

Integrating Surface and Upper-Air Observing Systems to Better Understand Meteorological and Air Quality Issues

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Overview

- Brief history of programs
- Routine monitoring in Hawaii
- Application in fugitive dust assessment - Arizona
- Wyoming wintertime ozone and related studies
- Clark County Nevada wildfire and transport studies
- Development of real-time display techniques and integration with commercially available software programs

Routine Monitoring

- PSD permit monitoring
- Surface meteorology (10m)
- Surface air quality
 - Gaseous, particulate matter
- Replacement of tall tower with remote sensor (sodar)
- Real-time communications for quality control of data



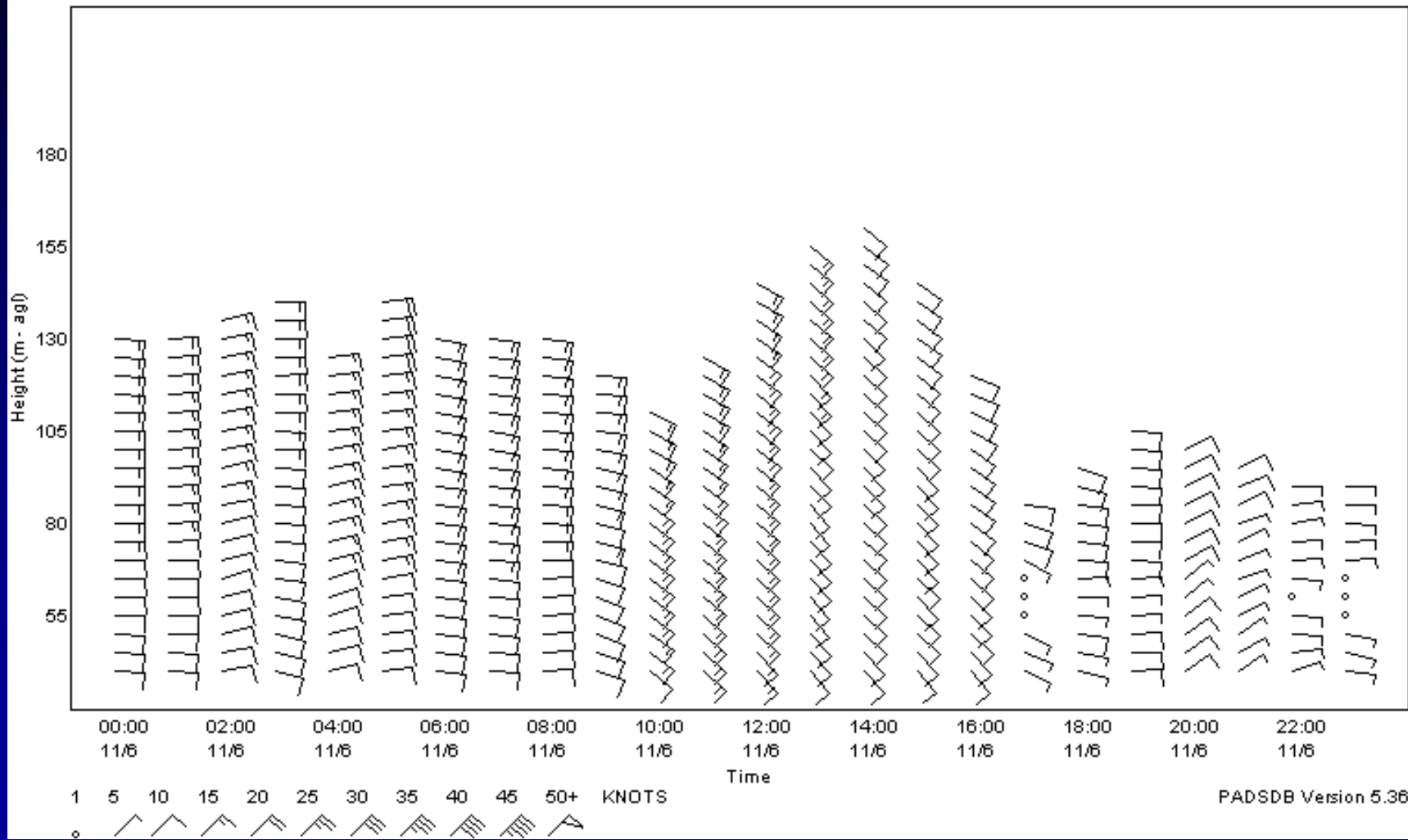
Routine Monitoring

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Routine Monitoring

Date : 11/1/2007 - 11/30/2007



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PM₁₀ Source Attribution

- 2006 Maricopa County Source Attribution and Deposition Study
- MiniSodar used to document the limited mixing and transport conditions
- Wintertime, low wind speed, stagnant conditions

PM₁₀ Source Attribution

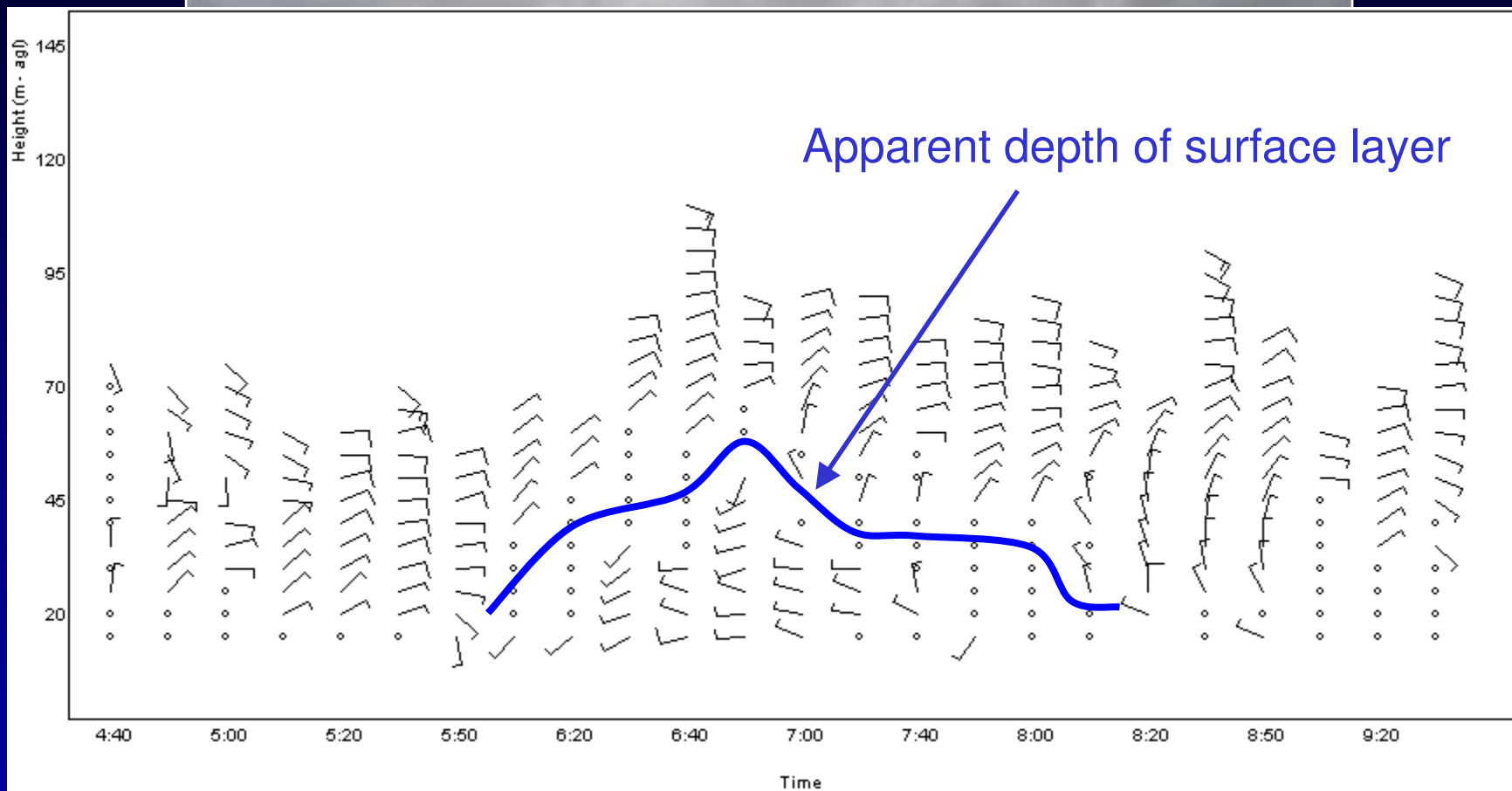


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PM₁₀ Source Attribution



PM₁₀ Source Attribution



T. B. Simpson

Wintertime Ozone

- Wyoming . . .



Wintertime Ozone

- Wyoming . . .
- Recent arrival of precursors
- Ozone meteorology
- Role of extremely limited mixing



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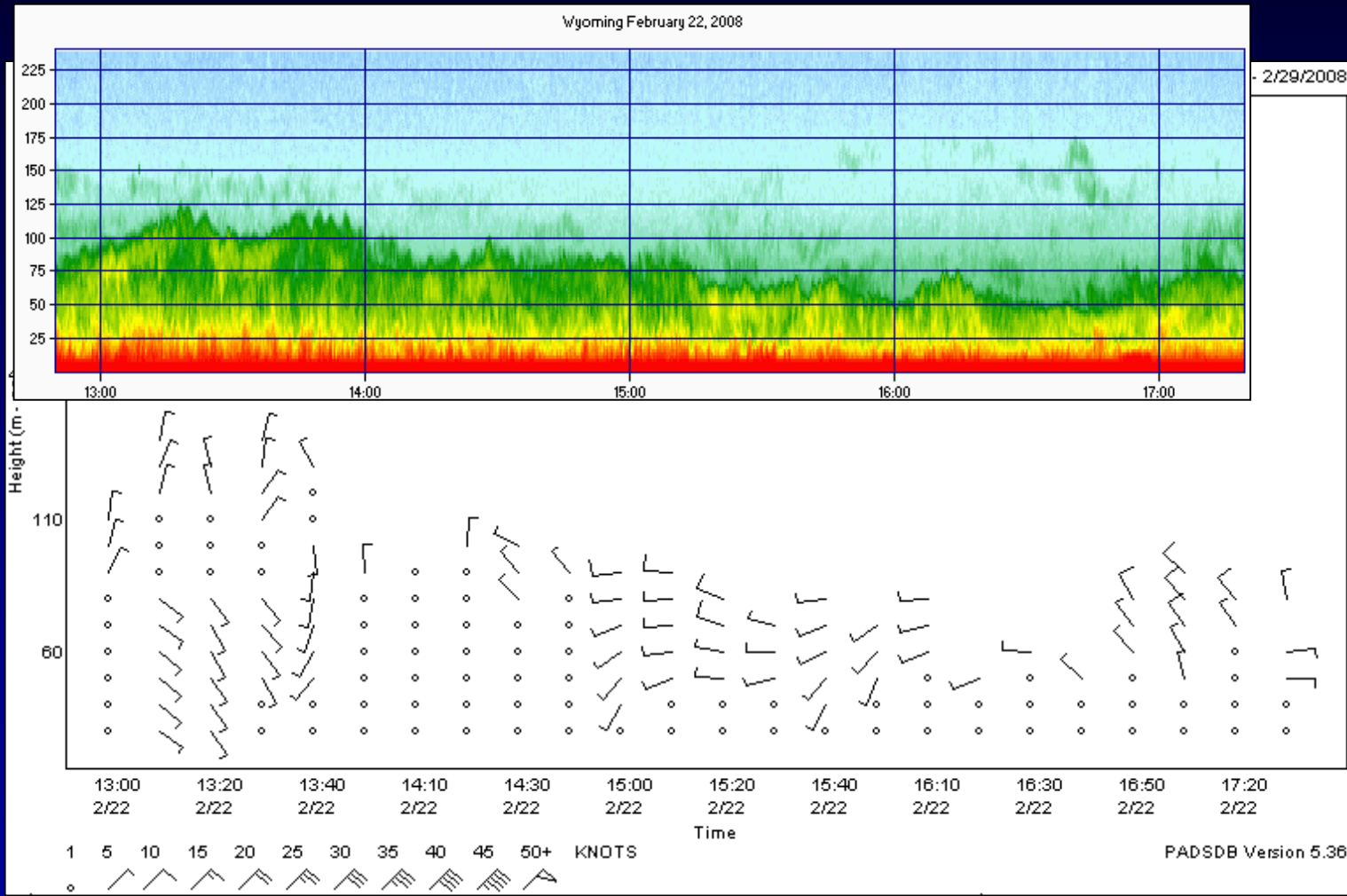
T&B Seppänen

Wintertime Ozone

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- Ozone meteorology
- Role of extremely limited mixing



Wintertime Ozone Extremely Limited Mixing



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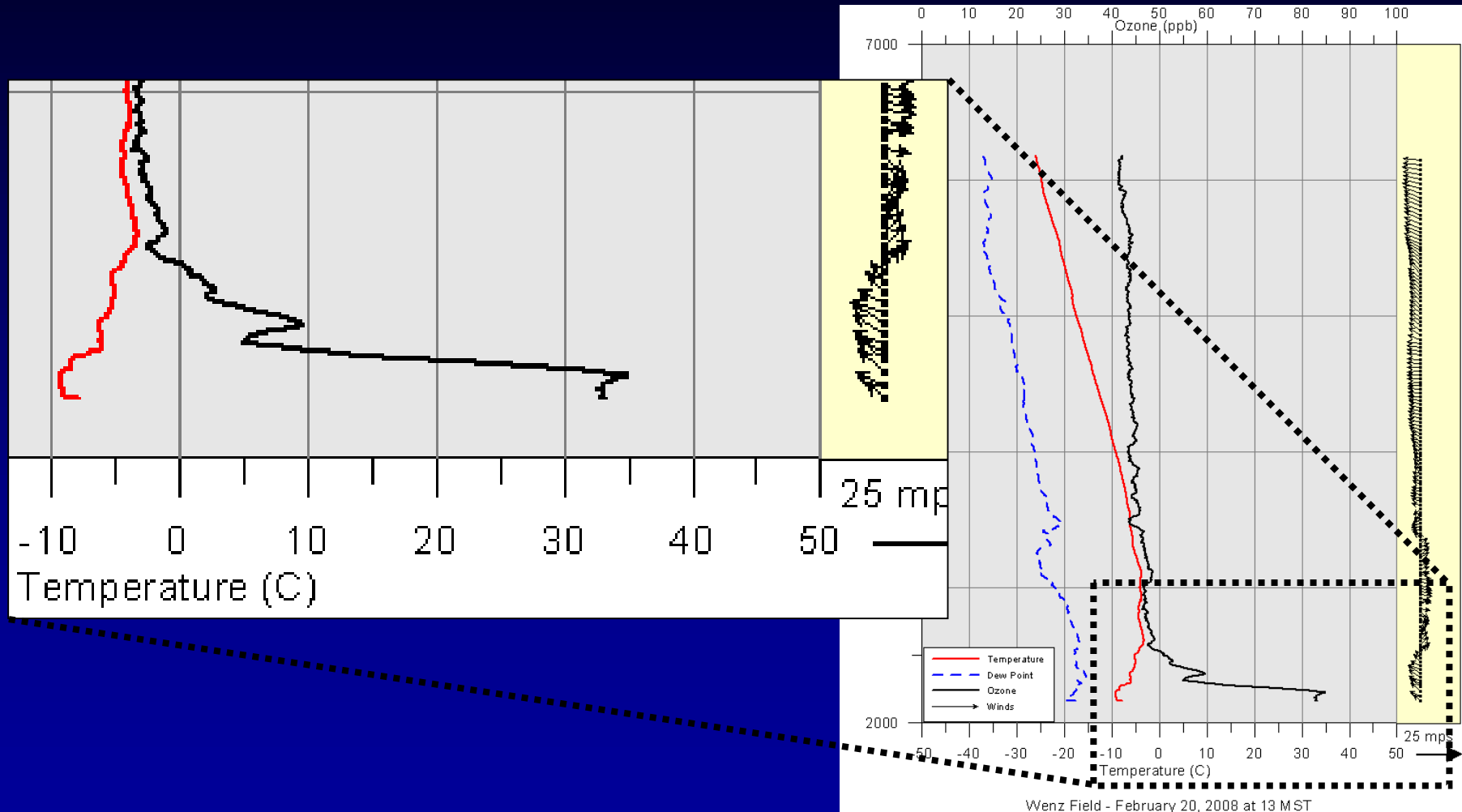
Wintertime Ozone Extremely Limited Mixing

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- Recent arrival of precursors
- Ozone meteorology
- Role of extremely limited mixing



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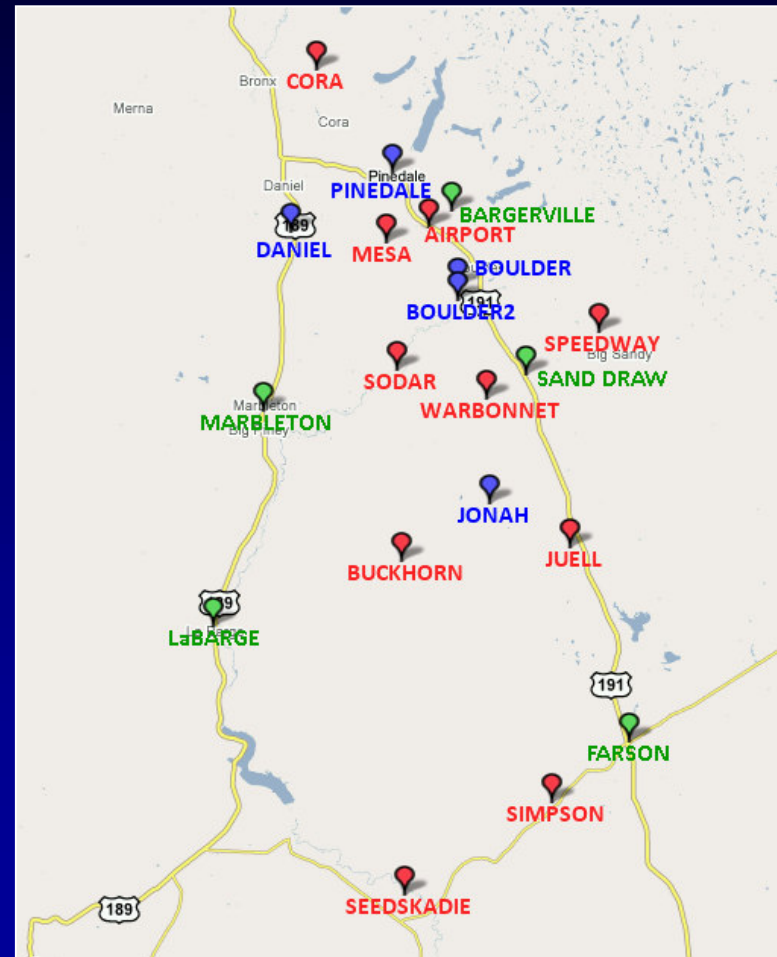
Wintertime Ozone Extremely Limited Mixing



Wintertime Ozone

2009 Additions

- Surface monitoring
- MiniSodar/Air Quality Station
 - Self contained & powered
 - Surface T/RH/press/winds
 - Upper-air winds and turbulence
 - Ozone with future expansion
 - Data posted every 5 minutes

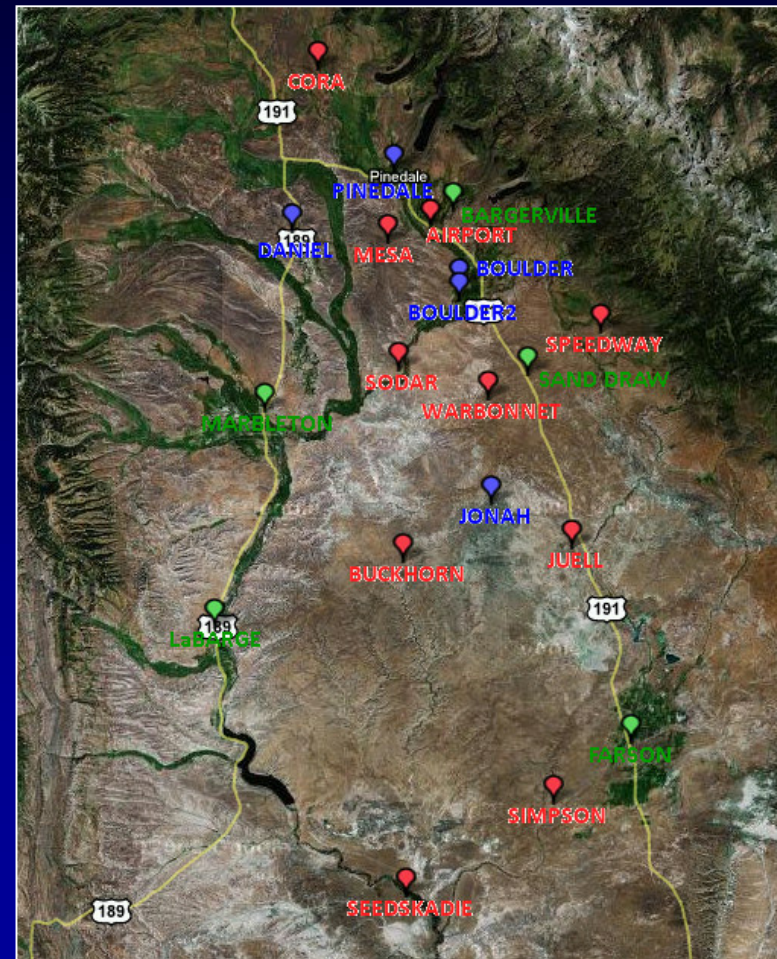


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Wintertime Ozone

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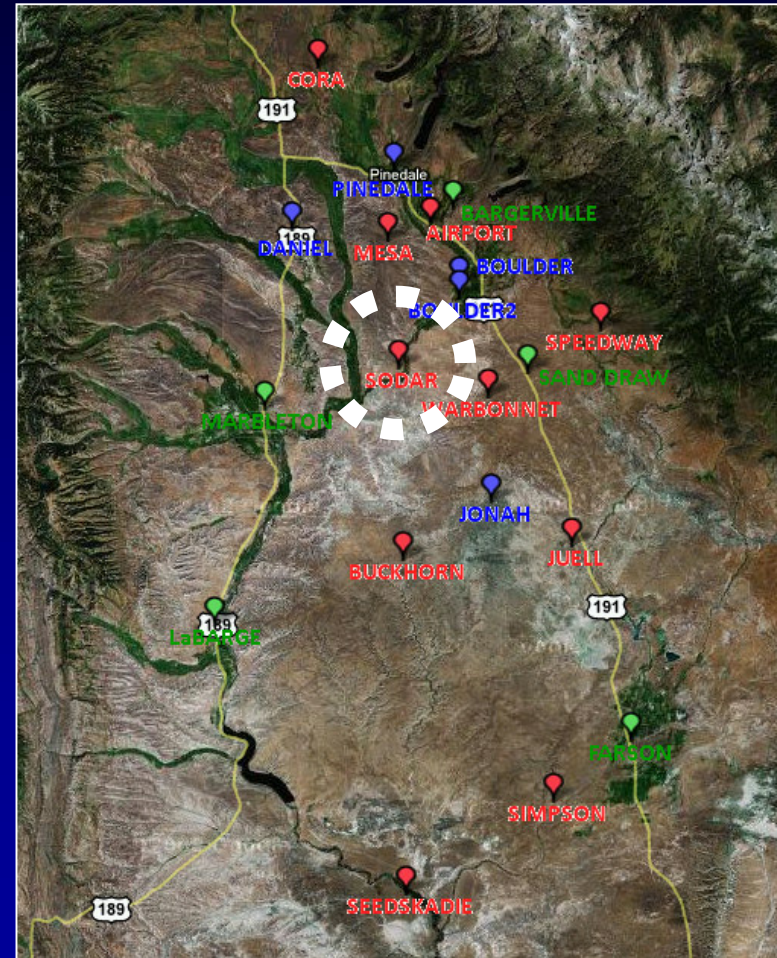


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Wintertime Ozone

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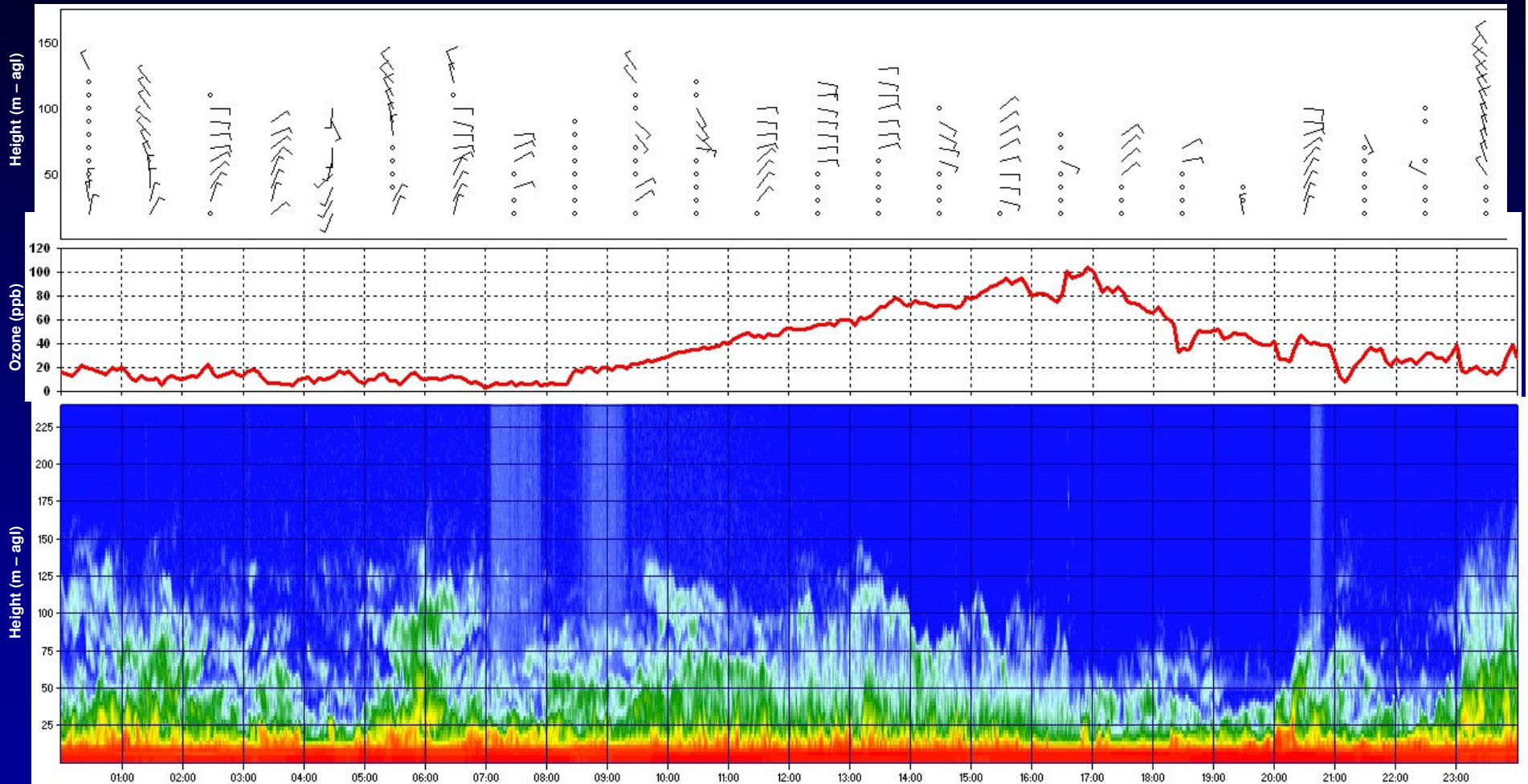
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Wintertime Ozone



2009 Data – February 4



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Wintertime Ozone

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Future Additions to Program

- Nitrogen species
- Integration with cloud seeding program radiometer measurements

Clark County Ozone Transport and Wildfire Studies

2005 Clark County Regional Ozone and Precursor Study (CCROPS)

- 4 sodars, 1 radar profiler
- 23 ozone sites
- 10 surface meteorology
- Rawinsondes/ozonesondes
- 2 aircraft
- Precursors (VOC, NO_y)

2006 Sunset Park Ozone Study

- One sodar
- Surface meteorology
- Four ozone sites

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Clark County Ozone Transport and Wildfire Studies

2007 Southwest Desert to Las Vegas Ozone Transport Study (SLOTS)

- Integrated MiniSodar, radar profiler and profiling radiometer
- 2 sodars
- 2 remote ozone with met
- Portable rawinsondes
- 1 Aircraft
- Precursors (VOC, NO_y)

2008 Fire Impacts and Related Events (FIRE 2008)

- 1 aircraft
- Integrated MiniSodar, radar profiler, profiling radiometer (waiting for construction permits)
- rawinsondes
- VOC, carbonyl precursors

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Clark County Ozone Transport and Wildfire Studies

2009 Ozone transport and related studies

- In planning
- Integrated Upper-Air Meteorological Station



2007



2009

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Clark County Integrated Upper-Air Meteorological Station

Three Monitoring Components

- ASC MiniSodar
- Vaisala Radar Wind Profiler
- Radiometrics Profiling Radiometer

Low level/high resolution winds

- 5 m resolution
- 15 m - 200 m altitude



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Clark County Integrated Upper-Air Meteorological Station

Three Monitoring Components

- ASC MiniSodar
- Vaisala Radar Wind Profiler
- Radiometrics Profiling Radiometer

Dual mode (high and low) winds

- 100 & 200 m resolution
- 150 m - 3600 m altitude



Clark County Integrated Upper-Air Meteorological Station

Three Monitoring Components

- ASC MiniSodar
- Vaisala Radar Wind Profiler
- Radiometrics Profiling Radiometer

Temperature and Humidity Profiles

- 100 m resolution sfc to 1 km
- 250 m resolution 1 to 10 km



Clark County Integrated Upper-Air Meteorological Station

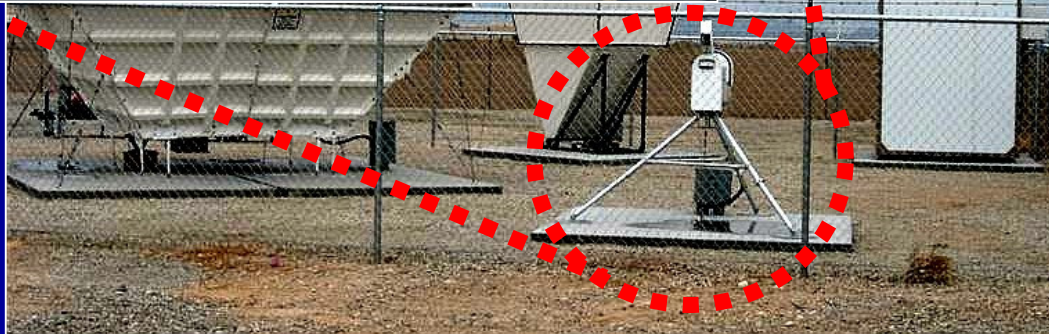


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Temperature and Humidity Profiles

- 100 m resolution sfc to 1 km
- 250 m resolution 1 to 10 km

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Clark County Integrated Upper-Air Meteorological Station

Shelter

- Real-time cellular communications
- Remote access to all instruments



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Clark County Integrated Upper-Air Meteorological Station

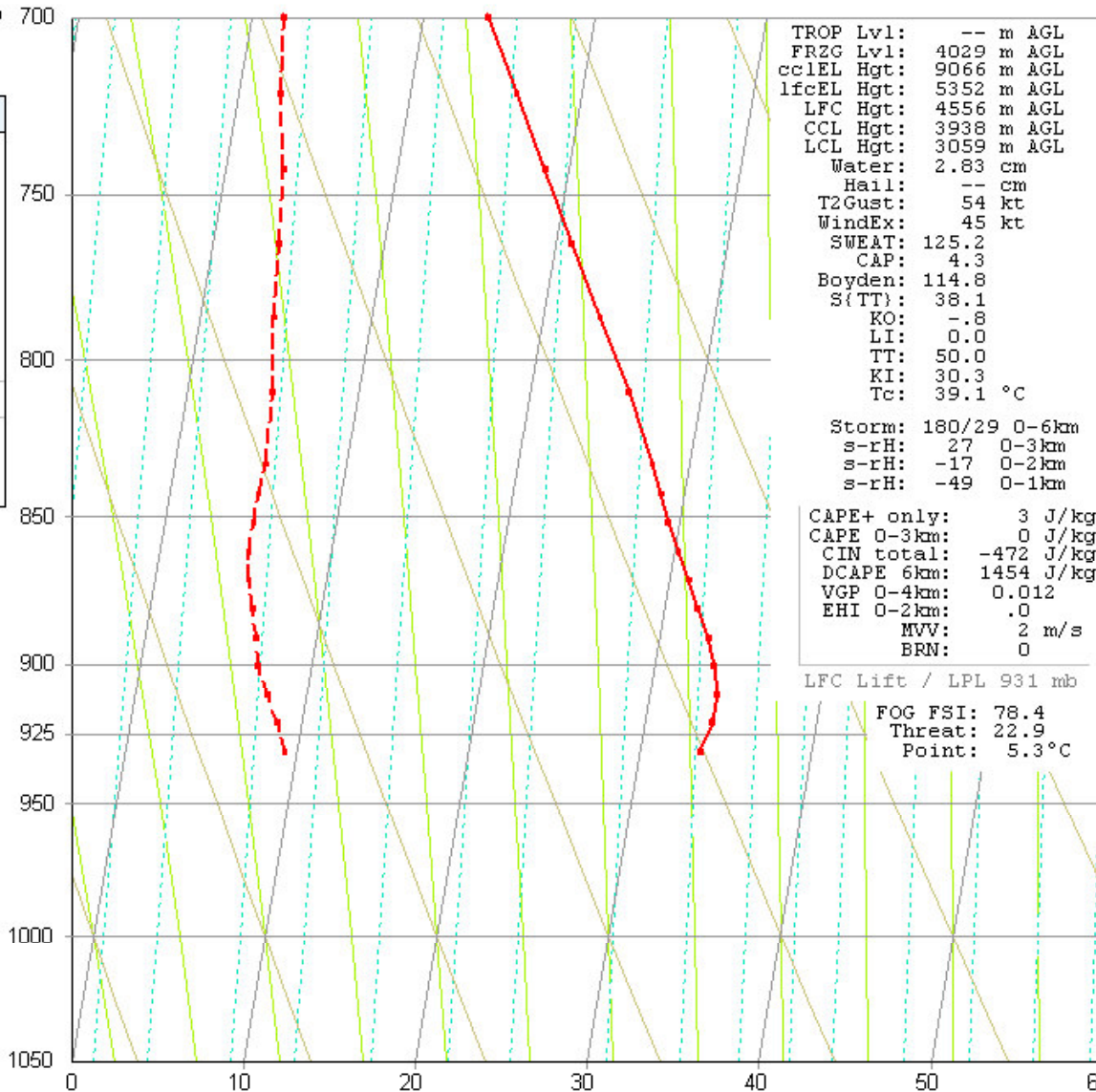
Goals of the Measurement System

- Integrate the existing systems into a package that emulate hourly radiosonde (rawinsonde) soundings
- 24-hour continuous monitoring
- Real-time data access
- Archive data access
- Format useable in the RAOB software package
- Integrate into the Clark County data display

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Raob Data	
Pres:	931.2 mb
Hgt:	0 m
(AGL)	0 ft
±Std:	-707 m
Temp:	33.5 °C
Td:	9.3 °C
T-Td:	24.2 °C
RH:	23%
PT:	313.0 °K
ePT:	336.6 °K
Tmax:	33.7 °C
Wind:	185/6 kts
Hgt:	15 m
(AGL)	49 ft

Diagram Data	
Pres:	930 mb
Hgt:	677 m
(MSL)	2,222 ft
Hgt:	8 m
(AGL)	27 ft
Temp:	
DryA:	
WetA:	
MixR:	

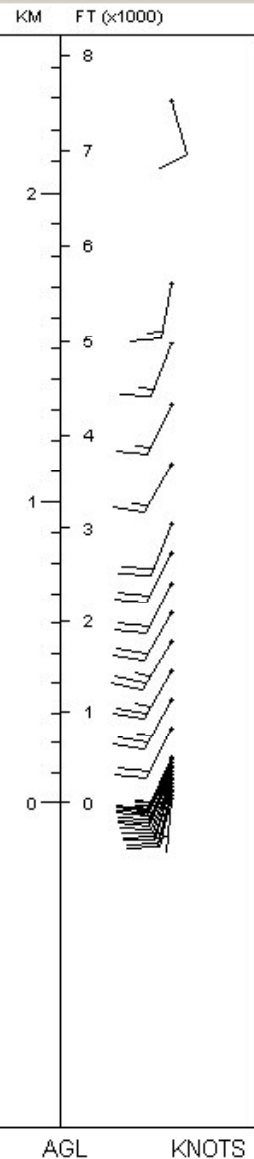


TROP Lvl: -- m AGL
 FRZG Lvl: 4029 m AGL
 cclEL Hgt: 9066 m AGL
 lfcEL Hgt: 5352 m AGL
 LFC Hgt: 4556 m AGL
 CCL Hgt: 3938 m AGL
 LCL Hgt: 3059 m AGL
 Water: 2.83 cm
 Hail: -- cm
 T2Gust: 54 kt
 WindEx: 45 kt
 SWEAT: 125.2
 CAP: 4.3
 Boyden: 114.8
 S(TT): 38.1
 KO: -.8
 LI: 0.0
 TT: 50.0
 KI: 30.3
 Tc: 39.1 °C

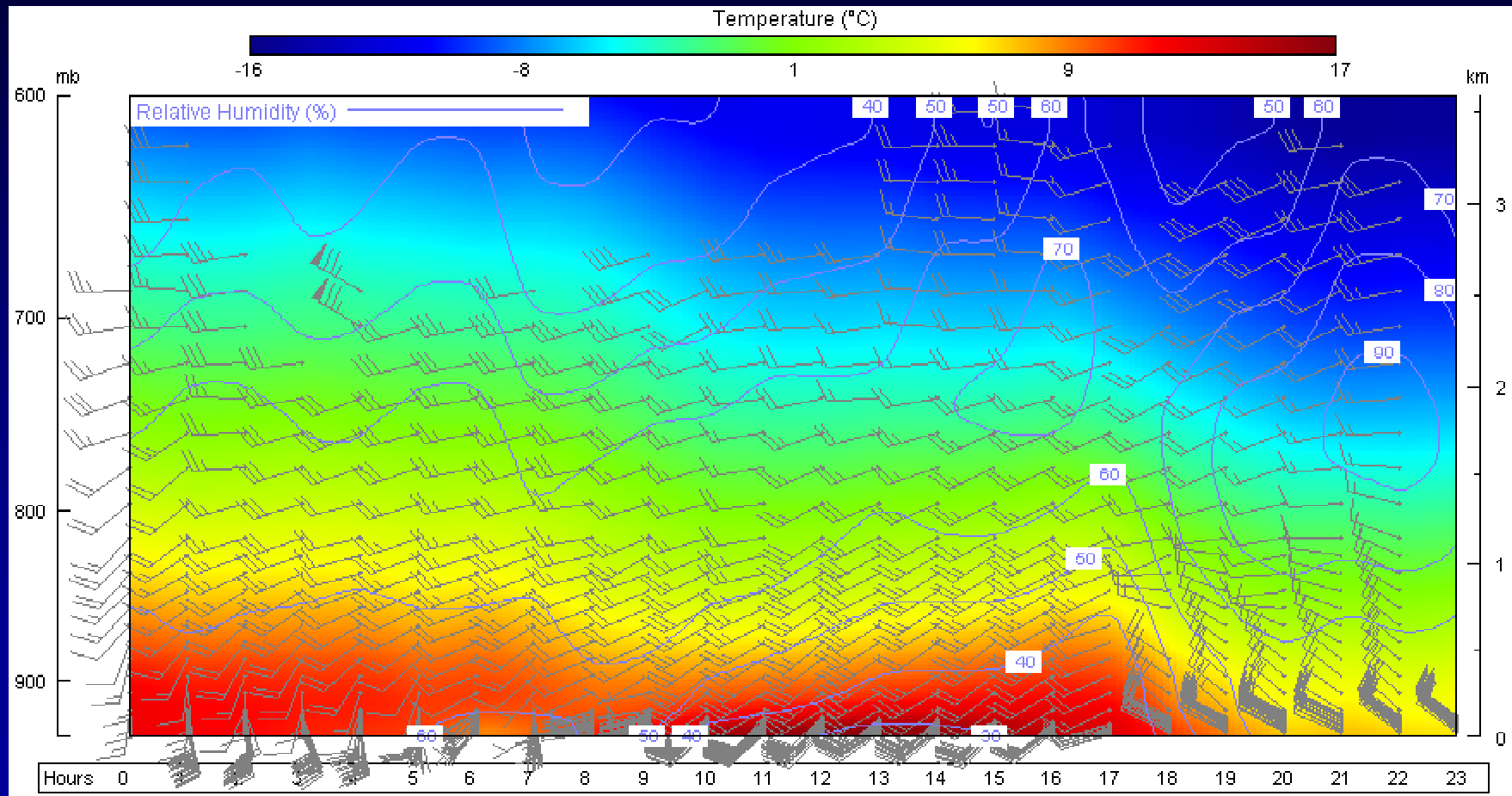
Storm: 180/29 0-6km
 s-rH: 27 0-3km
 s-rH: -17 0-2km
 s-rH: -49 0-1km

CAPE+ only: 3 J/kg
 CAPE 0-3km: 0 J/kg
 CIN total: -472 J/kg
 DCAPE 6km: 1454 J/kg
 VGP 0-4km: 0.012
 EHI 0-2km: .0
 MVV: 2 m/s
 BRN: 0

LFC Lift / LPL 931 mb
 FOG FSI: 78.4
 Threat: 22.9
 Point: 5.3 °C

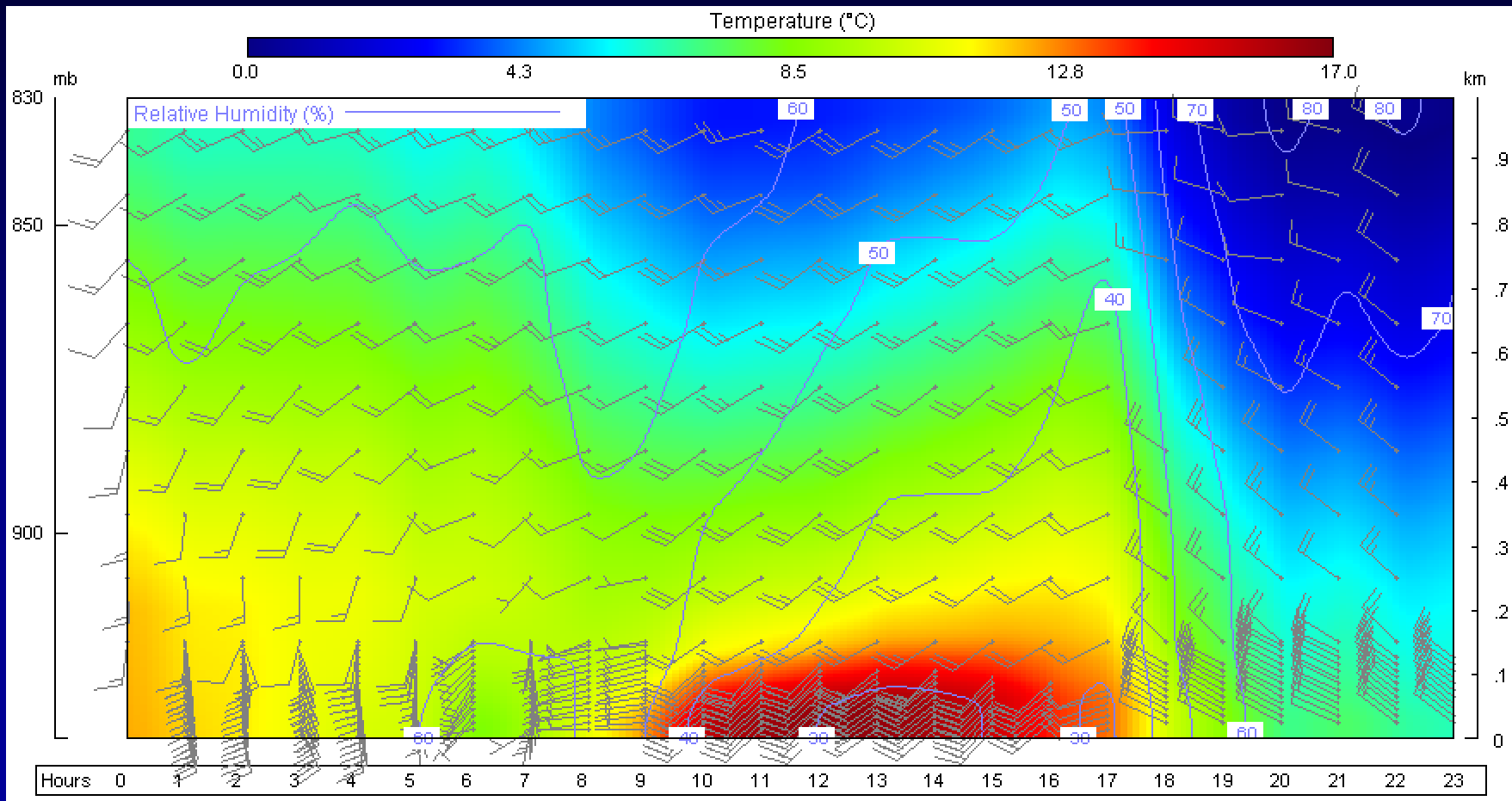


Clark County Integrated Upper-Air Meteorological Station



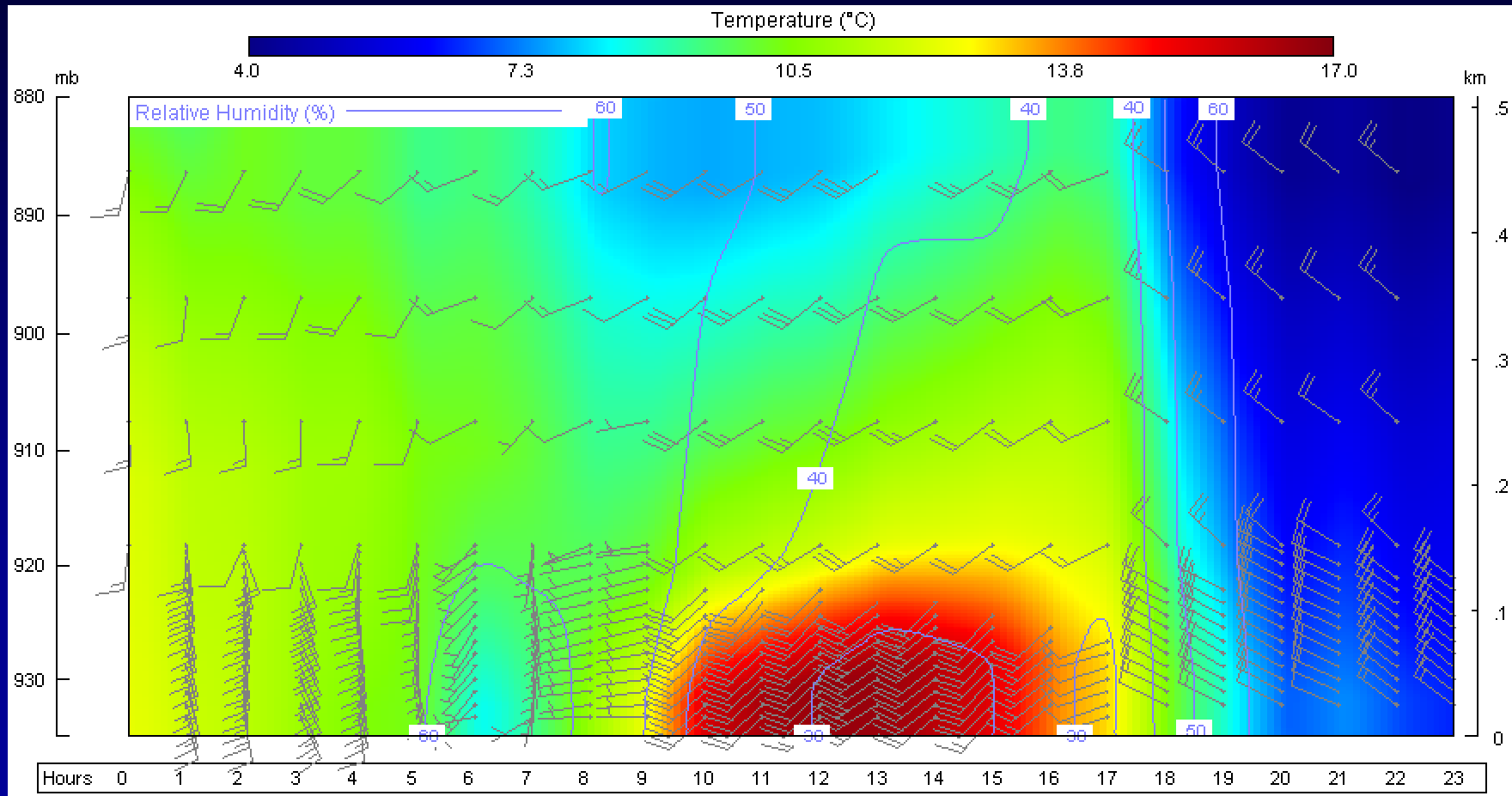
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Clark County Integrated Upper-Air Meteorological Station



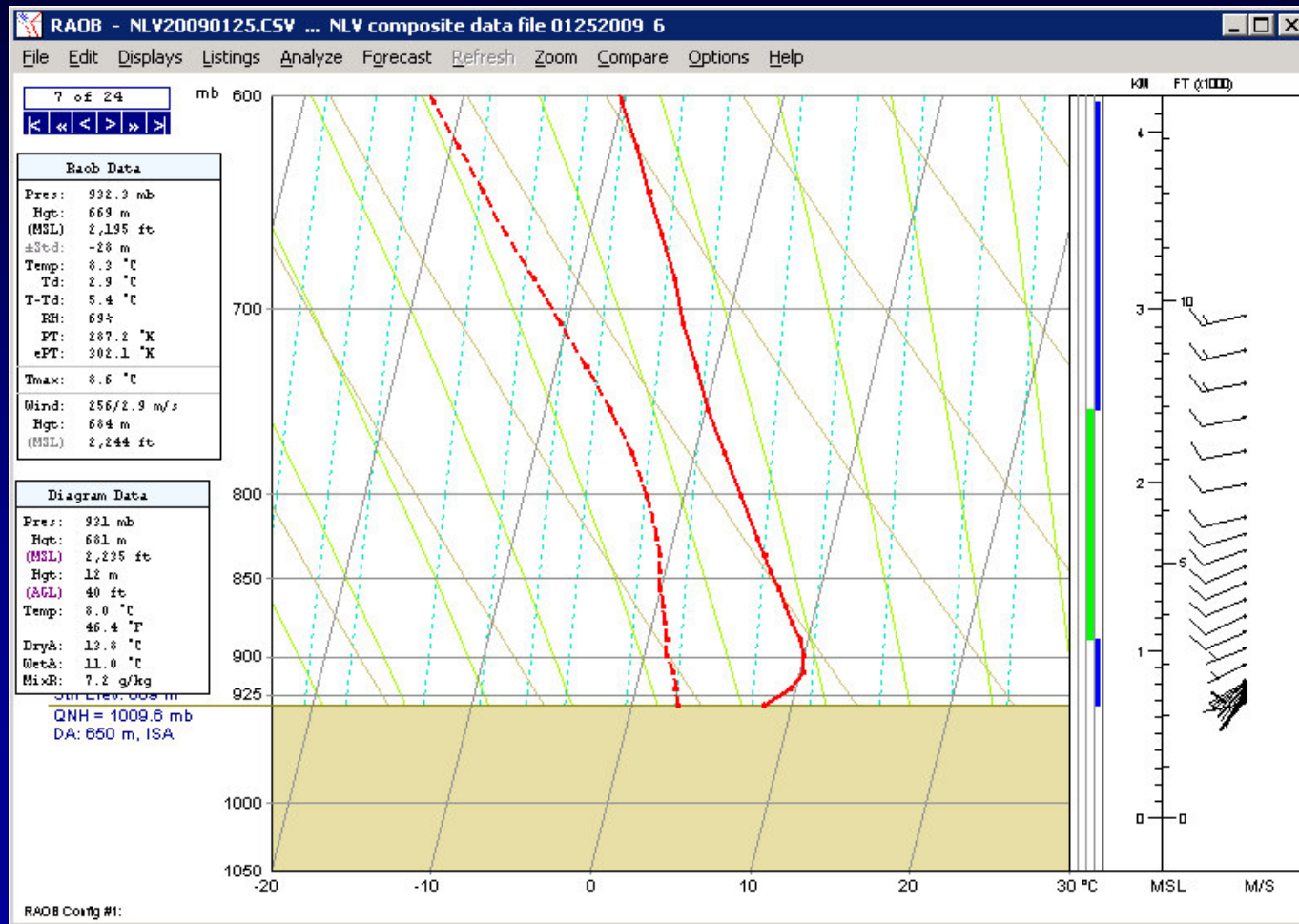
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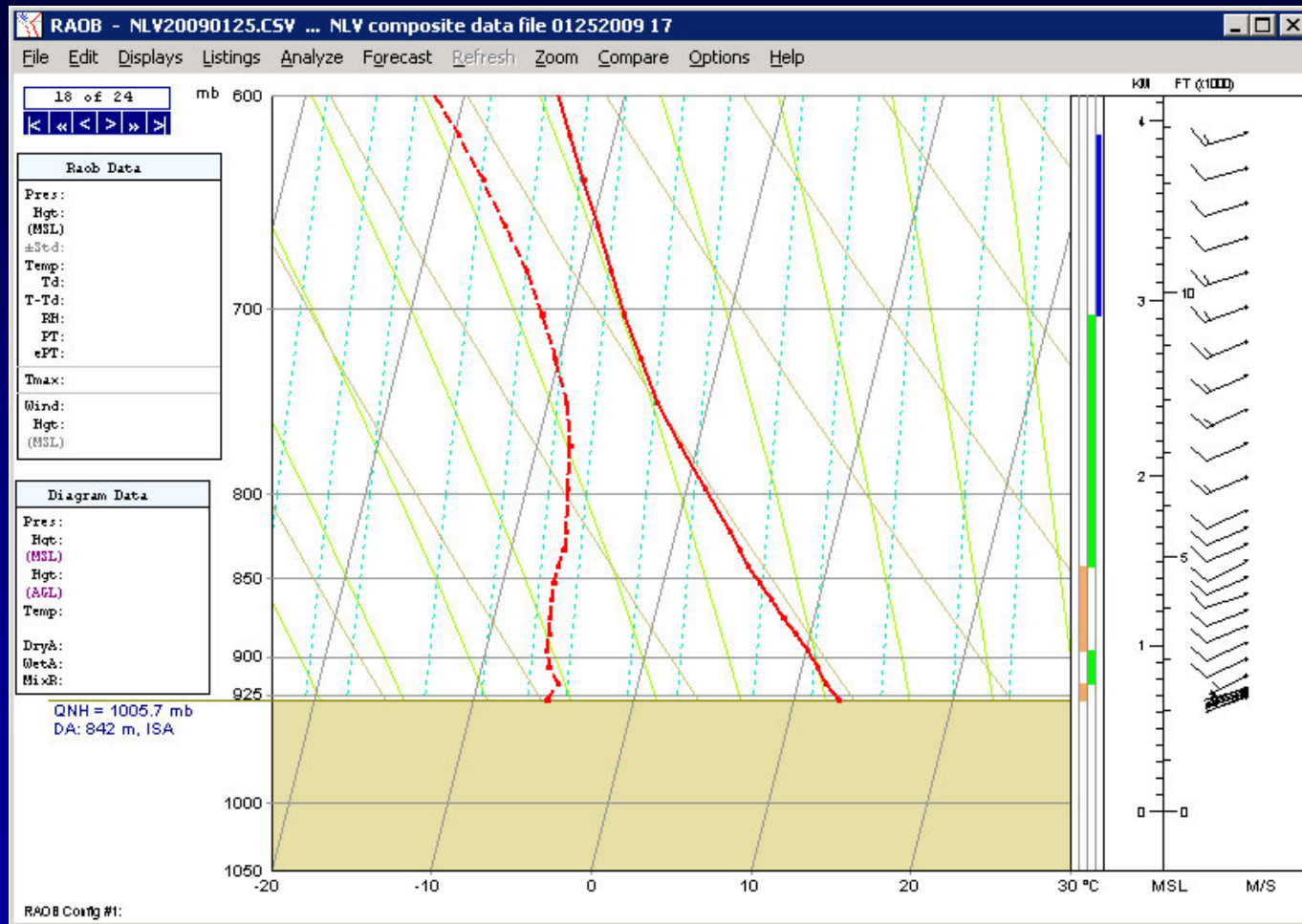
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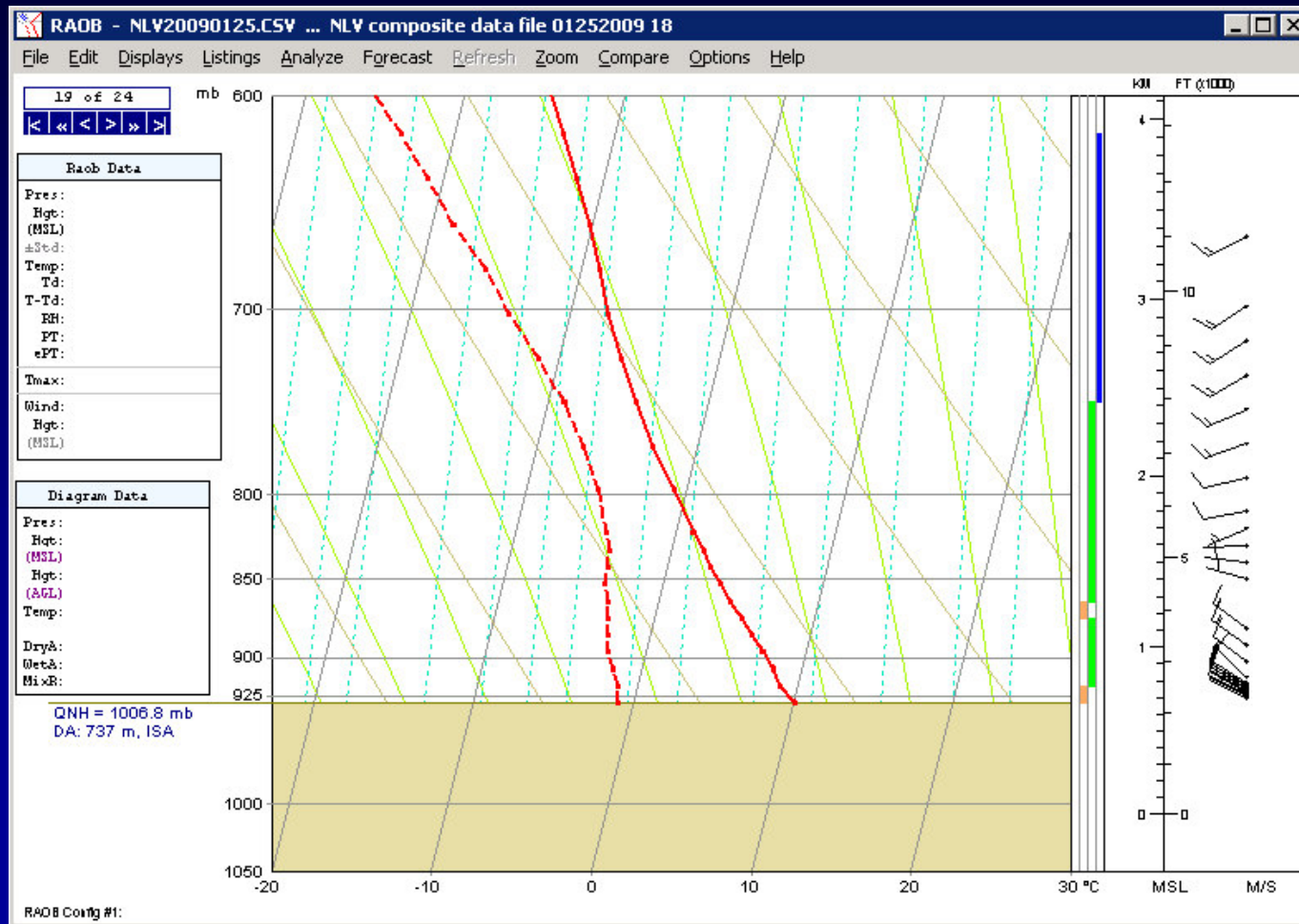
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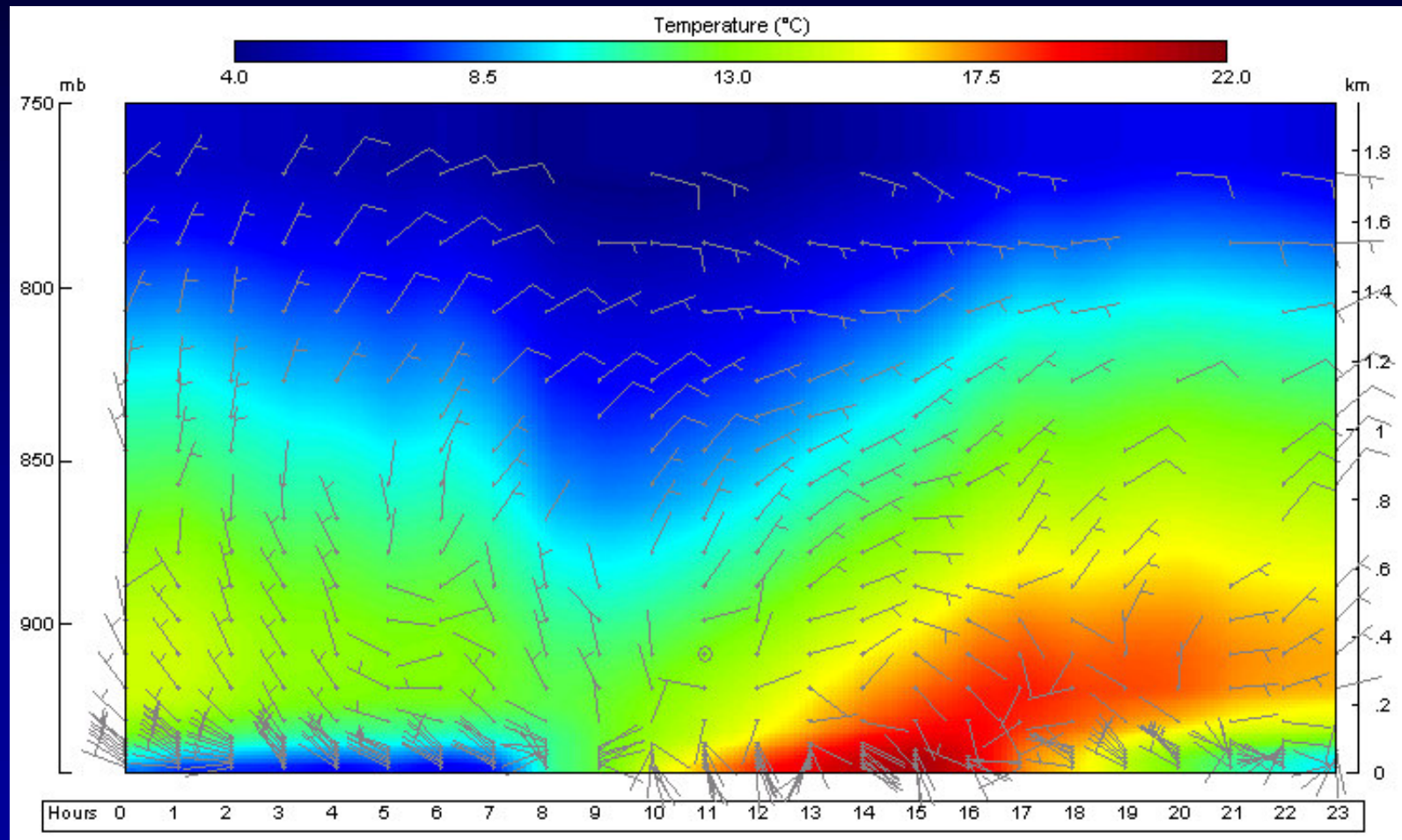
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Clark County Integrated Upper-Air Meteorological Station



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Clark County Integrated Upper-Air Meteorological Station



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North Las Vegas Airport Integrated Upper-Air Monitoring Station

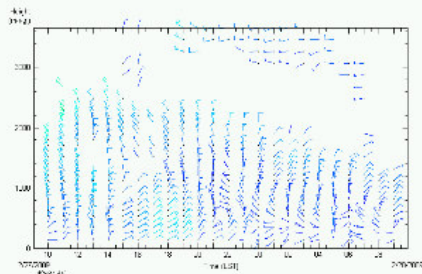
Operated by T&B Systems



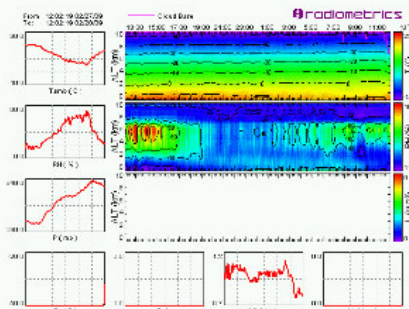
Under contract to the Clark County Department of Air Quality and Environmental Management (DAQEM), T&B Systems has installed and is operating an upper-air monitoring station comprised of a Vaisala radar wind profiler, AeroVironment (now ASC) sodar, and a Radiometrics profiling radiometer. Software developed by T&B Systems is used to automatically compile collected data into hourly averages and format the information into files compatible with the RAOB display software. These data are posted hourly to this site and are available using the data links below. The information provides an effective rawinsonde sounding every hour with wind profiles from the surface to 3 kilometers AGL and temperature and humidity profiles to 10 kilometers AGL. Data are screened using basic QC parameters following each hour of collection and the resulting data files made available approximately 15 minutes past the top of the hour.



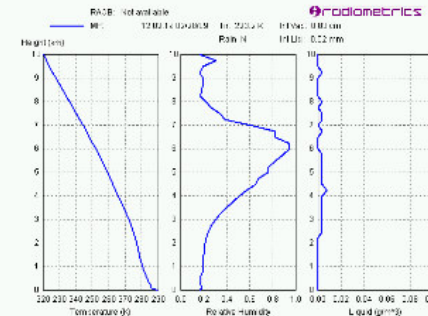
Each of the above instruments provides its own format of the data collected. Each of these formats are available through the FTP site. Additionally, graphical representations of the current collected data are provided. Radar wind profiler data are updated hourly, the profiling radiometer data are updated every five minutes. All data presented are in the raw form with no editing performed. Clicking on the image will open the graphic in the same window. Use the back button to return here.



Radar Wind Profiler 24-hour Time-Height Cross Section



Profiling Radiometer Thermodynamic 24-hour Time Series

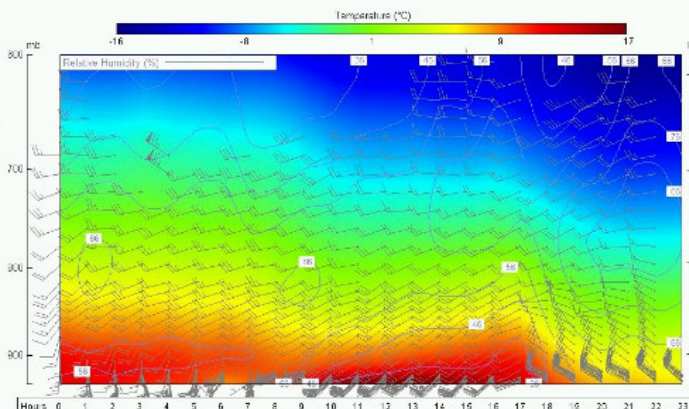


Profiling Radiometer Latest Sounding

The last week of daily real-time data files is available using the associated links. It should be noted that if this method is used to download the files then the files are not named with the date stamp. Date stamped files are available from the FTP site.

[Today's data \(day0\)](#) [day-1](#) [day-2](#) [day-3](#) [day-4](#) [day-5](#) [day-6](#)

To the right is an example time-height cross section generated using the RAOB software, just one of the many analysis displays available from the integrated format. These data are unedited and from January 25, 2009 when a frontal passage occurred in the late afternoon. The full size view can be obtained by clicking on the image.



T&B Systems

Summary of Integrated Systems

- Several types of integrated systems presented
- Wyoming real-time network
 - Extensive surface + upper air network
 - Web access to all data
- Clark County integrated meteorological station
 - High spatial and temporal resolution emulation of radiosonde data
 - Real-time data access for analysis in RAOB
 - Time-height cross sections plotted in real-time

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