

# El Paso, Texas blowing dust events from 2000-2019

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## Dust Event

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- Meteorological phenomenon where strong winds pick up loose particles and transport them far away from the source
- Mostly occur in arid and semi-arid environments

## Hazards

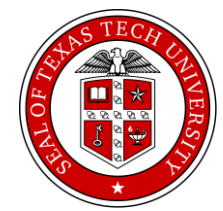
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- Blow dust can cause many hazards including
  - Travel interruption
  - Damage to property
  - Health problems

## Meteorological Disturbances

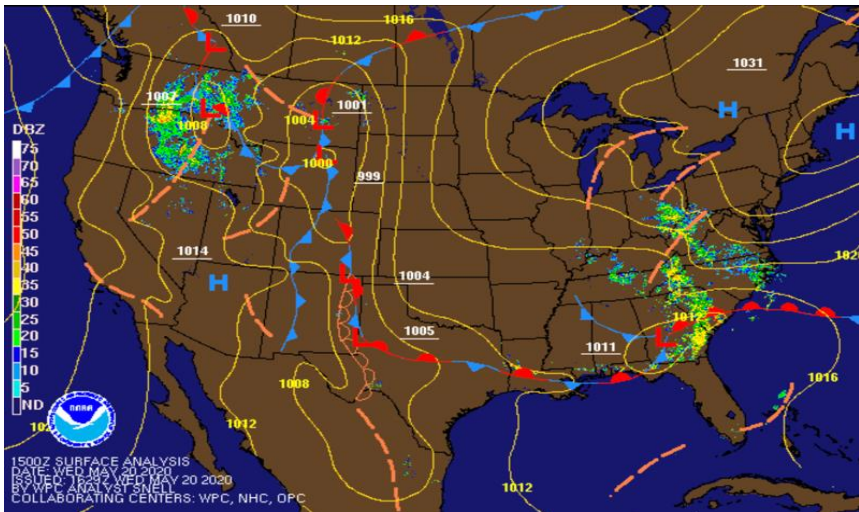
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- The increase in wind speeds are a result of two different types of meteorological disturbances:
  - Synoptic
  - Convective



# Synoptic

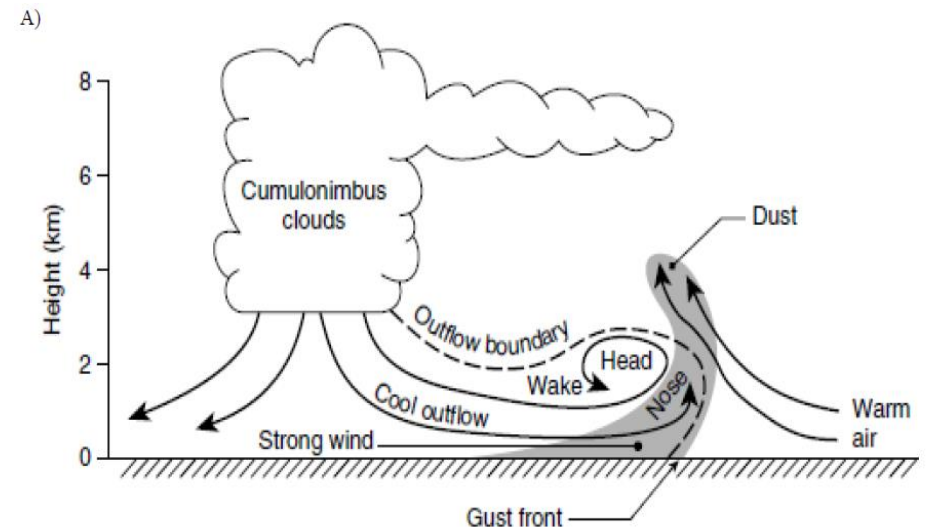
- Upper-level meteorological disturbance
- Includes frontal systems (warm and cold), cyclones (low and high), troughs and ridges



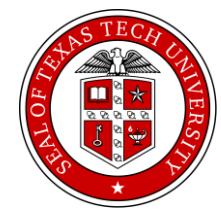
NOAA NWS Archive, 2020

# Convective

- Rapid increase of wind speed due to nearby thunderstorms
- Includes outflow boundaries, downbursts, micro- and macrobursts

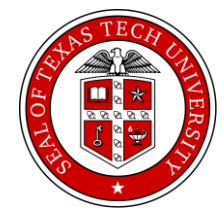


Goudie and Middleton, 2003



# Methods

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# Research Area



# Identification of blowing dust events

- METeorological Aerodrome Reports (METARs) from the local NWS from 2000-2019
  - Meteorological measurements taken by an ASOS station
- Present Weather Codes
  - BLDU
  - DU
  - DS

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ELP,2005-04-09 16:51,78.08,24.98,13.97,260.00,20.00,M,29.58,995.30,4.00,33.00,CLR, , ,M,M,M,M,M,BLDU,M,M,M,M,M,M,76.24,METAR KELP 092151Z 26020G33KT 4SM BLDU
CLR 26/M04 A2958 RMK AO2 PK WND 23036/2105 SLP953 MTNS OBSCD SW-NW T02561039 $,M
ELP,2005-04-09 17:51,77.00,28.94,17.04,260.00,28.00,M,29.56,995.10,4.00,41.00,CLR, , ,M,M,M,M,M,BLDU,M,M,M,M,M,M,75.20,METAR KELP 092251Z 26028G41KT 4SM BLDU
CLR 25/M02 A2956 RMK AO2 PK WND 26043/2218 SLP951 MTNS OBSCD SW-NW T02501017 $,M
ELP,2005-04-09 18:51,75.02,35.96,24.14,250.00,27.00,M,29.56,995.10,5.00,42.00,CLR, , ,M,M,M,M,M,BLDU,M,M,M,M,M,M,73.36,METAR KELP 092351Z 25027G42KT 5SM BLDU
CLR 24/02 A2956 RMK AO2 PK WND 27043/2318 SLP951 MTNS OBSCD SW-NW T02390022 10267 20228 56015 $,M
ELP,2005-04-09 19:51,71.96,37.94,28.94,260.00,28.00,M,29.58,995.90,6.00,41.00,CLR, , ,M,M,M,M,M,BLDU,M,M,M,M,M,M,70.22,METAR KELP 100051Z 26028G41KT 6SM BLDU
CLR 22/03 A2958 RMK AO2 PK WND 26042/0008 SLP959 MTNS OBSCD SW T02220033 $,M
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# Identification of meteorological cause

- Area Forecast Discussions from the local NWS were used in determining the meteorological cause for each dust event
  - Present Weather Code from METARs was used for confirming convective.

## Synoptic:

- Front
- Low PS
- Trough
- Jet

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000
FXUS64 KEPZ 200923
AFDELP

AREA FORECAST DISCUSSION
NATIONAL WEATHER SERVICE EL PASO TX/SANTA TERESA NM
220 AM MST MON MAR 20 2000

SYNOPSIS...
A VERY STRONG PACIFIC STORM SYSTEM NEAR THE GREAT BASIN WILL MOVE
SOUTH INTO ARIZONA TODAY. AS IT DOES...STRONG SURFACE LOW PRESSURE
WILL DEVELOP NEAR THE FOUR CORNERS AREA AND THIS WILL ALLOW STRONG
AND GUSTY WINDS TO DEVELOP ACROSS ALL OF NEW MEXICO AND WEST TEXAS.

A WIND ADVISORY REMAINS IN EFFECT FOR THIS AFTERNOON FOR ALL OF
SOUTHWESTERN AND SOUTHCENTRAL NEW MEXICO AND FAR WEST TEXAS. WINDS
WILL DIMINISH OVERNIGHT TONIGHT AS THE SURFACE LOW WEAKENS AND
MOVES WESTWARD INTO ARIZONA. THE STORM SYSTEM OVER ARIZONA WILL
BEGIN TO PUSH MOISTURE INTO THE REGION TODAY WITH A SLIGHT CHANCE
OF SHOWERS DEVELOPING TONIGHT ALONG THE ARIZONA AND NEW MEXICO
BORDER WITH SLIGHT CHANCES OF SHOWERS SPREADING EASTWARD ON TUESDAY.
TEMPERATURES TODAY WILL BE EIGHT TO TWELVE DEGREES ABOVE
TEMPERATURES ON SUNDAY. TEMPERATURES WILL BE LOWER ON TUESDAY DUE
TO OUR PROXIMITY TO THE STORM SYSTEM.
    
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000 station,valid,wxcodes
FXUS64 KEPZ ELP,2001-06-23 00:51,M
AFDELP ELP,2001-06-23 01:51,M
AREA FORECAST ELP,2001-06-23 02:51,M
NATIONAL WE ELP,2001-06-23 03:51,M
103 PM MDT S ELP,2001-06-23 04:51,M
ELP,2001-06-23 05:51,M
SYNOPSIS... ELP,2001-06-23 06:51,M
HIGH PRESSUR ELP,2001-06-23 07:51,M
DAYS. DAYTIM ELP,2001-06-23 08:51,M
MOISTURE UN ELP,2001-06-23 09:51,M
MOUNTAIN TH ELP,2001-06-23 10:51,M
NEAR OR SLIC ELP,2001-06-23 11:51,M
ELP,2001-06-23 12:51,M
DISCUSSION.. ELP,2001-06-23 13:51,M
NOT TOO MUC ELP,2001-06-23 14:51,M
FORECAST PE ELP,2001-06-23 15:51,M
MORE TO THE ELP,2001-06-23 16:51,M
OVER NEW ME ELP,2001-06-23 17:51,M
UNDER THE HJ ELP,2001-06-23 18:51,M
SOURCE OF EN ELP,2001-06-23 19:51,M
AFTERNOON HE ELP,2001-06-23 20:51,-TSRA BLDU
THE AREA TO ELP,2001-06-23 21:51,M
DEVELOPMENT. ELP,2001-06-23 22:51,M
NIGHT WITH A ELP,2001-06-23 23:51,M
SHOULD INCR ELP,2001-06-23
SHOWERS...ES ELP,2001-06-23
TUESDAY. BY ELP,2001-06-23
AND SHUT OFF
WILL CONTINUE FOR THE REST OF THE WEEK.
    
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THE NEXT SEVERAL
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WILL SHIFT BACK
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IF THUNDERSTORMS
    
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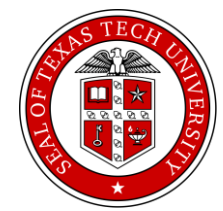
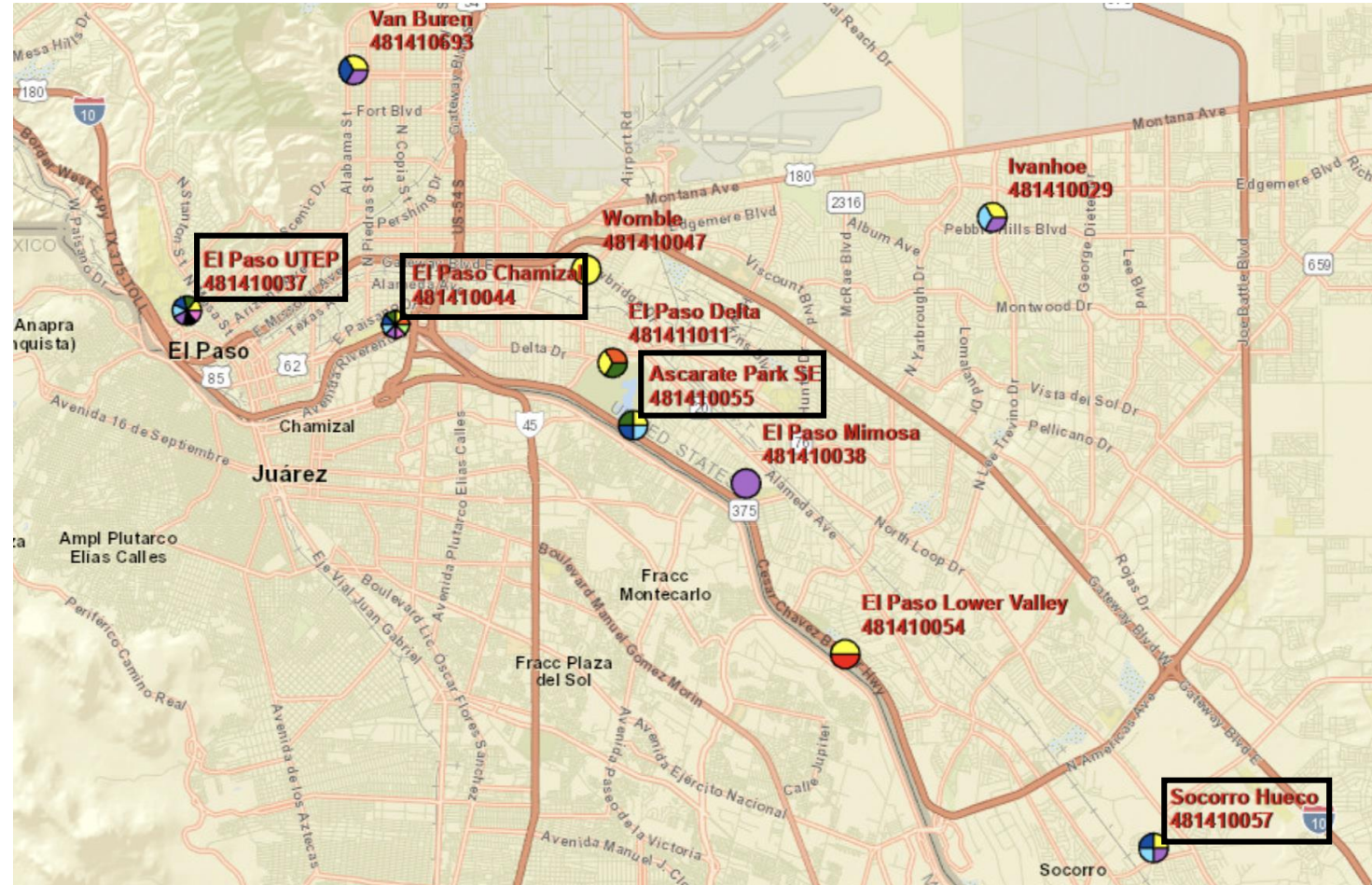
## Convective:

- SQ
- TS
- RA



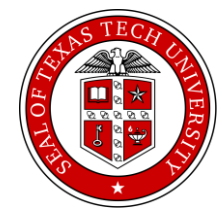
# Particulate matter data collection (PM<sub>10</sub> and PM<sub>2.5</sub>)

- Texas Commission on Environmental Quality (TCEQ) ([www.tceq.texas.gov](http://www.tceq.texas.gov))
- Hourly PM<sub>10</sub> and PM<sub>2.5</sub> concentrations (2000-2019)



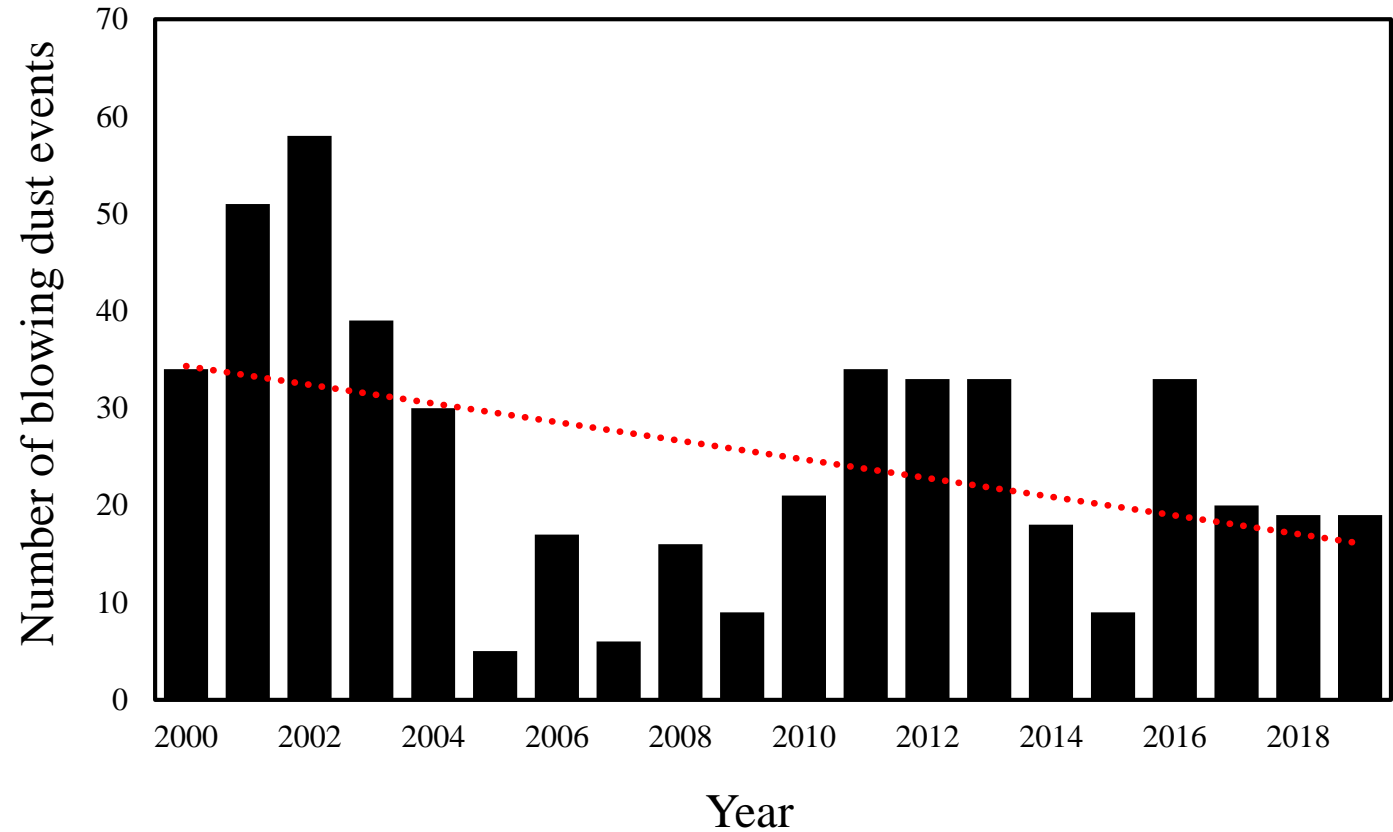
# Results

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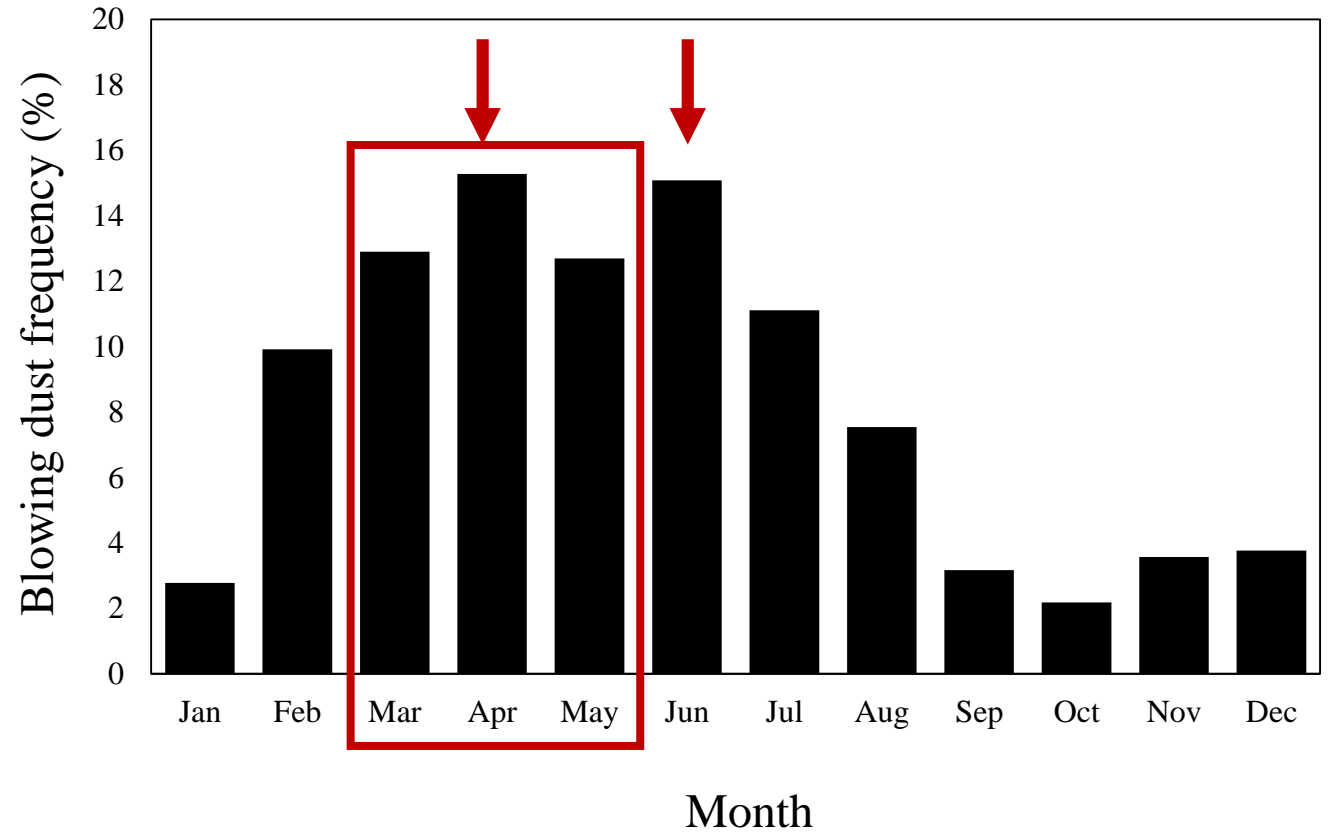
# Blowing dust events in El Paso

- 458 blowing dust events
- 3,385 dust codes
  - 3,293 BLDU
  - 36 DU
  - 56 DS
- $R^2 = 0.1567$



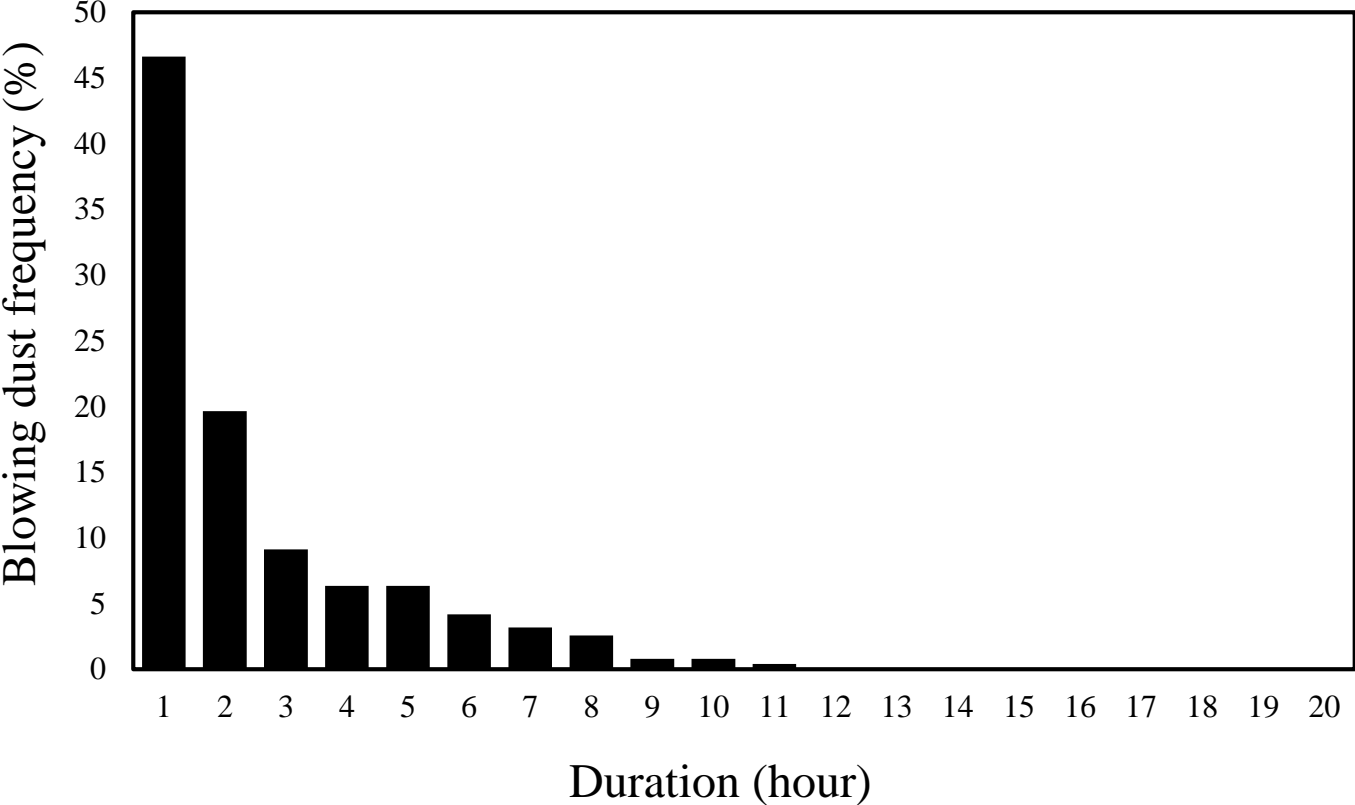
# Temporal changes of blowing dust events in El Paso

- Highest frequency in April (15.3%)
- June (15.1%) closely follows April
- Majority during Spring



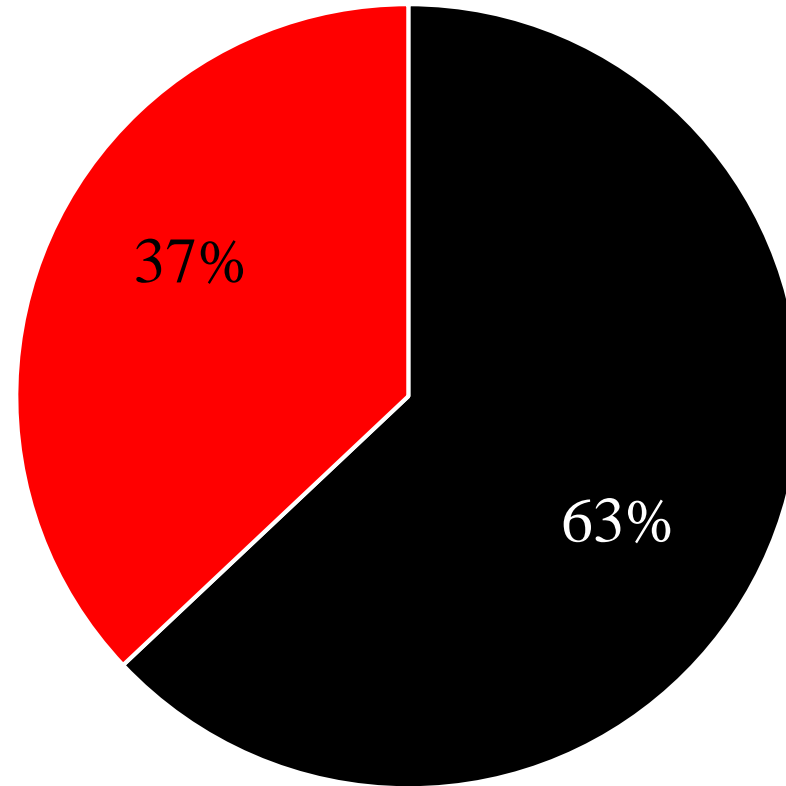
# Duration of blowing dust events in El Paso

- Predominantly two hours or less
- 46.6% were one hour or less



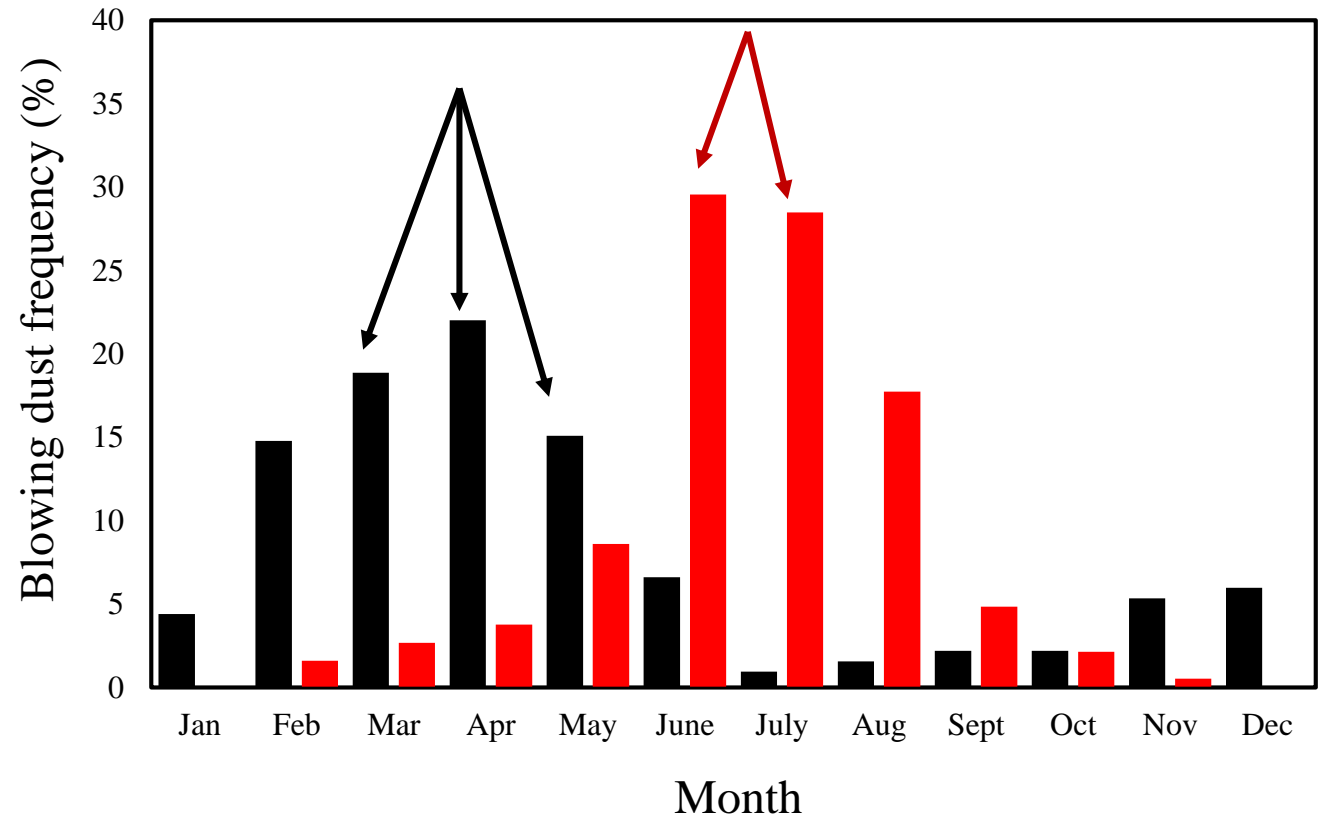
# Meteorological disturbances of blowing dust events in El Paso

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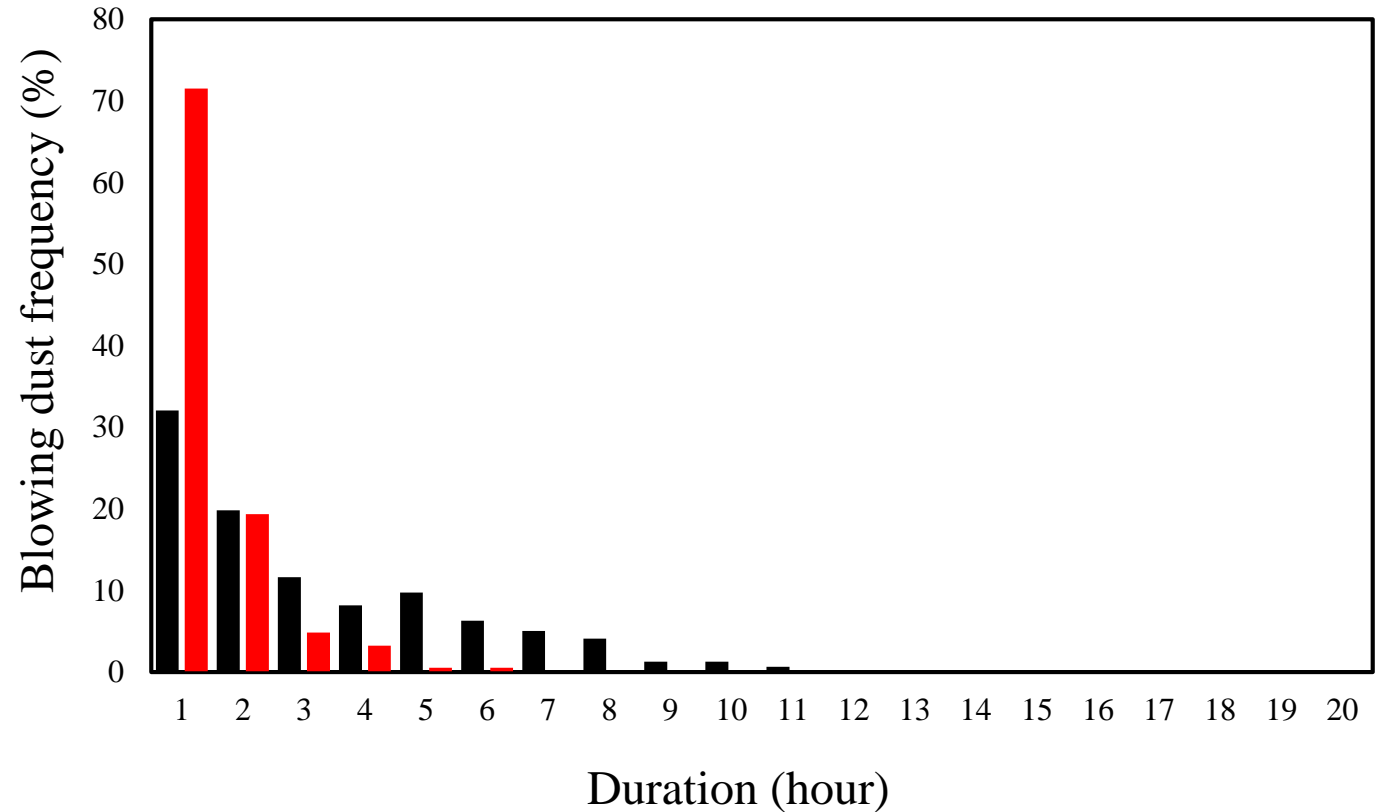
# Temporal Changes of blowing dust event in El Paso by meteorological disturbance

- Synoptic predominantly in spring
- Convective predominantly in summer

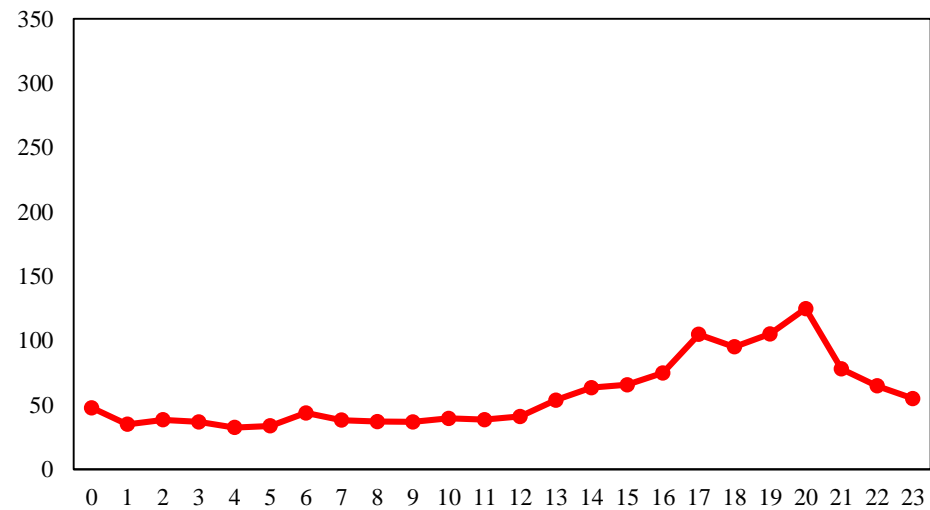
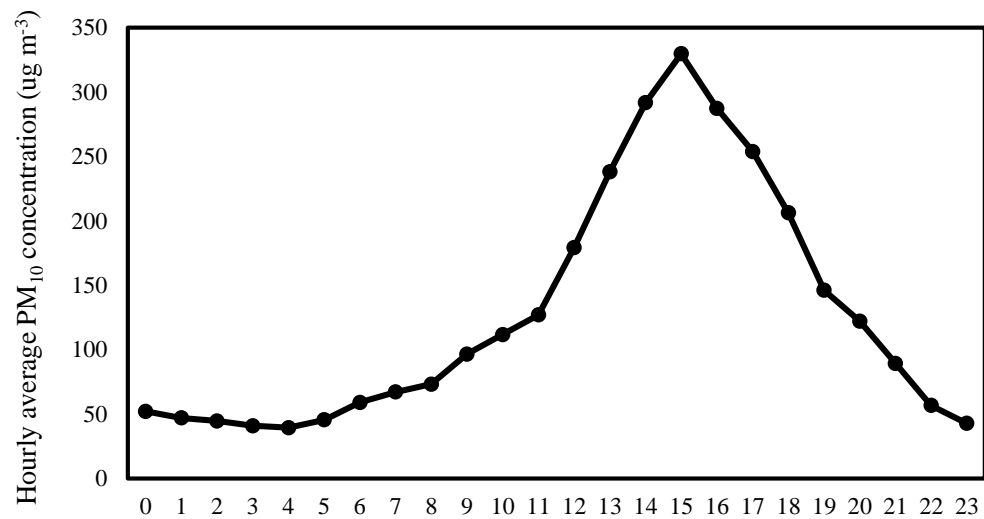
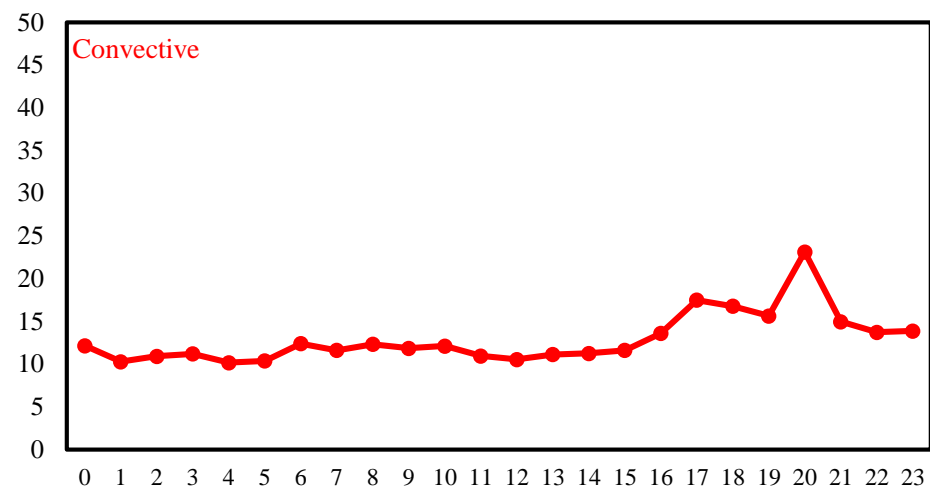
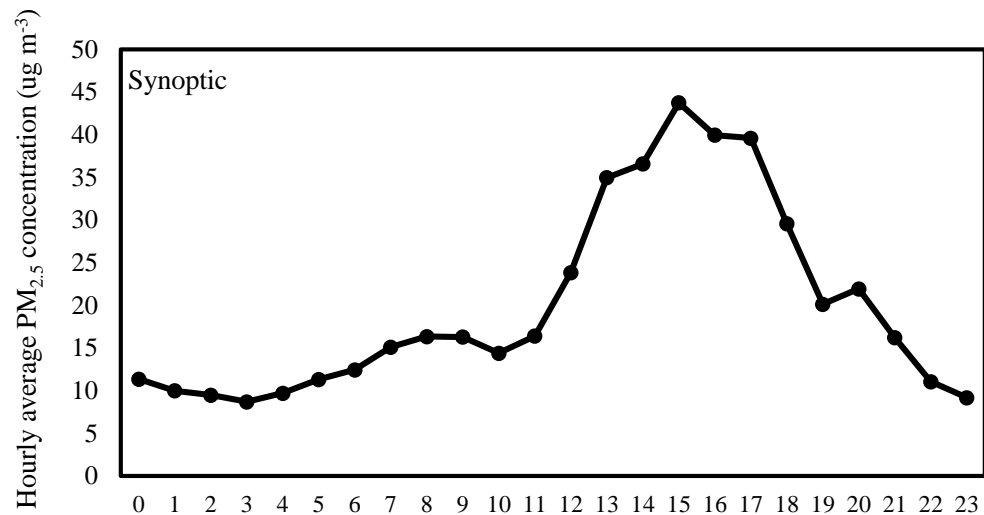


# Duration of blowing dust in El Paso by meteorological disturbance

- Most convective dust events were one hour or less but synoptic dust events last much longer



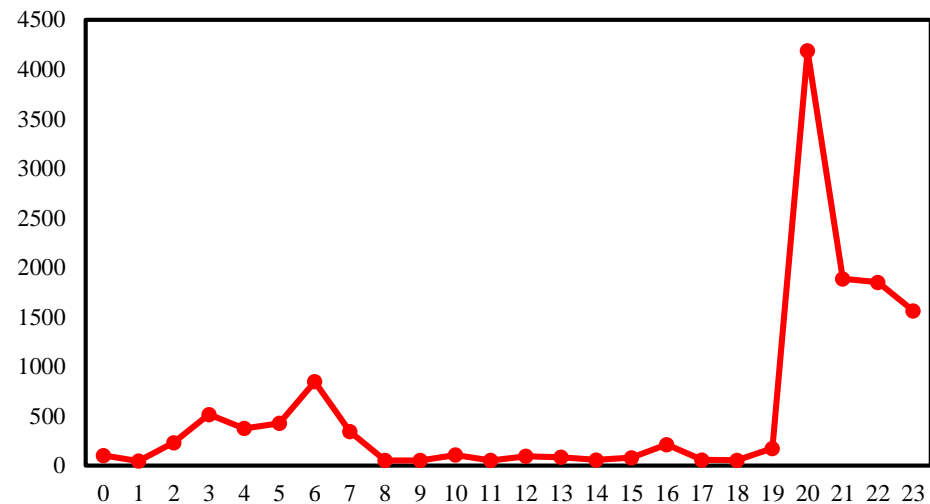
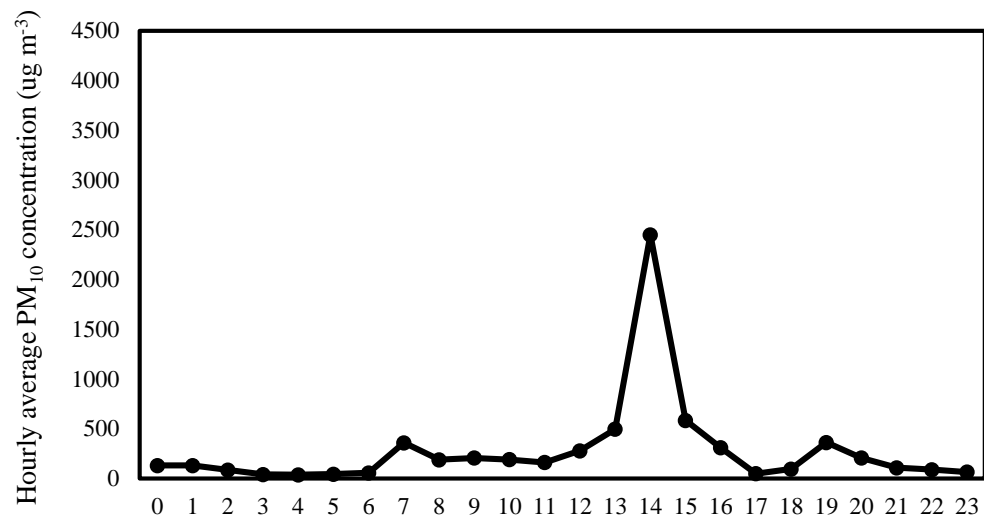
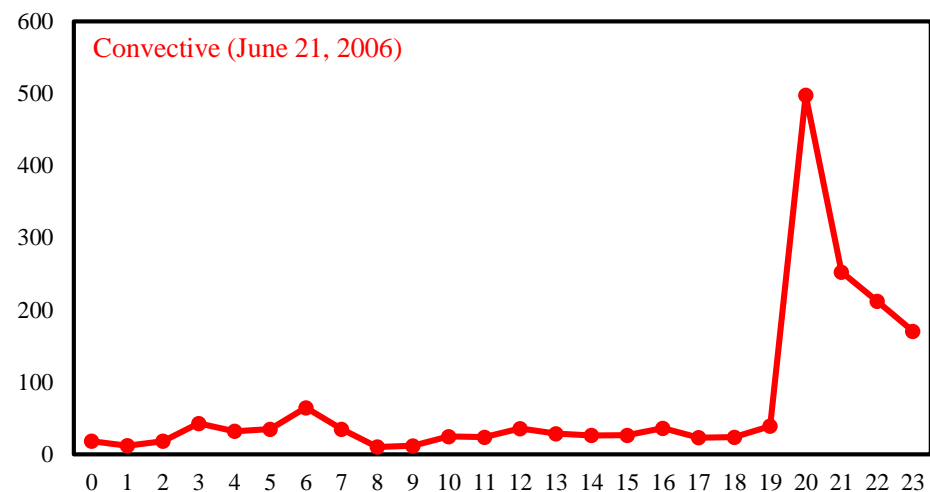
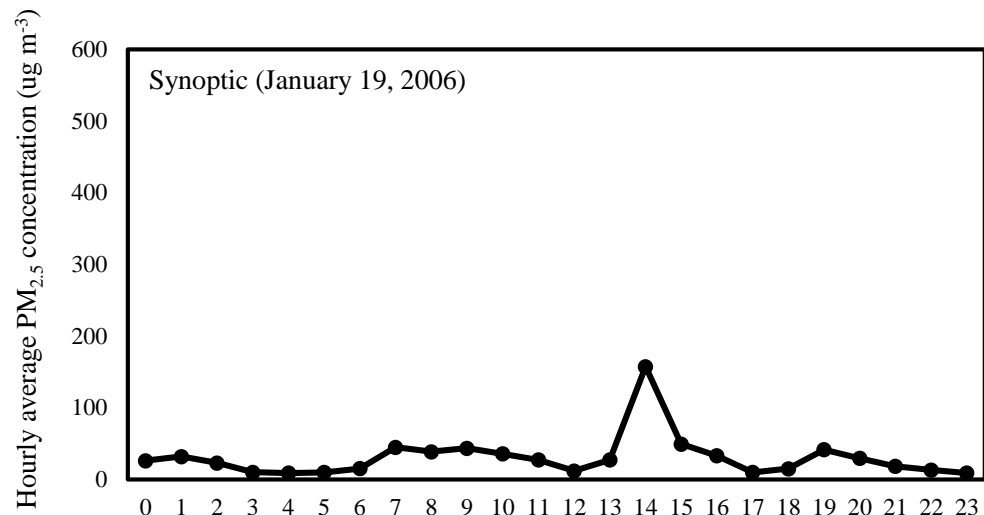
# Diurnal PM concentrations during a synoptic and convective dust events in El Paso



Time (hour)

Time (hour)

# Diurnal PM concentrations during a synoptic and convective dust events in El Paso



Time (hour)

Time (hour)

# Conclusions

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- Over 450 blowing dust events
- Most dust codes were BLDU
- Highest number of blowing dust events occurred in spring and April
- The duration for blowing dust events were predominantly  $< 2$  hours
- Most blowing dust events were caused by a synoptic disturbance
- Synoptic blowing dust events mostly occurred in spring and convective in summer
- Convective blowing dust events were predominantly an hour or less while synoptic dust events tend to last much longer
- Highest PM for synoptic dust events was in the afternoon and convective occurred in the evening hours



# Future work

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- Particulate matter data ( $PM_{10}$  and  $PM_{2.5}$ )
- Analyzing ASOS stations without observer for possible missed dust codes



Thank you!

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