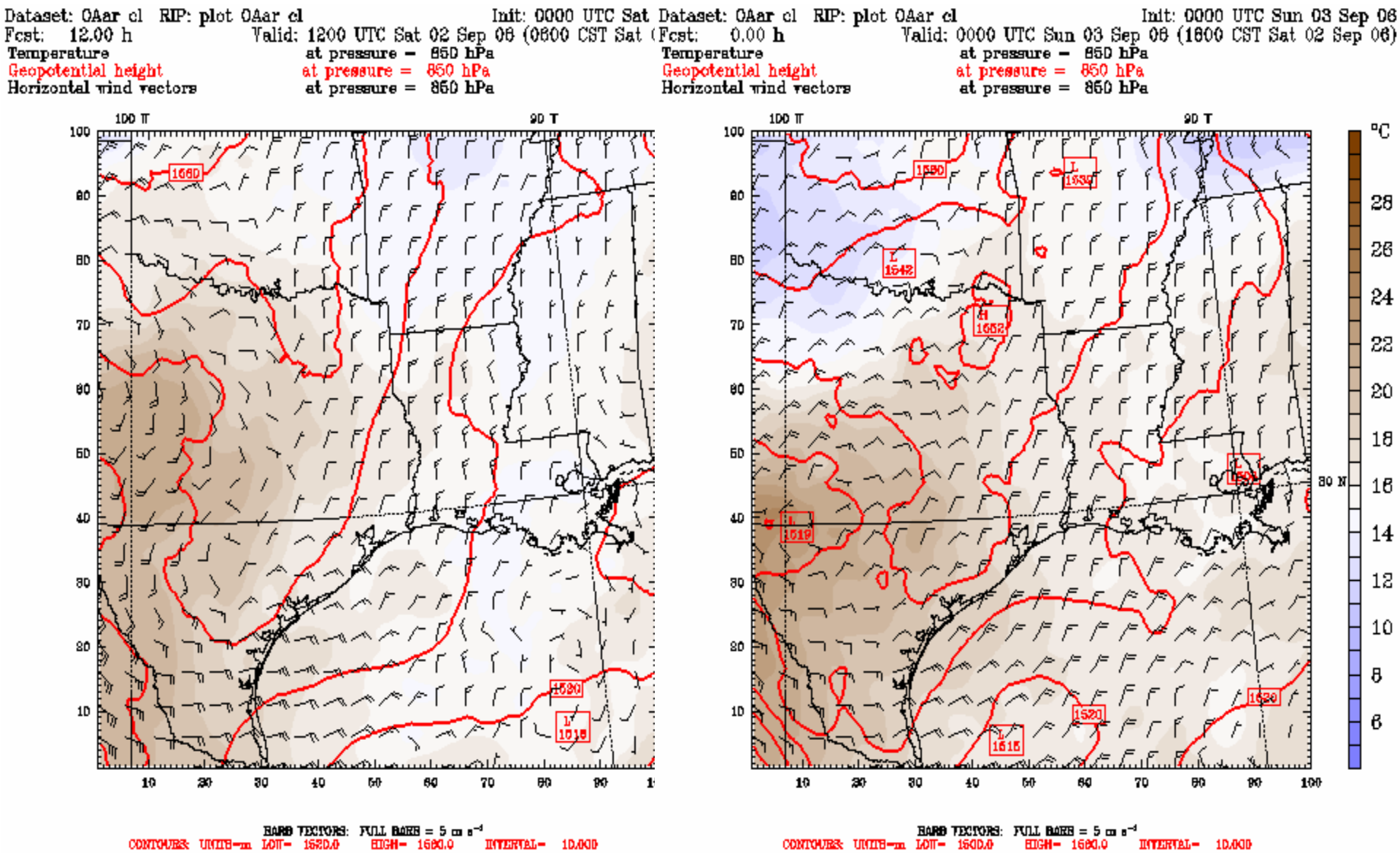
9-1 1300 sounding



9-1 1300 Ozonesonde

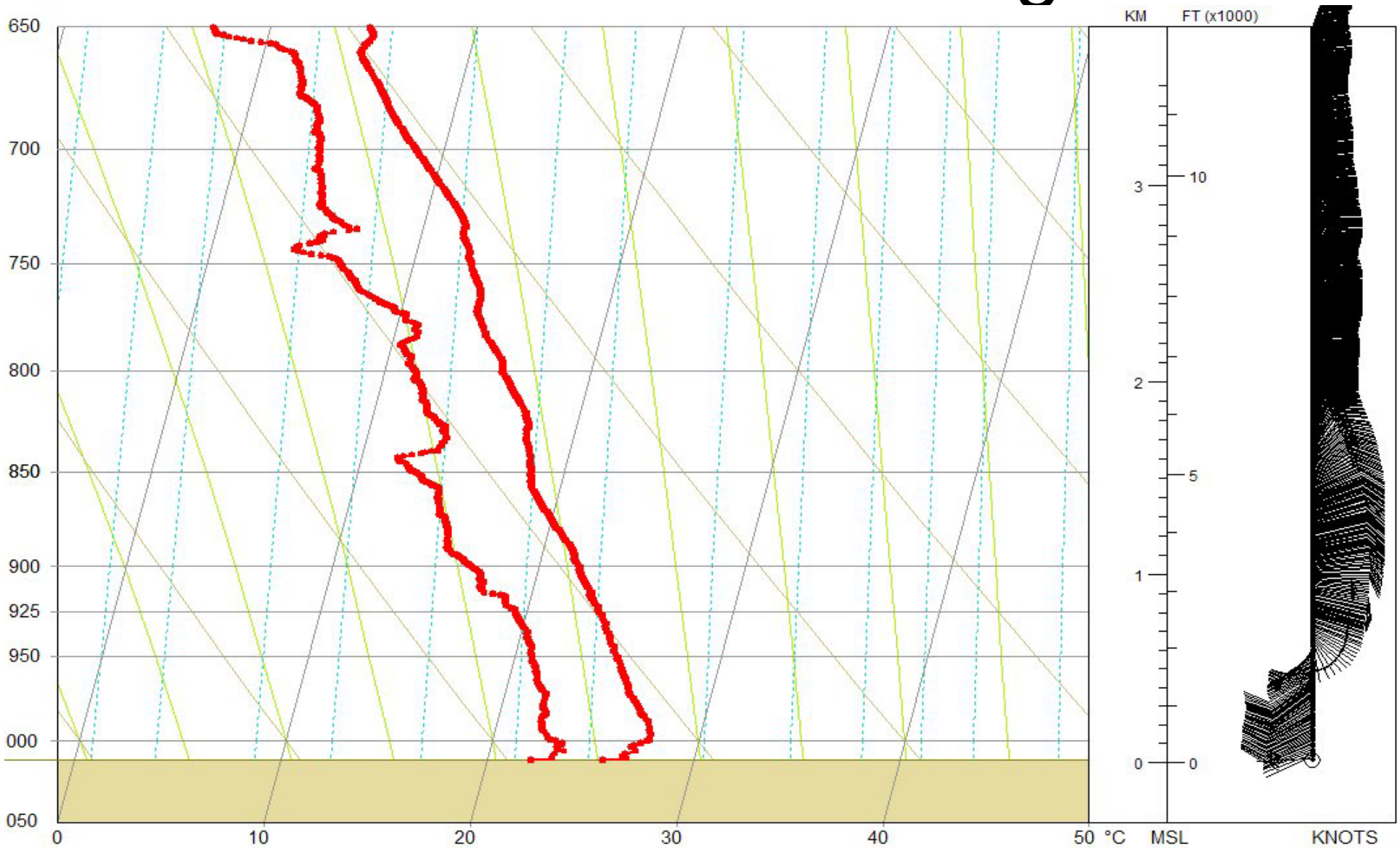


9-2-06

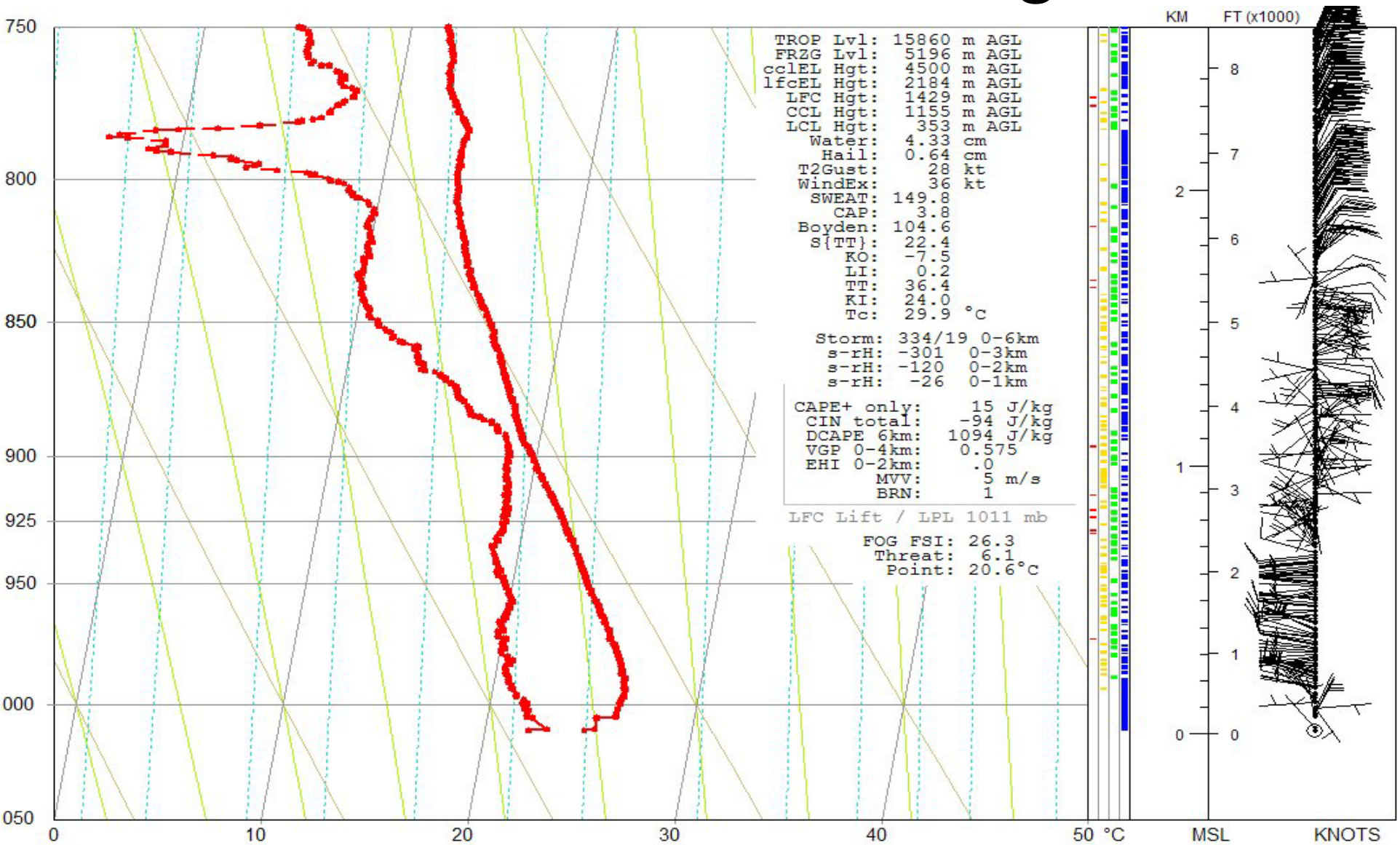


Dataset: OAar cl RIP: plot OAar cl
Init: 0000 UTC Sat
Fcst: 12.00 h
Valid: 1200 UTC Sat 02 Sep 06 (0600 CST Sat
Temperature at pressure = 850 hPa
Geopotential height at pressure = 850 hPa
Horizontal wind vectors at pressure = 850 hPa
100 W
90 W
BARB VECTORS: FULL BARB = 5 m s⁻¹
CONTOURS: UNITS=m LOW= 1520.0 HIGH= 1560.0 INTERVAL= 10.000
Dataset: OAar cl RIP: plot OAar cl
Init: 0000 UTC Sun 03 Sep 06
Fcst: 0.00 h
Valid: 0000 UTC Sun 03 Sep 06 (1800 CST Sat 02 Sep 06)
Temperature at pressure = 850 hPa
Geopotential height at pressure = 850 hPa
Horizontal wind vectors at pressure = 850 hPa
100 W
90 W
30 N
°C
BARB VECTORS: FULL BARB = 5 m s⁻¹
CONTOURS: UNITS=m LOW= 1500.0 HIGH= 1560.0 INTERVAL= 10.000

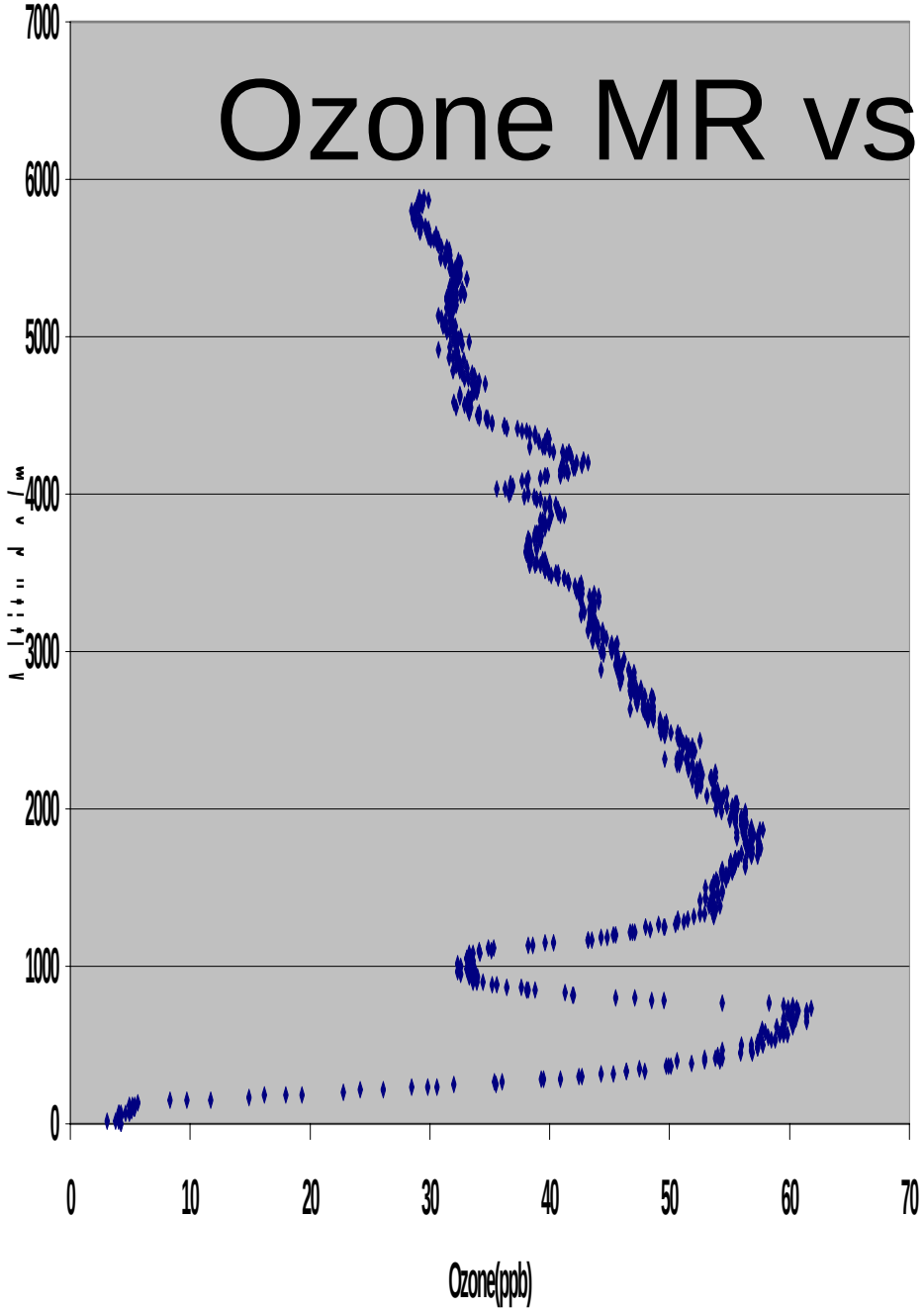
9-2 0500 Sounding

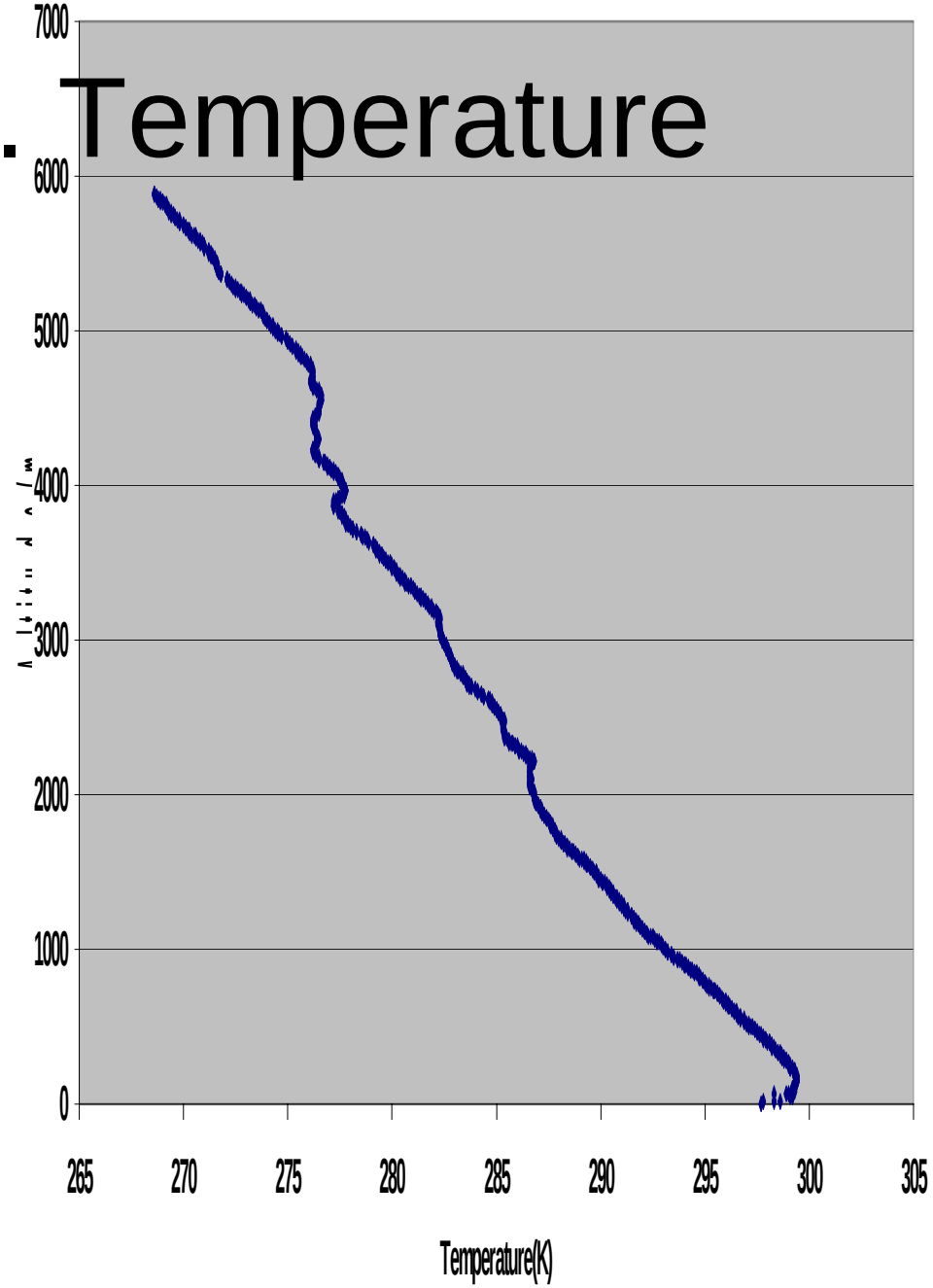


9-2 0700 Sounding

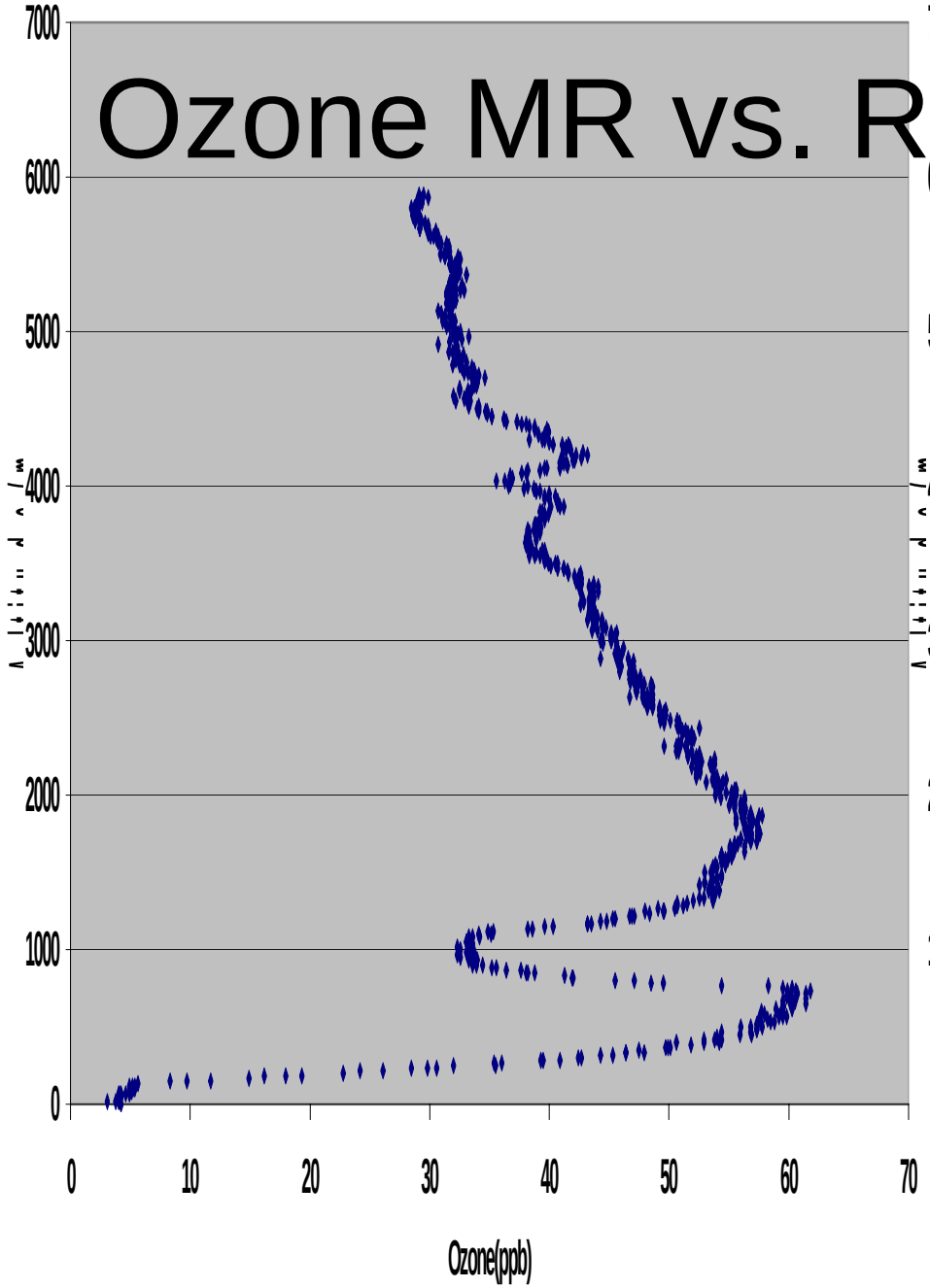


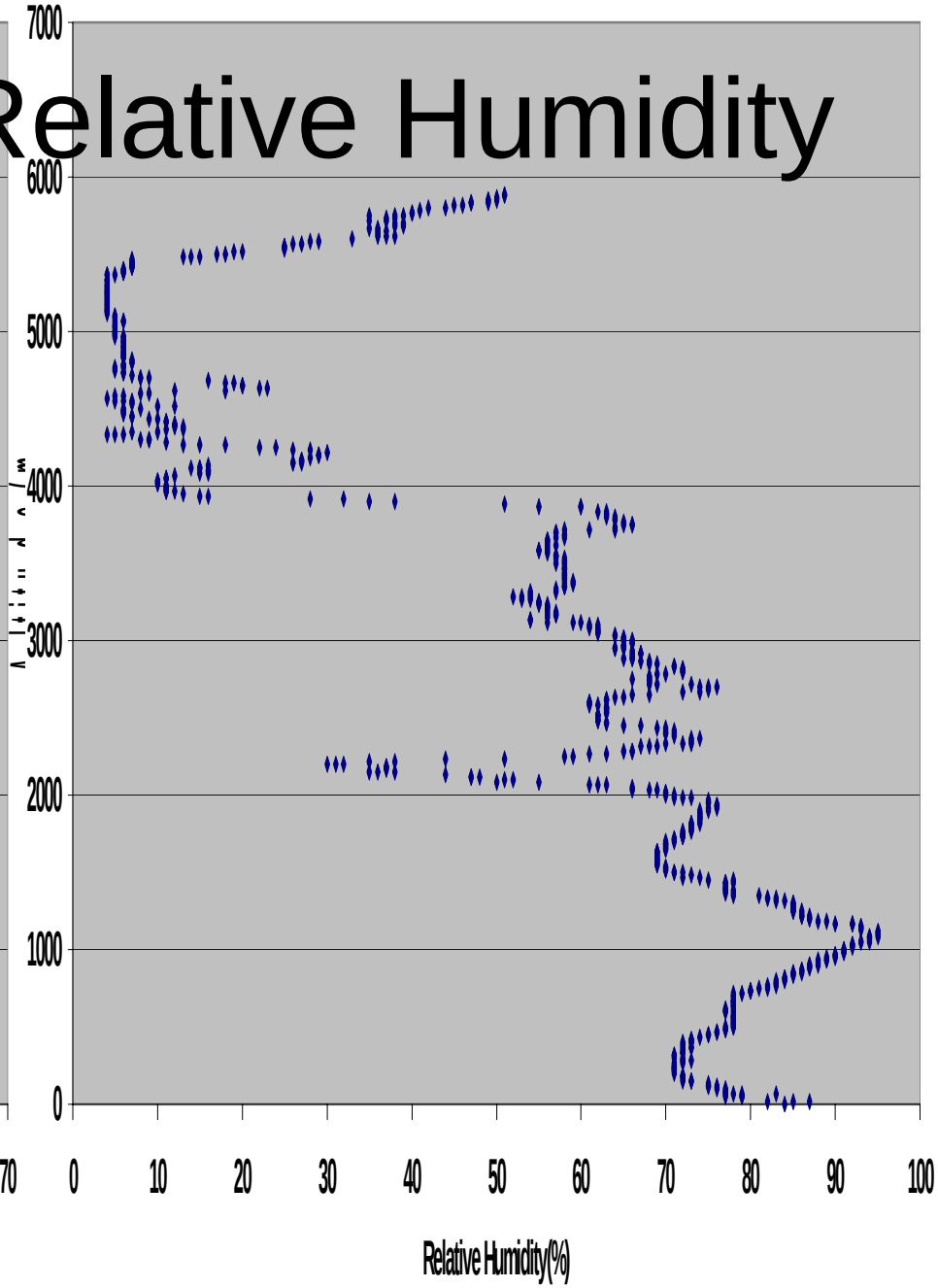
Ozone MR vs. Temperature



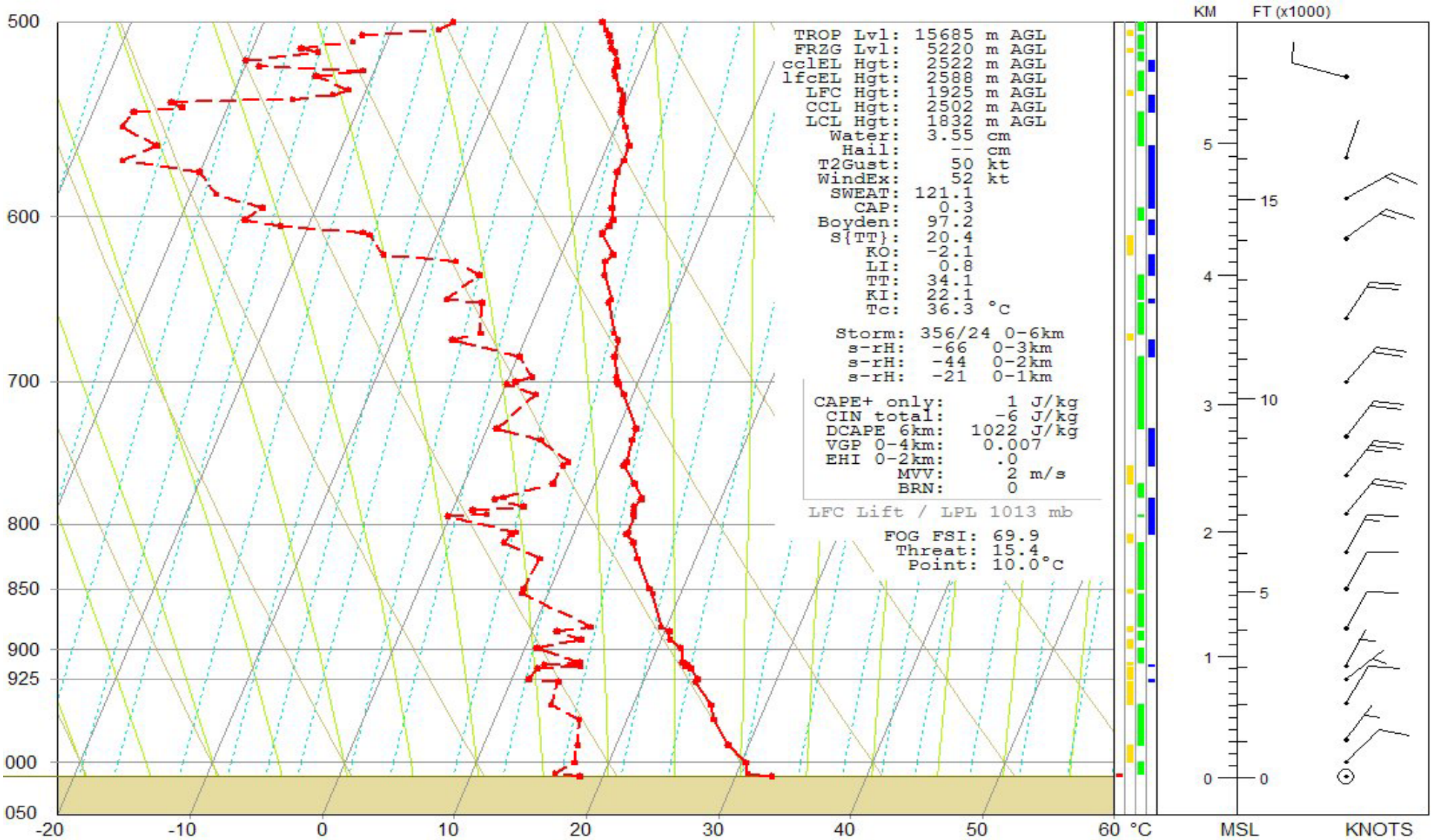


Ozone MR vs. Relative Humidity

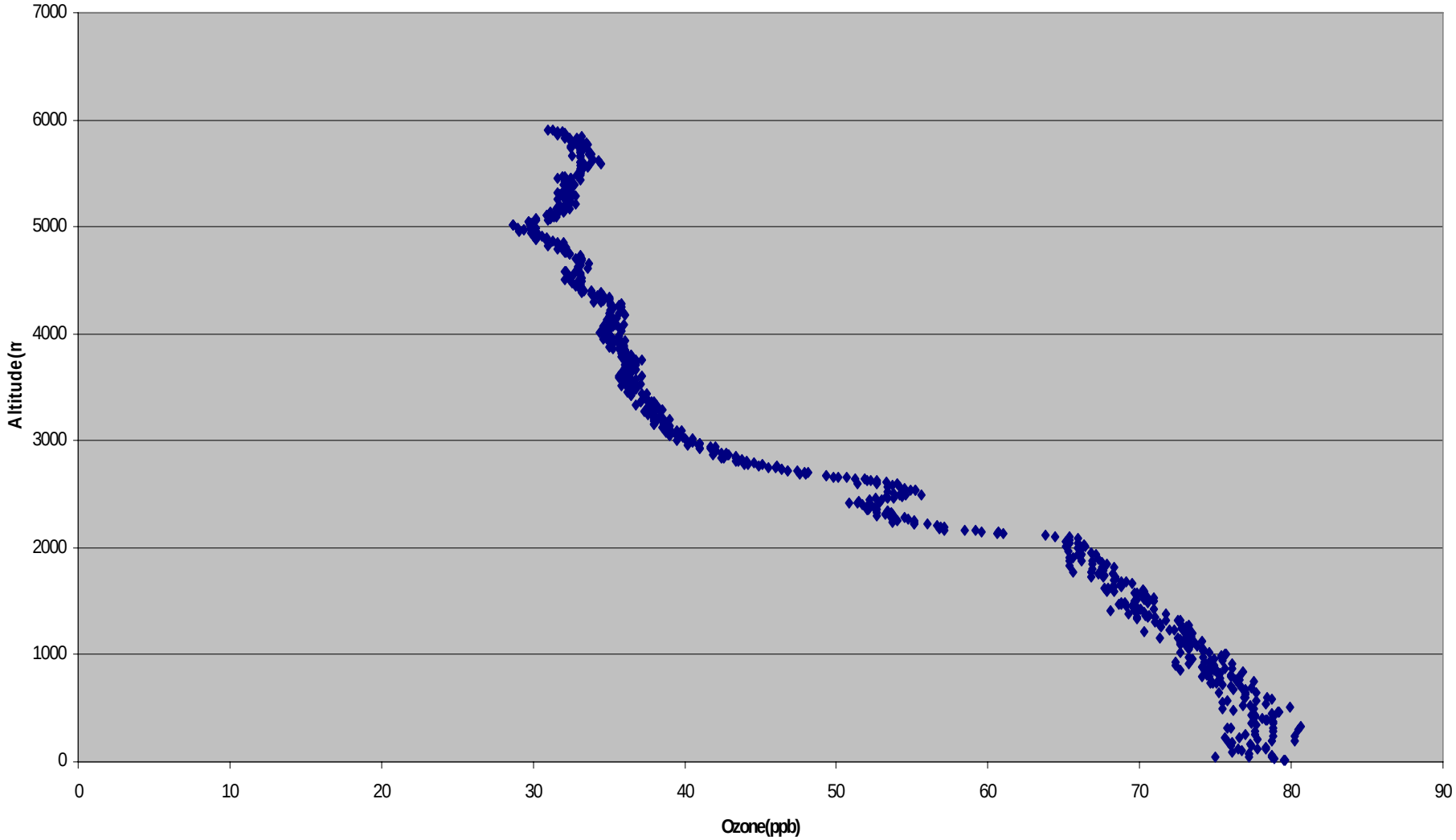




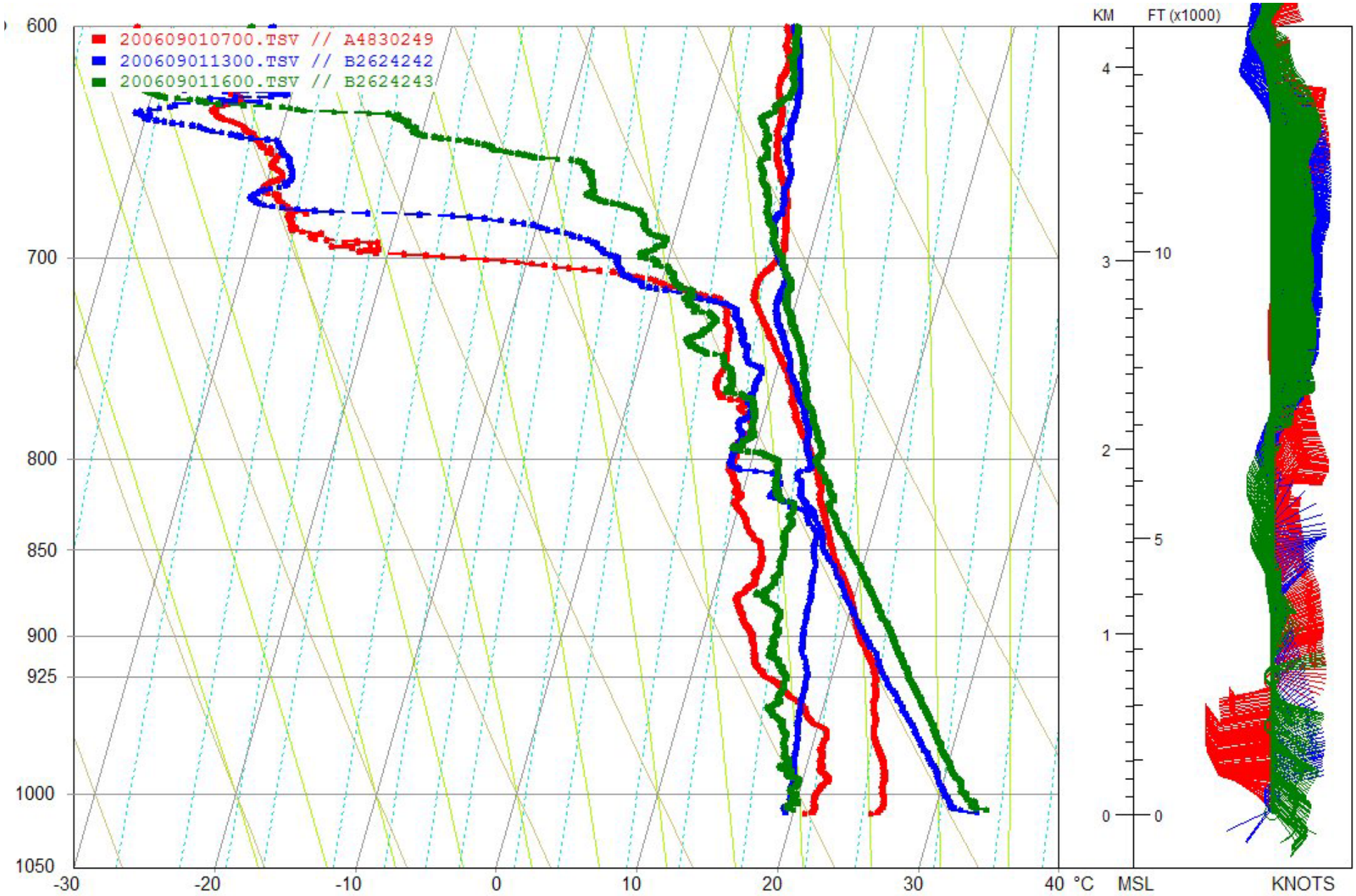
9-2 1300 Sounding



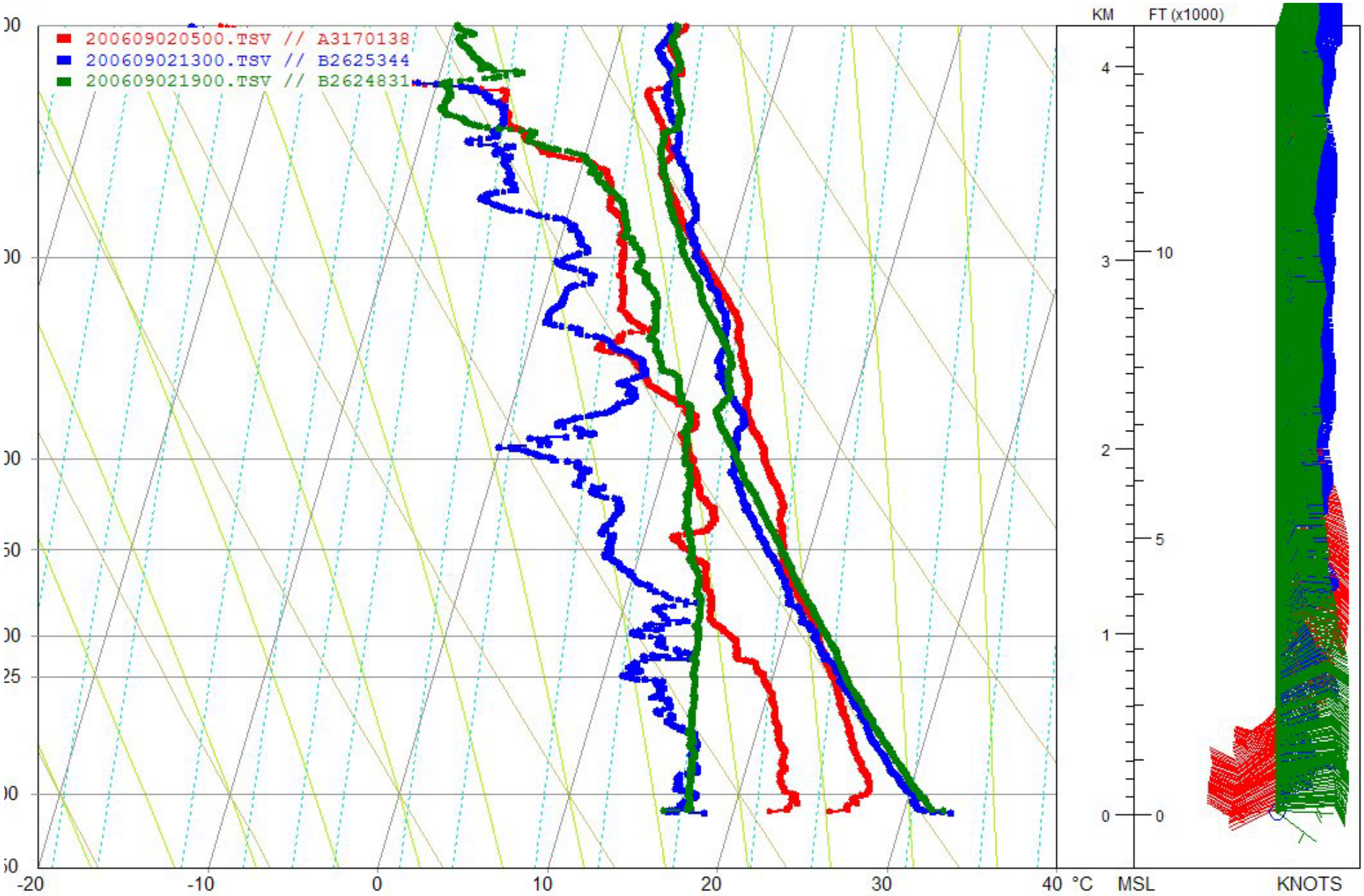
9-2 1300 Ozone Profile



9-1 Daily Progression

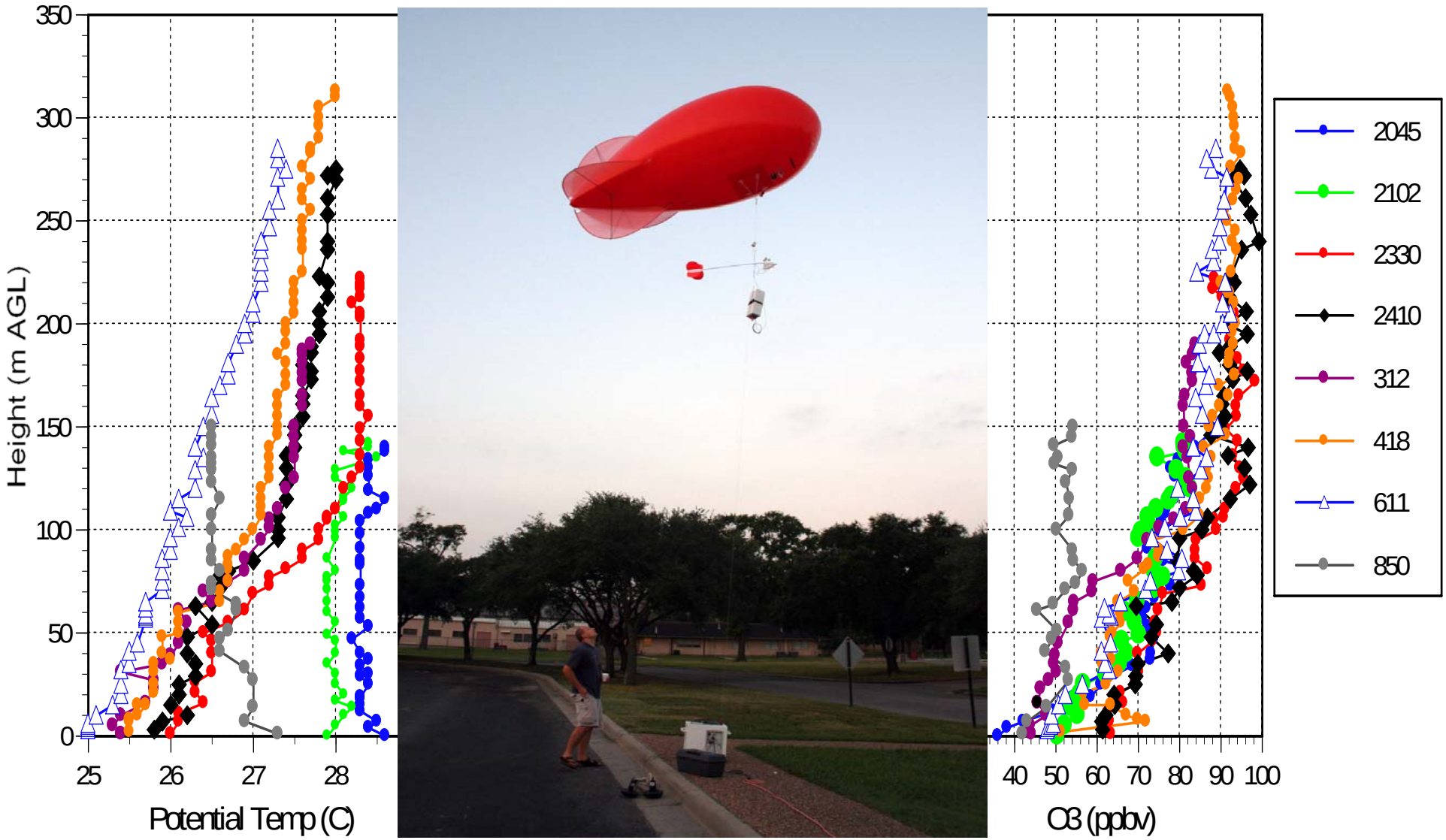


9-2 Daily Progression



Boundary Layer Evolution

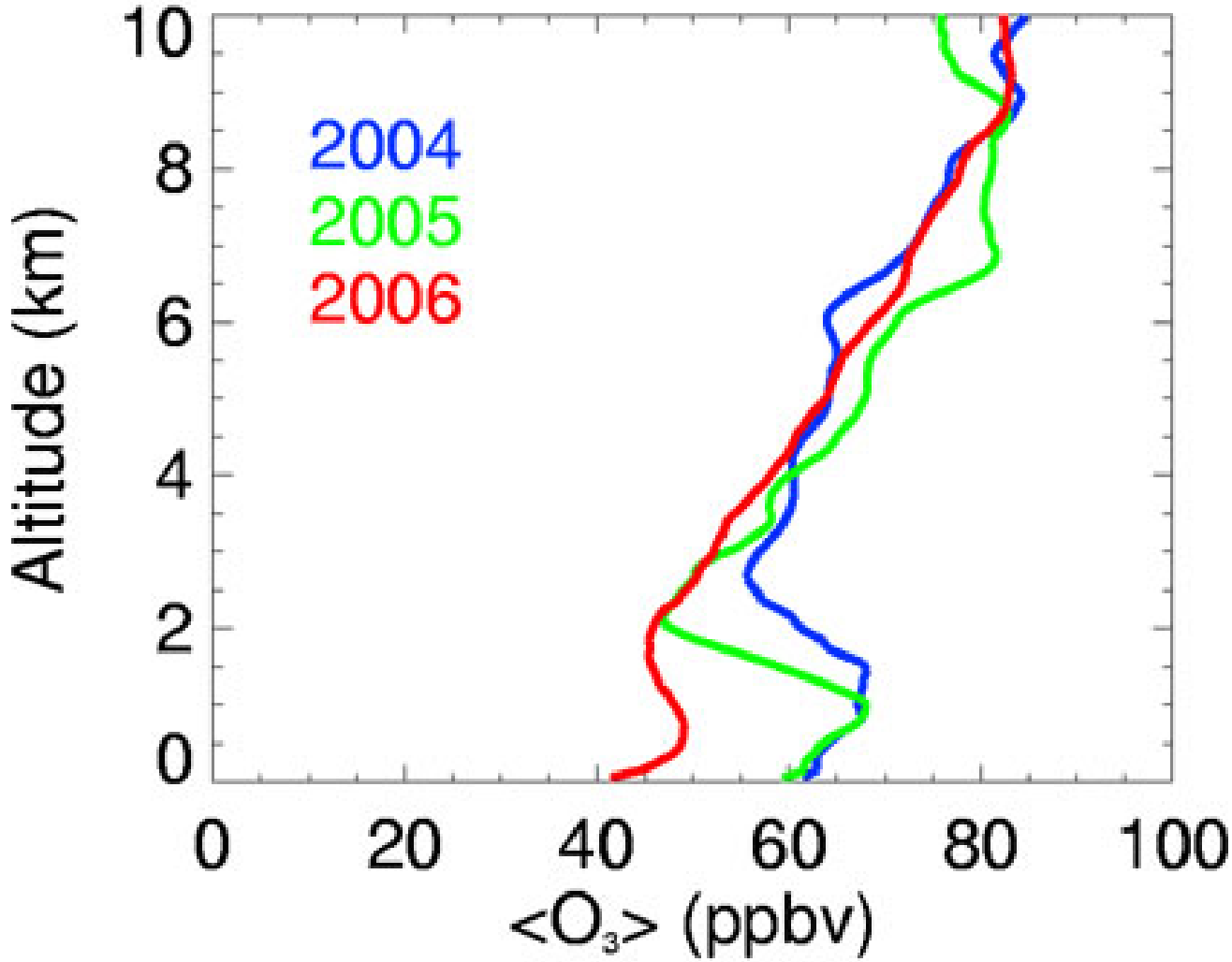
UH Tethersonde Profiles (8/31-9/1)



Overall Tentative Conclusions

- Vertical Ozone Profile determined by:
  - Multiple Temperature Inversions
  - Wind Direction/Wind Speed (unidirectional vertical winds may result in lower ozone values)
  - Presence/Absence of Cloud Layer

Houston Ozonesonde Data



www.rice.edu/ozone

Radiosonde Data

- www.imaqs.uh.edu/balloon.htm

Ozonesonde Data

- www.rice.edu/ozone
- physics.valpo.edu/ozone