Quarterly Report, August 31, 2017
Partially Satisfying Tasks 2 and 6
WORK ORDER UNDER THE CONTRACT BETWEEN TCEQ AND CONTRACTOR:
The University of Texas at Austin

Umbrella Contract 582-16-560422
Internal TCEQ PCR#: 61800
Work Order 6

Maintenance, Data Validation, and Data Analysis of El Paso Radar Wind Profiler

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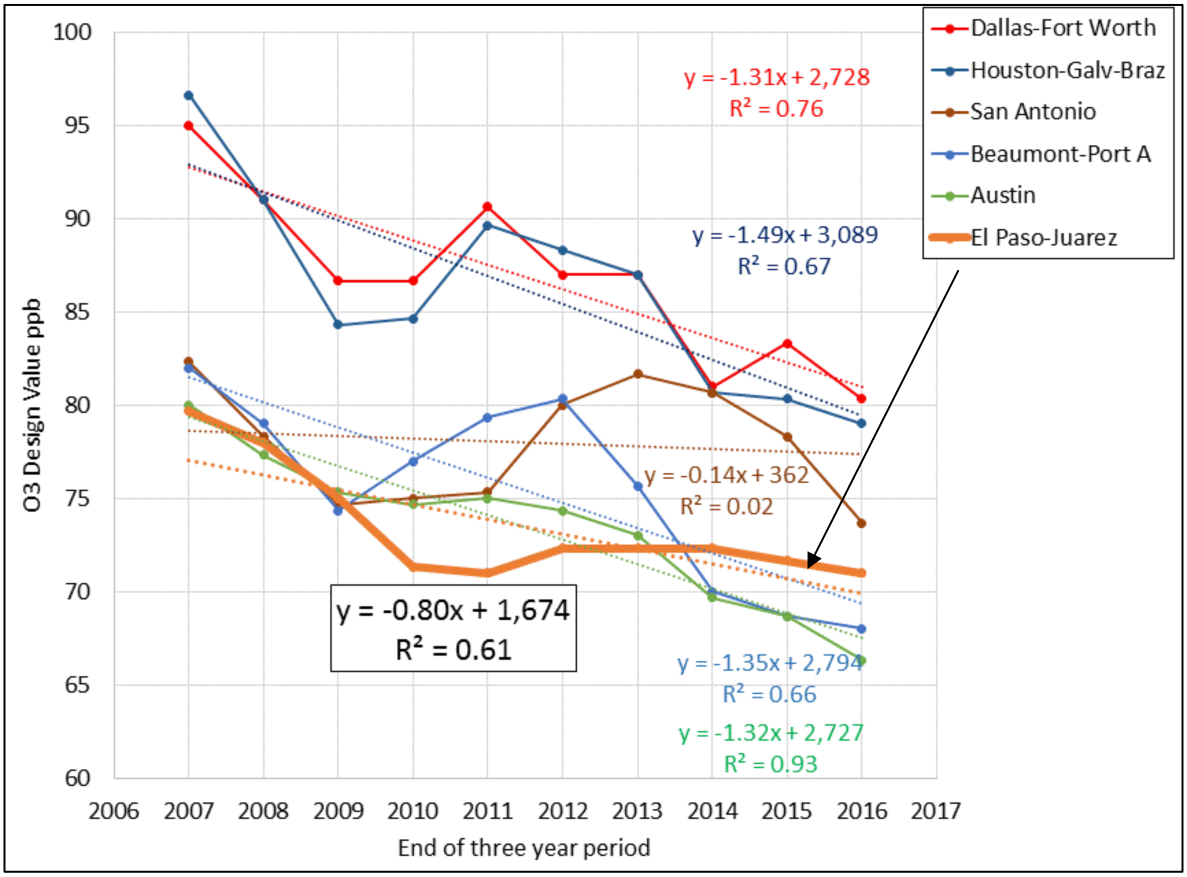
1. Background

Texas Commission on Environmental Quality (TCEQ) desires to collect accurate and reliable aloft meteorological data to support various air quality research activities in El Paso, Texas. Radar Wind Profilers (RWPs) are very effective instruments for acquiring these needed data. An RWP provides continuous vertical profiles of winds and mixing heights. These profiles can be used to characterize 3-dimensional meteorological processes (such as those that affect trans-border pollutant transport) and to show how these processes influence spatial and temporal distribution of pollution. In addition, these data are very important for verifying and improving the meteorological and air quality models used to investigate the effects of emission control strategies and to predict air pollution. The RWP currently in El Paso is being operated to support trans-border air pollution research activities. The objective of this project is for The University of Texas at Austin (UT) and Sonoma Technology (STI) to operate and maintain the profiler through the end of the project period and conduct research on the upper air winds that affect pollutant transport in the Paso del Norte.

Figure 1 shows some of the need for additional data collection. Figure 1 shows the trends for the ozone (O_3) design value of major metropolitan areas in Texas. The current National Ambient Air Quality Standard (NAAQS) for O_3 states that the area design values should be at or below 70 parts per billion (ppb). The current O3 design value of El Paso is just above the level of the NAAQS at 72 ppb as of late August 2017. Figure 1 features O_3 design value trend lines showing the slope, the y-intercept, and the R-squared (R^2) for the trends. The y-intercepts are meaningless in this application, and the R^2 represents the percent of variance in the range of design values for an area that is explained by the regression line. Caution must be taken in assessing statistical significance with design value trends, as design values are based on three years of data and are thus not statistically independent from each other on a year to year basis. The slope is the average change in the design value on a year to year basis, and the graph shows that for four of six urban areas the O_3 design value dropped an average of 1.31 – 1.49 ppb per year over 10 years. The smallest slope belongs to the San Antonio area, where the change over 10 years averaged less than 0.15 ppb per year, although there is a downward trend over the past 4 years. The second smallest slope – 0.80 ppb per year – belongs to the El Paso area, although the El Paso area has experienced negligible design value change over the past 7 years.

Figure 1 Ozone design values for six large Texas urban areas 2007 – 2016. Least squares line fits shown (although design values are serially correlated)



2. Summary of Activities through August 31, 2017

Figure 2 is a high altitude aerial from Google Earth Pro of the current profiler location at the TCEQ Socorro Hueco CAMS 49 at 320 Old Hueco Tanks Road. Figure 3 is a closer view aerial of the current RWP location. These images have also appeared in earlier reports on this project.

The RWP has been operating without problem since June of 2016 with exception of a break in service from August 11 to September 9, 2016 caused by a power supply failure, although a review of the data suggests that data from July 21 to August 10, 2016 are of questionable quality based on uncharacteristic low wind speeds. Since September 2016, very few problems have been noted.

Figure 2 Aerial from altitude 30 mi of current profiler location at Socorro Hueco CAMS 49

Figure 3 Aerial of current profiler location from 1300 ft AGL altitude

3. RWP Operations and Data

RWP Operations

As was reported in the previous quarterly report, the RWP reports are time stamped data in local standard time in El Paso, TX, Mountain Standard Time (MST). Upper air wind speed units are meters per second. The RWP collects data for horizontal winds and vertical air velocity from about 150 to 3,800 meters (m) above ground level (AGL) (depending on atmospheric conditions) at a vertical resolution of about ~60 m. To adjust altitude relative to sea level, one would add the height above sea level for the Socorro Hueco site, which is 1,118 m.

The radar runs in two modes: **low mode** and **high mode**. Every half hour, both low-mode and high-mode data are reported. The heights (in meters above ground) for the reported data are shown in Tables 1 and 2. These tables have also appeared in earlier reports. As of August 31, 2017, images for individual days wind distributions area available at https:\\sanantonio.sonomatechdata.com.

Access to El Paso RWP and Ceilometer Data

Data can now be viewed at https://sanantonio.sonomatechdata.com with a username and password that can be communicated over the phone. This website has images from both El Paso and San Antonio for both radar wind profilers and ceilometers. Figure 4 shows an image of RWP data from May 30, 2017. A Users' Guide for accessing data appears as an appendix to this report.

Figure 4 Typical image from the Sonoma Website for May 30, 2017

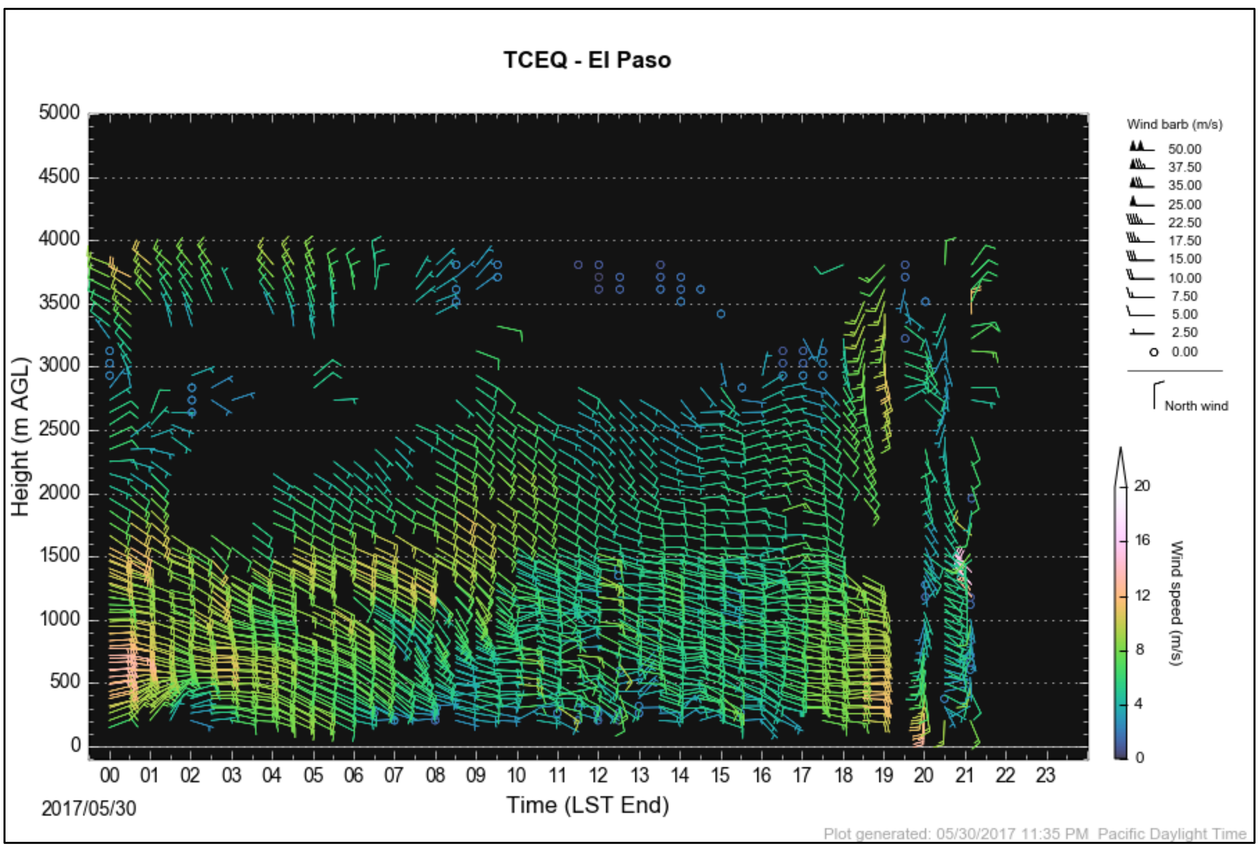


Table 1 Altitudes (meters (m) above AGL) at which RWP winds are estimated (146 m – 1.5 km) in the low mode

Low-mode altitudes, m AGL
146
203
260
317
375
432
489
546
604
661
718
775
832
890
947
1,004
1,061
1,118
1,176
1,233
1,290
1,347
1,405
1,462
1,519

Table 2 Altitudes (meters (m) above AGL) at which RWP winds are estimated (200 m – 3.8 km) in the high mode

High-mode altitudes, m AGL
206
304
401
498
596
693
790
887
985
1,082
1,179
1,276
1,374
1,471
1,568
1,665
1,763
1,860
1,957
2,055
2,152
2,249
2,346
2,444
2,541
2,638
2,735
2,833
2,930
3,027
3,124
3,222
3,319
3,416
3,514
3,611
3,708
3,805

4. Data Analyses (Task 6)

Task 6 of this project requires UT and STI to collaborate on case study data analyses of multiple interesting air quality events. The balance of this report is dedicated to this subject.

Table 3 lists the four highest eight-hour ozone averages in parts per billion (ppb) at El Paso County ozone monitoring sites, shown in Figure 5, for the years 2015 through 2017 (as of August 28, 2017). Table 4 list days on which four or more of six ozone monitoring sites, illustrated in Figure 5, recorded an eight-hour ozone average among the top four measurements of the year, for 2015, 2016, and 2017 (through August 28). Shown are the eight-hour maxima and the one-hour maxima for each site on each day.

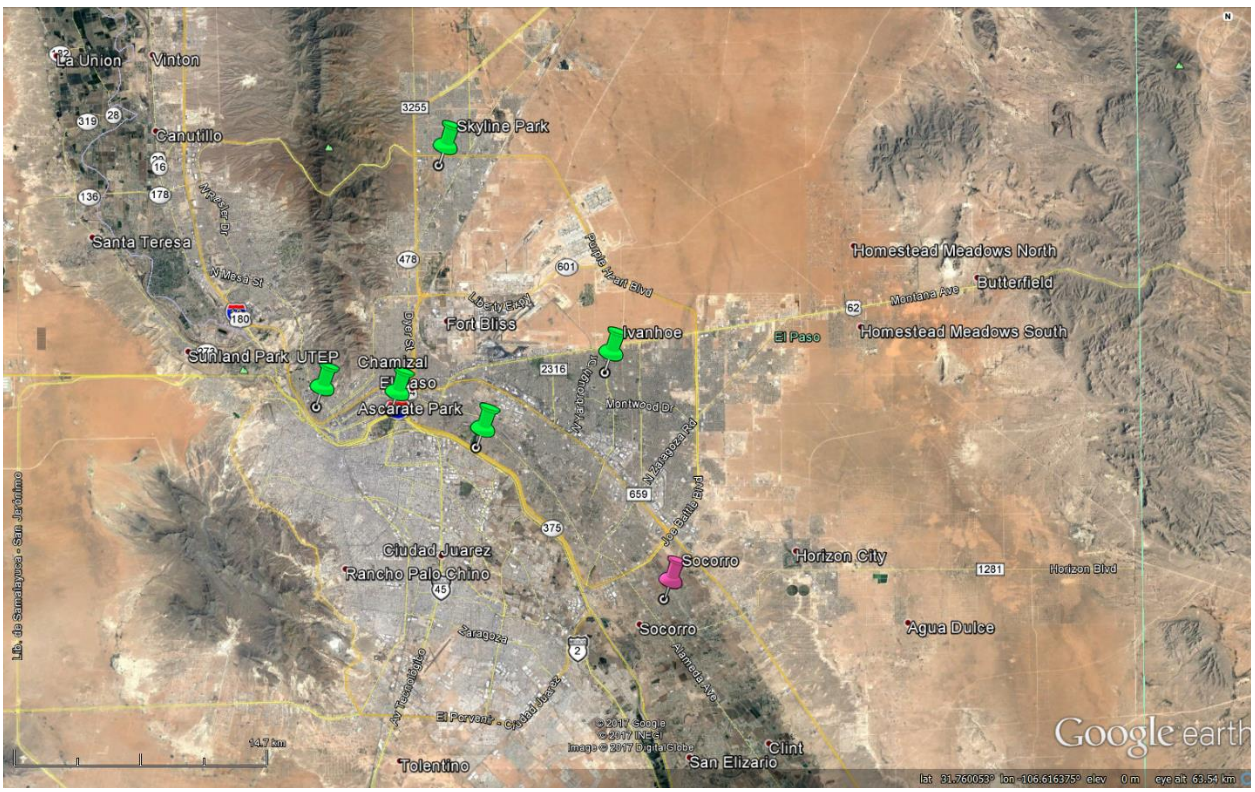
Table 3 Four highest 8-hour O_3 ppb averages at 6 sites by year, 2015 – 2017 (through 8/28/2017)

Year	Site	1st dates	1st	2nd dates	2nd	3rd dates	3rd	4th dates	4th
2017 –(thru 8/28)	UTEP C12	6/27/2017	75	6/6/2017	75	8/17/2017	74	7/28/2017	74
	Ascarate Park C37	6/2/2017	69	6/27/2017	68	8/24/2017	67	6/4/2017	67
	Chamizal C41	6/27/2017	74	6/4/2017	74	8/24/2017	72	5/20/2017	72
	Socorro Hueco C49	6/27/2017	67	6/4/2017	63	7/12/2017	62	7/3/2017	61
	Skyline Park C72	6/27/2017	75	7/21/2017	68	7/11/2017	67	8/4/2017	66
	Ivanhoe C414	6/27/2017	75	6/15/2017	63	6/4/2017	63	6/2/2017	63
2016	UTEP C12	8/8/2016	78	6/23/2016	78	6/6/2016	72	7/16/2016	71
	Ascarate Park C37	6/23/2016	80	8/8/2016	76	7/16/2016	72	6/2/2016	66
	Chamizal C41	6/23/2016	84	8/8/2016	81	5/7/2016	67	6/21/2016	65
	Socorro Hueco C49	6/25/2016	69	9/17/2016	68	6/2/2016	68	7/9/2016	64
	Skyline Park C72	6/23/2016	77	8/8/2016	68	7/16/2016	67	8/22/2016	66
	Ivanhoe C414	6/23/2016	68	7/18/2016	62	7/16/2016	61	7/9/2016	59
2015	UTEP C12	6/17/2015	81	6/21/2015	77	8/10/2015	74	6/29/2015	72
	Ascarate Park C37	8/31/2015	68	6/17/2015	66	6/18/2015	65	8/10/2015	64
	Chamizal C41	6/17/2015	75	6/21/2015	72	8/10/2015	70	8/2/2015	70
	Socorro Hueco C49	8/9/2015	75	8/31/2015	70	10/13/2015	69	6/18/2015	69
	Skyline Park C72	7/1/2015	76	8/31/2015	72	8/2/2015	70	8/17/2015	69
	Ivanhoe C414	8/31/2015	71	8/9/2015	67	8/6/2015	67	7/1/2015	65

Table 4 Days on which ≥4 of 6 O_3 sites recorded an 8-hour O_3 average among the top 4 measurements in 2015, 2016, 2017 (through 8/28/2017). Maxima for 8-hour and 1-hour shown.

Date	#sites with date among top 4	UTEP C12		Ascarate C37		Chamizal C41		Socorro C49		Skyline C72		Ivanhoe C414	
		8-hour	1-hour	8-hour	1-hour	8-hour	1-hour	8-hour	1-hour	8-hour	1-hour	8-hour	1-hour
6/27/2017	6	75	92	68	73	74	85	67	72	75	92	75	79
6/23/2016	5	78	108	80	104	84	116	62	81	77	89	68	94
8/31/2015	4	63	75	68	78	68	78	70	81	72	80	71	82
7/16/2016	4	71	97	72	99			56	57	67	84	61	78
8/8/2016	4	78	107	76	97	81	113	61	54	68	77	57	75
6/4/2017	4	73	83	67	76	74	84	63	67	64	68	63	72

Figure 5 Locations of six ozone monitorng stations in El Paso County, with one site in magenta in the lower center of the figure for the Socorro Hueco CAMS 49 RWP and celimoter site



Particulate matter is also an issue in El Paso. The University of Texas at Austn currently has a contract with the TCEQ to assess the causes of occasional elevated fine particulate matter – particulate matter with 2.5 micron or smaller aerodynamic diameter – and so cases of elevated $PM_{2.5}$ can be considered for case studies also. The hourly continuous $PM_{2.5}$ data from El Paso in 2016 and 2017 were examined. Table 5 lists days from mid-December 2016 through August

2017 on which both:

- the monitor at Chamizal CAMS 41 had a 24-hour averages above 19.1 micrograms per cubic meter (μg/m^3) and
- the monitor at UTEP CAMS 12 had a 24-hour average above 15.5 μg/m^3.

These threshold values are the 95th percentile values for 24-hour concentrations from January 1 – August 28, 2017. With approximately 200 days of coincident data for the two sites, one would expect coincident values in the top 5 percent only 0.25 percent of the time, or only around once a year, but four days are noted in Table 5, suggesting a regional effect.

Table 5 Dates and $PM_{2.5}$ concentrations with coincident 95th p-tile 24-hour measurements in late 2016 and 2017

Date	C12 μg/m^3	C41 μg/m^3
12/17/2016	17.78	25.44
12/20/2016	19.12	26.04
2/2/2017	16.47	27.44
5/16/2017	18.47	27.92

Ozone case study September 17, 2016

In the May 31, 2017 Quarterly Report under this project, a case study analysis was conducted on September 17, 2016, an interesting day in El Paso because the CAMS 49 Socorro Hueco site recording higher ozone than other sites in the area. Figure 6 shows the ozone data for El Paso sites in mid-September 2016, with September 17 in the center and the standout concentrations at CAMS 49 clearly visible.

Winds at the surface on September 17, 2016, were light and variable mid-day, as shown in Table 6. Table 7 lists the average mid-day wind speeds for CAMS 49 over several days, along with the peak one-hour wind gust. Both September 17 and 19 have the lowest speeds.

Figures 7 through 12 show the RWP winds aloft data for September 15 – 20, 2016. (Ceilometer data were not available until December 2016.) On both September 15 and 16, the wind speeds near the surface were southerly around 4 meters/sec (~8mph), then westerly at lighter 3 m/s (~6 mph) speeds. On September 17, wind speeds were lighter and more variable up to a few hundreds of meters height, and this light and variable wind pattern persisted for the next couple of days. On September 20 wind speeds picked up, and ozone concentrations fell to levels near or below 60 ppb.

Figure 6 Ozone time series for El Paso sites mid-Sept. 2016

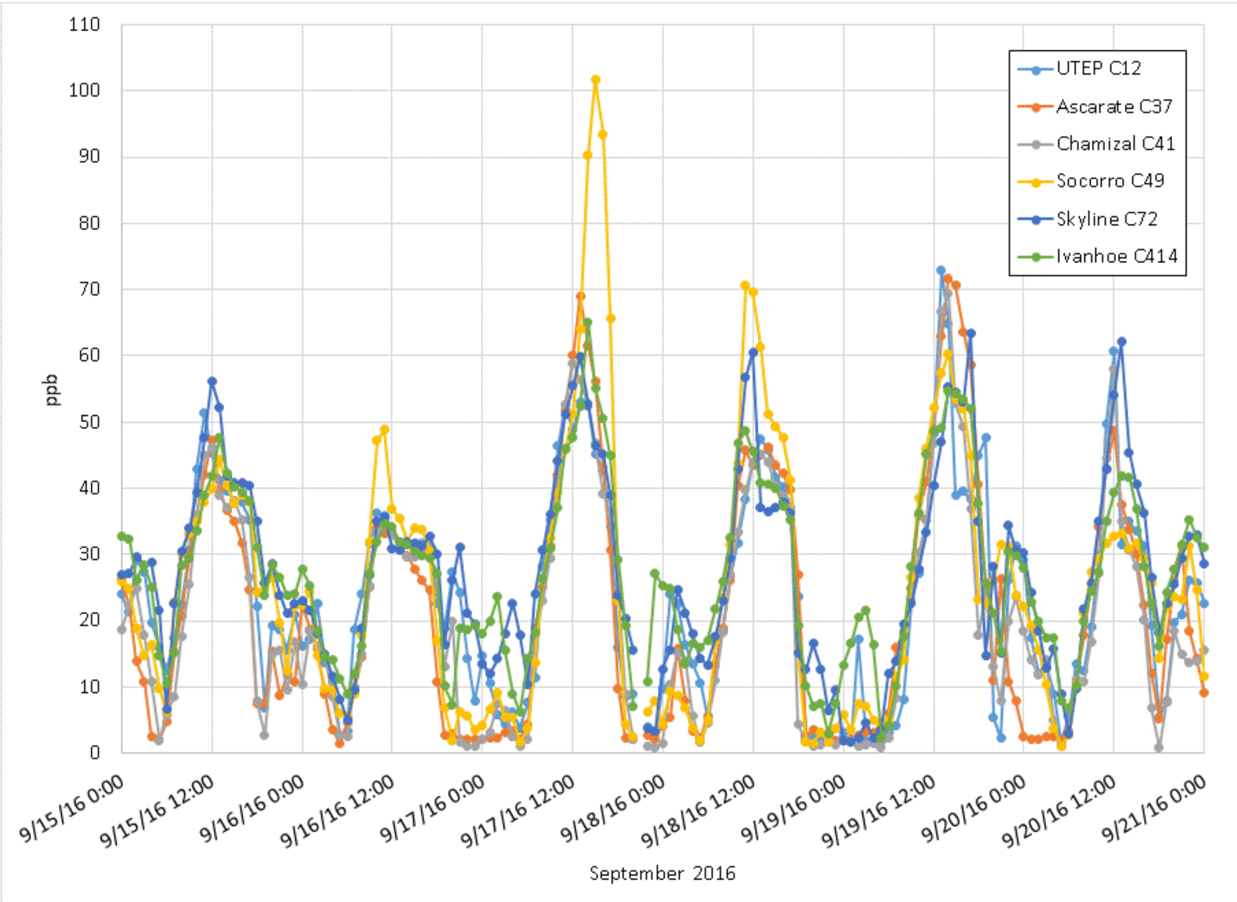


Table 6 Measurements mid-day at CAMS 49 on September 17, 2016

Parameter	9mst	10mst	11mst	12mst	13mst	14mst	15mst	16mst	17mst	18mst	19mst
Ozone ppb	32.0	39.0	45.0	51.0	64.0	90.0	**101.**	93.0	65.0	23.0	4.0
Wind Speed mph	**4.8**	2.5	1.6	1.3	2.4	0.9	3.0	2.8	0.7	2.3	***0.5***
Max Wind Gust mph	10.8	8.7	7.4	8.2	**11.3**	11.3	9.0	7.9	9.7	6.9	3.6
Wind Direction deg.	137	153	**352**	205	211	***19***	50	24	299	266	313
Std Dev Dir deg.	26.0	46.0	58.0	64.0	54.0	**72.0**	38.0	33.0	69.0	***17.0***	69.0
Temperature deg. F.	76.8	79.9	82.5	85.7	87.7	88.4	88.8	89.4	**89.8**	87.1	82.5
PM-10 μ/m^3	24.6	16.7	16.5	***8.5***	16.3	30.4	32.2	26.7	18.7	19.4	50.6
PM-2.5 μ/m^3	7.6	4.0	2.5	***1.5***	3.8	9.4	10.9	8.4	5.8	3.8	14.1

Table 7 Mean CAMS 49 surface winds 11 am – 4 pm MST September 15 – 19, 2017

Date	Mean WSR mph	Peak Gust mph
9/15/2016	6.2	21
9/16/2016	5.4	19
9/17/2016	2.0	11
9/18/2016	3.5	13
9/19/2016	2.0	9

Figure 7 El Paso RWP data from September 15, 2016, modest mid-day winds

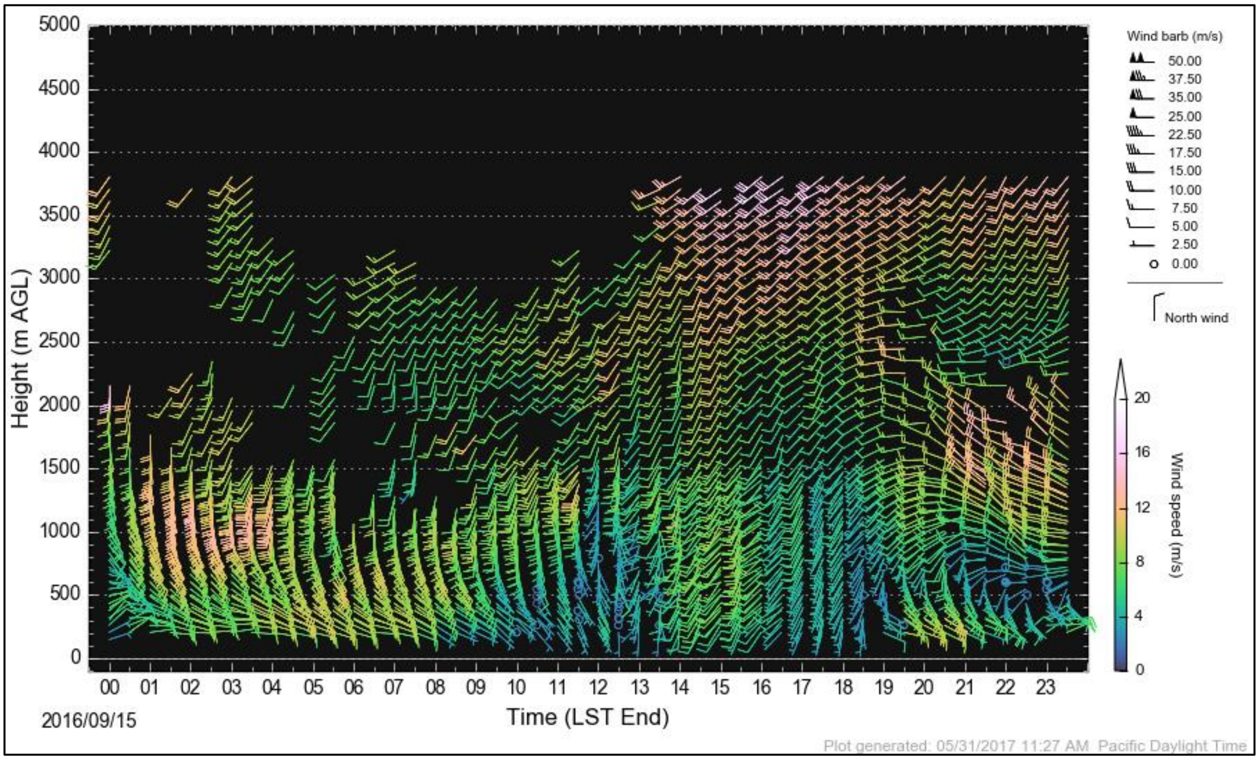


Figure 8 El Paso RWP data from September 16, 2016, more light & variable winds

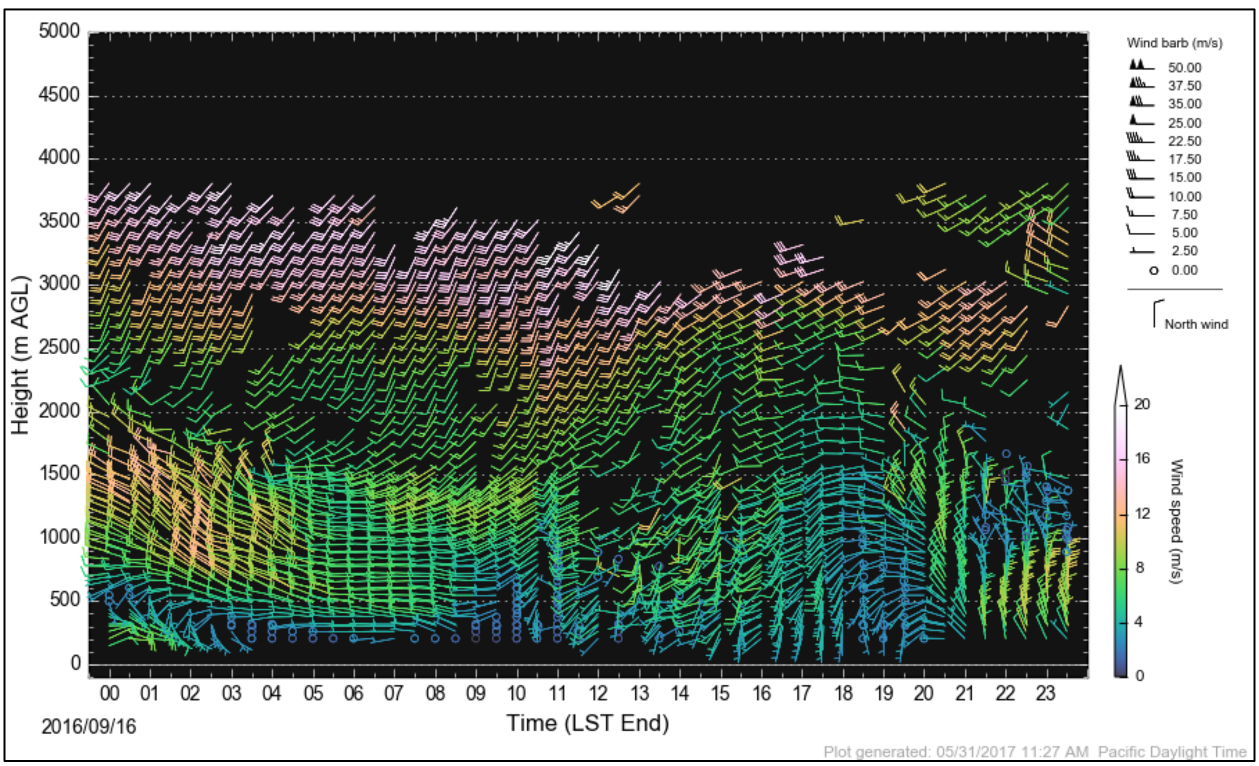


Figure 9 El Paso RWP data from September 17, 2016, light & variable winds mid-day

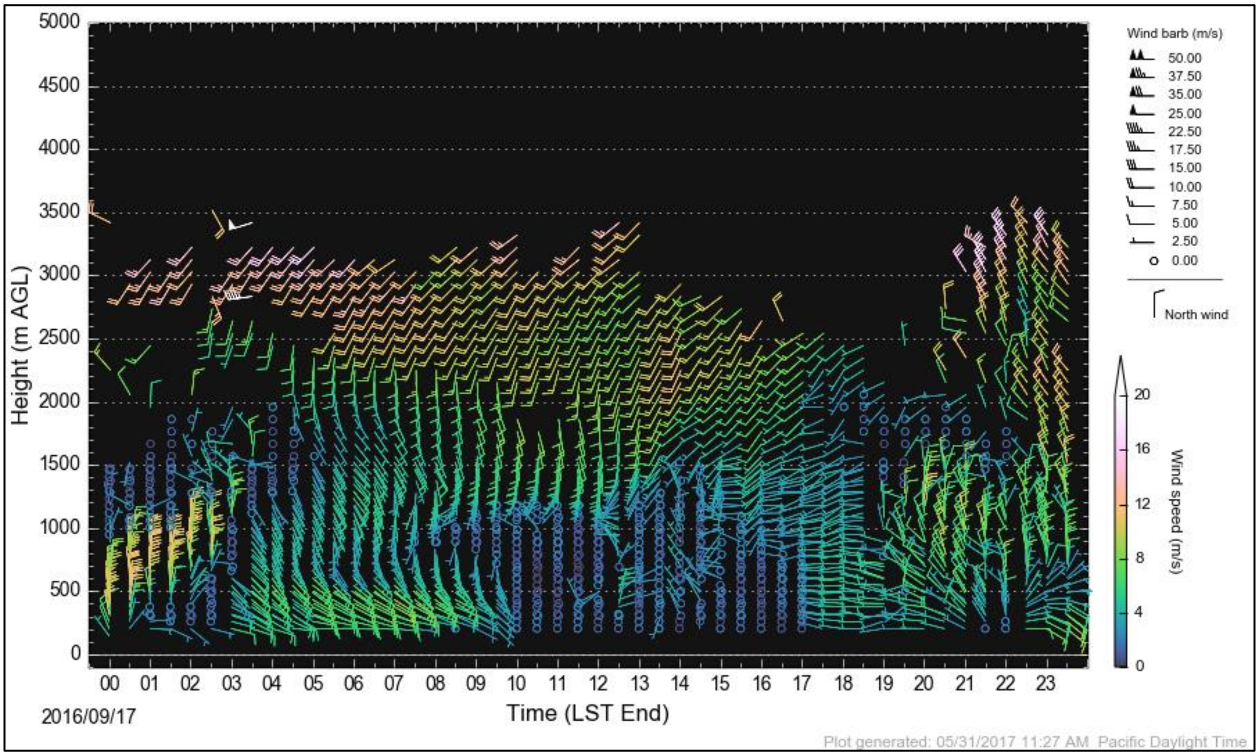


Figure 10 El Paso RWP data from September 18, 2016, light & variable winds mid-day

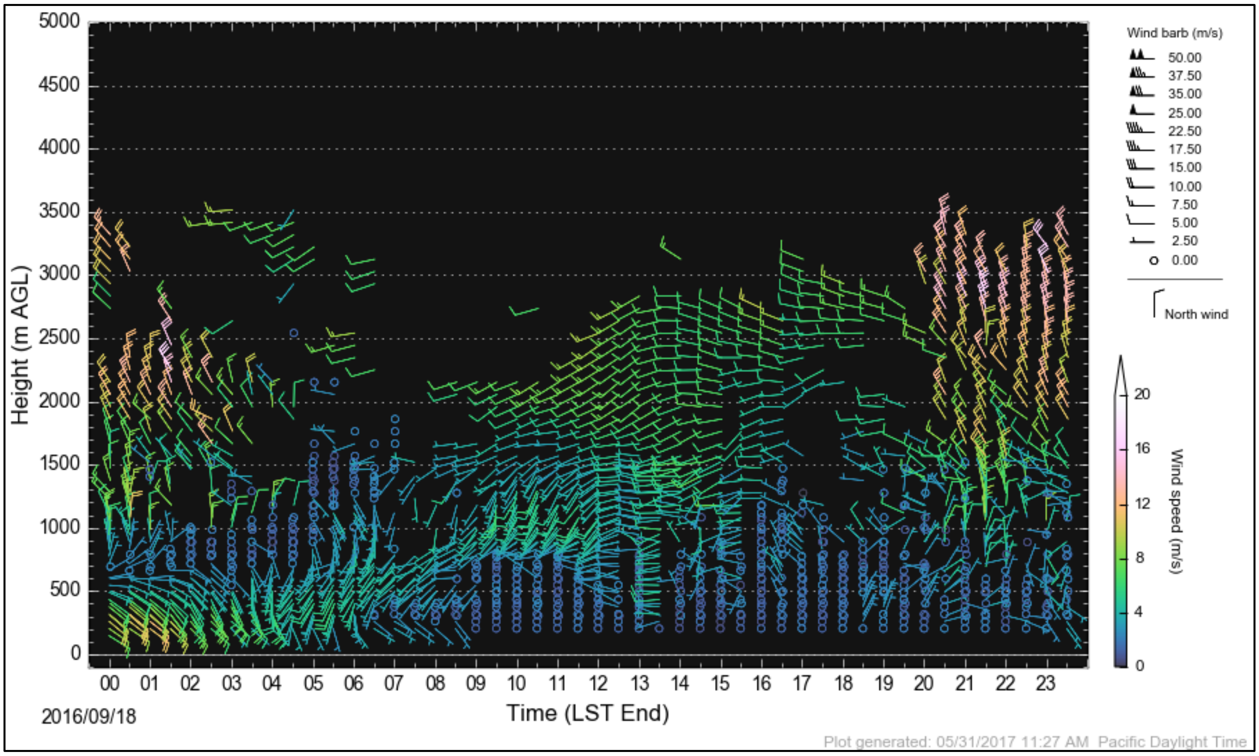


Figure 11 El Paso RWP data from September 19, 2016, light & variable winds mid-day

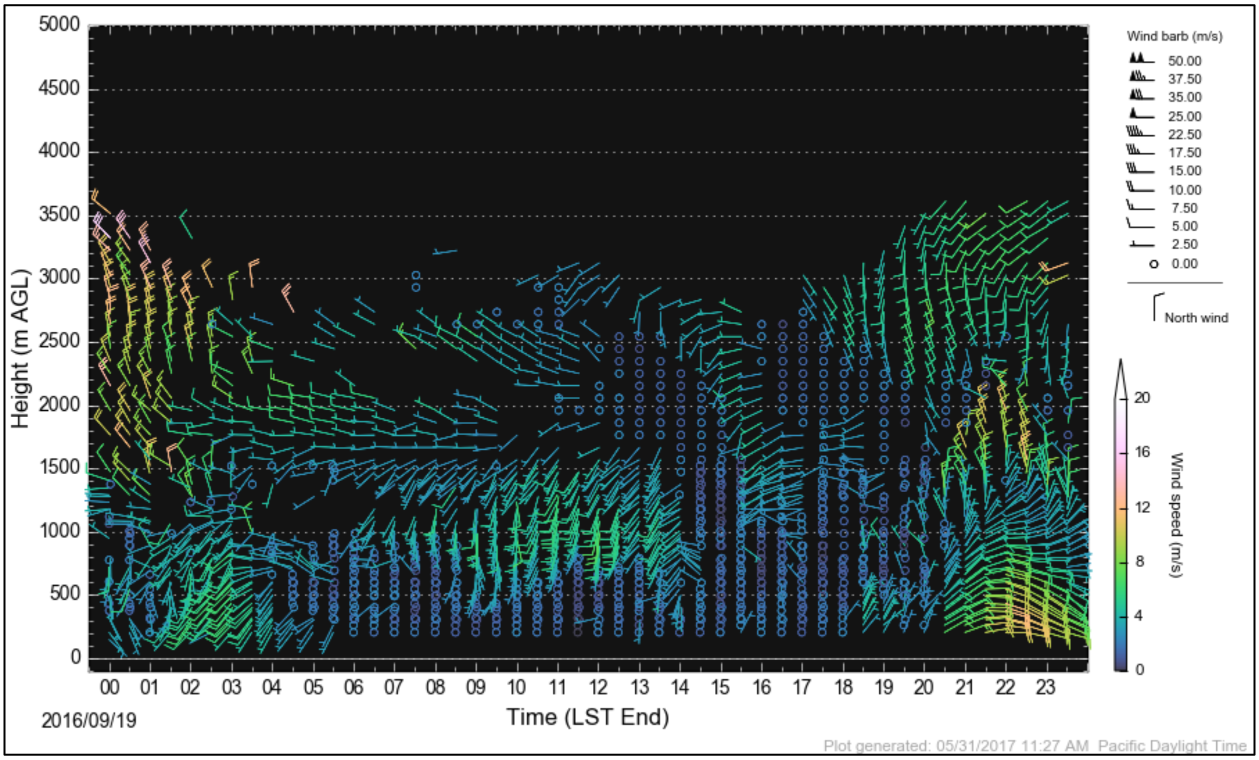
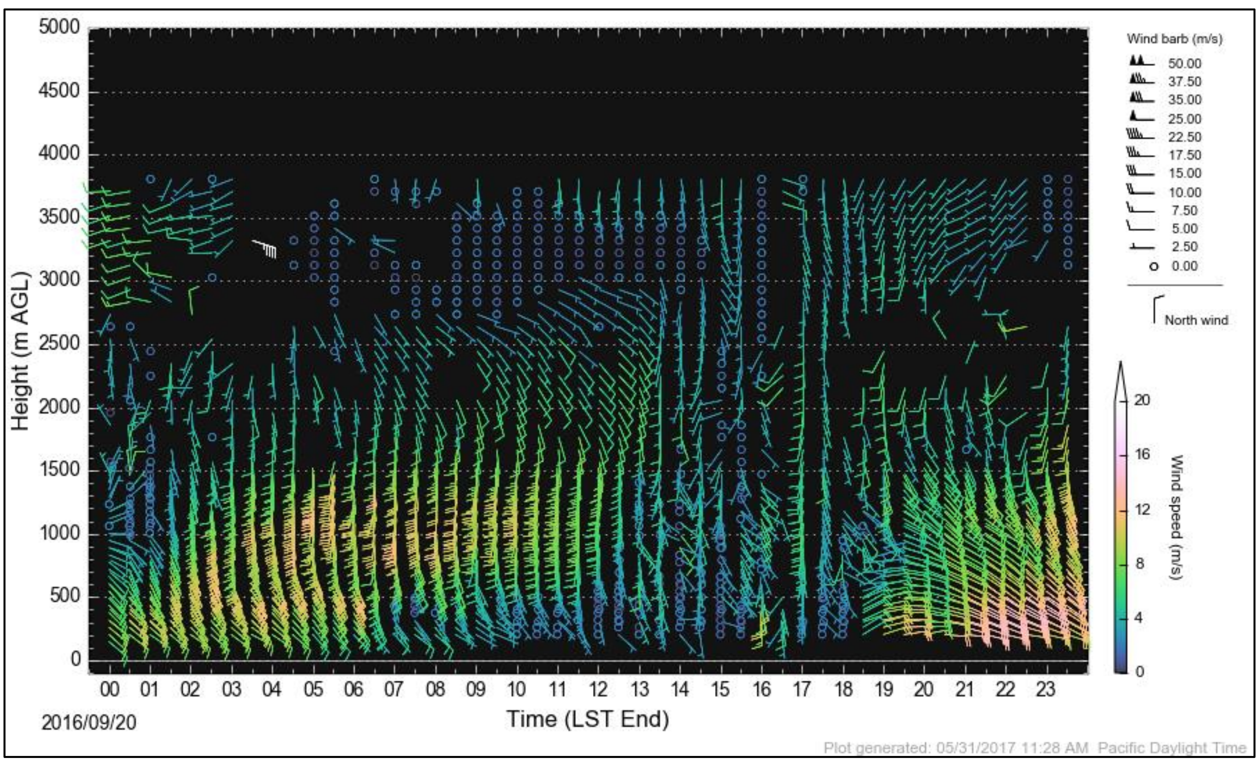


Figure 12 El Paso RWP data from September 20, 2016, wind speeds pick up



The higher concentrations at the Socorro Hueco site on September 16, 17, and 18, 2016, are interesting in part because of the fact that on each day, ozone concentrations were similar between CAMS 49 and other five other ozone monitoring sites in the county, but for four hours during which the CAMS 49 ozone readings surged to levels 10 to 30 ppb higher over four mid-day hours, and then dropped back to concentrations similar to other sites. This suggests that a local source may have affected CAMS 49 on these three days.

Ozone case study June 27, 2017

Figure 13 shows a time series for the hourly ozone concentrations from June 23 to July 1, 2017 at six El Paso County ozone monitors. On June 27, 2017, ozone concentrations peaked to the extent that all six monitors recorded daily eight-hour maxima that fell among the top four days of 2017 through August 28, and for five sites it was the highest day of 2017 through August 28, while for one site (Ascarate Park CAMS 37) it was the second highest concentration through August 28. Figure 14 focuses on ozone concentrations on June 27, 2017 with the day before and after.

Figures 15 and 16 show the RWP and ceilometer data from June 26, which had incomplete data that day, and Figure 17 shows a 72-hour HYPSLIT[1] back -trajectory ensemble run from El Paso near 250 meters (m) above ground level (AGL) at 12 noon MST on June 26. When run in the trajectory ensemble mode, HYSPLIT runs 27 trajectories starting with the initial location and using a cube of starting locations (3 × 3 × 3) centered on the initial point. This results in trajectories run starting from small steps from the initial point in the X, Y, and Z directions. HYSPLIT advises using an initial starting height at 250 m or greater for best results. The June 26 results suggest that the air was moving relatively fast, with local upper air wind speeds in the 8 meter/sec (m/s) range (~16 mile / hour) from the east. The HYSPLIT ensemble fetch runs back in the Gulf of Mexico, suggesting speed greater than 6 m/s along the route (1,000 miles in 72 hours).

Figures 18 and 19 show the RWP and ceilometer measurements on the high ozone day, June 27, 2017. These figures show light and variable winds mid-day, and a lower mixing height earlier in the day, which allows more photochemical reactivity in a smaller mixing volume at low altitudes. This combination may result in higher pollutant concentrations. Figure 20 shows the HYSPLIT 72-hour back-trajectory ensemble for June 27. Synoptic winds were easterly, but the fetch was much shorter than the preceding day, suggesting widespread low wind speeds.

Finally, Figures 21 and 22 show RWP and ceilometer measurements on June 28, the day following the elevated ozone day. These figures show robust westerly winds, and a variable boundary layer mixing height between 500 and 1000 m. Figure 23 shows the HYSPLIT 72-hour

[1] *Stein, A.F., Draxler, R.R, Rolph, G.D., Stunder, B.J.B., Cohen, M.D., and Ngan, F., (2015). NOAA's HYSPLIT atmospheric transport and dispersion modeling system, Bull. Amer. Meteor. Soc.,* ***96****, 2059-2077,* http://dx.doi.org/10.1175/BAMS-D-14-00110.1
Rolph, G., Stein, A., and Stunder, B., (2017). Real-time Environmental Applications and Display sYstem: READY. Environmental Modelling & Software, ***95****, 210-228,* https://doi.org/10.1016/j.envsoft.2017.06.025.
*(*http://www.sciencedirect.com/science/article/pii/S1364815217302360)

back-trajectory ensemble for June 28 with the fetch extending the west.

A conclusion would be that meteorological factors of wind speed and mixing heights affected the variation in ozone concentrations over these days. However, it should not be overlooked that the air entering the Paso del Norte area on June 27 had spent the preceding 72 hours over the more densely populated parts of the state with an array of industrial, urban, transportation, and oil & gas activities.

Figure 13 El Paso County ozone concentrations June 23 – July 1, 2017

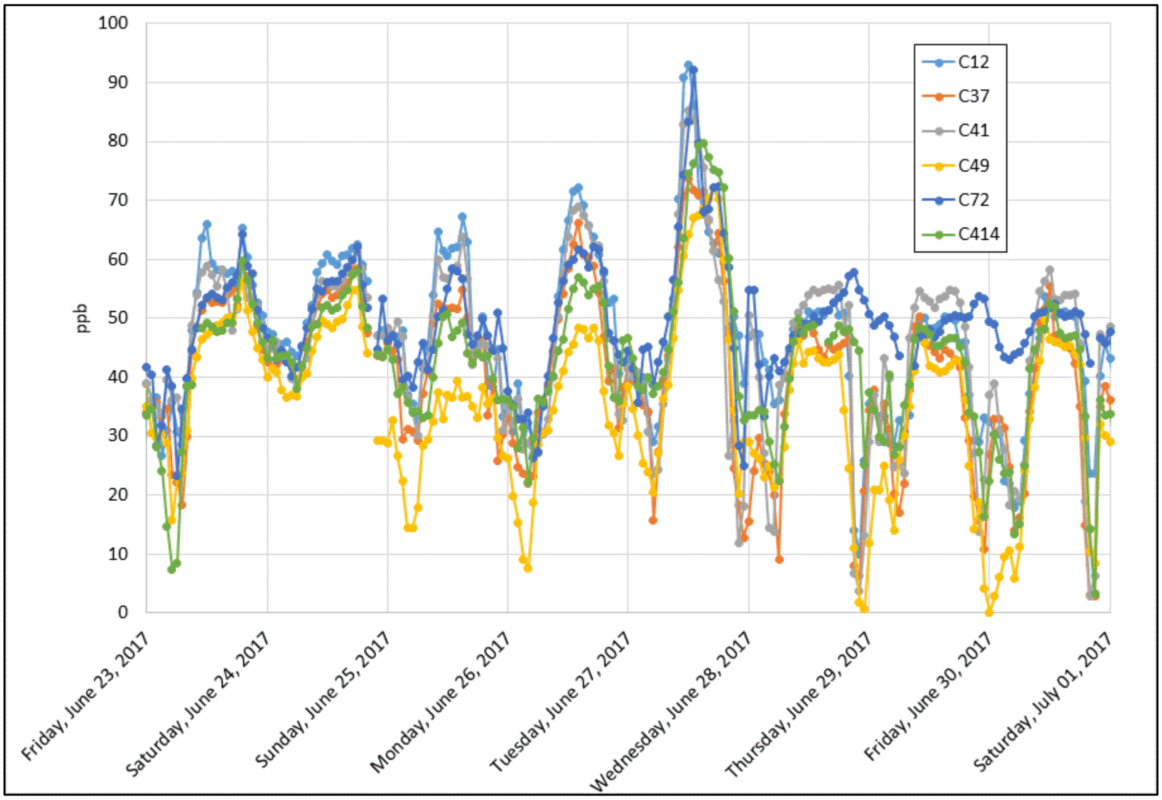


Figure 14 El Paso County ozone concentrations Jun 26 – June 29, 2017

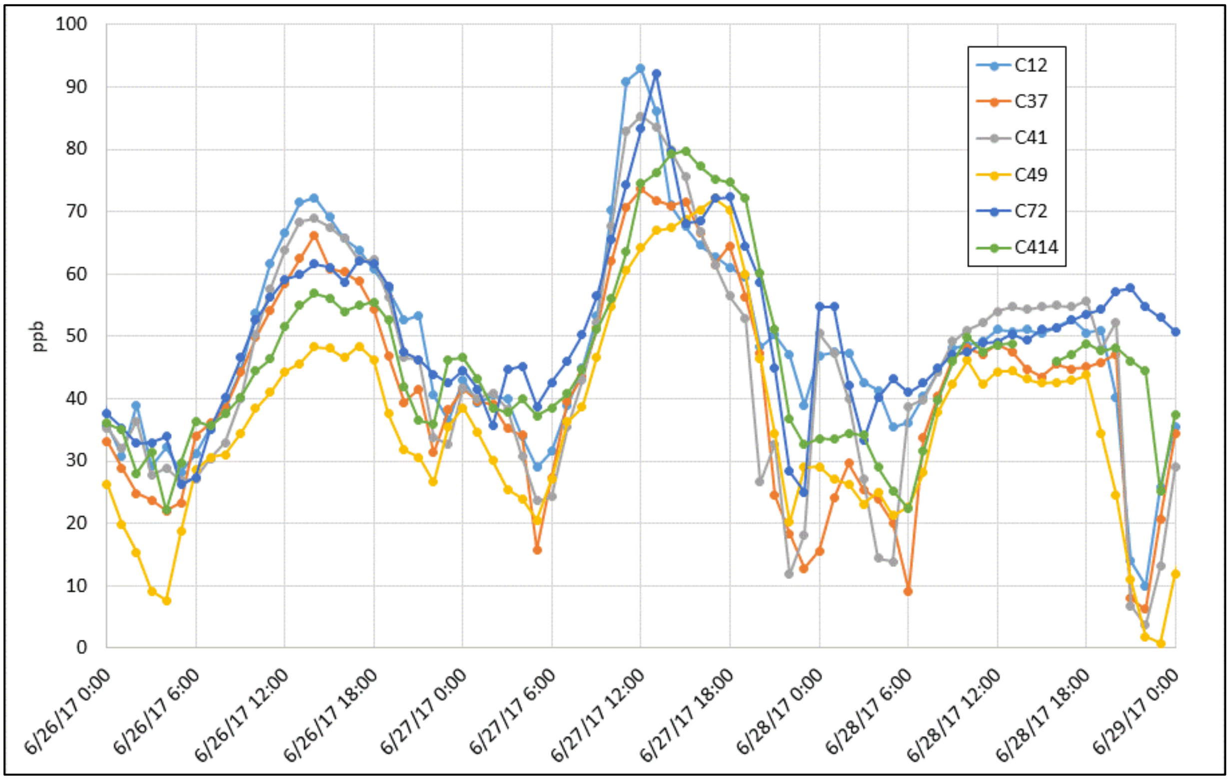


Figure 15 El Paso radar wind profiler on June 26, 2017, the day before a high ozone day, light & variable winds second half of the day (partial data missing)

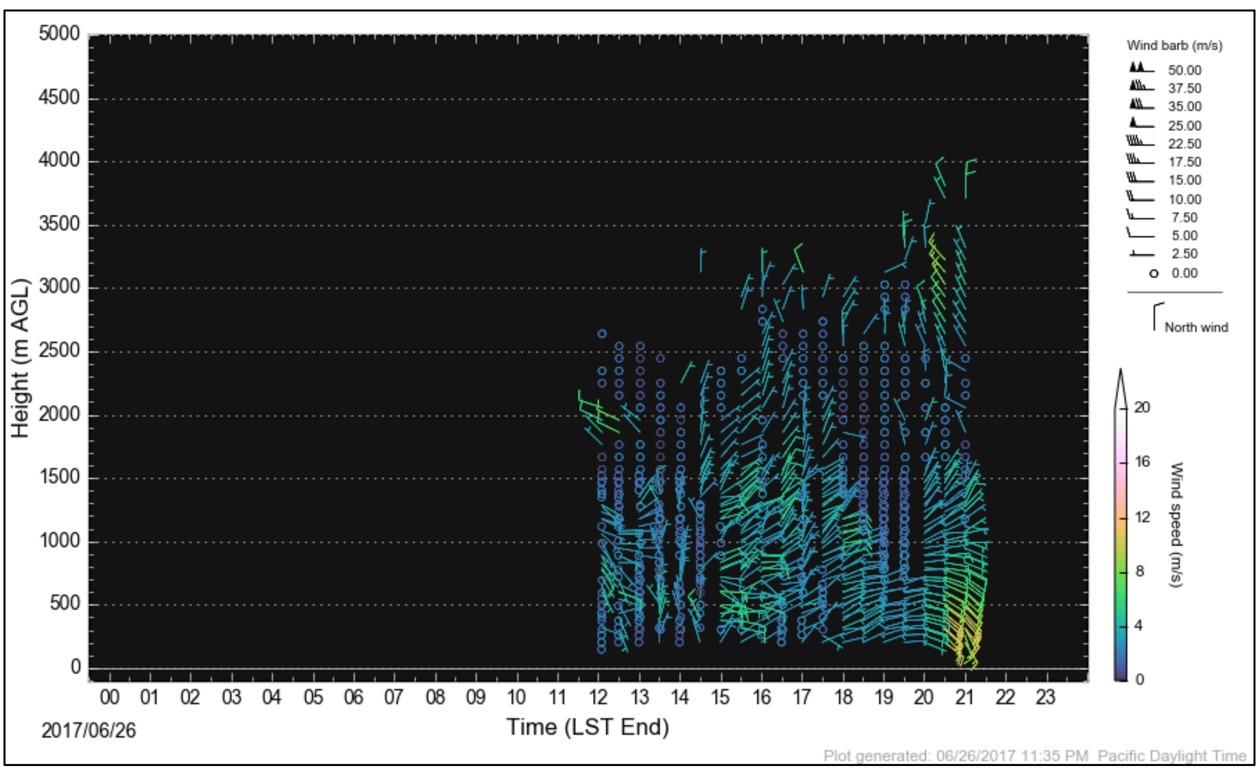


Figure 16 El Paso ceilometer cloud height and boundary layer (BL) height on June 26, 2017, the day before a high ozone day, stable 500 m BL (partial data missing)

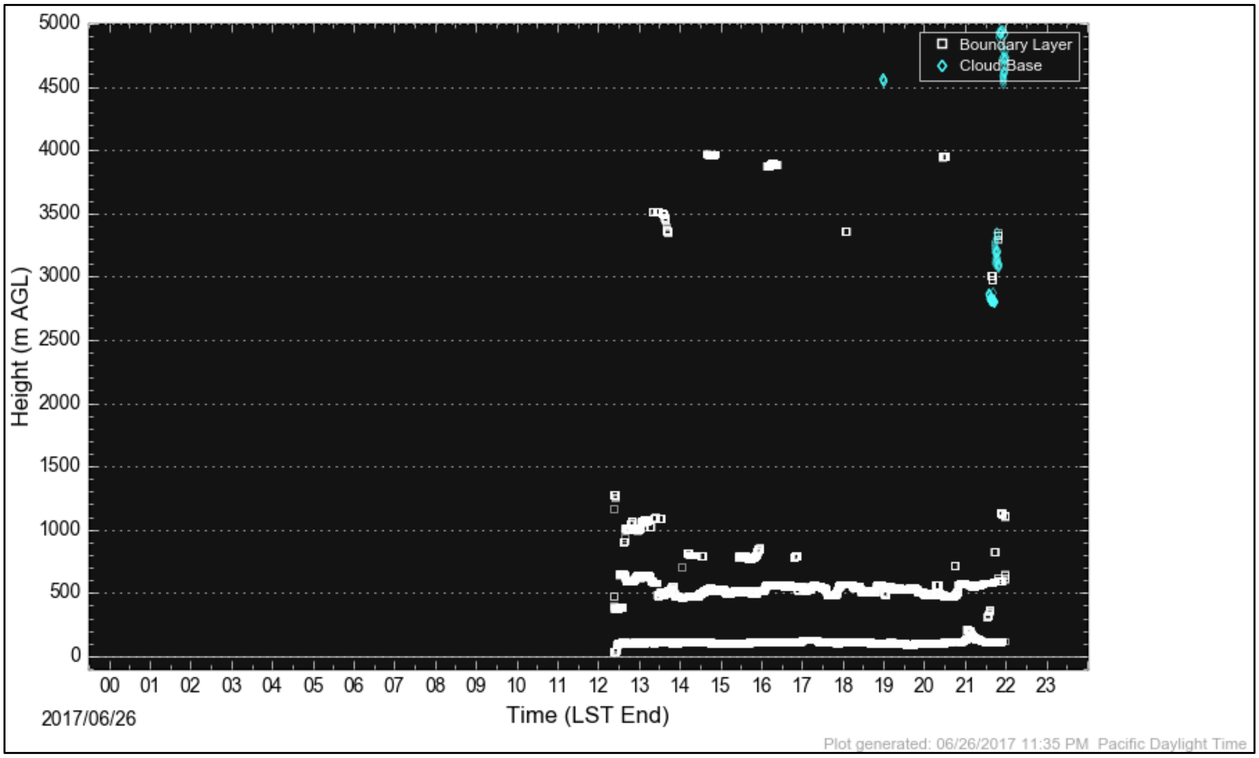


Figure 17 HYSPLIT ensemble 72-hour back trajectories from El Paso noon MST 6/26/2017, lengthy fetch back into the Gulf of Mexico suggests transport winds > 6 m/s

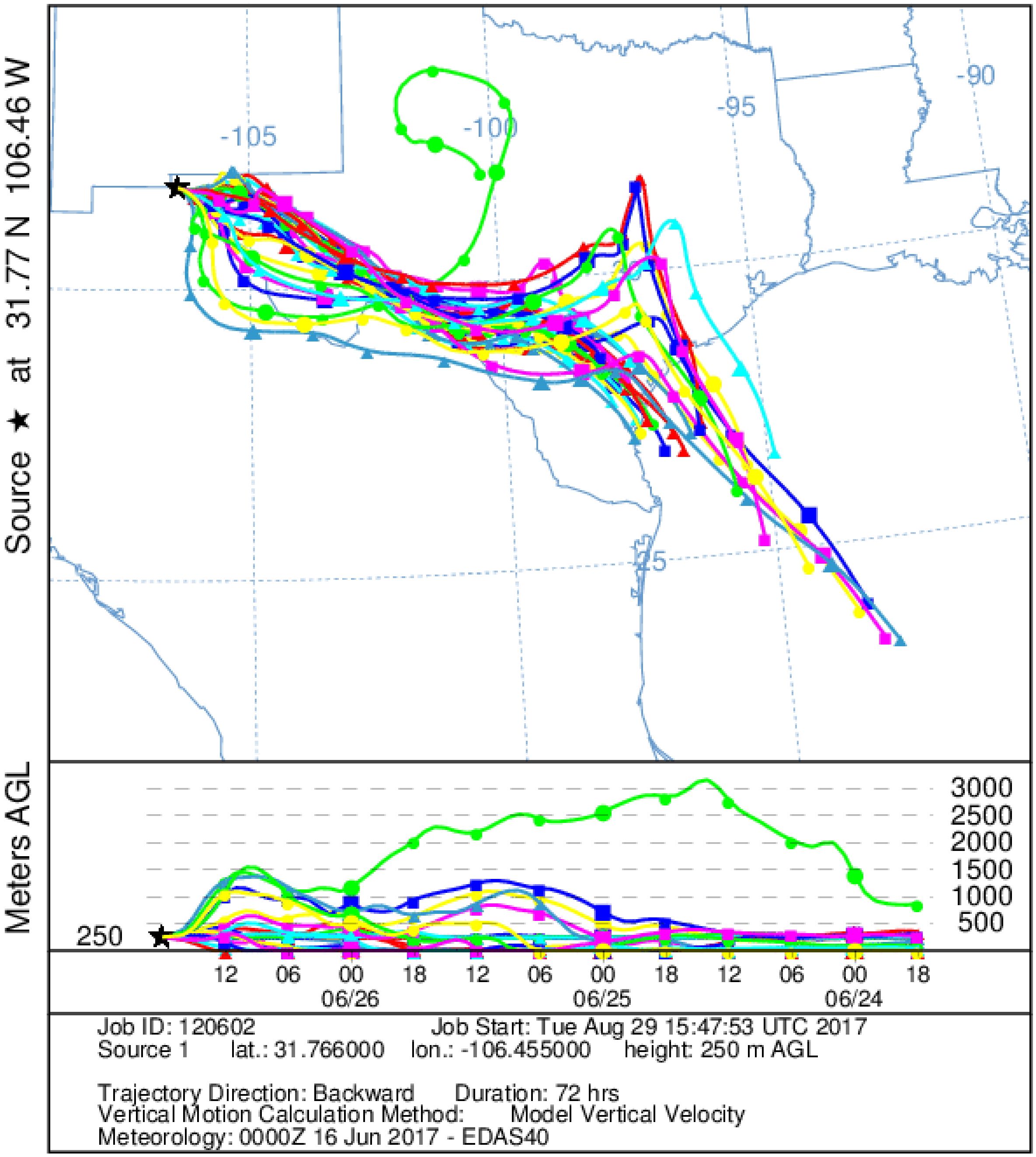


Figure 18 El Paso radar wind profiler on June 27, 2017, a high ozone day, light & variable winds during mid-day

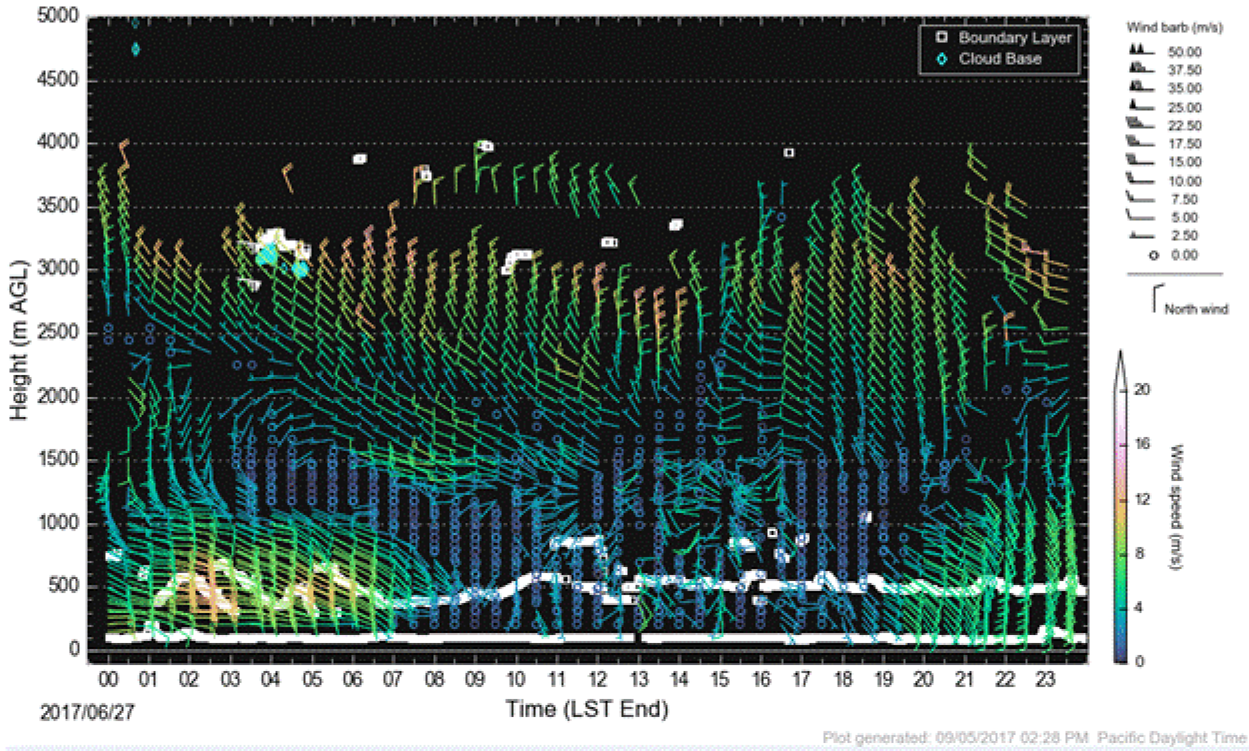


Figure 19 El Paso ceilometer cloud height BL height on June 27, 2017, high ozone day, with lower mixing height in the morning, 500 m BL later in the day

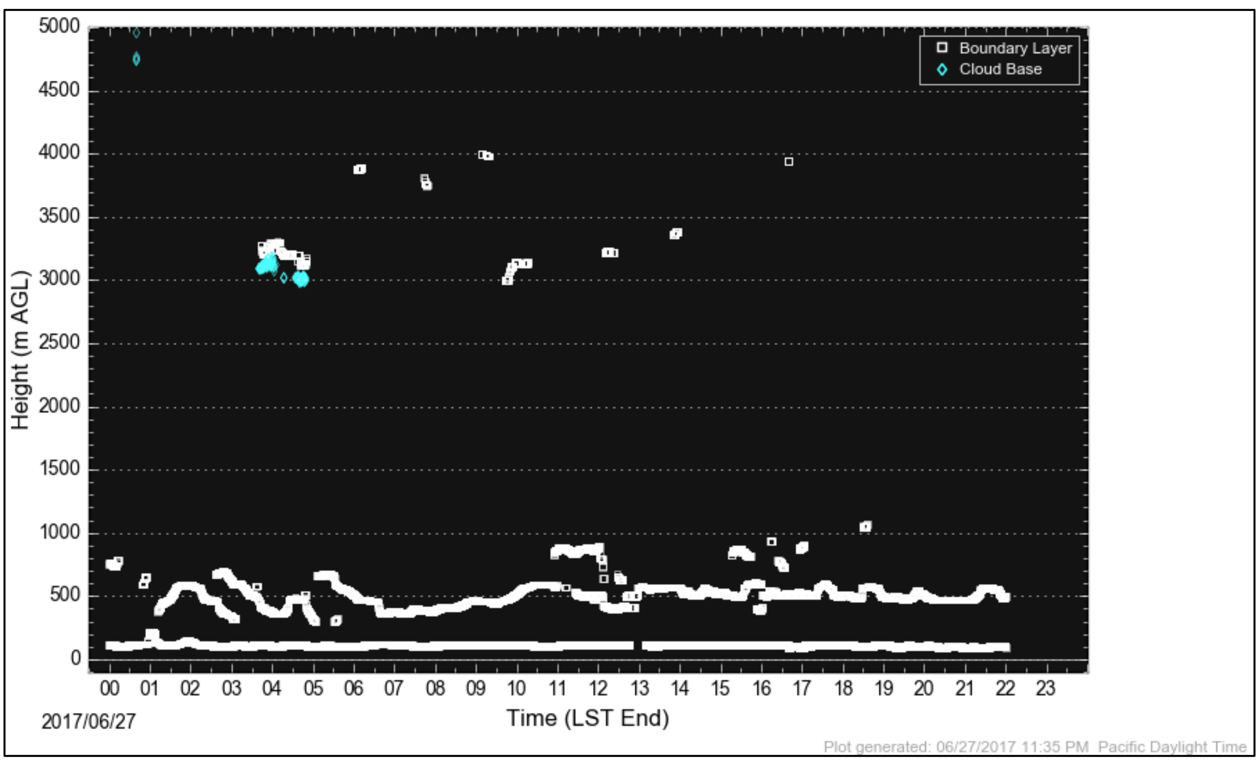


Figure 20 HYSPLIT ensemble 72-hour back trajectories from El Paso noon MST 6/27/2017

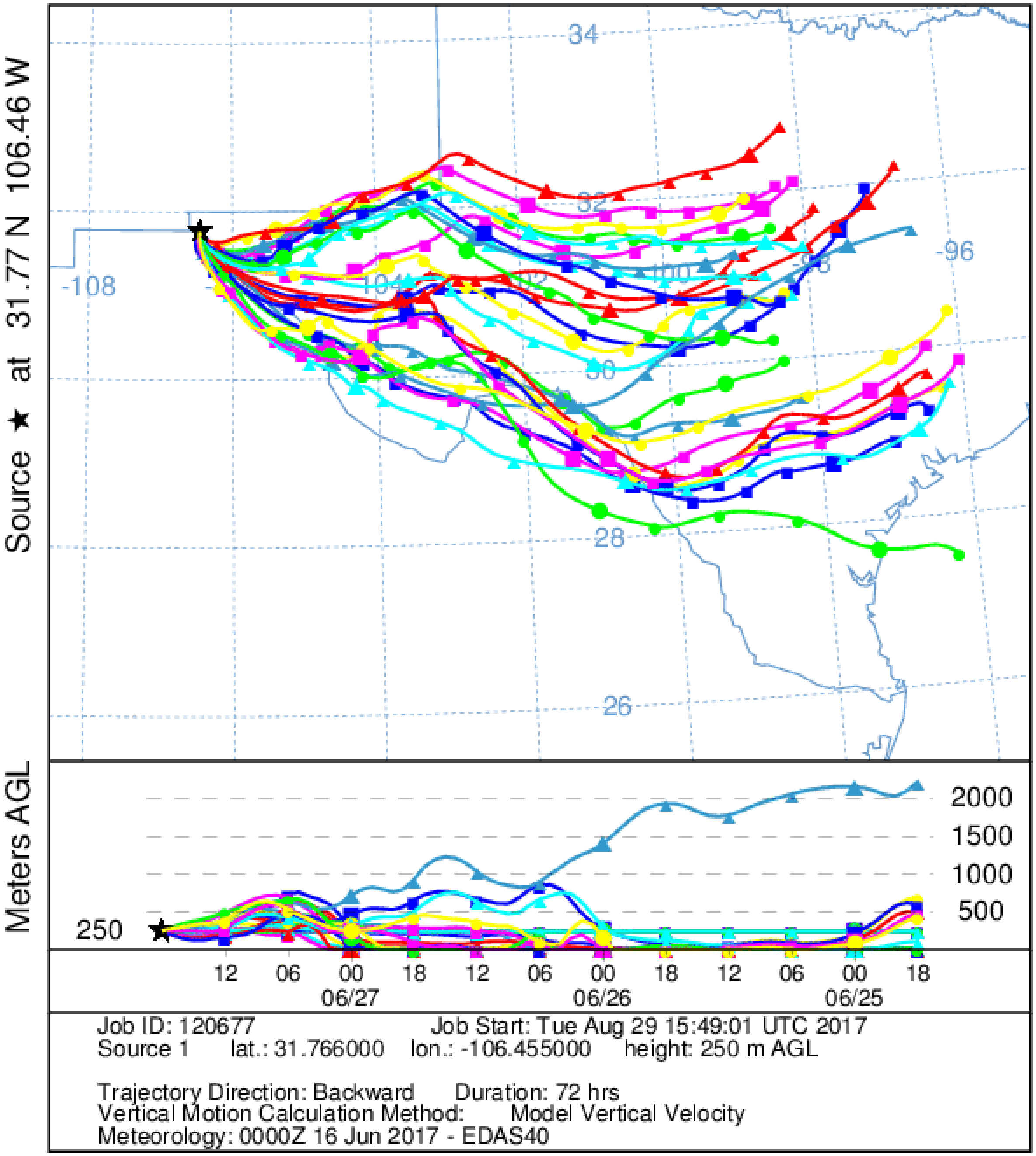


Figure 21 El Paso radar wind profiler on June 28, 2017, data after a high ozone day, strong westerly winds all day

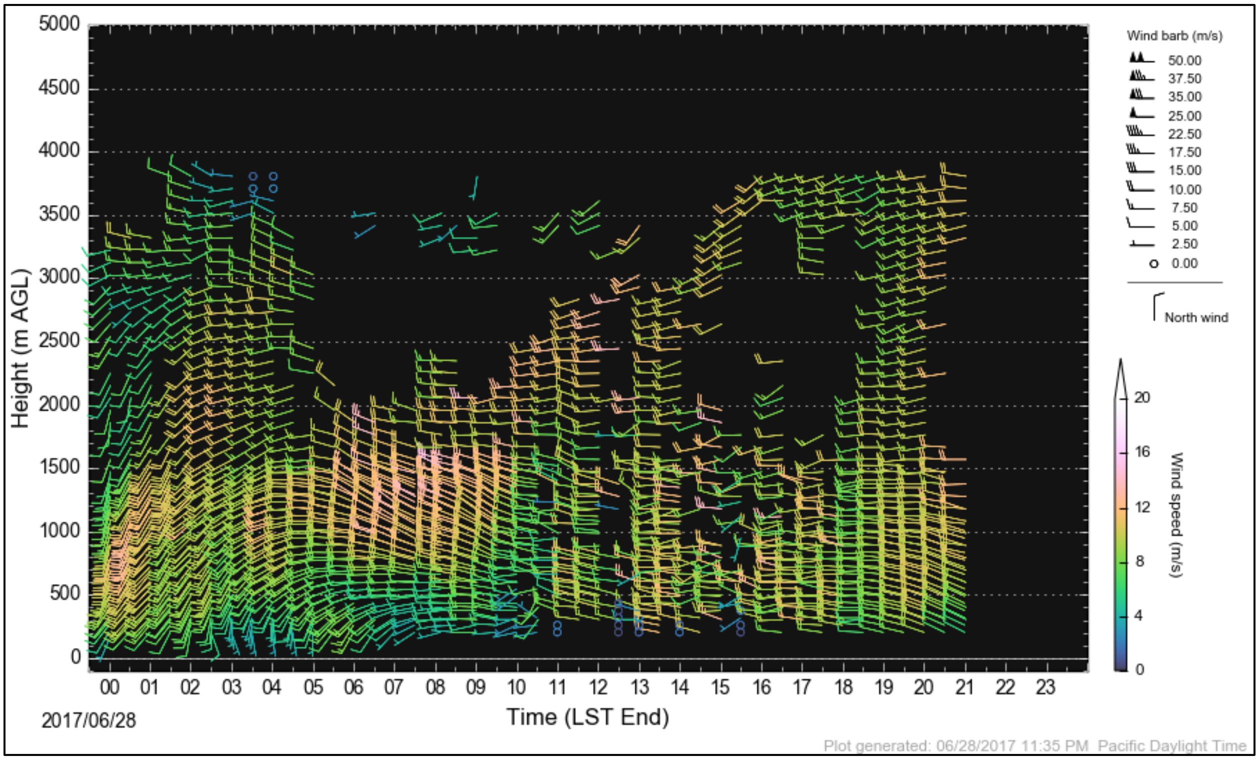


Figure 22 El Paso ceilometer cloud height BL height on June 28, 2017, day after a high ozone day, with variable mixing height all day from 500 m to 1000 m BL.

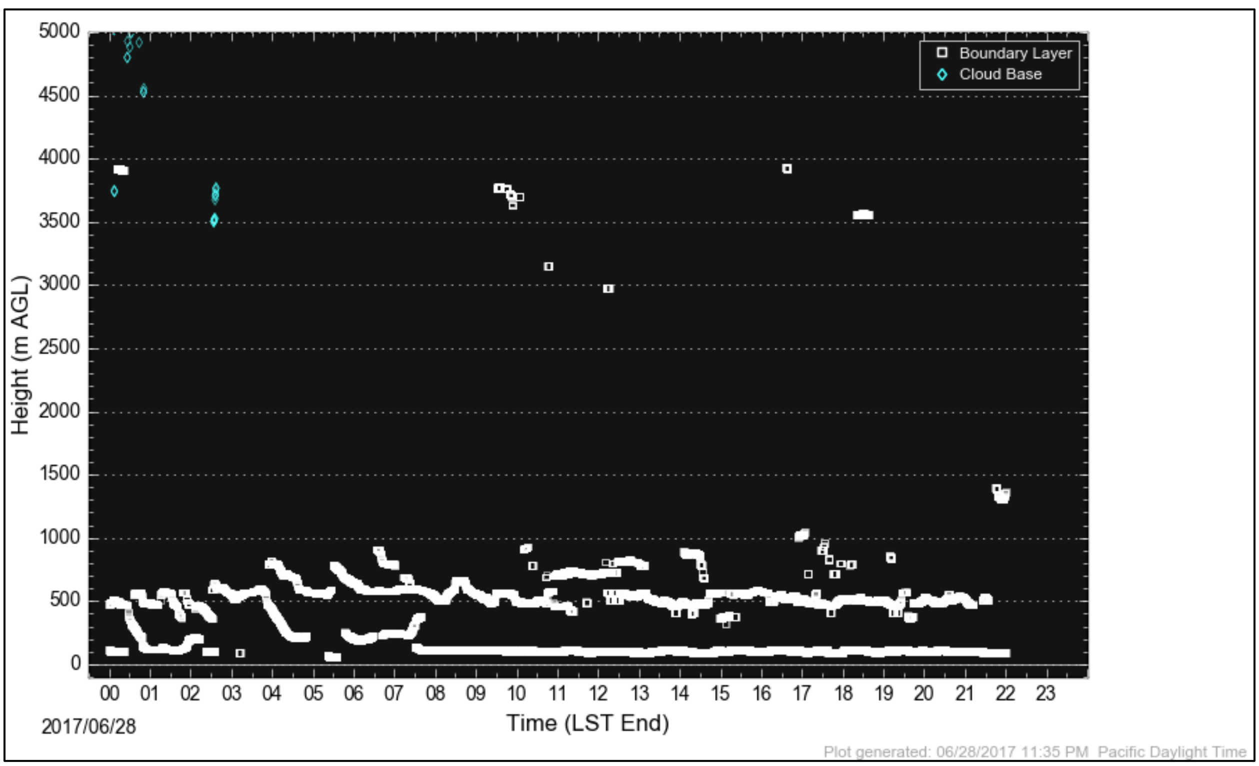
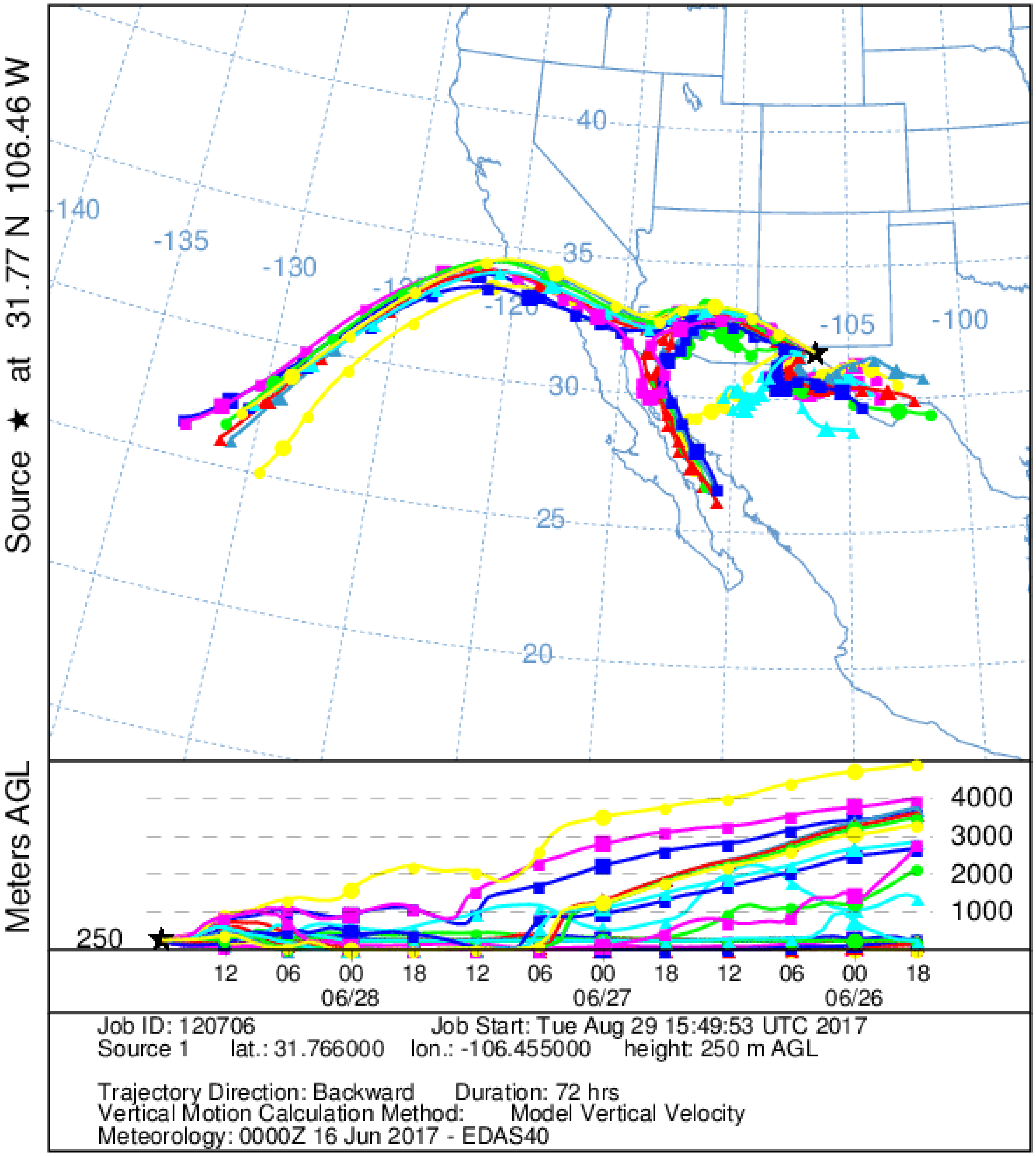


Figure 23 HYSPLIT ensemble 72-hour back trajectories from El Paso noon MST 6/28/2017



PM$_{2.5}$ case study May 16, 2017

Figure 24 shows the time series from May 10 to May 22, 2017, for hourly fine particulate matter for tapered element oscillating microbalance (TEOM) instruments at Ascarate Park CAMS 37 and UTEP CAMS 12, along with the beta-gauge instrument at Chamizal CAMS 41. The day of May 16 is a clear outlier, with all three sites measuring elevated concentrations. Figure 25 is a closer look at May 15 – 17, 2017. The local news media in El Paso reported on a high dust event in the area in the May 16, 2017 forecast (http://kfoxtv.com/news/local/winds-blowing-dust-back-

in-the-borderland). The TCEQ weather forecast on Tuesday May 16 said:
Strong afternoon winds are expected to generate and transport patchy blowing dust in parts of West Texas and the Panhandle, including in the El Paso area, where the daily PM10 AQI could reach "Moderate" or possibly higher levels, and in the Lubbock and Midland-Odessa areas, where the duration, intensity, and associated precipitation is not expected allow the daily PM10 AQI to rise beyond the "Good" range.

Figure 24 El Paso County $PM_{2.5}$ monitor (TEOM & Beta-gauge) concentrations May 10 – 22, 2017

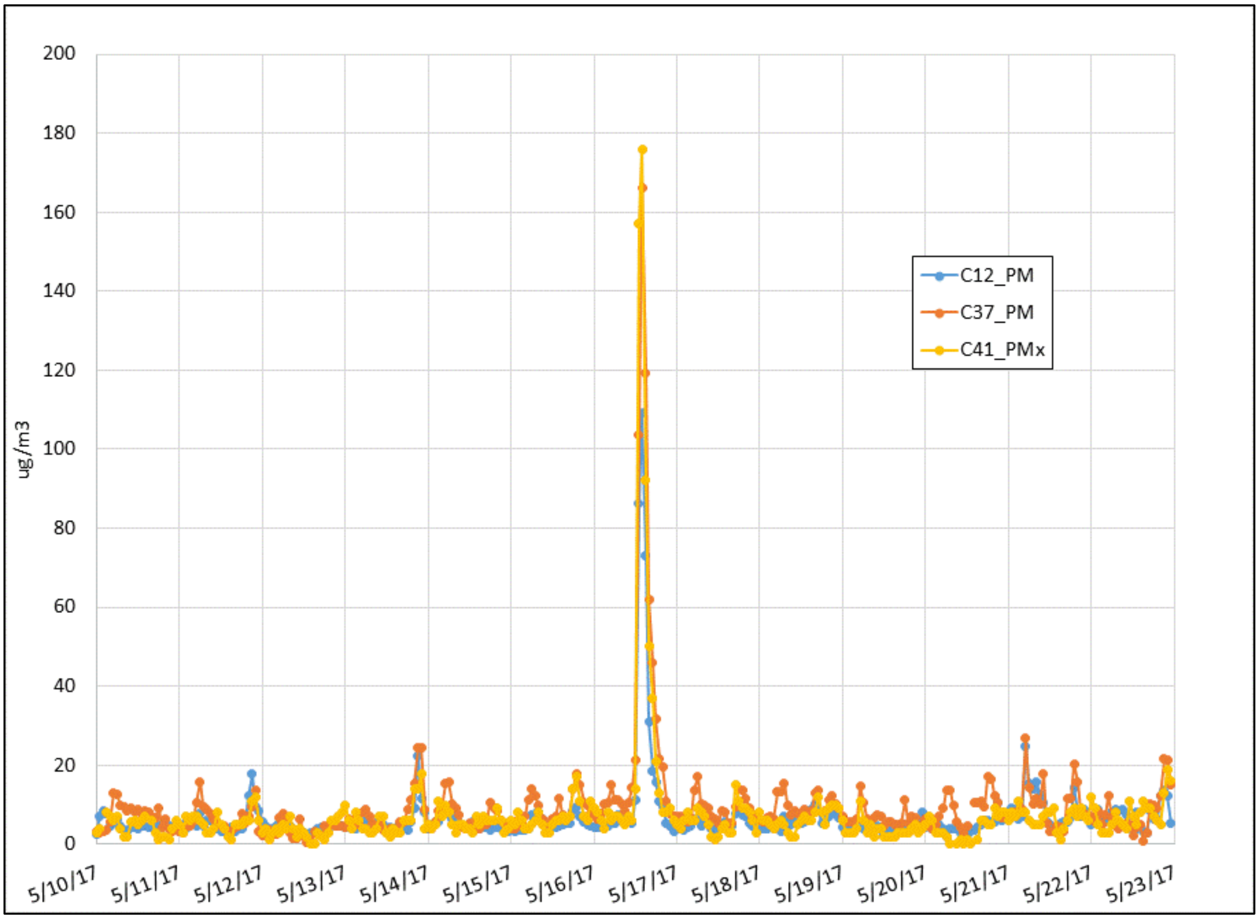
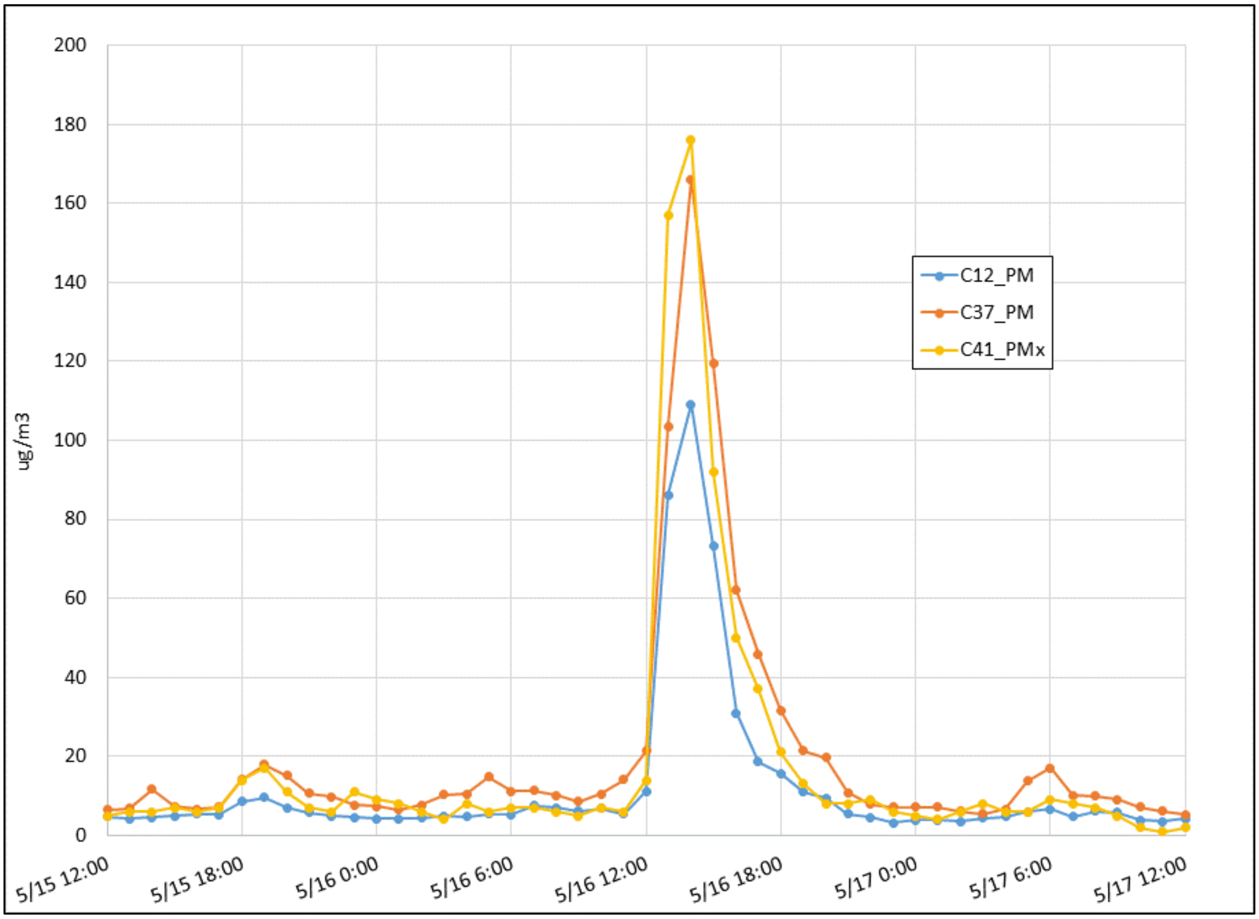


Figure 25 El Paso County $PM_{2.5}$ monitor (TEOM & Beta-gauge) concentrations May 15 – 17, 2017



The RWP, in Figure 26, shows on May 15, 2017, the area was experiencing light and variable winds, and Figure 27 for the ceilometer shows variable mixing height all day. On May 16, shown in Figure 28, wind speed picked up under westerly flow over a deep range of the atmosphere. Surface winds had peak gusts around 50 miles per hour in mid-afternoon, although the RWP suggests the highest wind near the surface would have been just after noon MST. Figure 29 shows the ceilometer results on May 16, with a thick cloud layer in the afternoon. Strong winds were still present in the early morning on the following day May 17, shown in Figure 30, which may have caused to the elevated $PM_{2.5}$ at 6 a.m. MST in Figure 25 (above). Figure 31 shows the ceilometer results on May 17.

Figure 26 El Paso radar wind profiler on May 15, 2017, data before a high particulate matter day, light and variable mid-day winds picking up at night to strong westerly

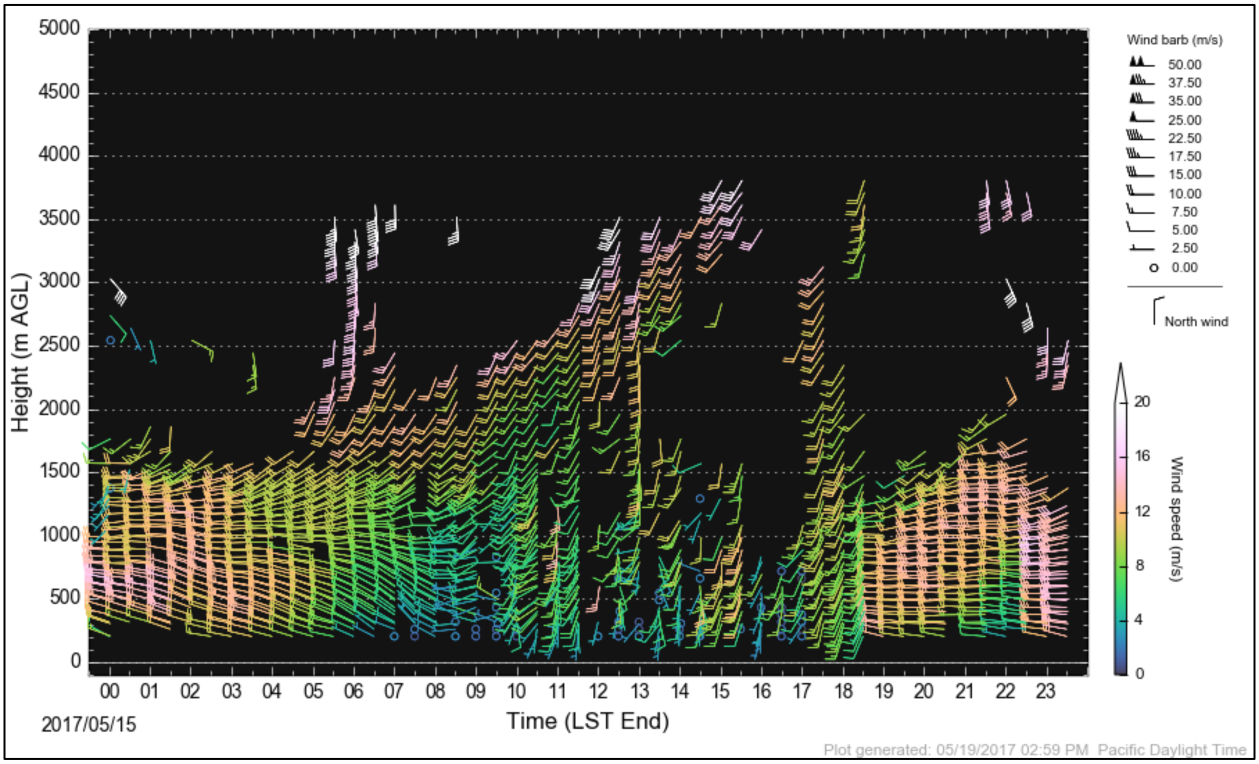


Figure 27 El Paso ceilometer cloud height BL height on May 15, 2017, day before a high dust day, with variable mixing height all day

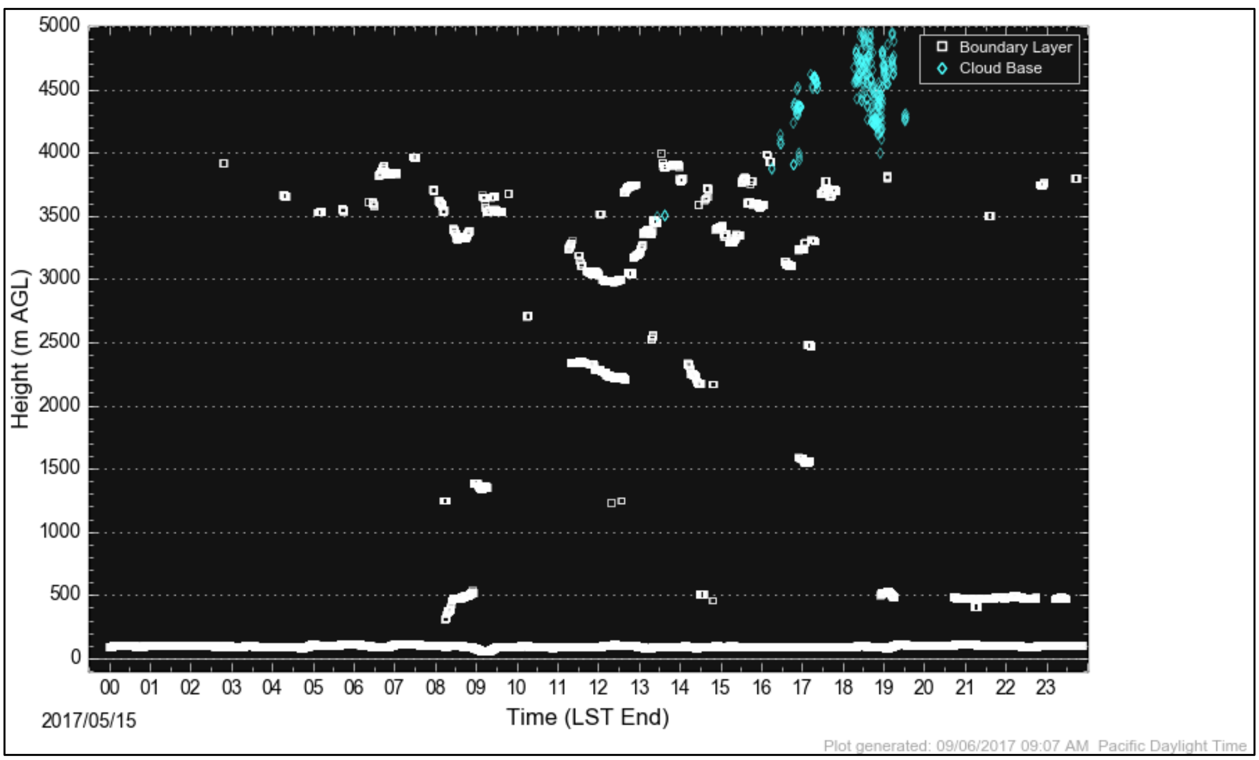


Figure 28 El Paso radar wind profiler on May 16, 2017, high particulate matter day, winds picking up and strong westerly flow

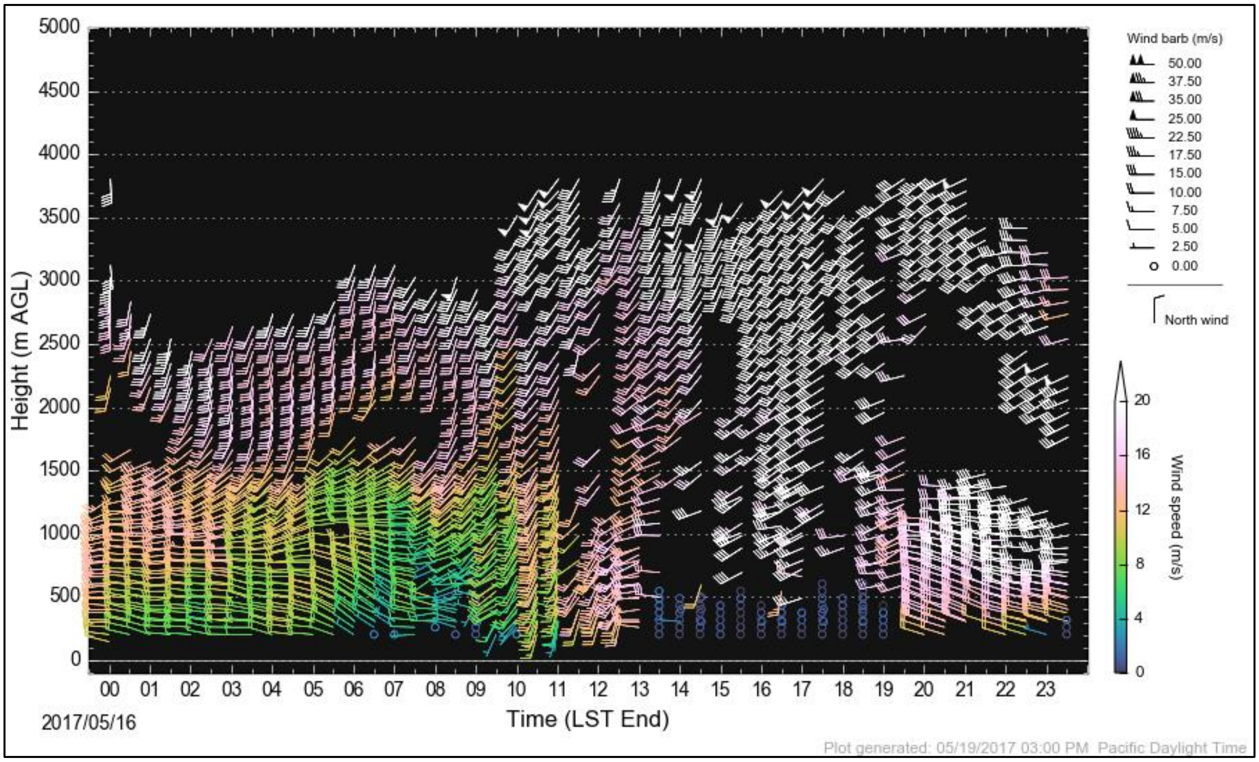


Figure 29 El Paso ceilometer cloud height BL height on May 16, 2017, high dust day

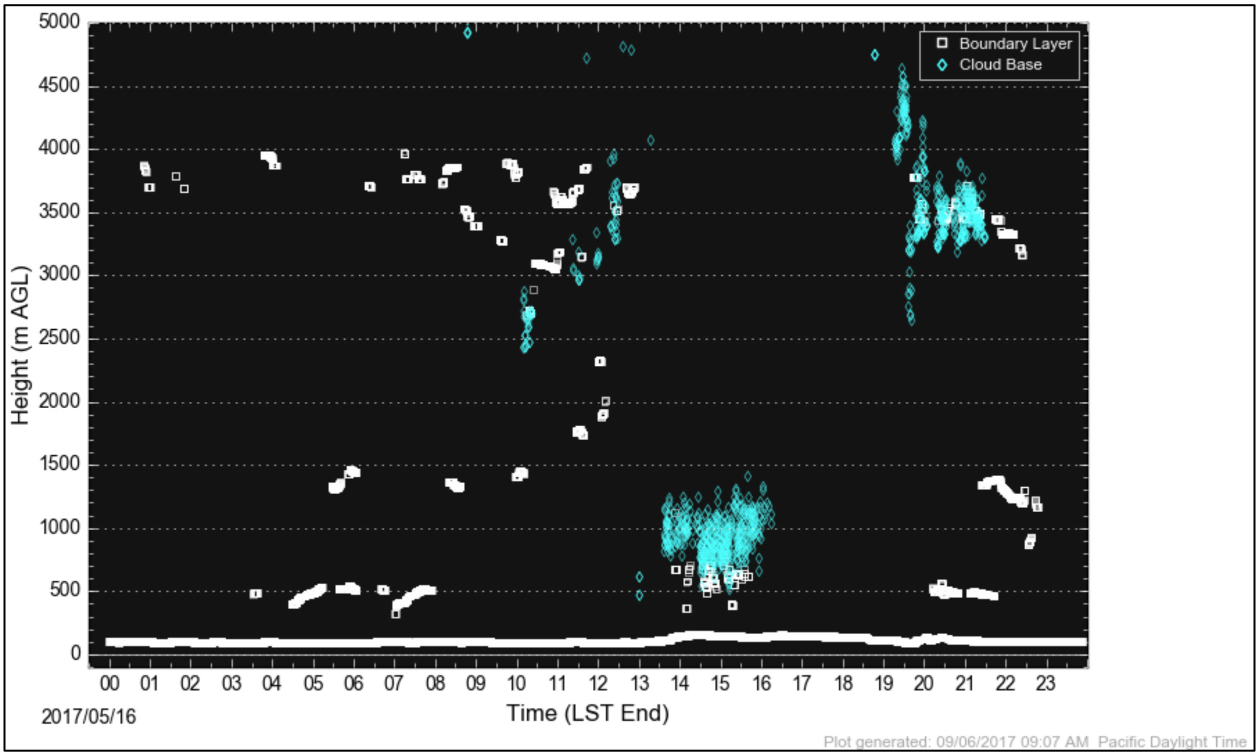


Figure 30 El Paso radar wind profiler on May 17, 2017, day after a high particulate matter day, more daytime light and variable winds

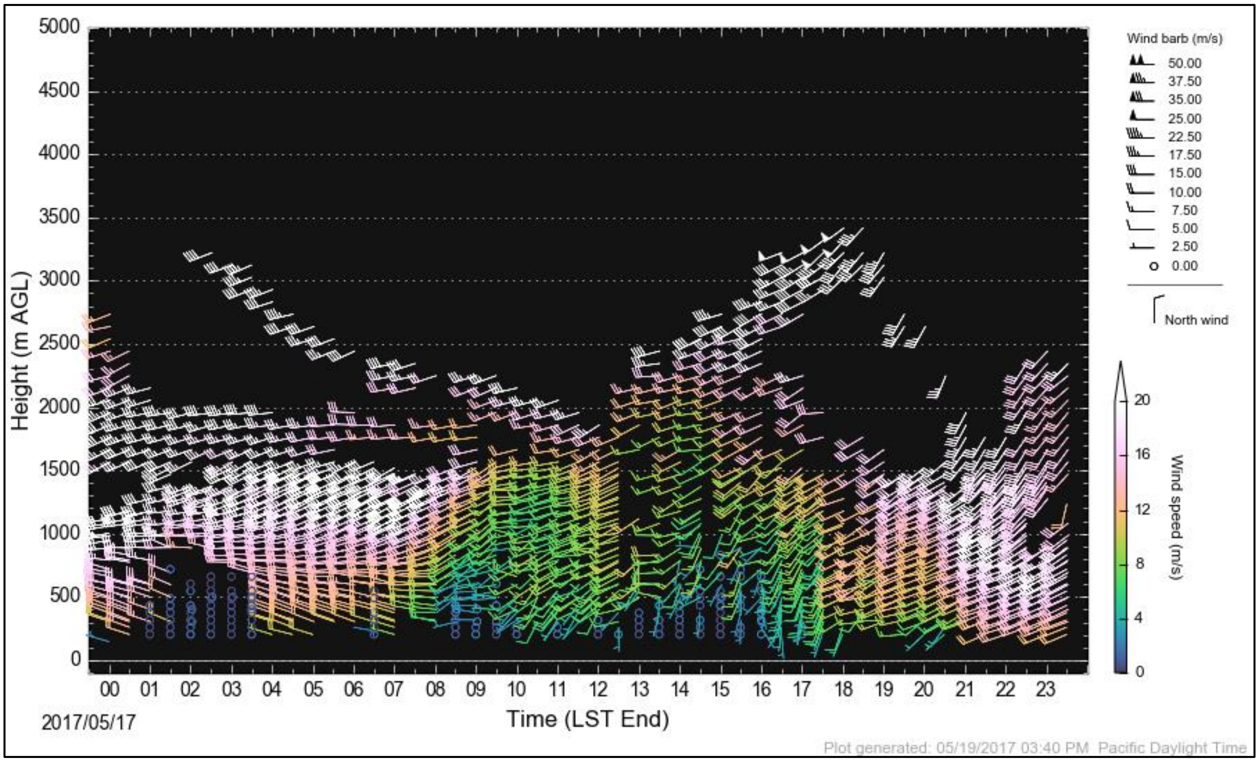
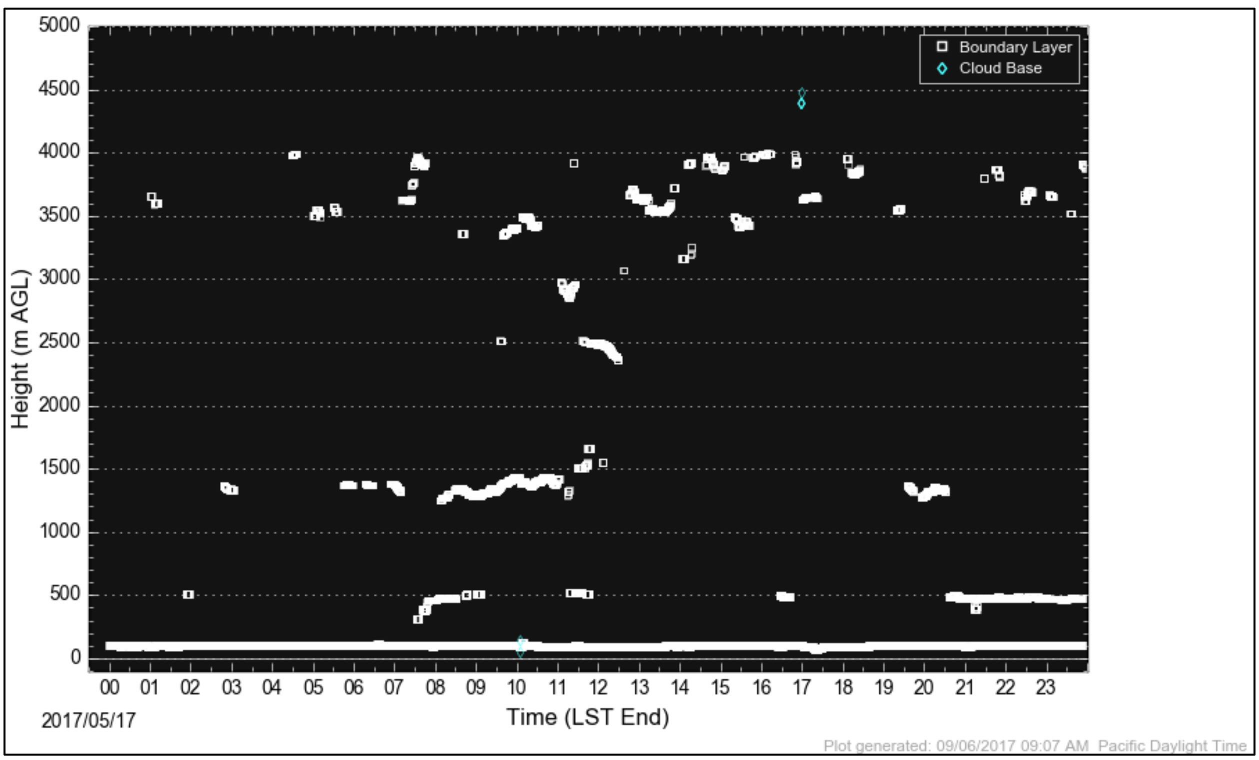


Figure 31 El Paso ceilometer cloud height BL height on May 17, 2017, day after high dust day



$PM_{2.5}$ case study December 17 – 20, 2016

Figure 32 shows the $PM_{2.5}$ time series from December 15 to December 22, 2016, for Ascarate Park CAMS 37, UTEP CAMS 12, and Chamizal CAMS 41. The day of December 17 is a clear outlier, with all three sites measuring elevated concentrations. Figure 33 is a closer look at December 16 – 18, 2016. The TCEQ weather forecast for December 17, 2016 was:
Strong afternoon winds are forecast to generate and transport patchy blowing dust into parts of the southern Panhandle and West Texas. Although areas of light precipitation may help reduce the dust, the overall daily PM10 AQI could reach "Moderate" levels in the El Paso, Lubbock, and Midland-Odessa areas, with highest concentrations in the afternoon and early evening.

Figure 32 shows that there were several short term spikes in $PM_{2.5}$ measured by the CAMS 41 beta-gauge instrument over these days in December 2016. However, on December 20 and December 21, concentrations rose above typical background concentrations for many hours, and all three instruments measured hourly values over 30 $\mu g/m^3$ for several hours. Figure 34 is a close-up look at the days December 19 – December 21, 2016.

The TCEQ weather forecast for December 20, 2016 was:
With light winds forecast today, slightly elevated fine particulate levels caused by urban air stagnation may allow the overall daily PM2.5 AQI to reach the low end of the "Moderate" range in parts of the El Paso area, with highest concentrations in the morning and evening hours.

The TCEQ weather forecast for December 21, 2016 was:
Increasing fine particulate background levels associated with building continental haze, combined with winds light enough to allow some local add-on, could be enough for the daily PM2.5 AQI to reach the low end of the "Moderate" range in parts of the El Paso and Houston areas, with highest concentrations in the morning and evening hours.

Figures 35 through 48 show the RWP and ceilometer graphs for the days December 15 through December 21, 2016. The RWP show on December 16 and 17, the area had high speed winds, and the winds dropped in speed on December 18 and remained the range around 4 m/s (8 mph) through December 21. The difference between the elevated $PM_{2.5}$ concentrations on December 16 and 17 compared to the concentrations on December 20 and 21 could be that the days with higher speed winds had more crustal component and the days with lower wind speeds more carbon and other urban emission species. An examination of speciated data could assist in this assessment.

Figure 32 El Paso County $PM_{2.5}$ monitor (TEOM & Beta-gauge) concentrations Dec. 15 – 21, 2016, two periods of city-wide elevated $PM_{2.5}$ indicated

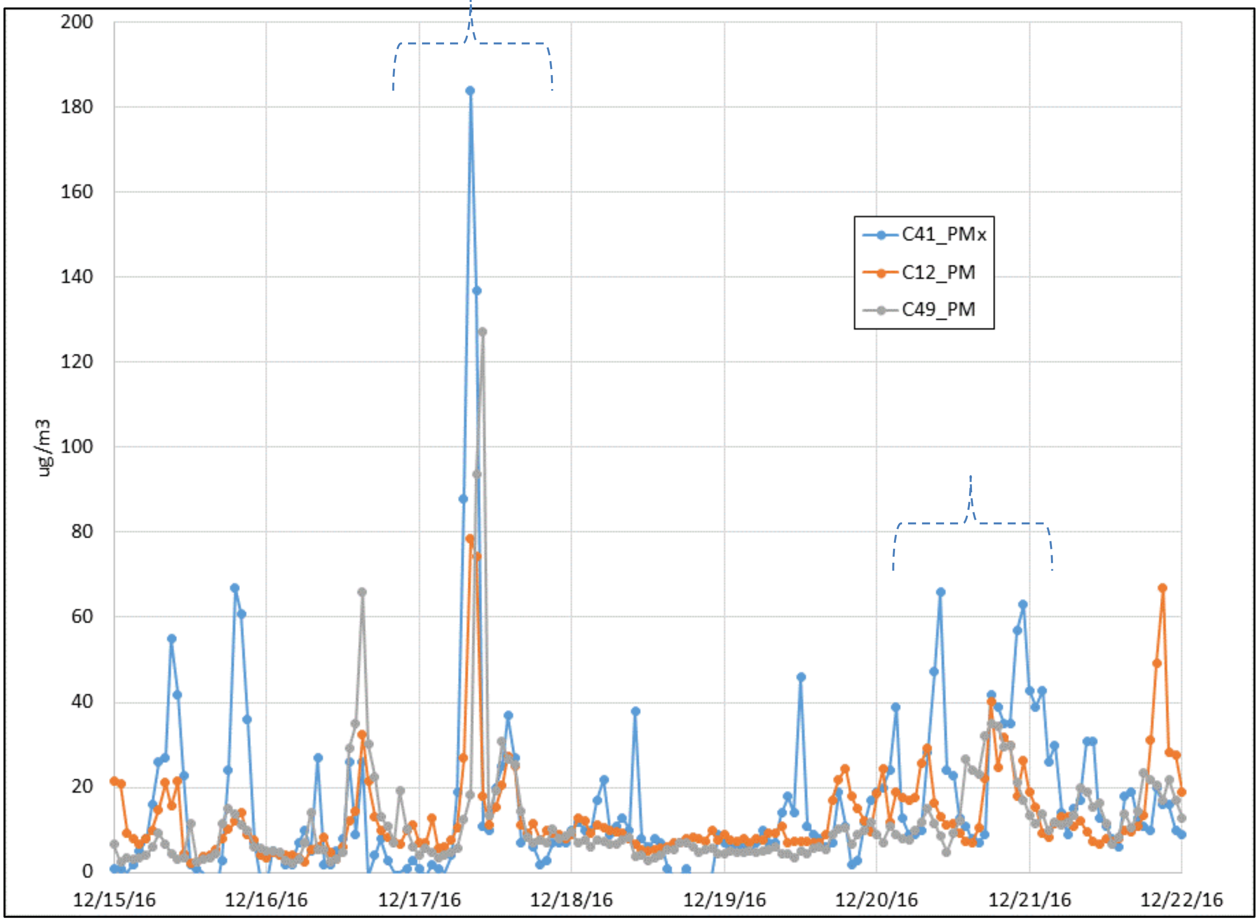


Figure 33 El Paso County $PM_{2.5}$ monitor (TEOM & Beta-gauge) concentrations Dec. 16 – 18, 2016

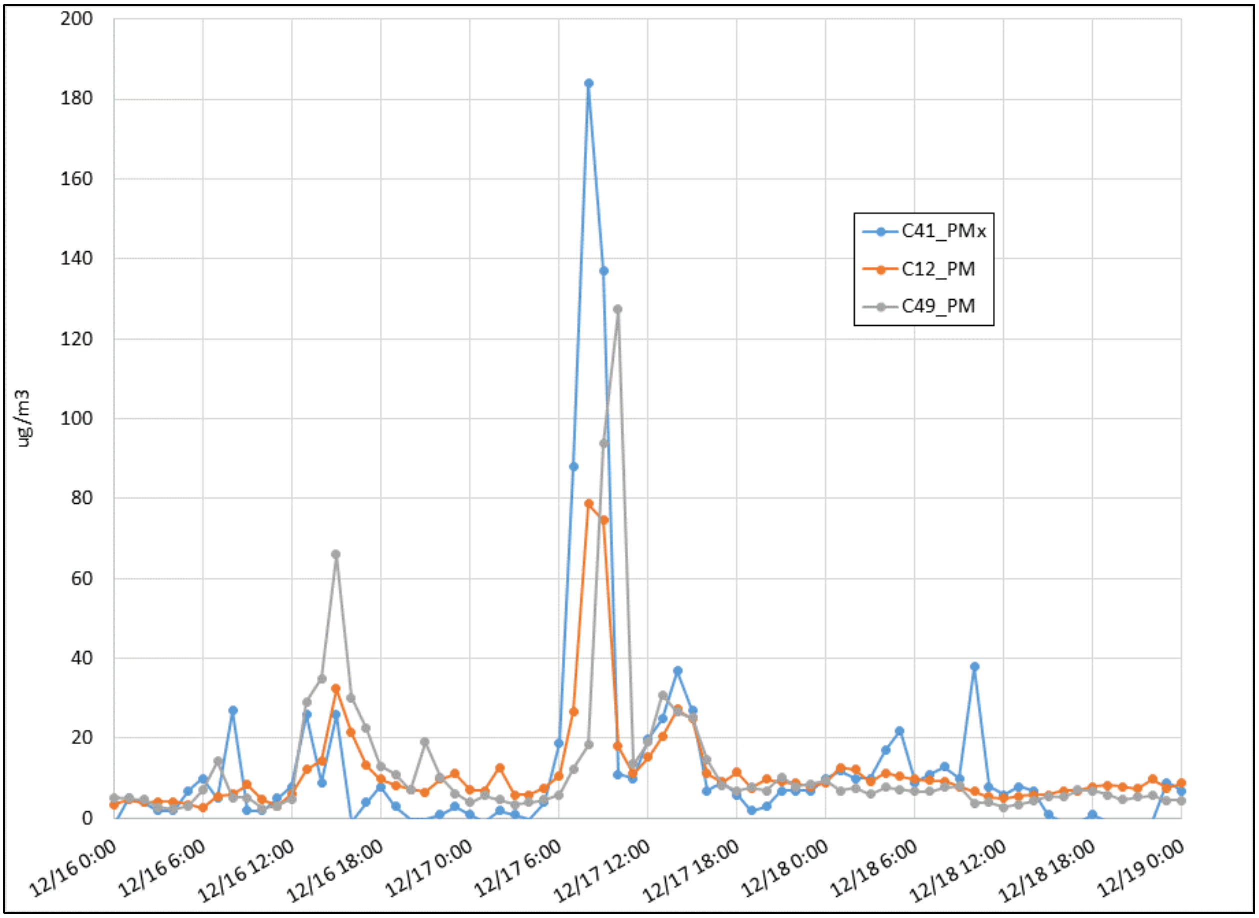


Figure 34 El Paso County $PM_{2.5}$ monitor (TEOM & Beta-gauge) concentrations Dec. 19 – 21, 2016

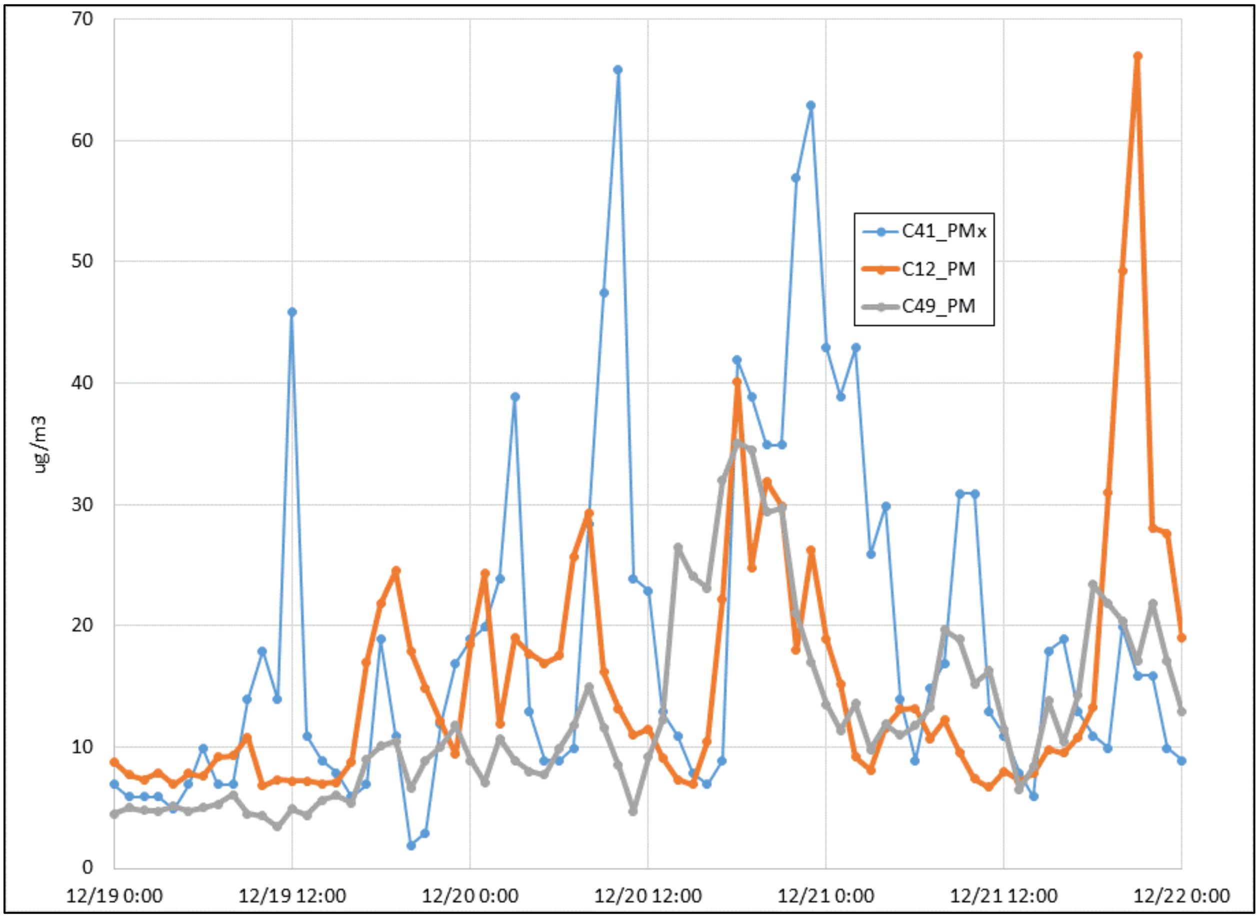


Figure 35 El Paso RWP data from December 15, 2016, light winds, picking up at night

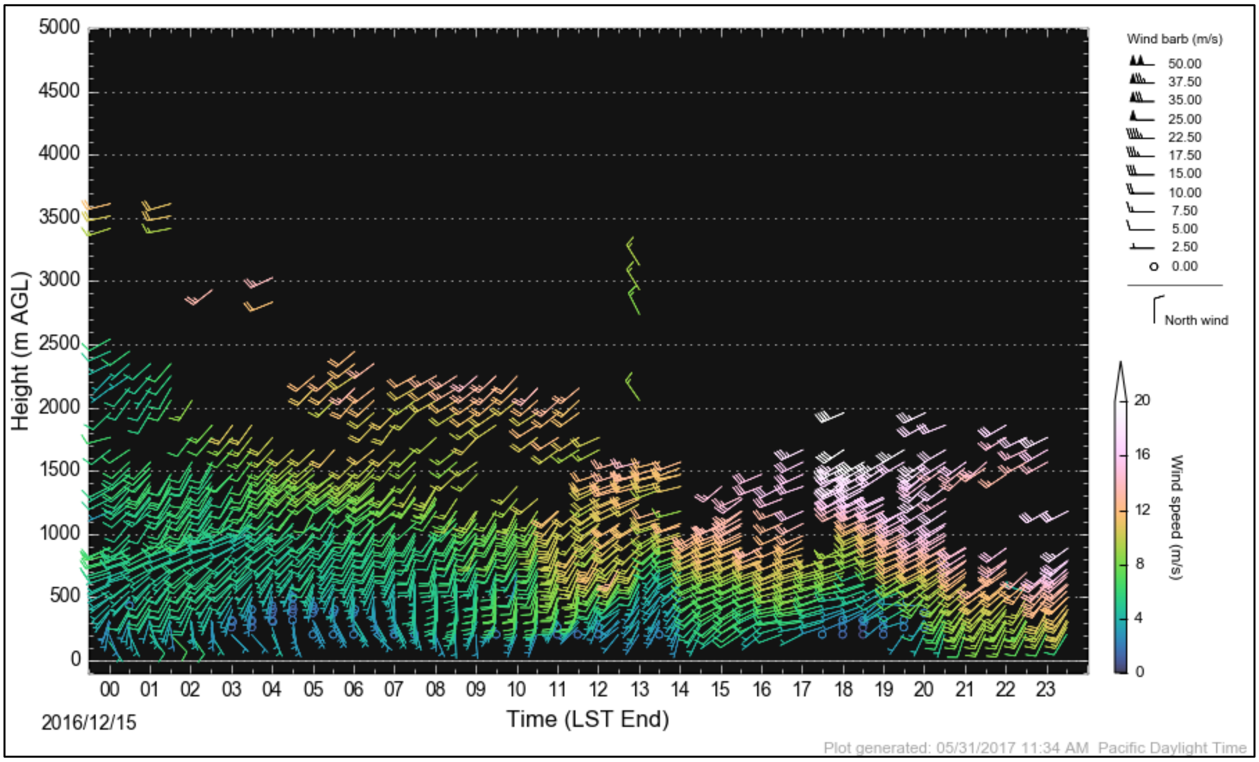


Figure 36 El Paso ceilometer cloud height BL height on December 15, 2016, with poorly defined mixing height

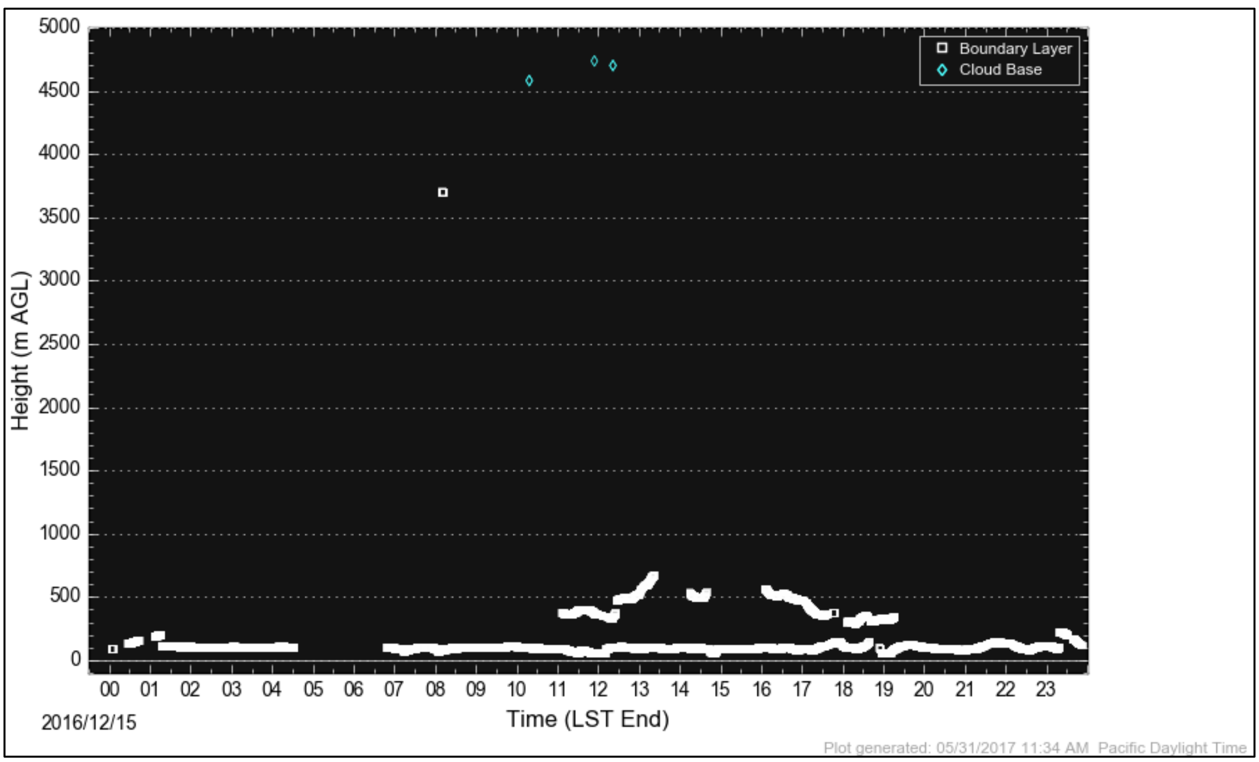


Figure 37 El Paso RWP data from December 16, 2016, strong westerly winds

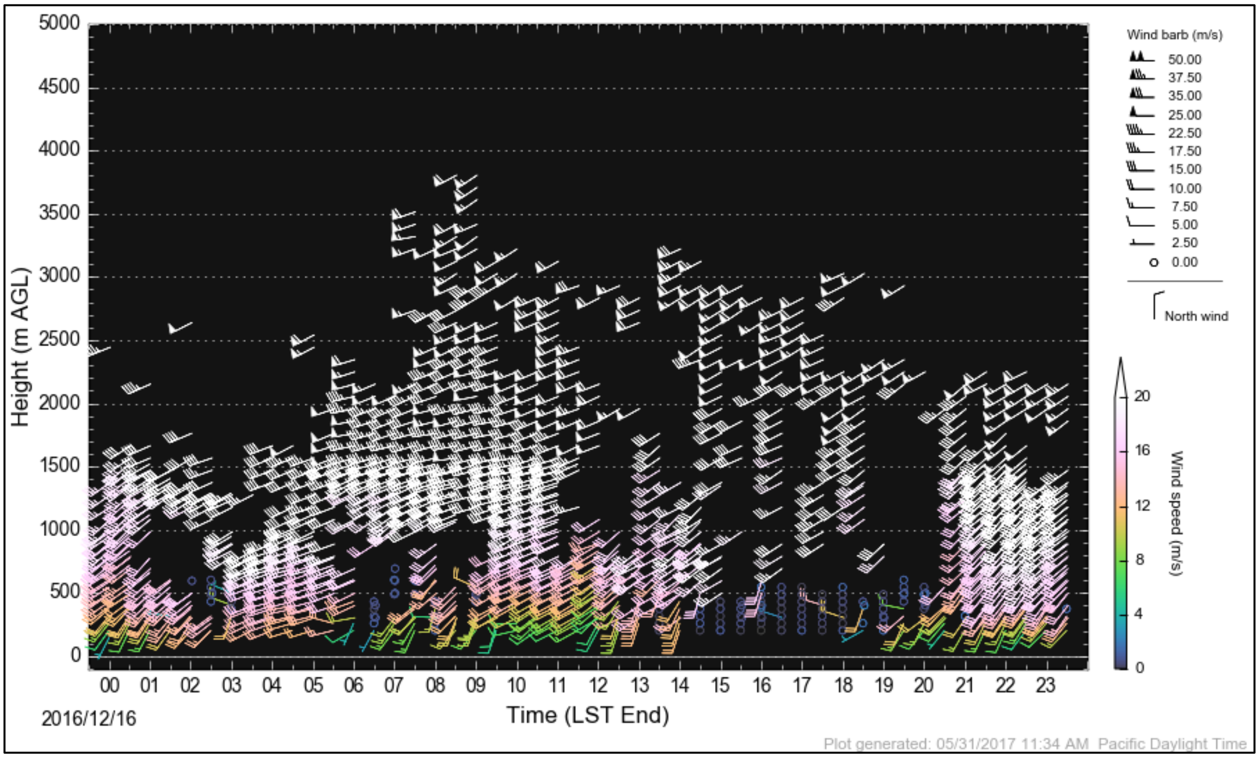


Figure 38 El Paso ceilometer cloud height BL height on December 16, 2016, with mixing height around 500 meters

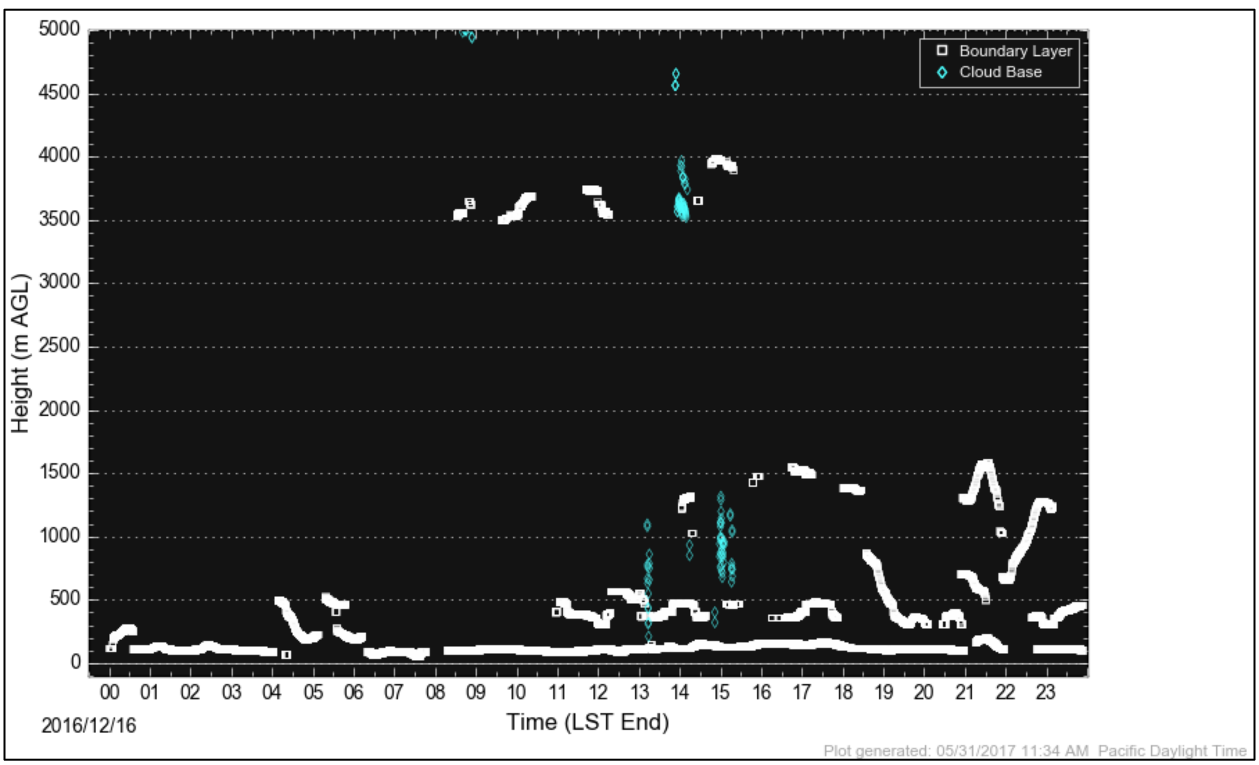


Figure 39 El Paso RWP data from December 17, 2016, strong westerly winds, light surface winds mid-day

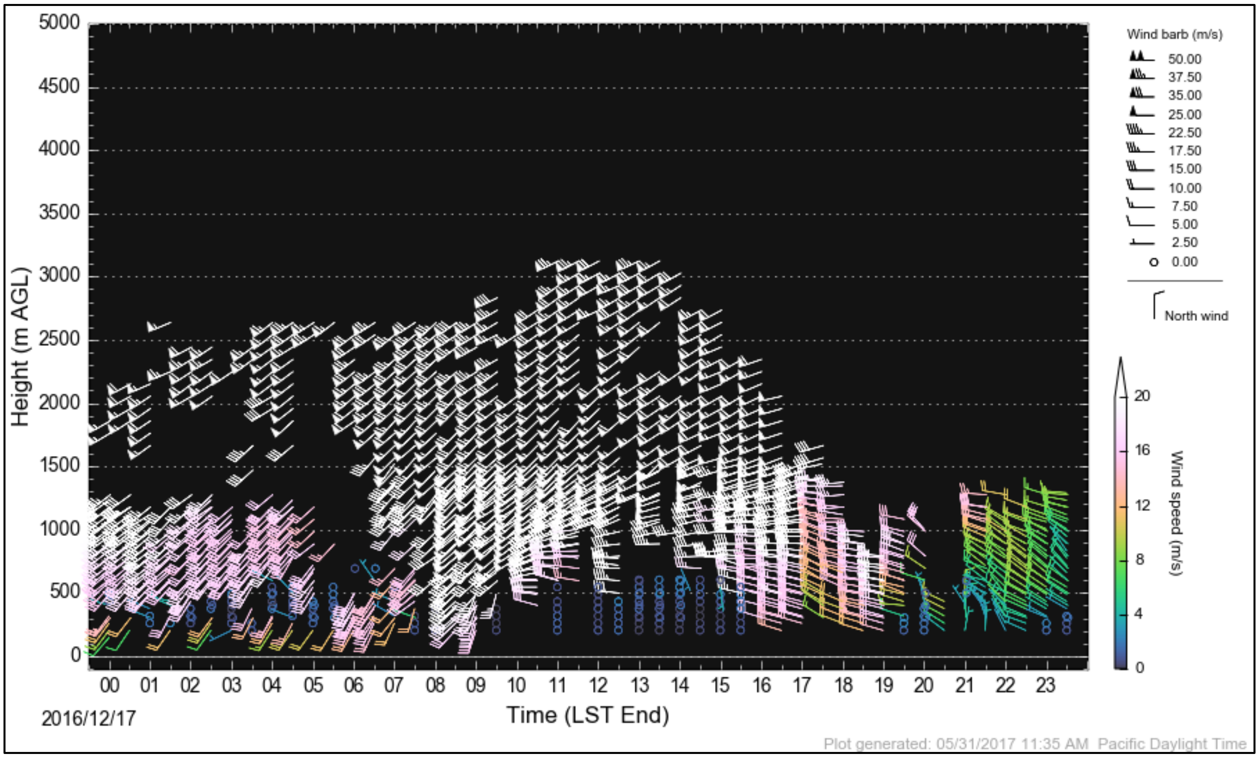


Figure 40 El Paso ceilometer cloud height BL height on December 17, 2016, with mixing height up to 1,500 meters, suggesting dust carried aloft could mix to the ground

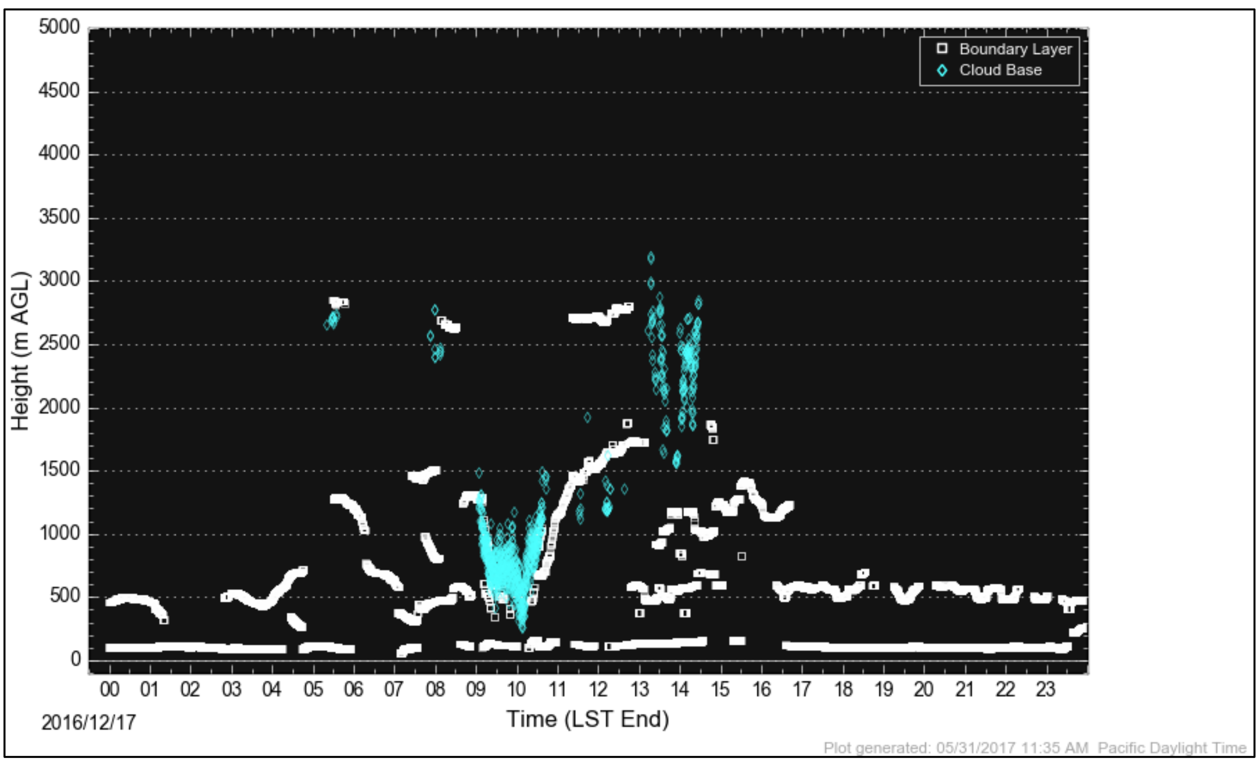


Figure 41 El Paso RWP data from December 18, 2016, light westerly winds

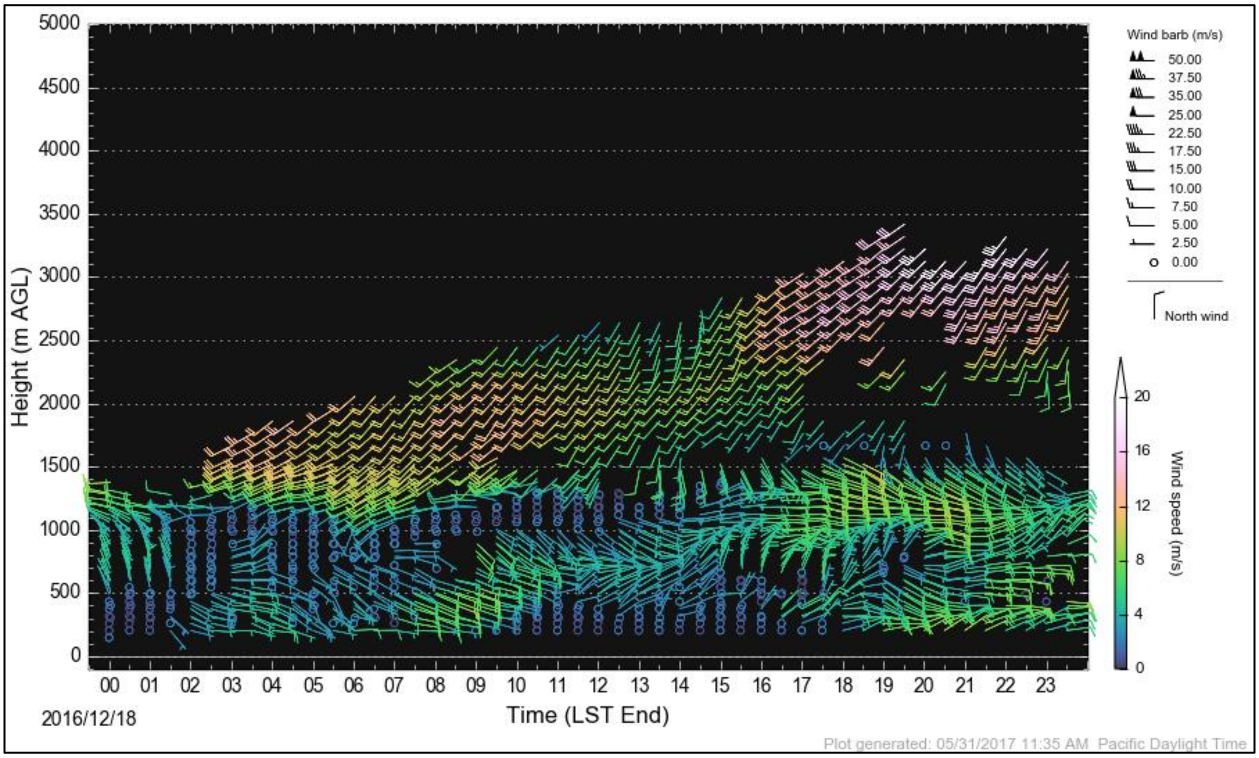


Figure 42 El Paso ceilometer cloud height BL height on December 18, 2016, with poorly defined mixing height

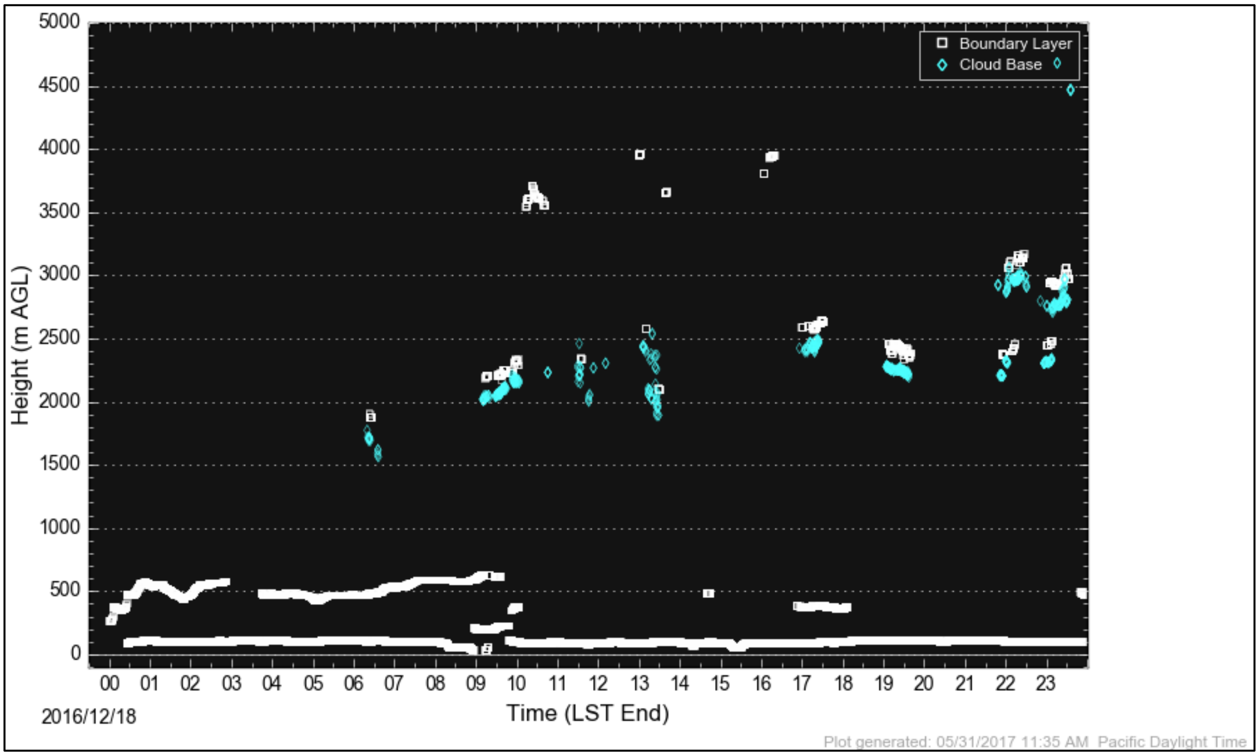


Figure 43 El Paso RWP data from December 19, 2016, light & variable winds

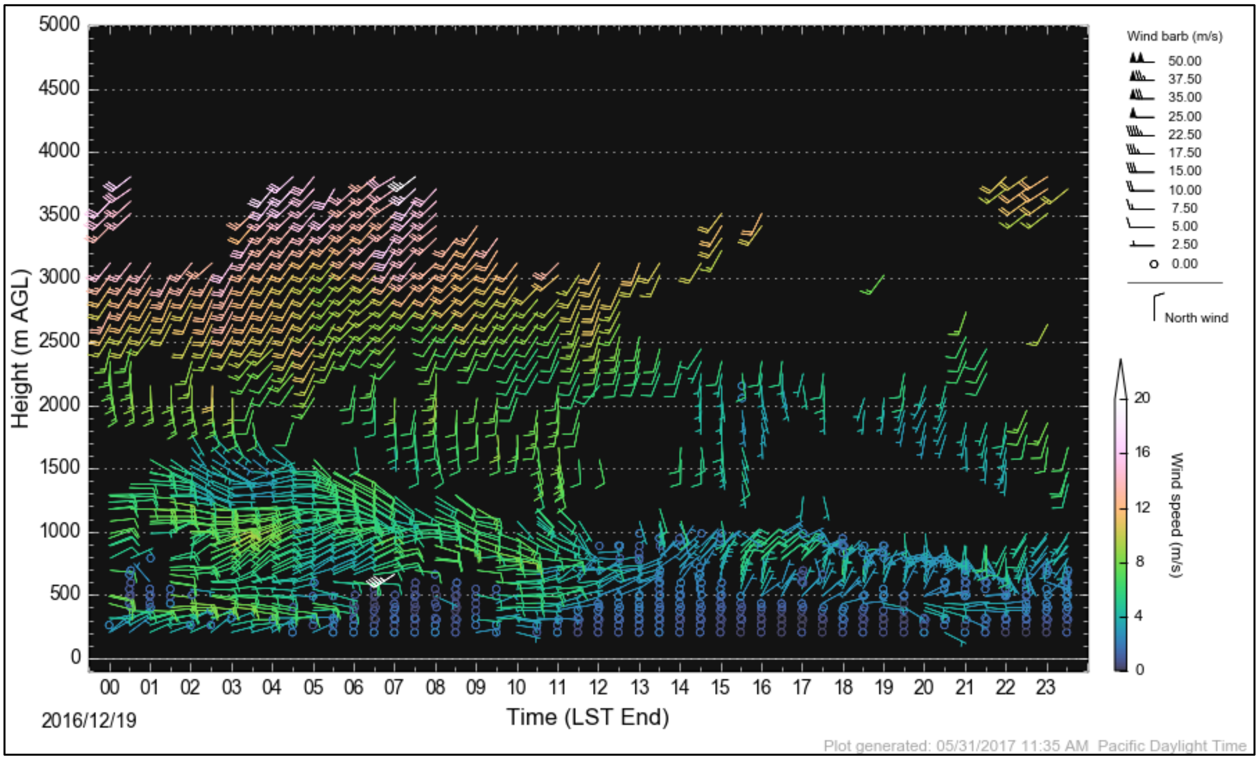


Figure 44 El Paso ceilometer cloud height BL height on December 19, 2016, with mixing height around 500 meters

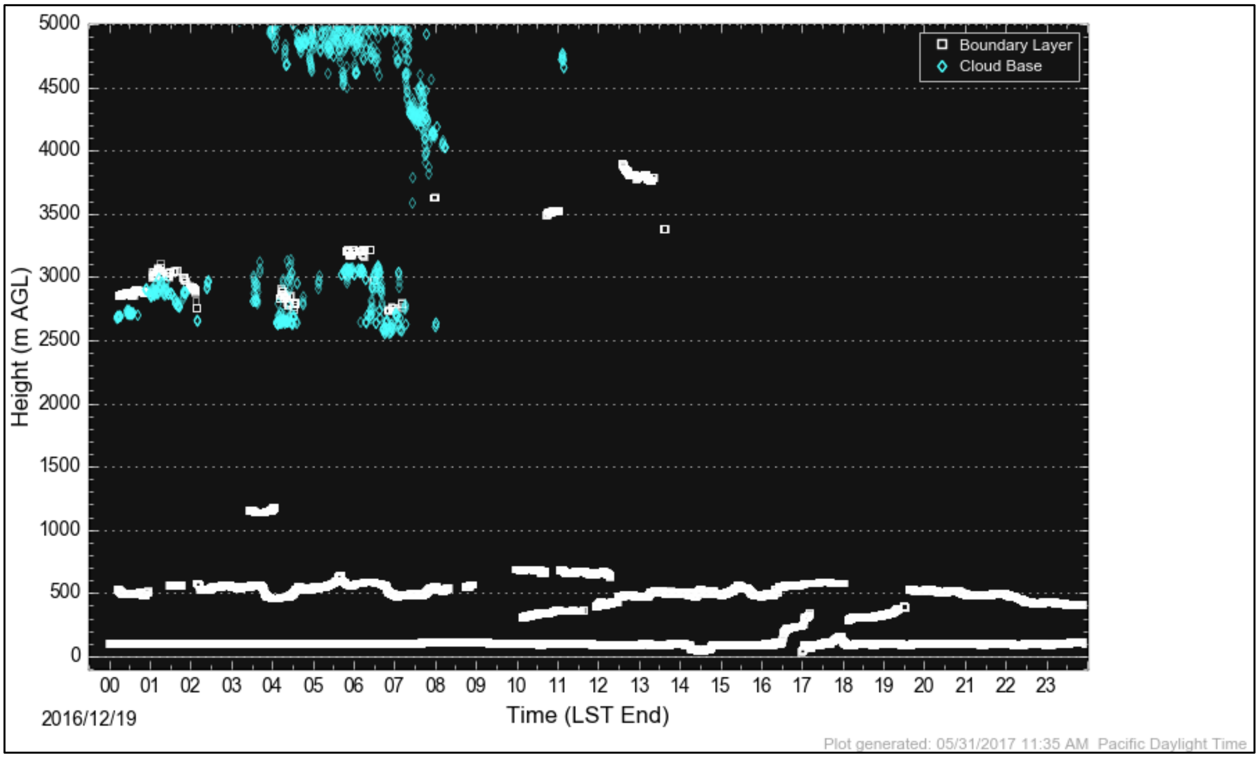


Figure 45 El Paso RWP data from December 20, 2016, light & variable winds

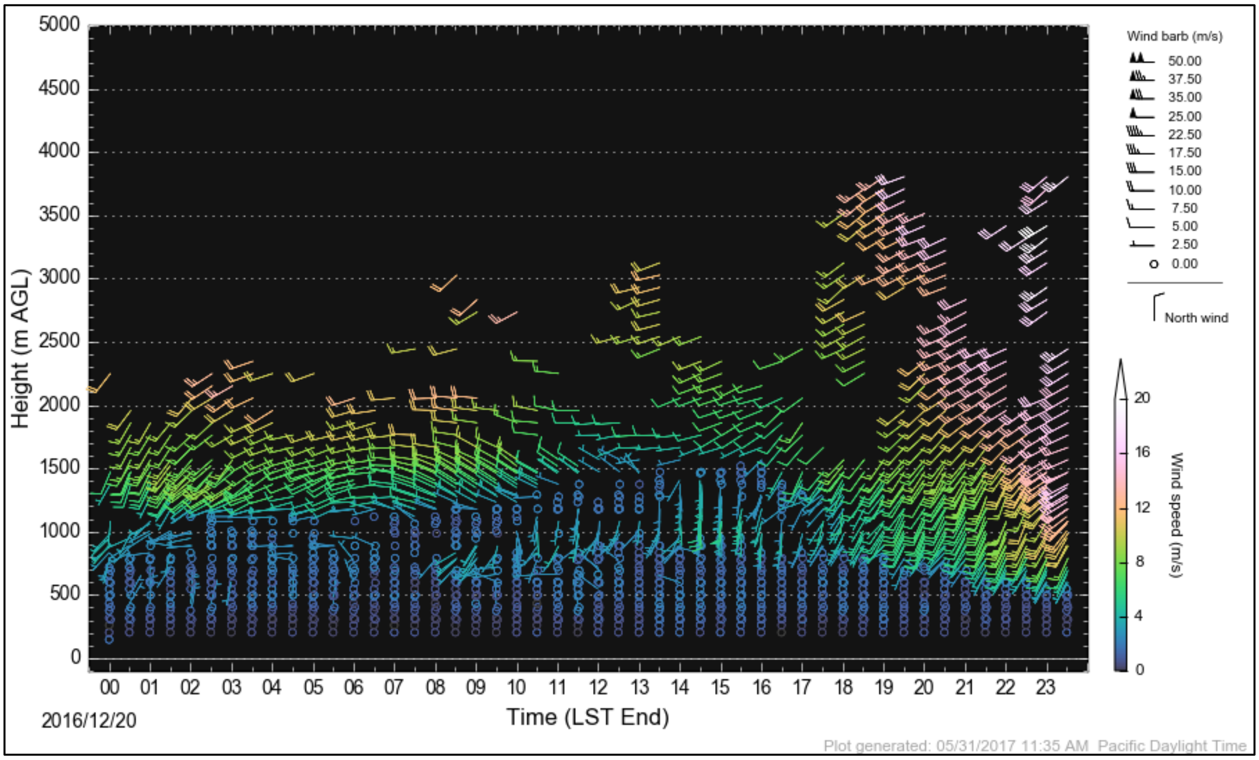


Figure 46 El Paso ceilometer cloud height BL height on December 20, 2016, with mixing height constrained early in the day the rising to 500 meters

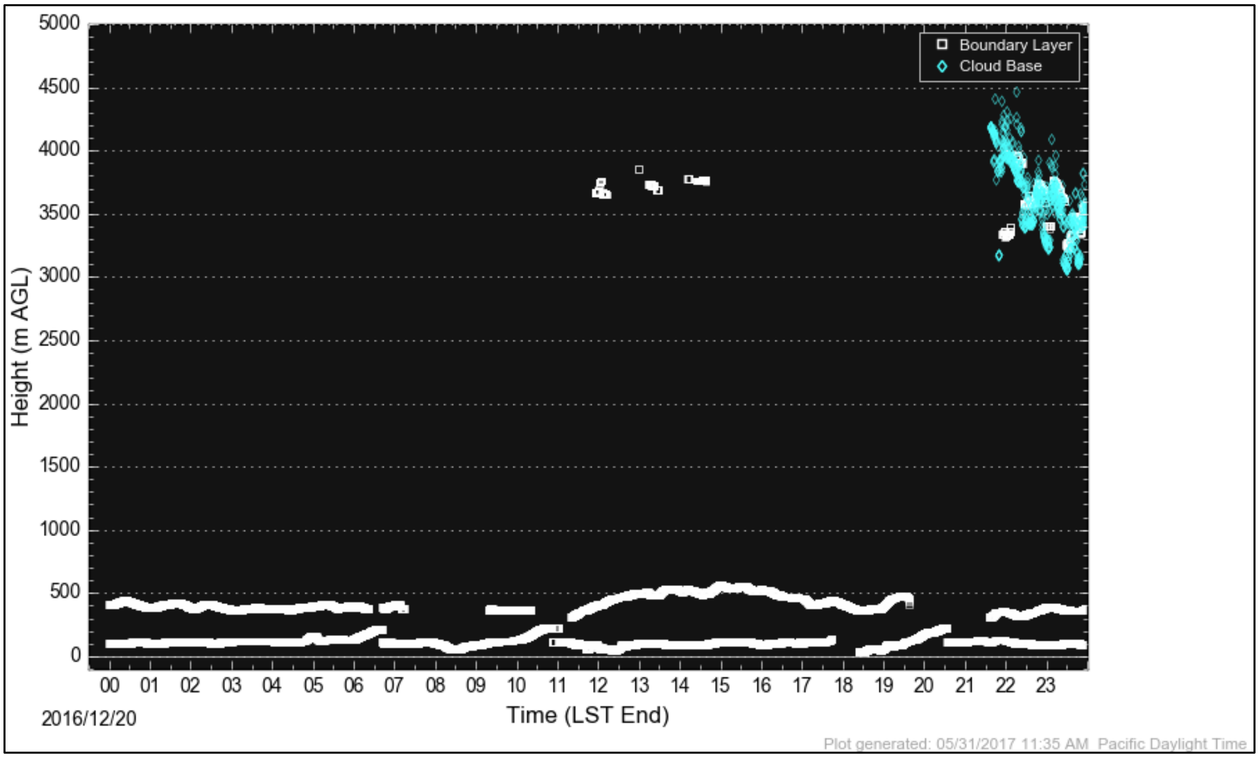


Figure 47 El Paso RWP data from December 21, 2016, southwesterly winds

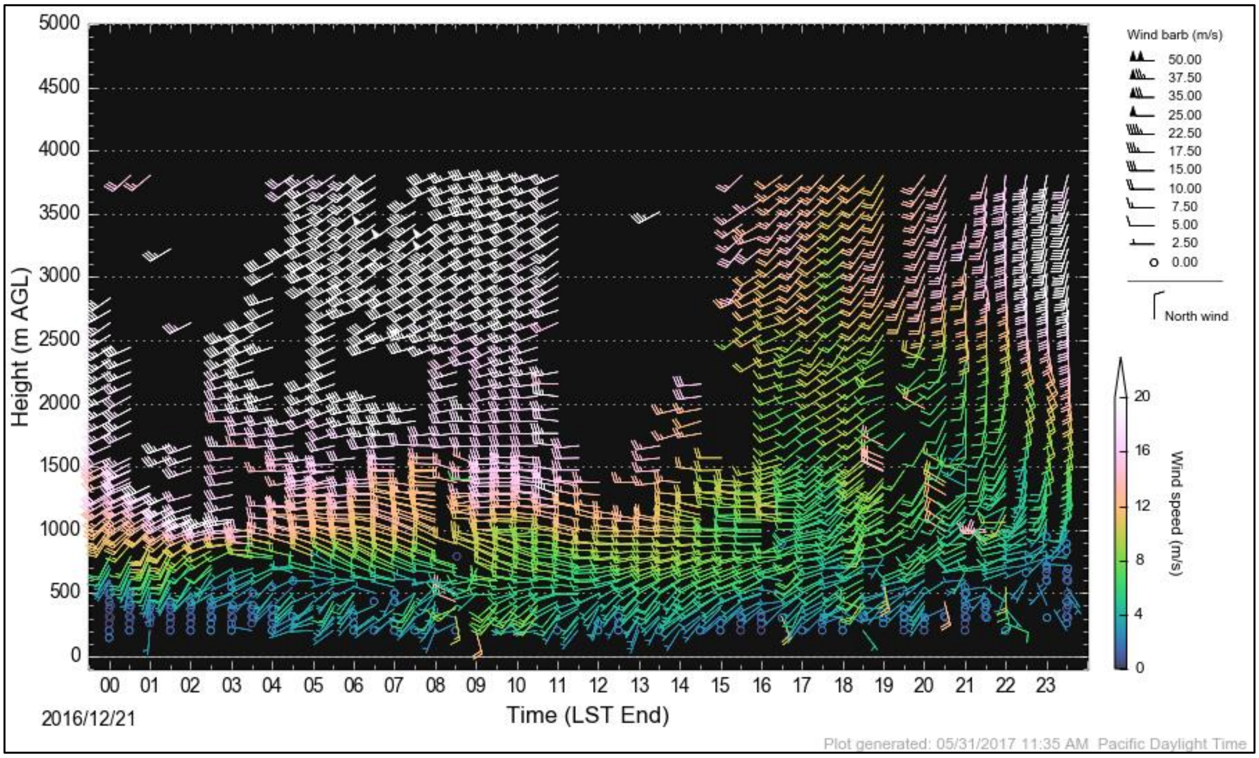
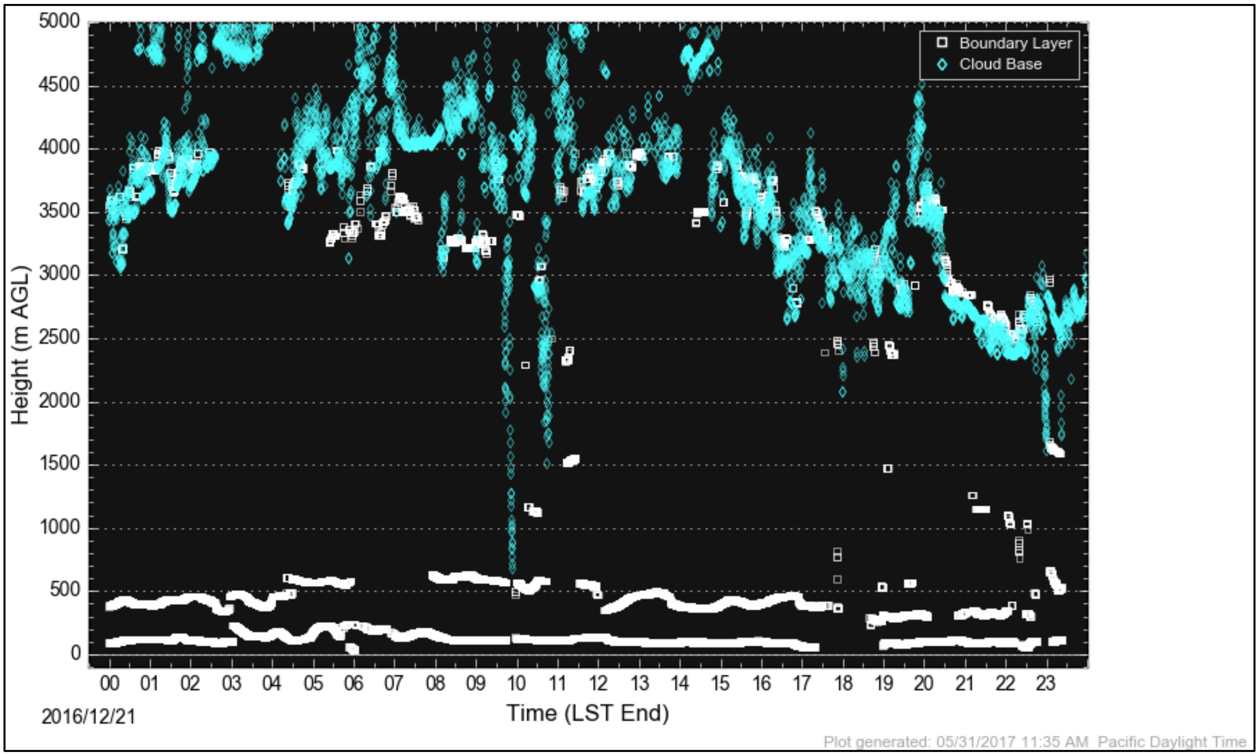


Figure 48 El Paso ceilometer cloud height BL height on December 21, 2016, with significant clouds



Ozone case study June 2 – 7, 2017

Figure 49 shows the O_3 time series from May 28 to June 10, 2017, for six O_3 monitors in El Paso County. On June 2, and June 4 – 7, concentrations above 70 ppb were measured at several sites, and on June 4, four out of six sites recorded one of its top four 8-hour averages of 2017 through late August 2017.

Figure 49 El Paso County ozone concentrations May 28 – June 10, 2017

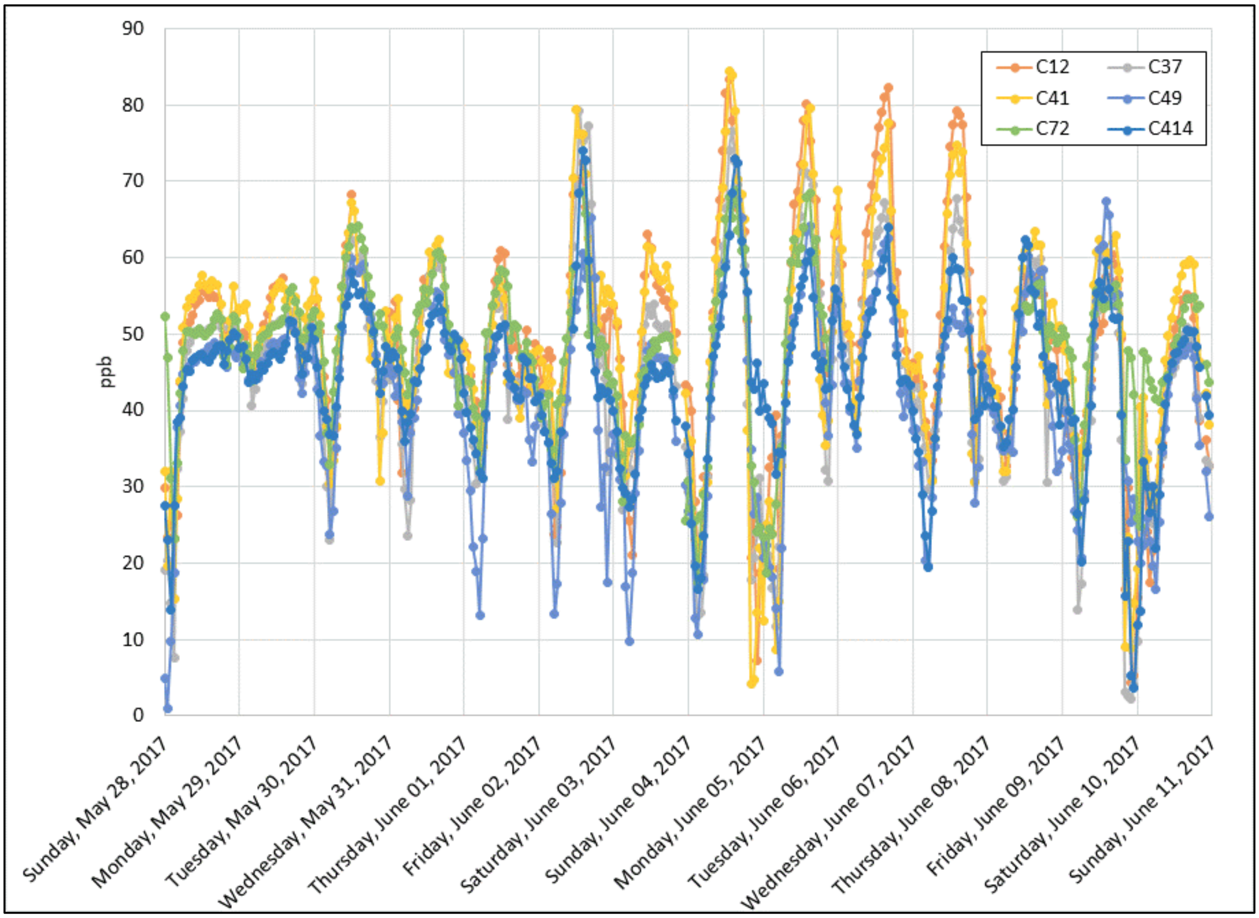


Figure 50 El Paso RWP data from June 1, 2017, southwesterly winds

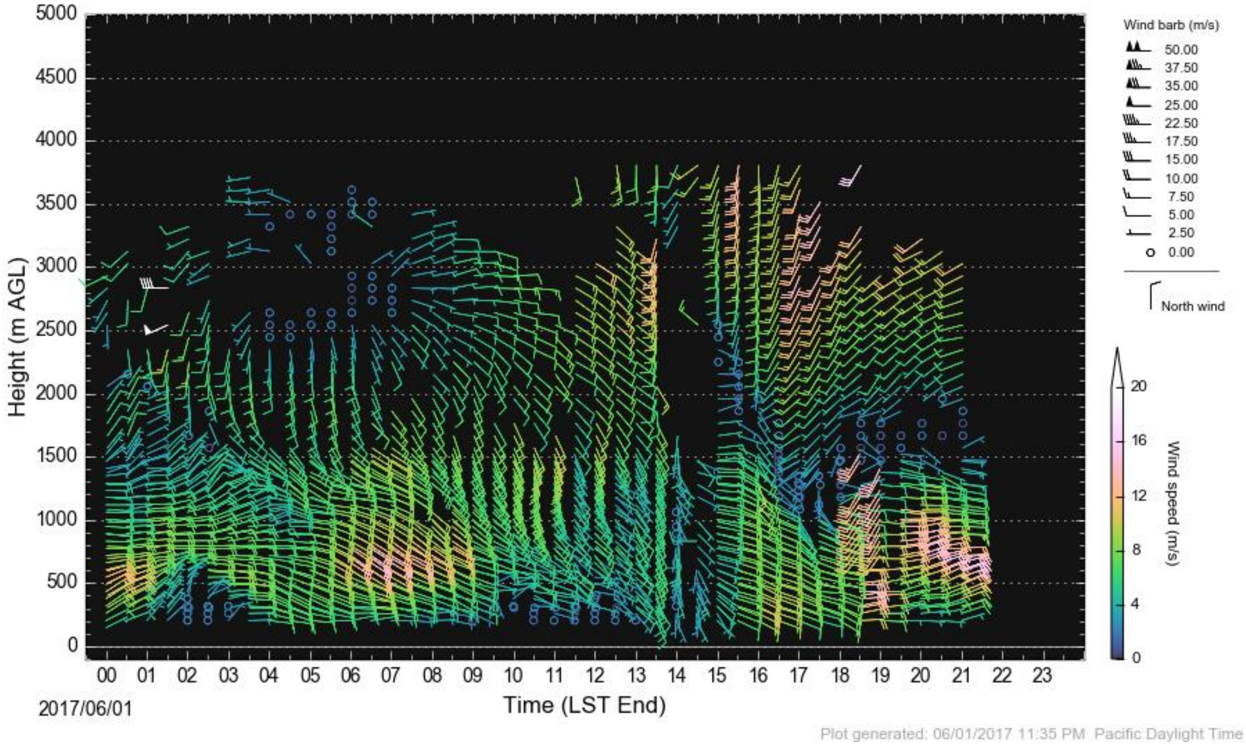


Figure 51 El Paso ceilometer cloud height BL height on June 1, 2017, with afternoon clouds

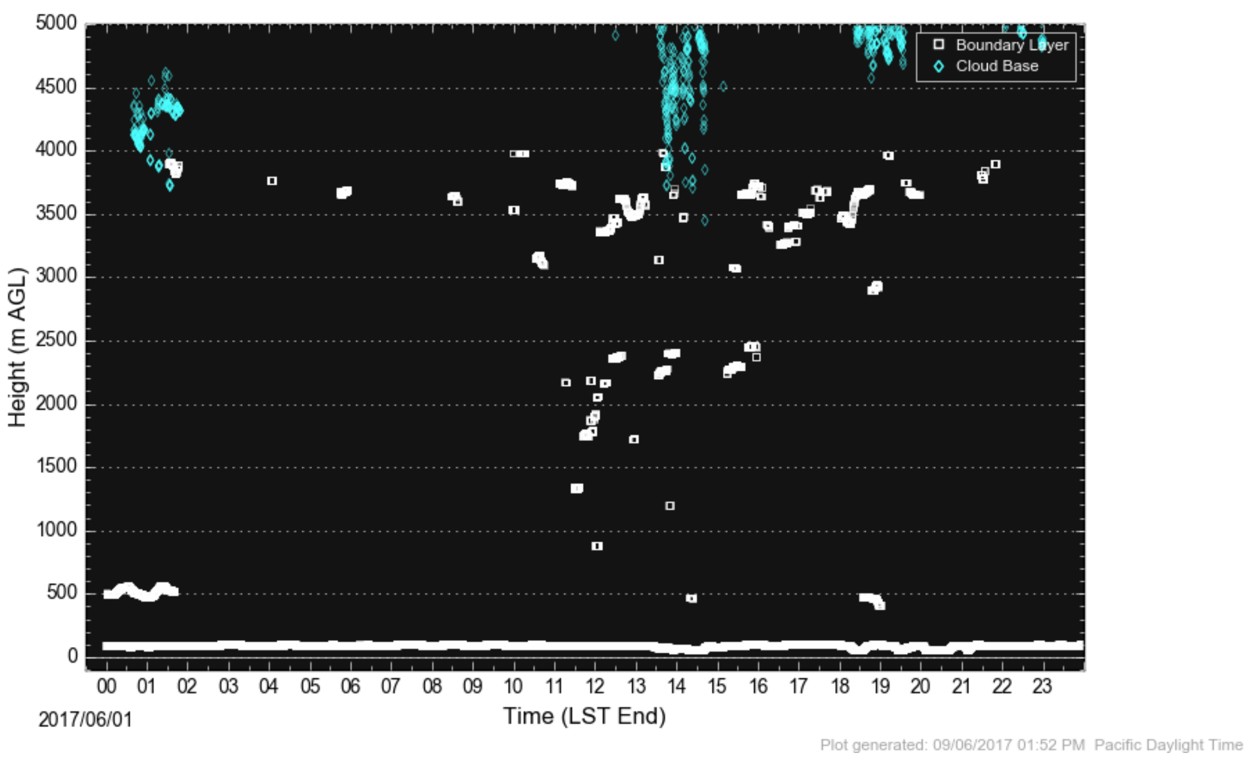


Figure 52 El Paso RWP data from June 2, 2017, stagnant afternoon winds

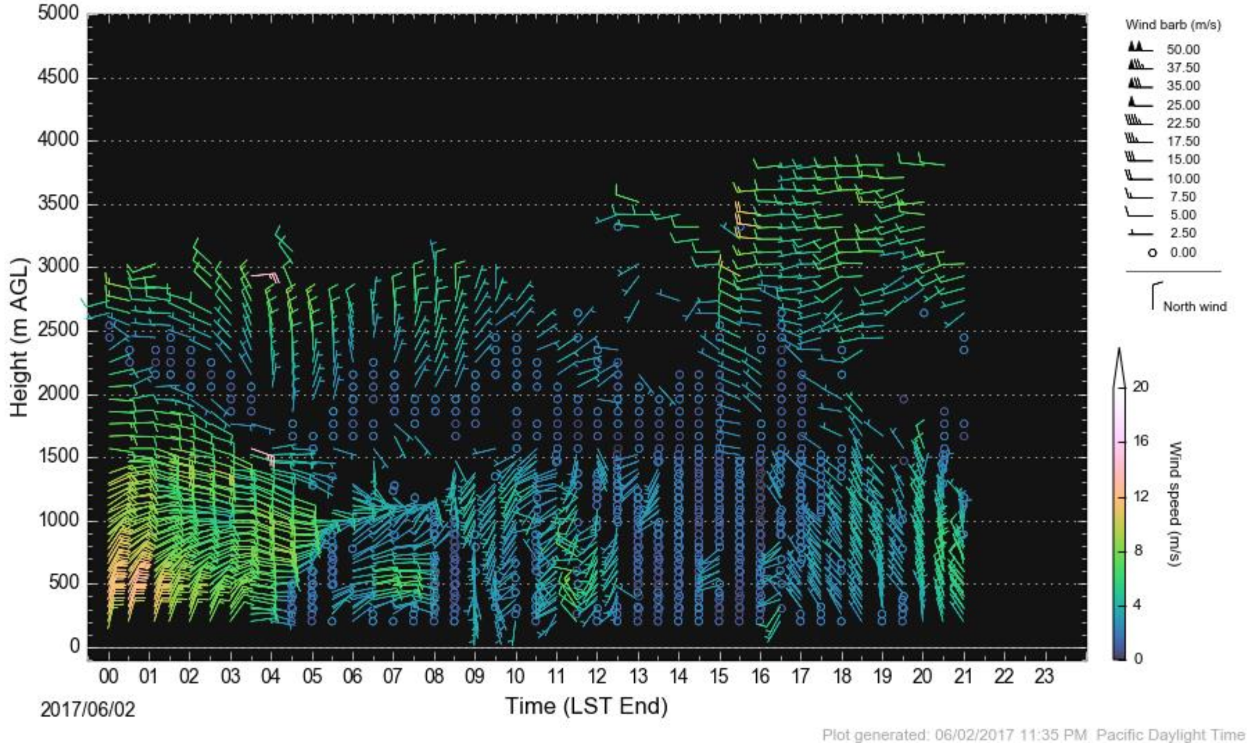


Figure 53 El Paso ceilometer cloud height BL height on June 2, 2017, with afternoon clouds

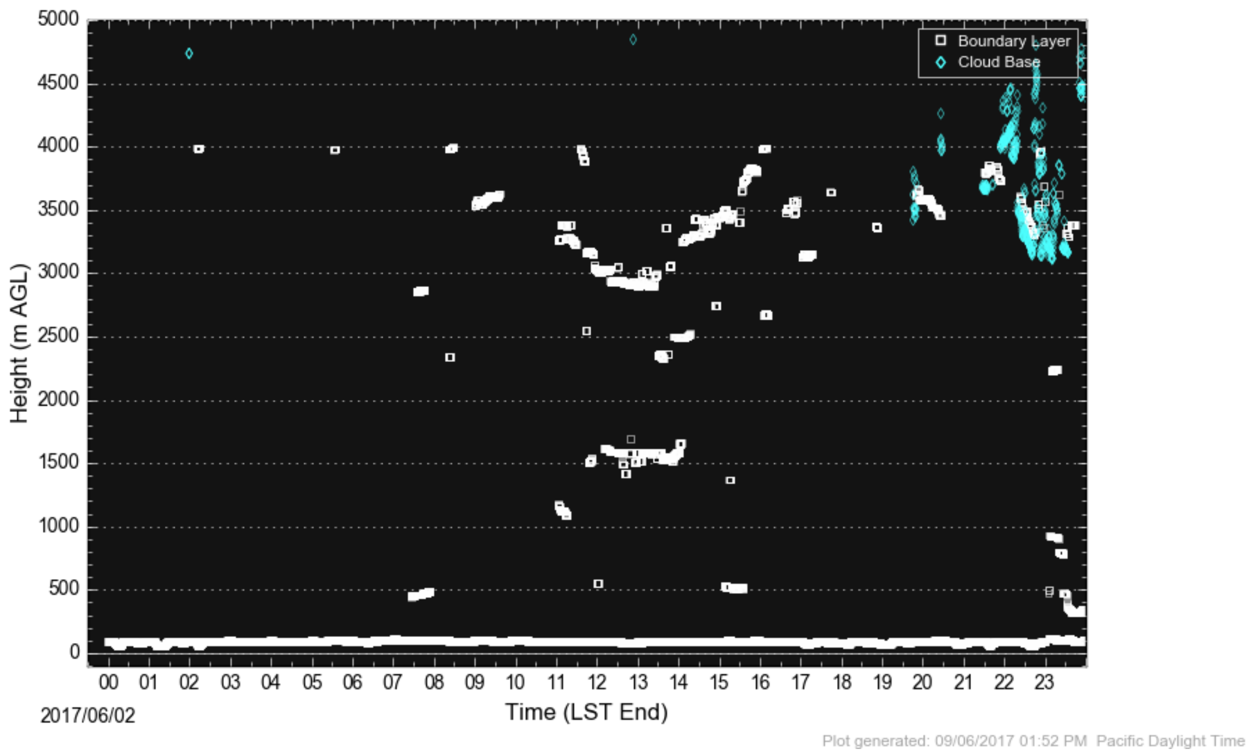


Figure 54 El Paso RWP data from June 3, 2017, light and variable winds

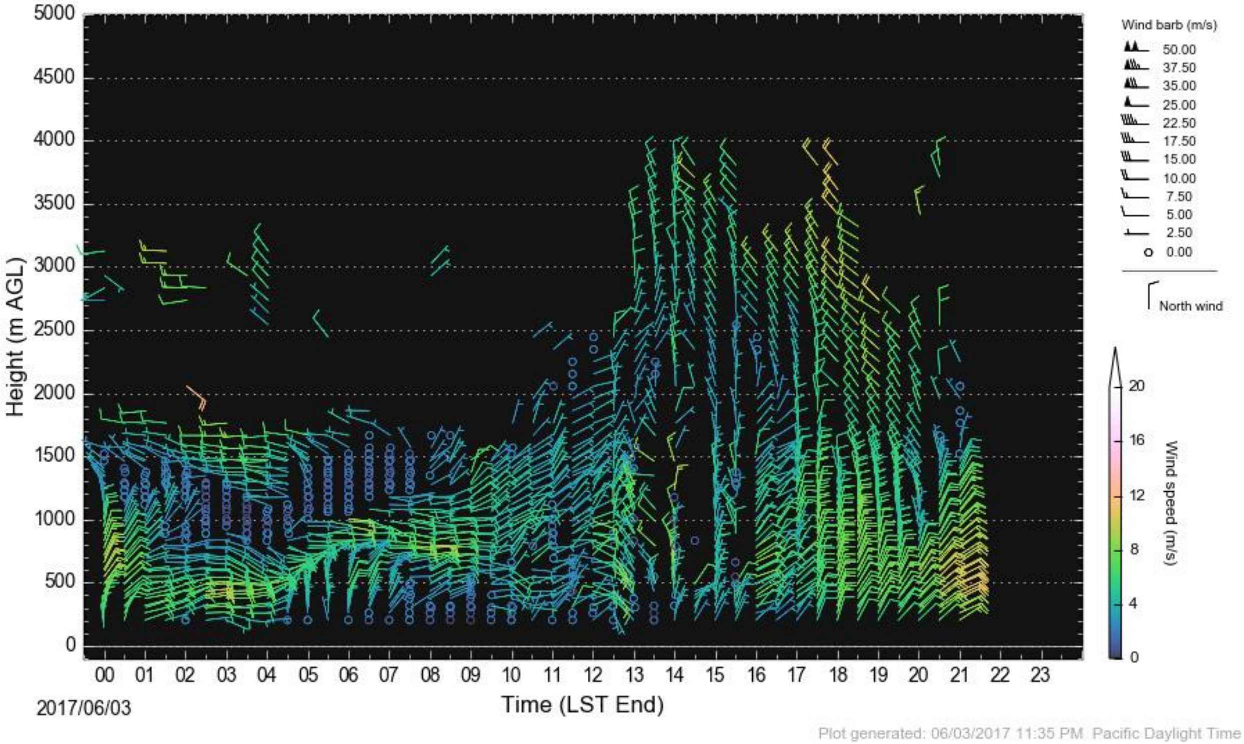


Figure 55 El Paso ceilometer cloud height BL height on June 3, 2017, with afternoon clouds

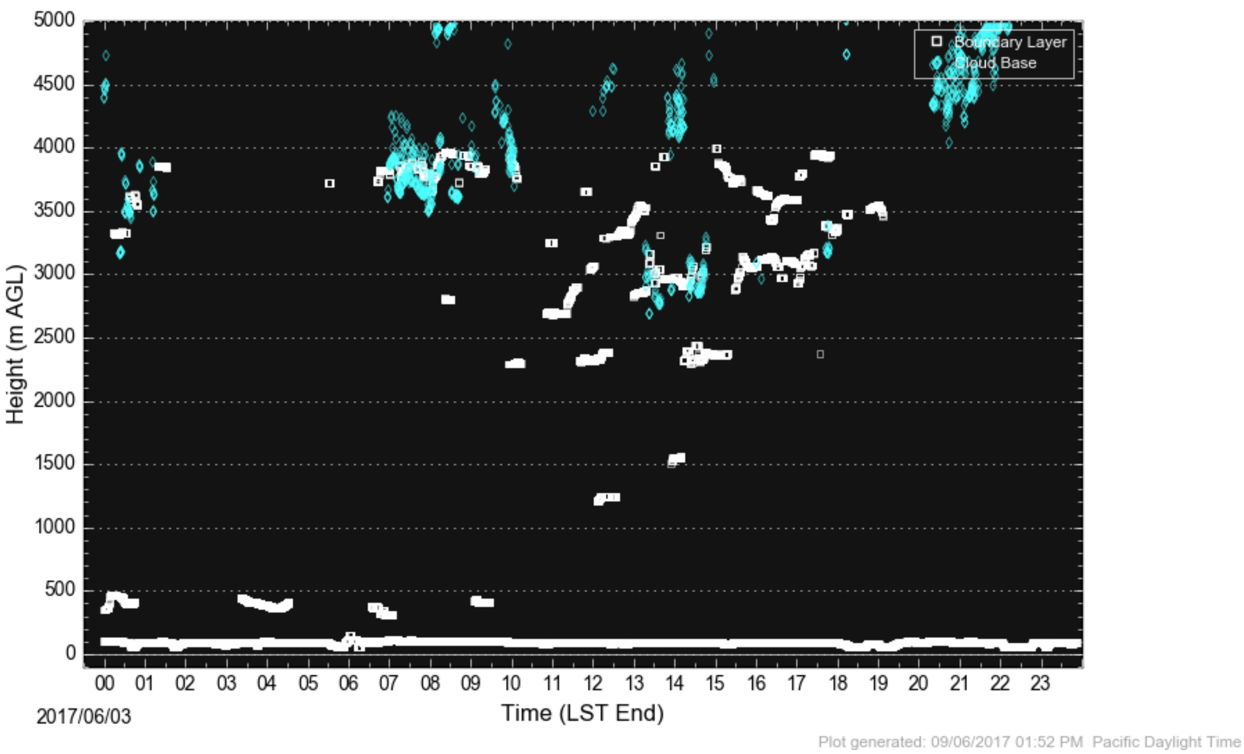


Figure 56 El Paso RWP data from June 4, 2017, light and variable winds

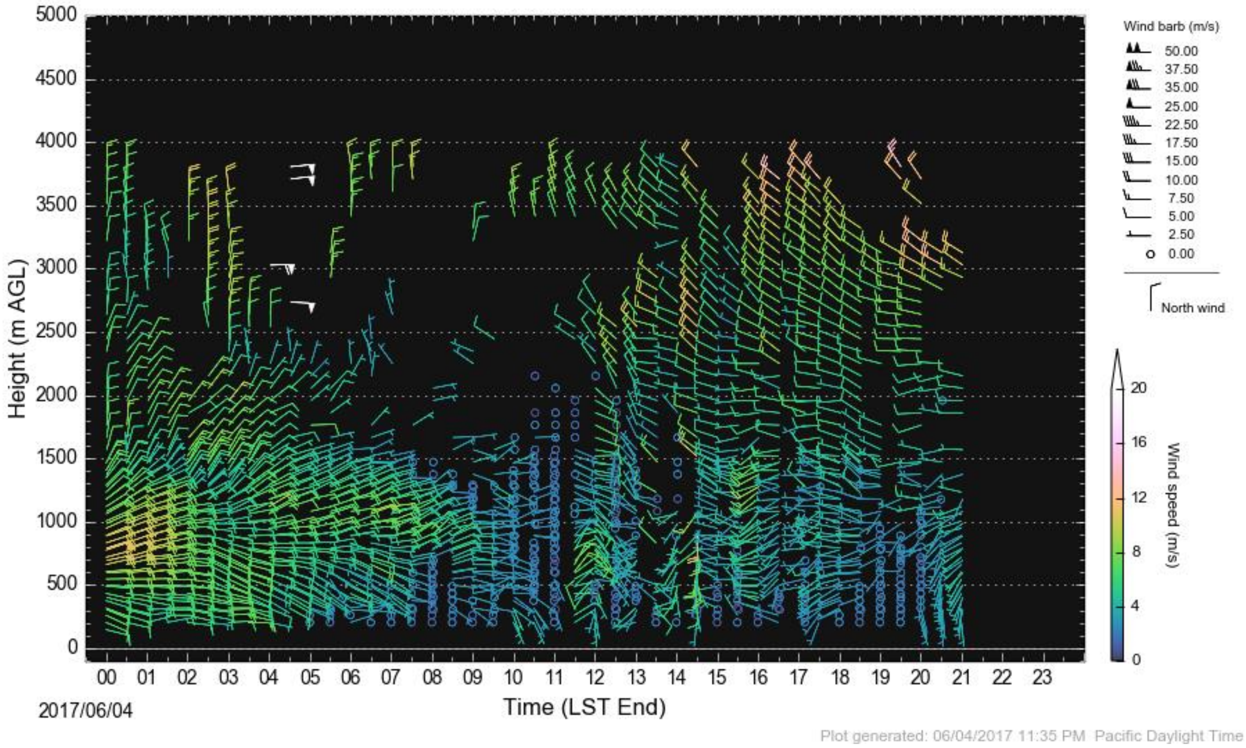


Figure 57 El Paso ceilometer cloud height BL height on June 4, 2017, with afternoon clouds

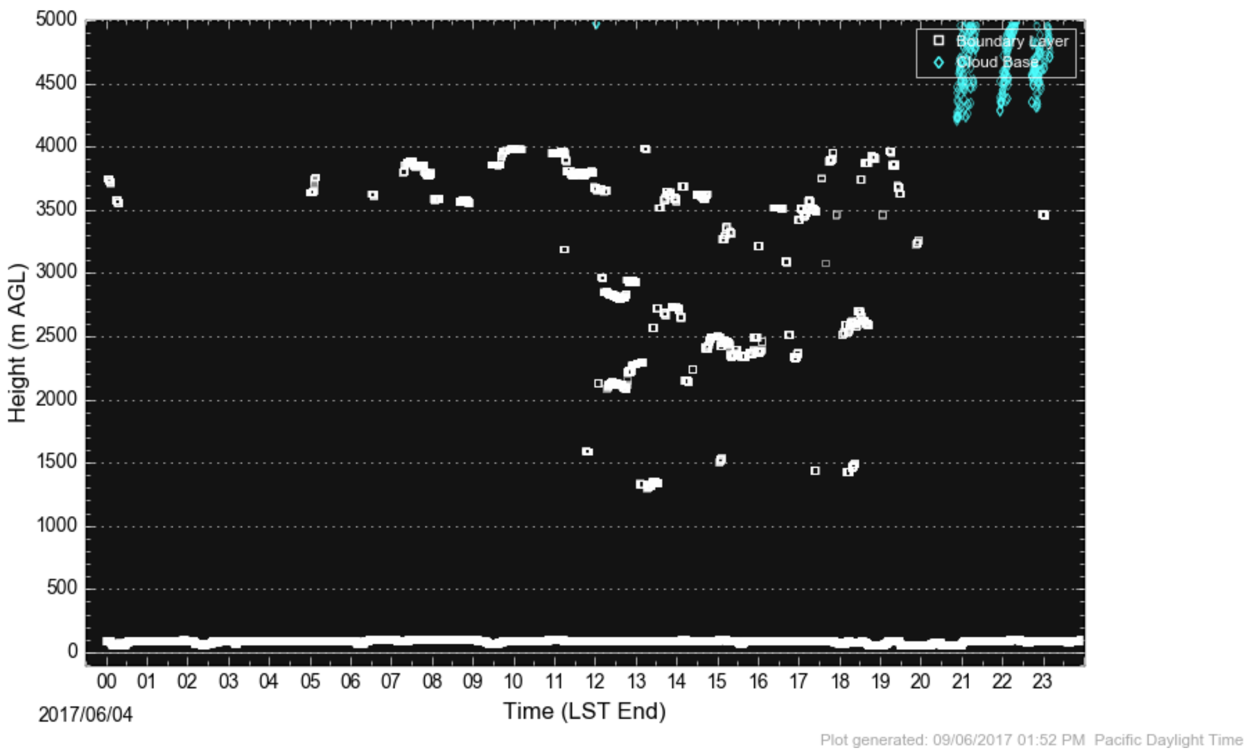


Figure 58 El Paso RWP data from June 5, 2017, stagnant winds

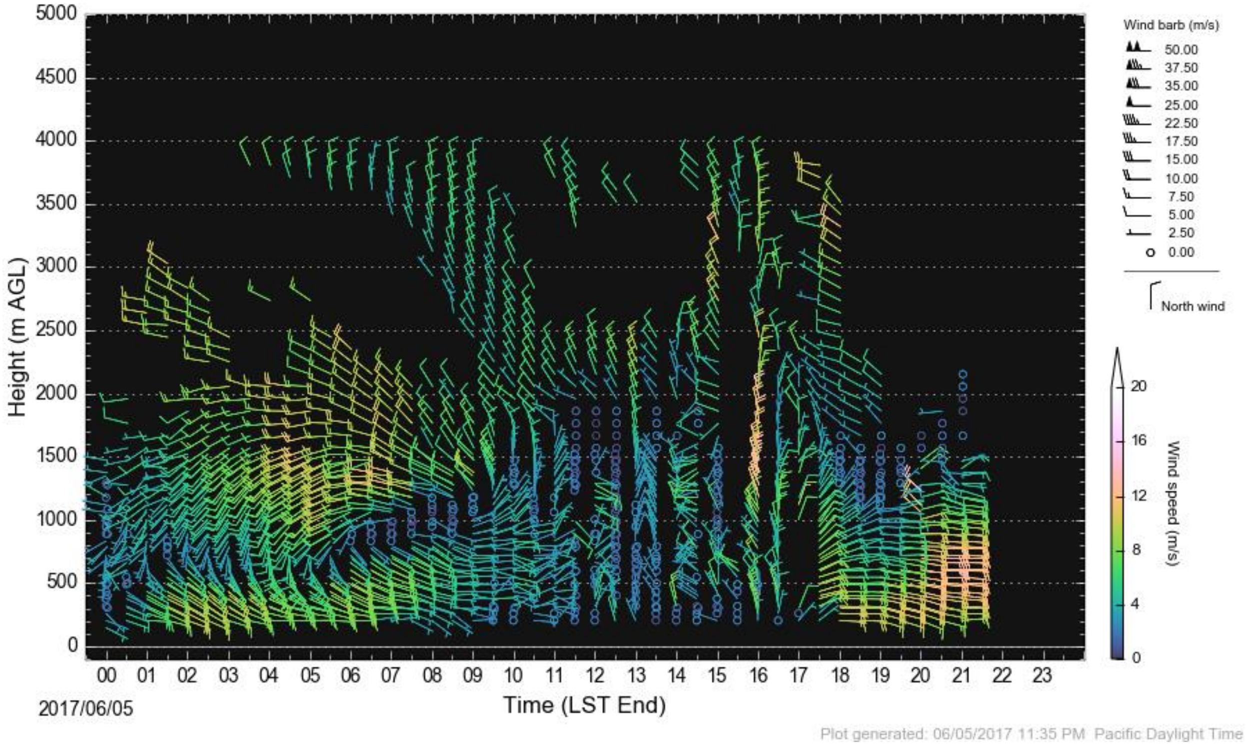


Figure 59 El Paso ceilometer cloud height BL height on June 5, 2017, with afternoon clouds

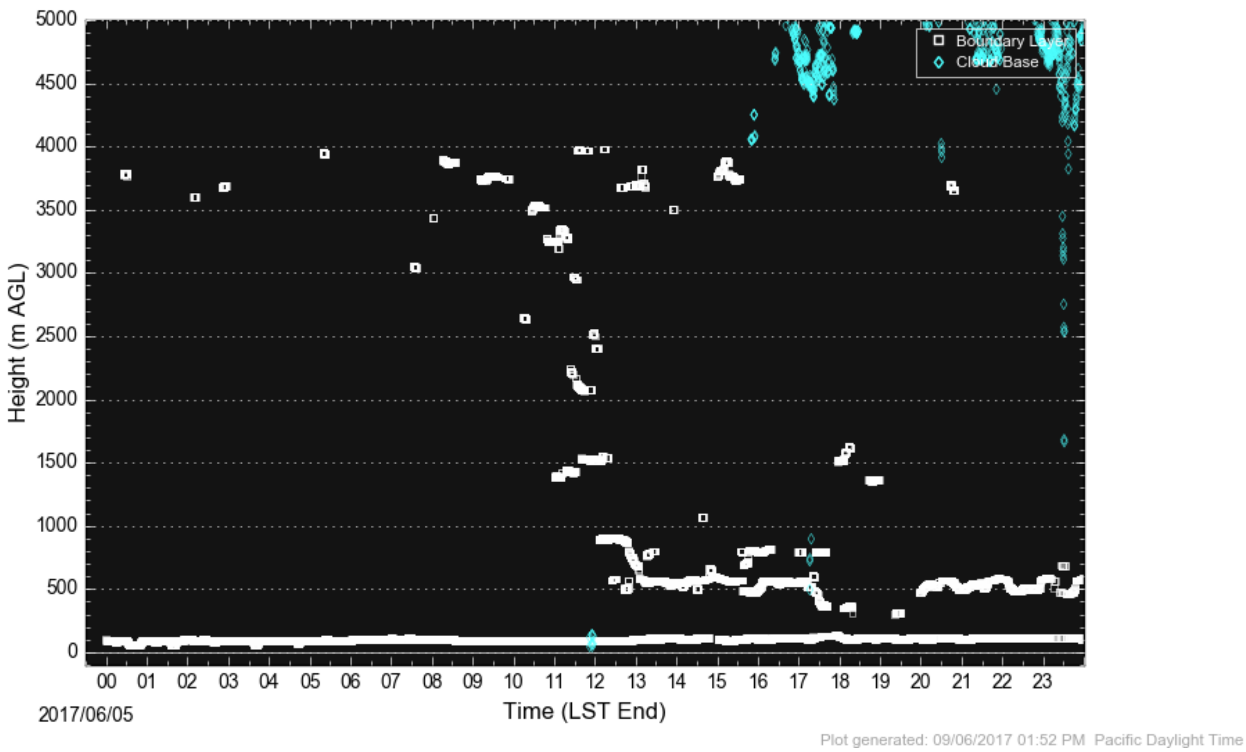


Figure 60 El Paso RWP data from June 6, 2017, light and variable winds

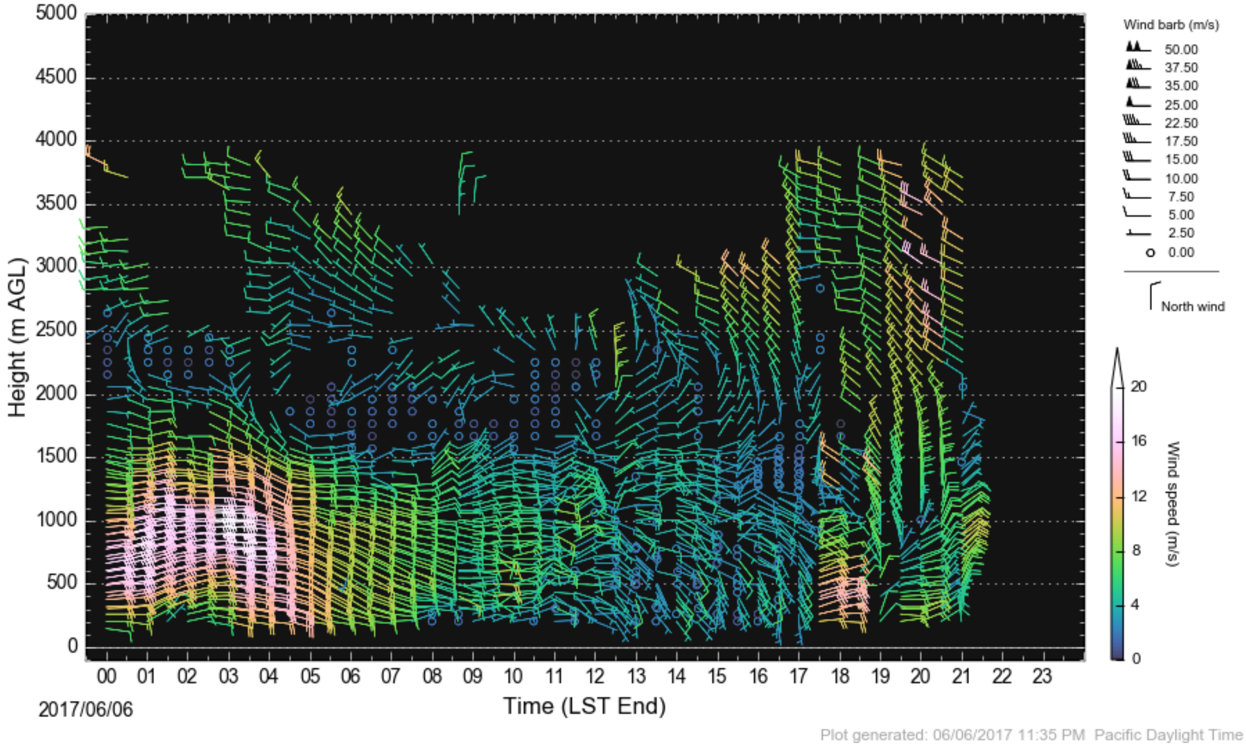


Figure 61 El Paso ceilometer cloud height BL height on June 6, 2017, with afternoon clouds

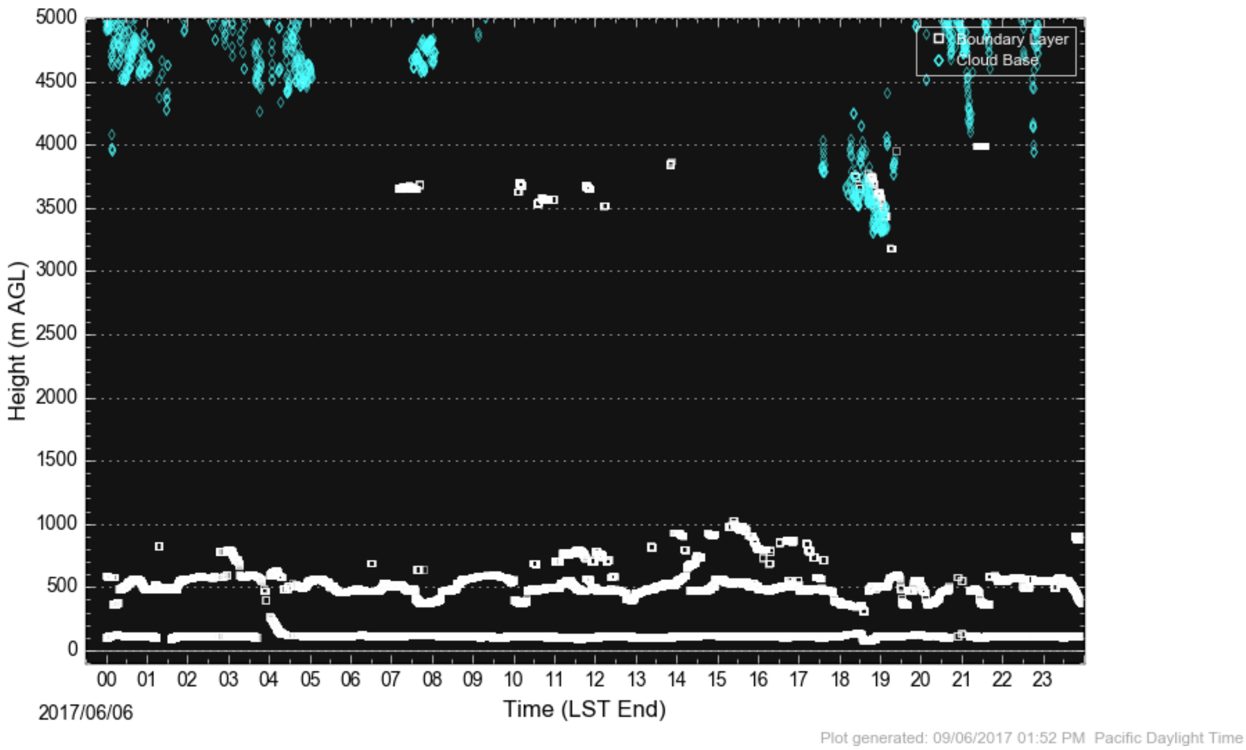


Figure 62 El Paso RWP data from June 7, 2017, light and variable winds

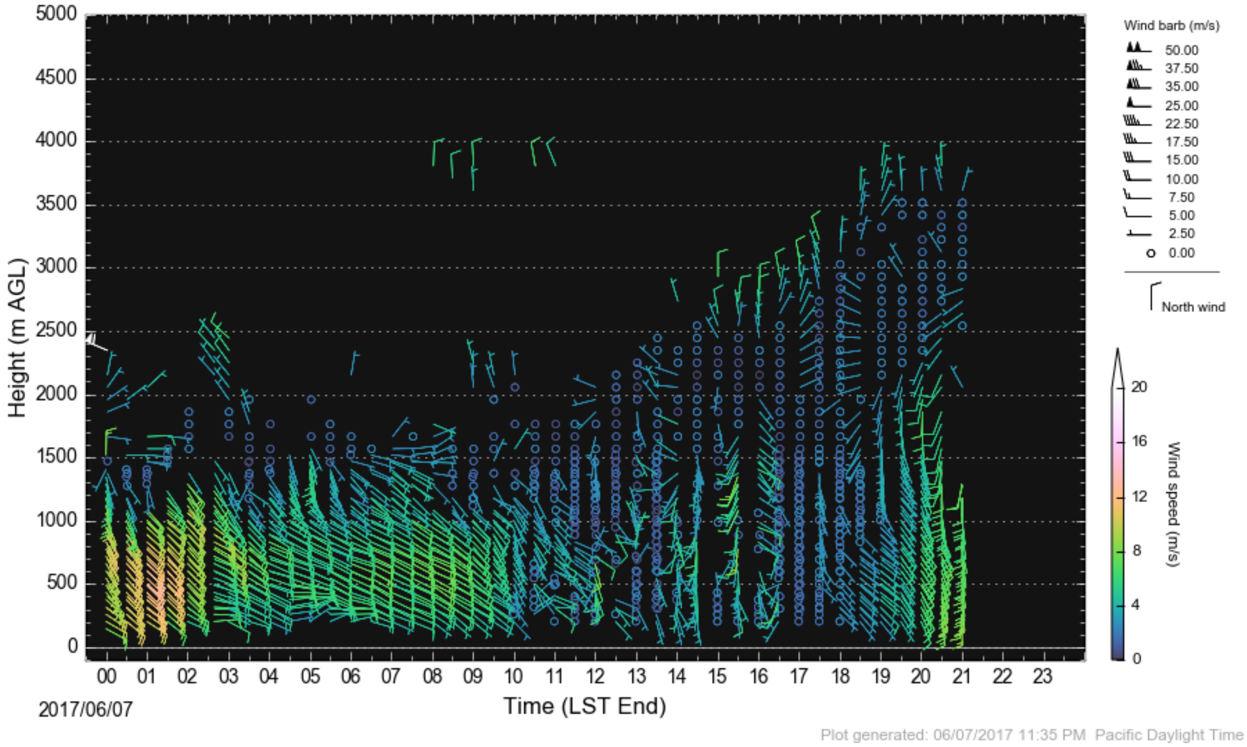


Figure 63 El Paso ceilometer cloud height BL height on June 7, 2017, with afternoon clouds

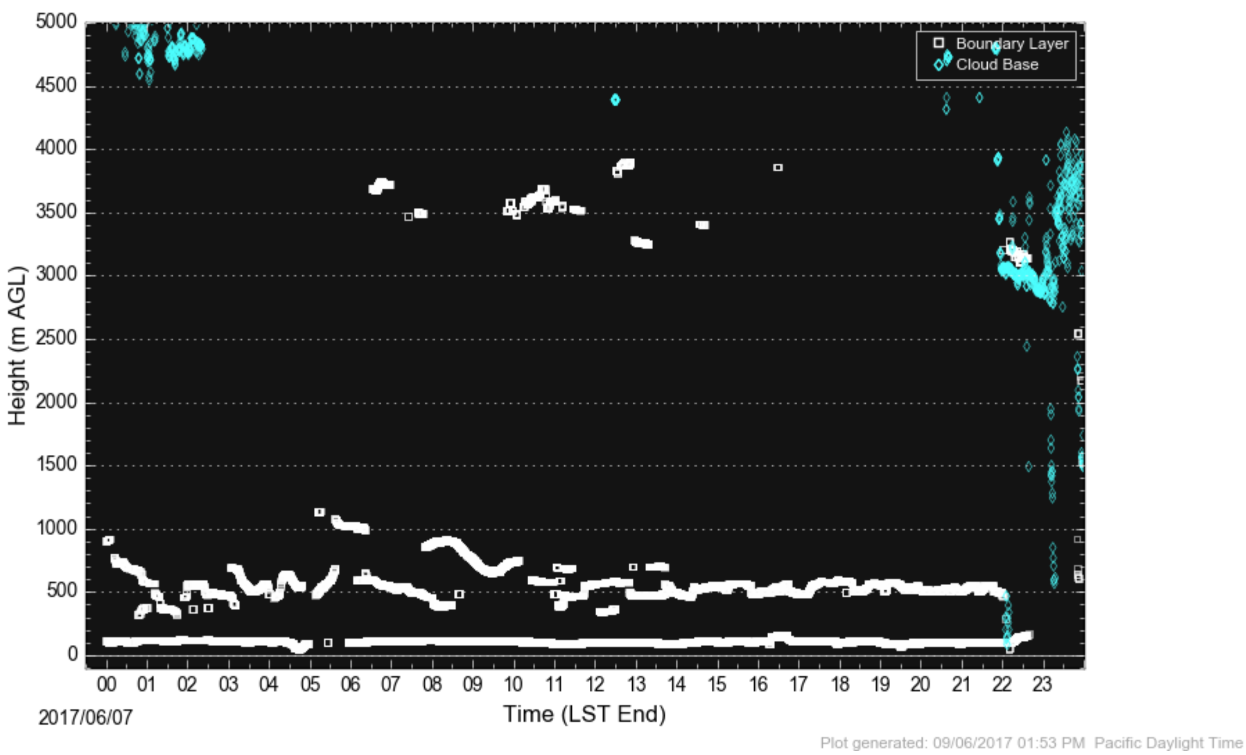


Figure 64 El Paso RWP data from June 8, 2017, light and variable winds

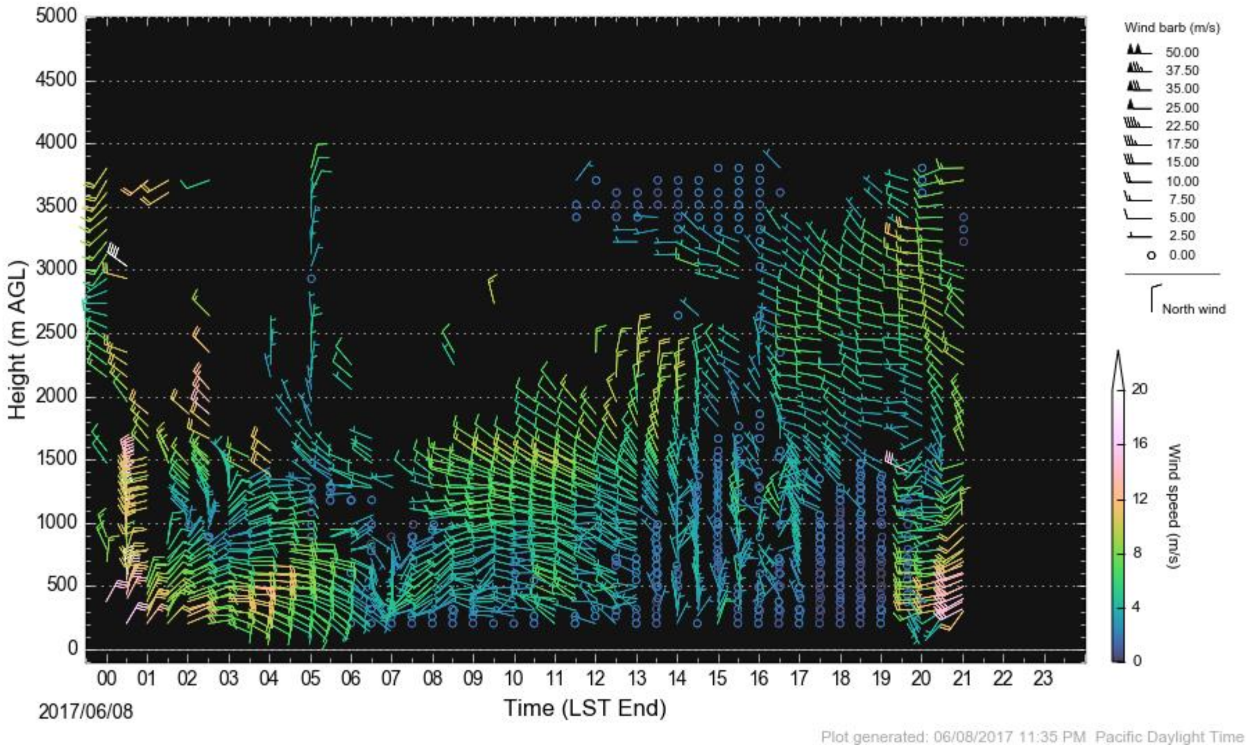
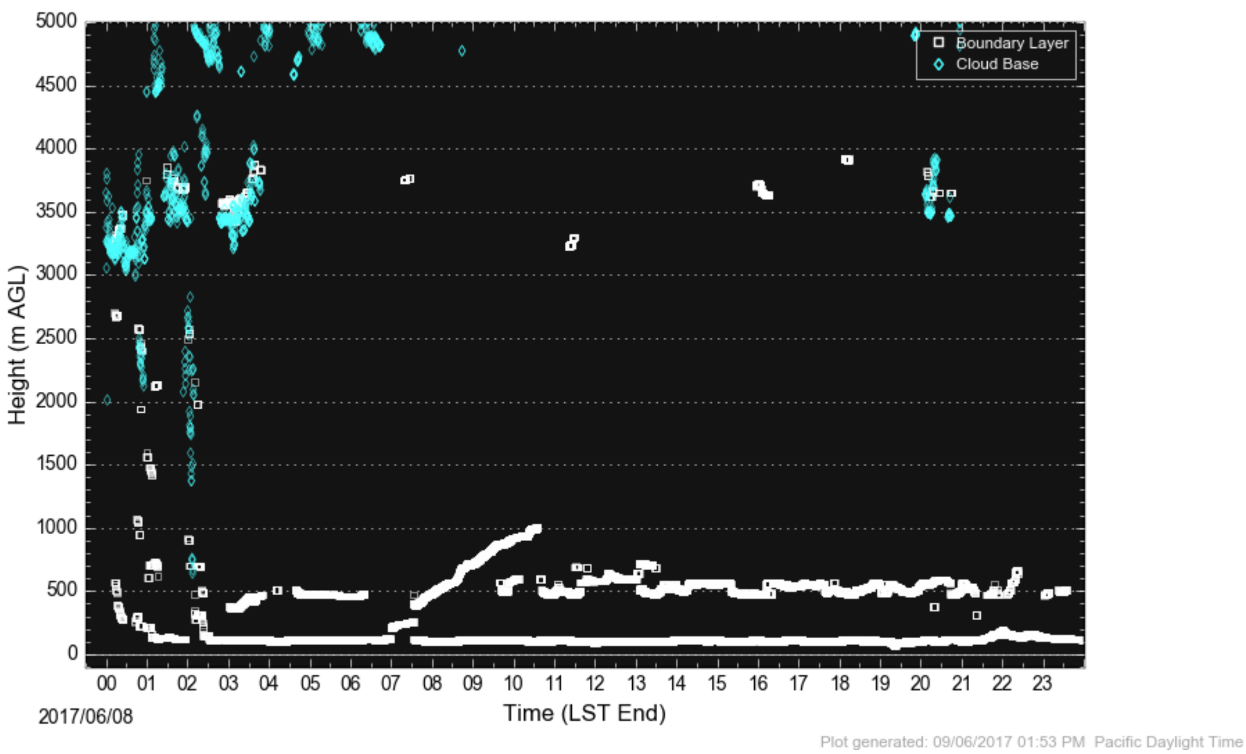


Figure 65 El Paso ceilometer cloud height BL height on June 8, 2017, with afternoon clouds



5. Conclusion

STI has agreed to maintain the operation of the upper air equipment at Socorro Hueco CAMS 49.

Additional case studies may be done upon request. If more data are made available during the data quality assurance process then this report may be updated at no cost to the client.