

# The Flavors of Dust Storms Across the Southwestern US

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# Our dust issues

Dust and dust storms are a nuisance, but more importantly, present a significant health and safety hazard to those living in it and cause impacts to our climate and water supply

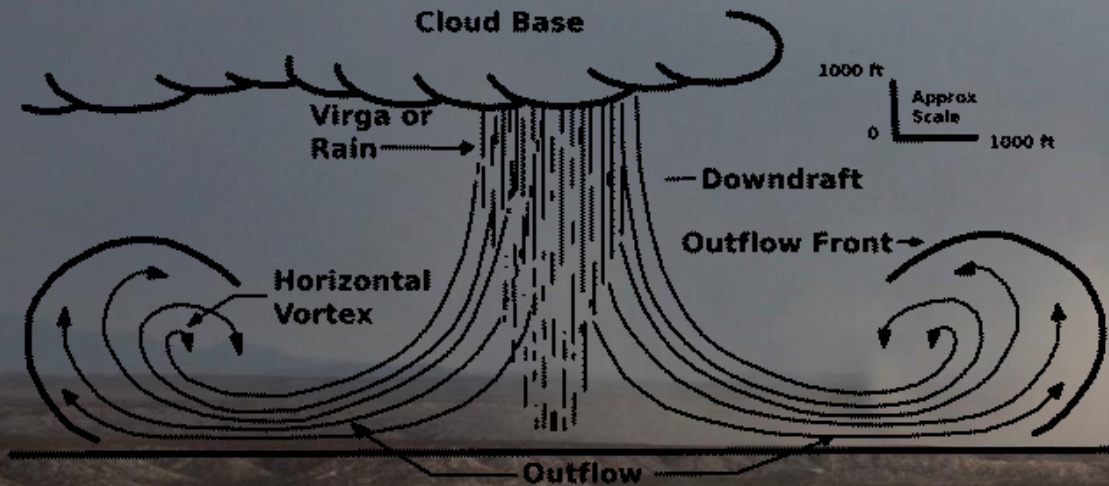
# Main Types of Dust Events

- Local to Mesoscale
  - Dust devils
  - Thunderstorm microburst
  - Thunderstorm gust front
  - Convective outflow
- Synoptic
  - Frontal

# Dust Devil Events



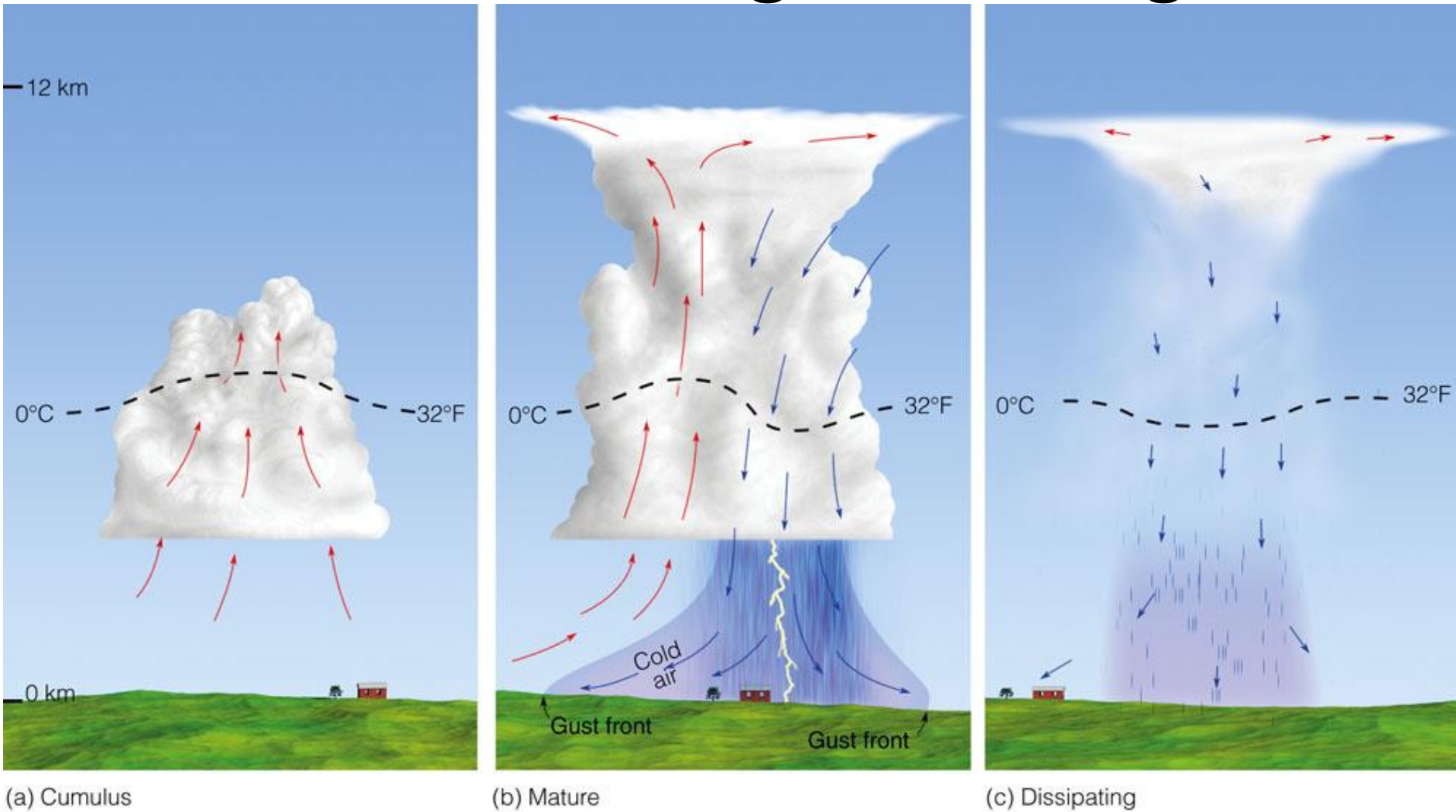
# Microburst



Size < 4km, duration 2 to 5 minutes



# Thunderstorm growth stages



(a) Cumulus

(b) Mature

(c) Dissipating

© Brooks/Cole, Cengage Learning

Figure from Ahrens (2009)

# Thunderstorm outflow

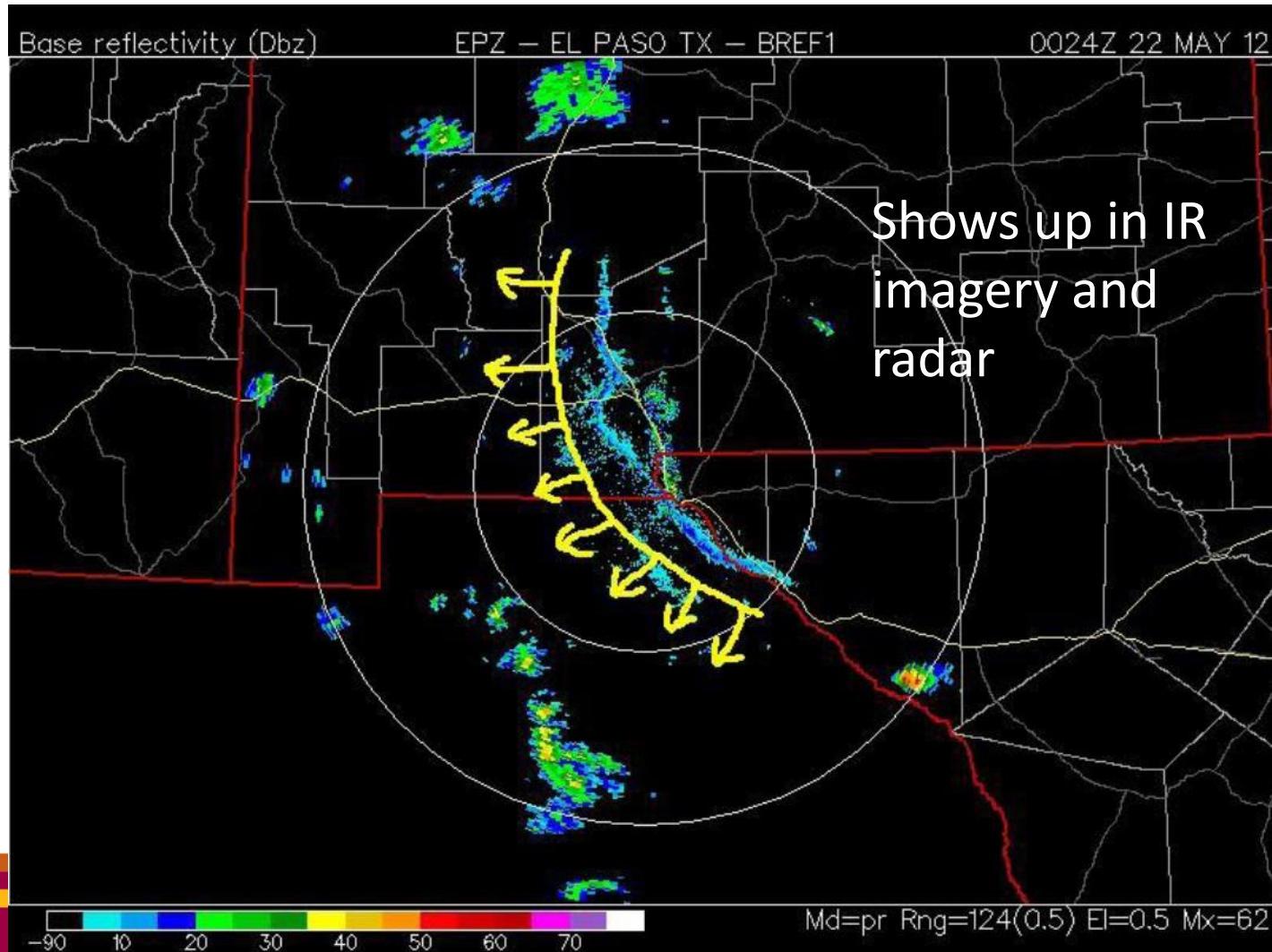


Image courtesy of College of DuPage

# July 9, 2015 outflow example

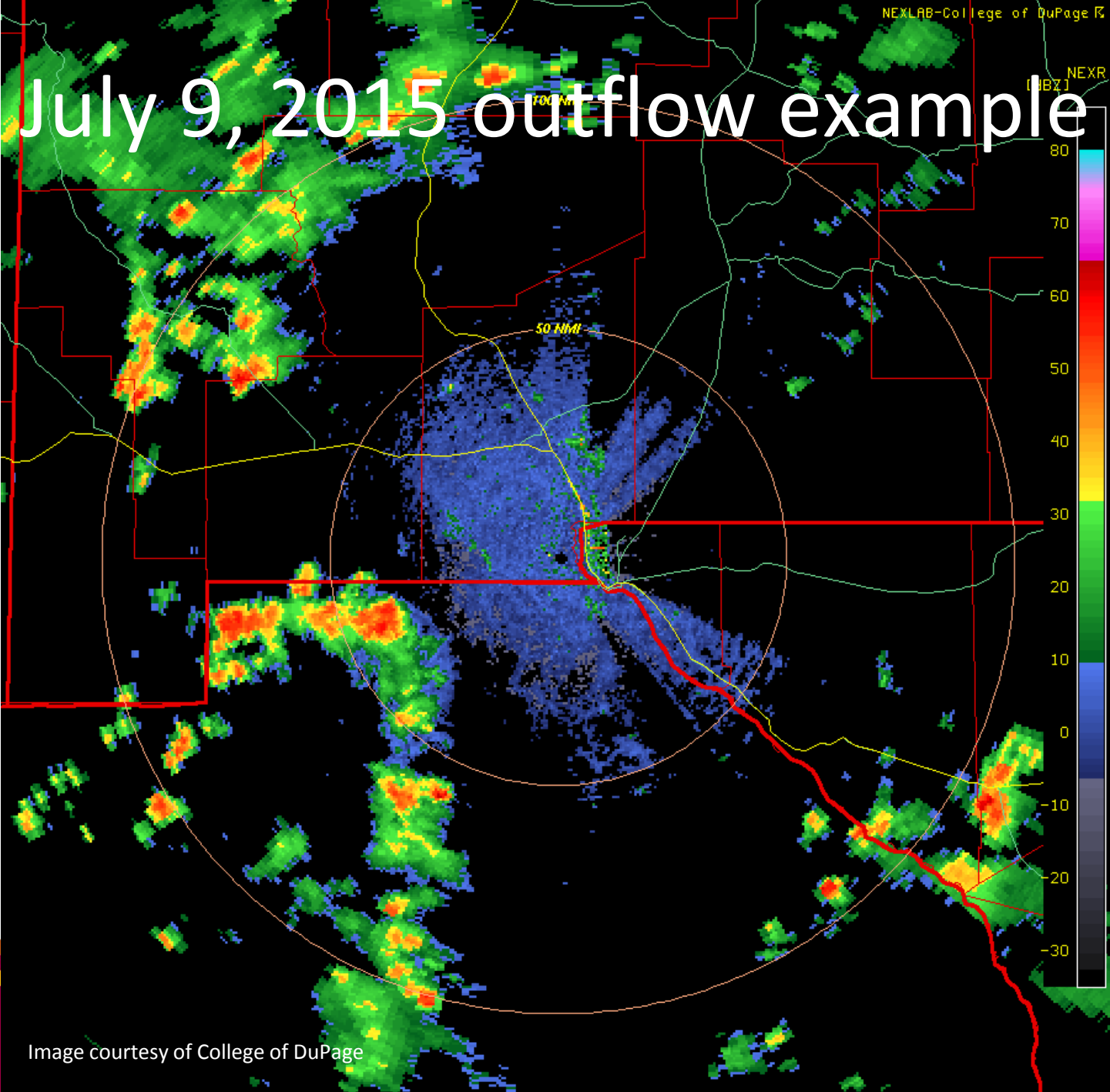
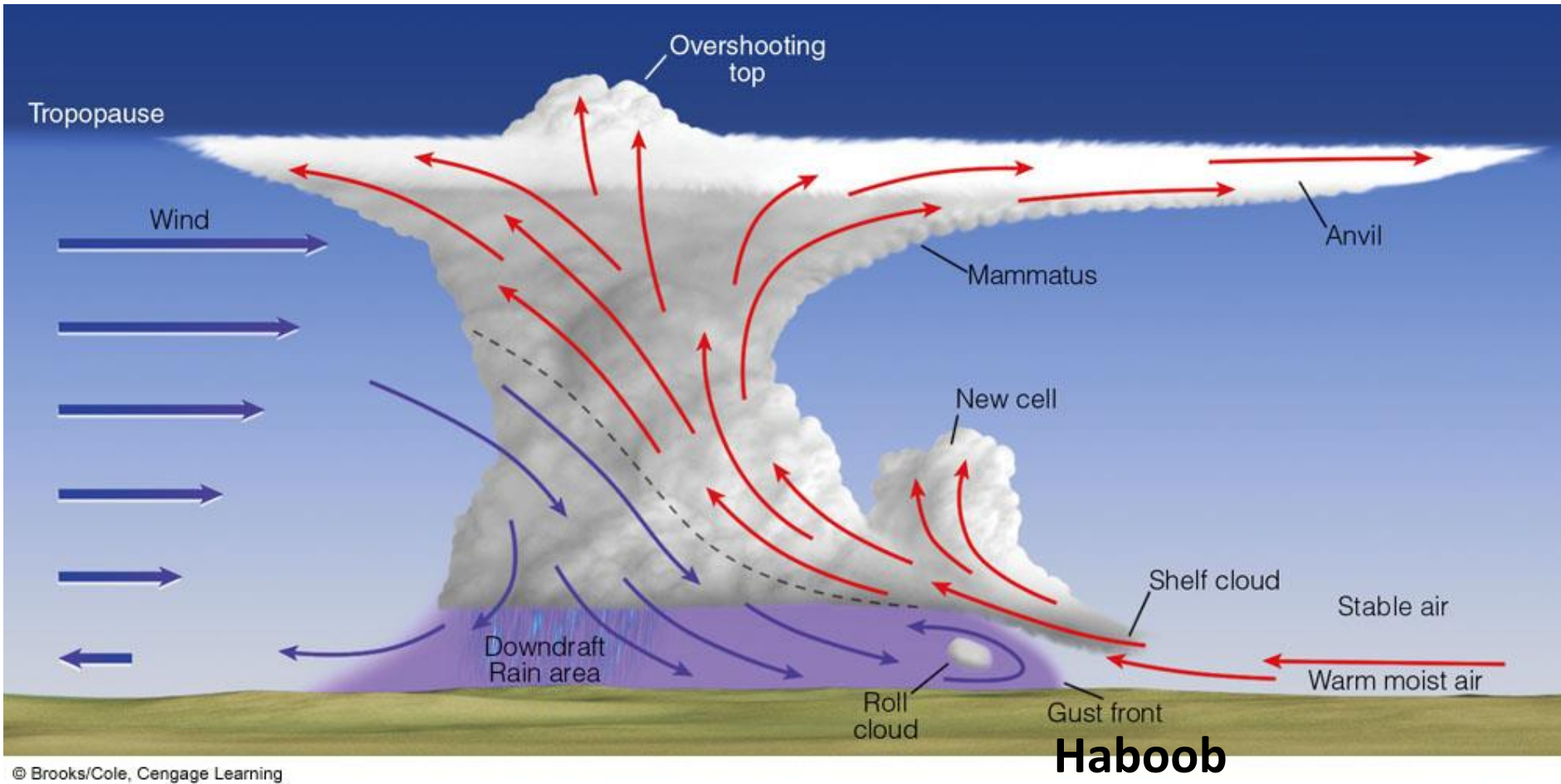


Image courtesy of College of DuPage





# Haboob



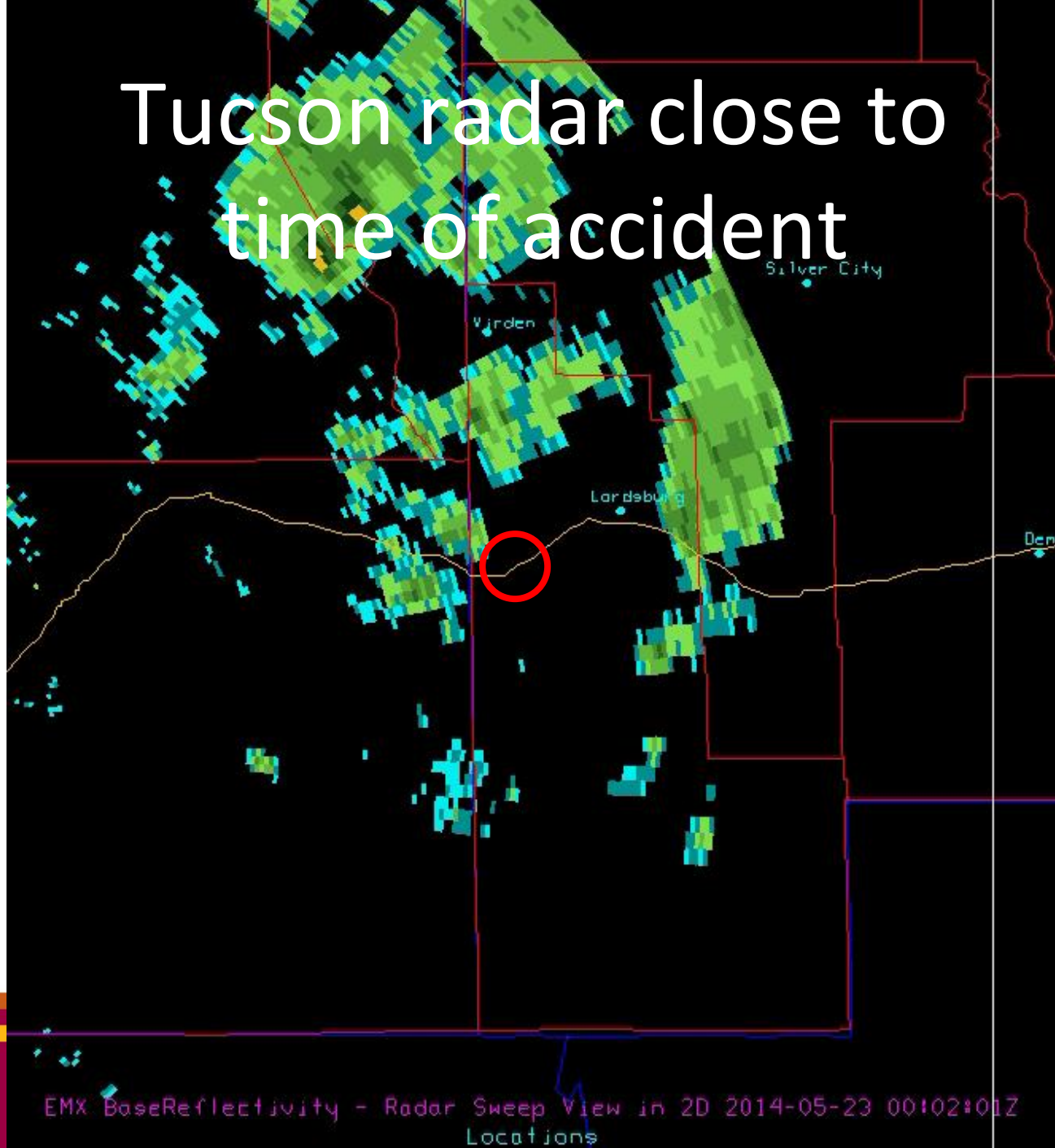
Cold air from the downdraft undercutting warm air

# Interstate 10 accident in 2014



May 22, 2014  
Fatal accident on I-10 dust to dust storm

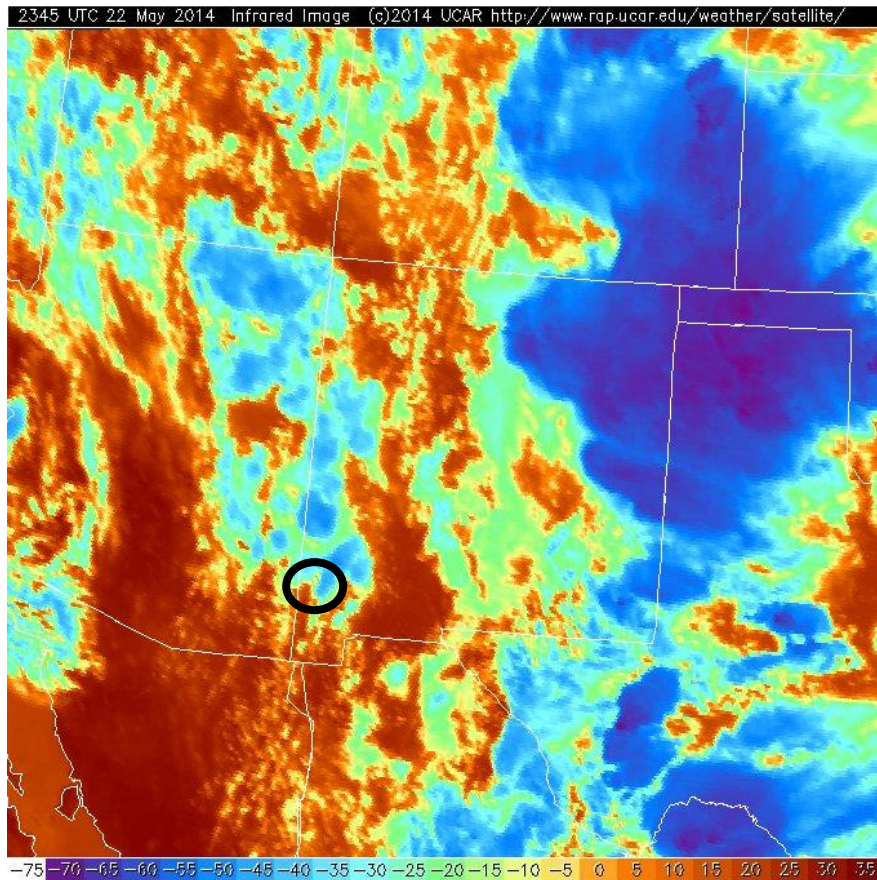
# Tucson radar close to time of accident





# GOES close to time of accident

infrared



visible

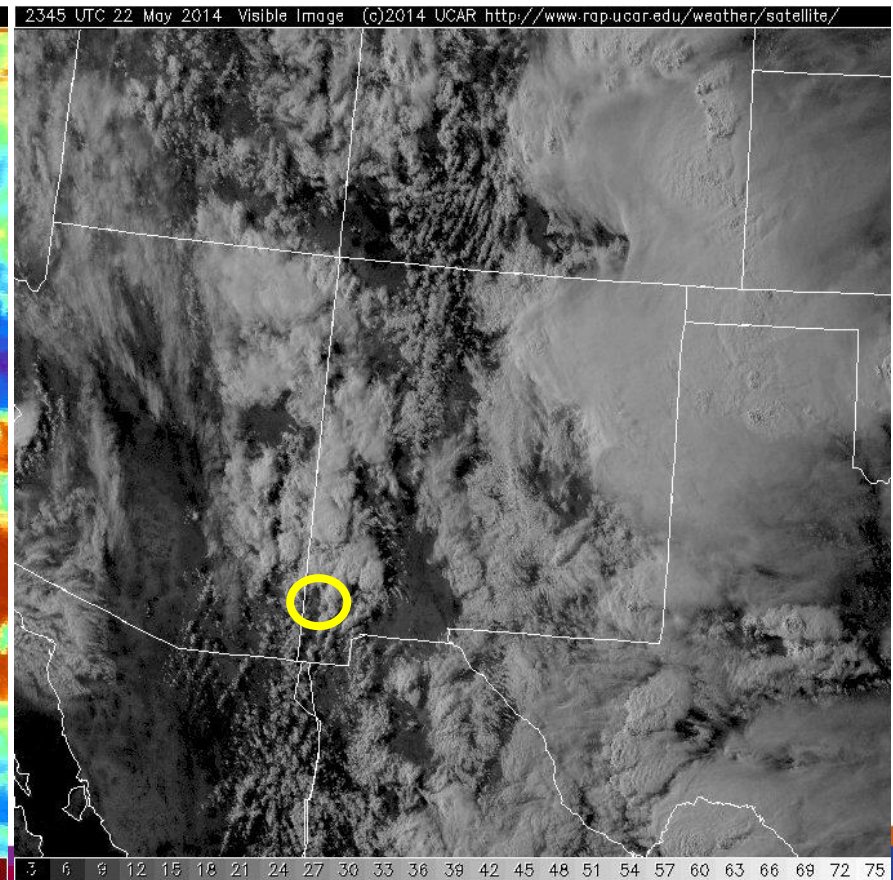


Image courtesy of NCAR



# Gust front horizontal winds



PLOTWATCHER PRO

06/09/2015 04:59:05PM 65% 98F



# Haboob



6/16/15

PLOTWATCHER PRO

06/16/2015 05:33:06PM 60% 109F ○

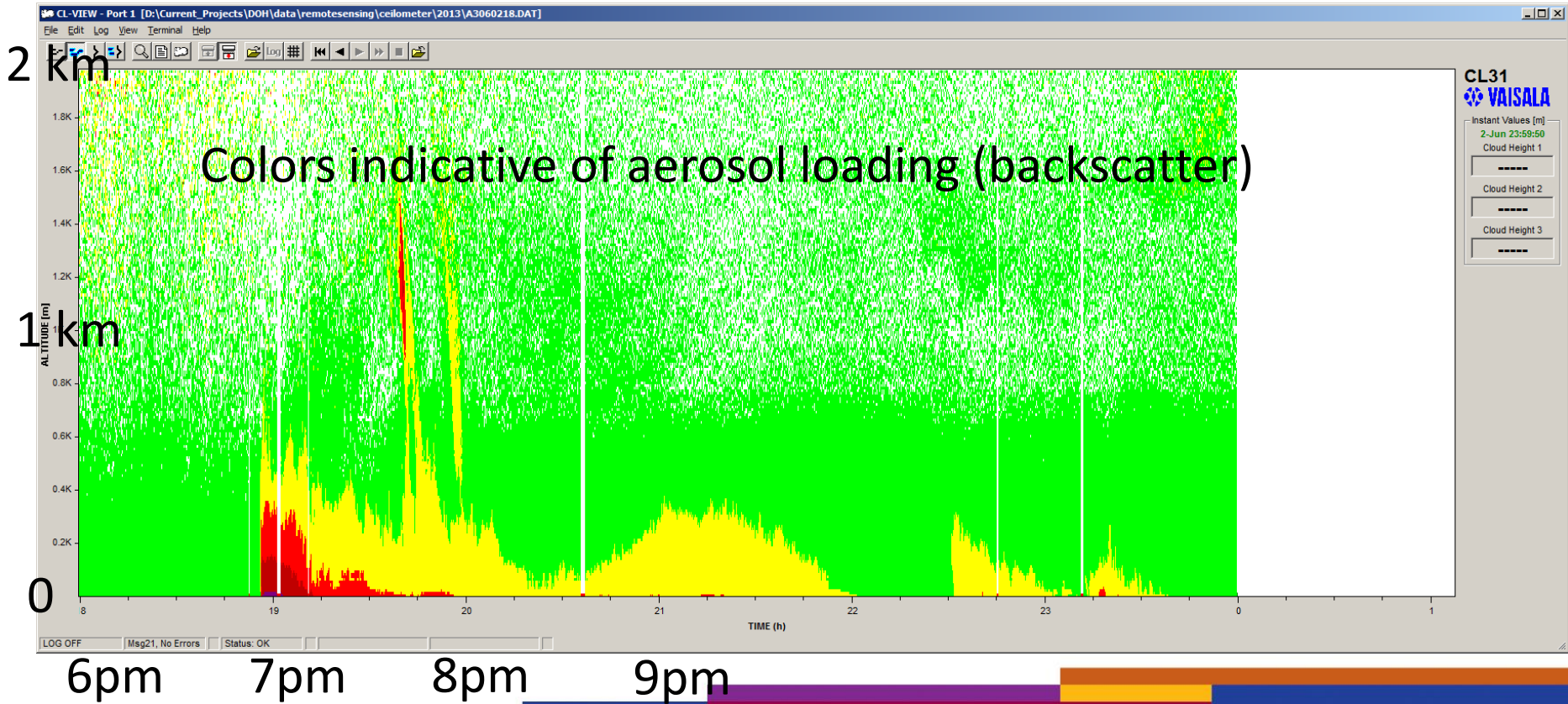
# Haboob

June 2, 2013 over Las Cruces



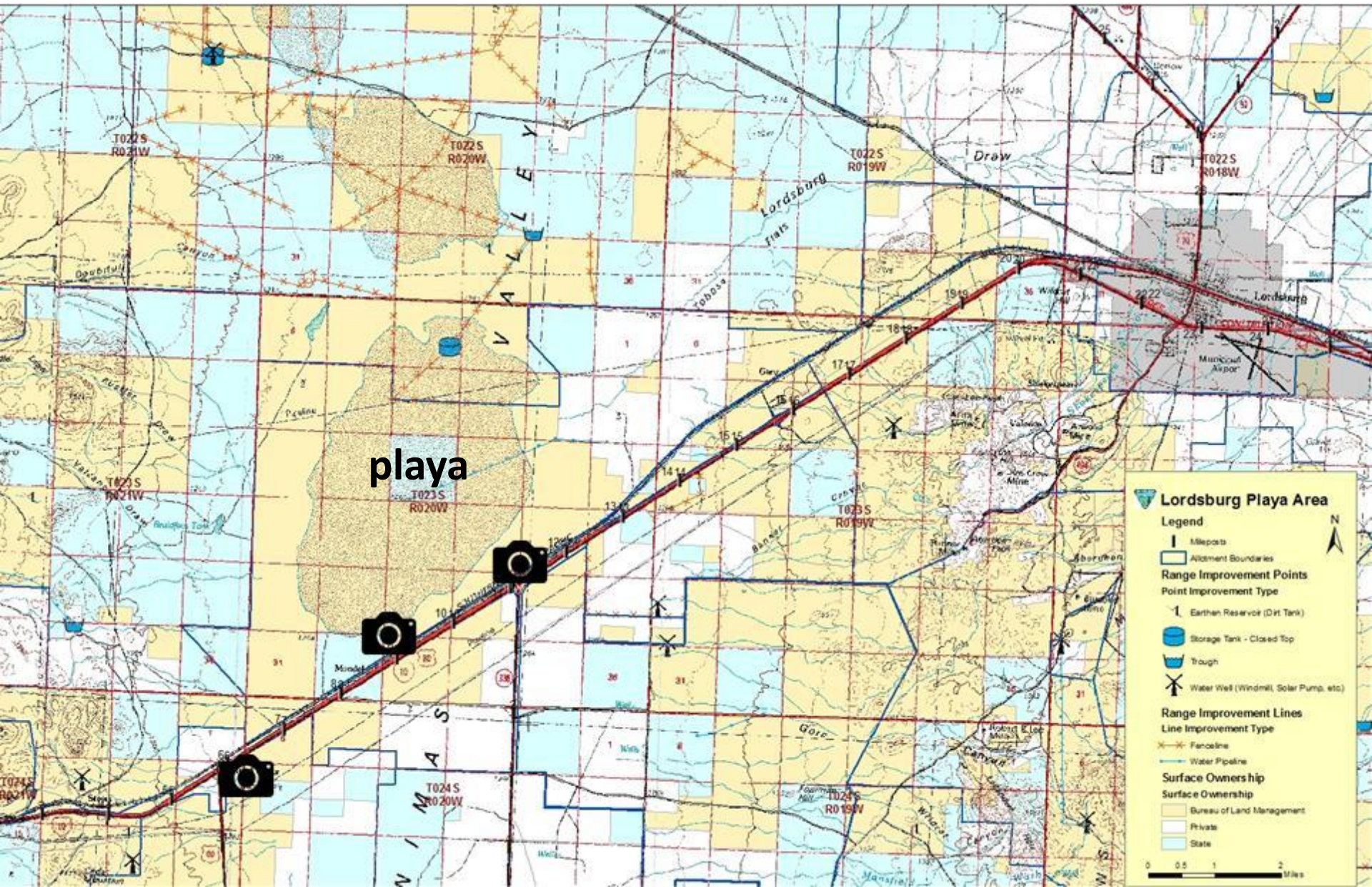


# June 2, 2013 lidar: Las Cruces





# Playa west of Lordsburg





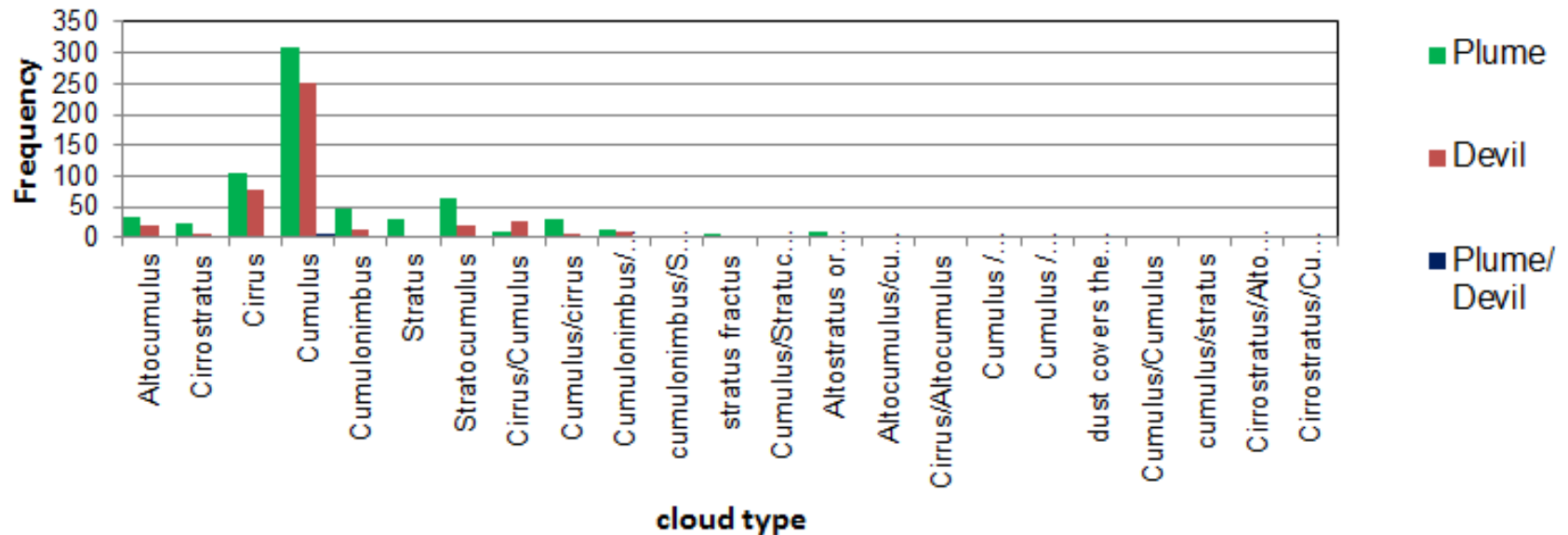
# Time lapse camera network





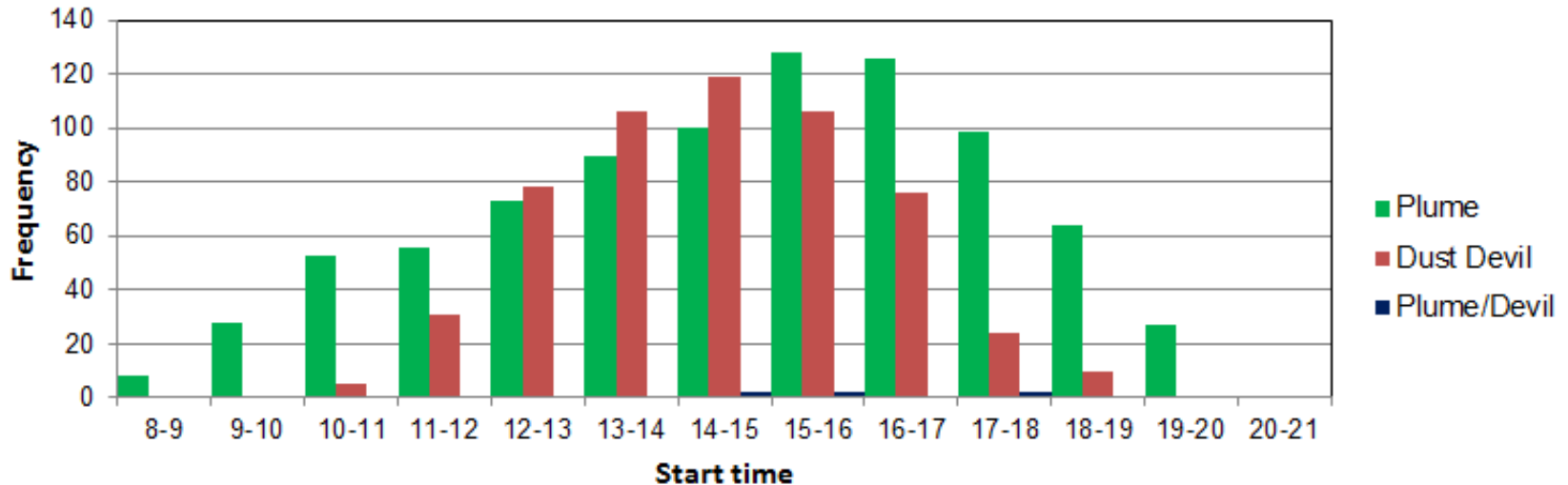
# Summer/Fall Dust Events over Playa

- Primarily associated with convective clouds



# Playa Dust Event Start Times

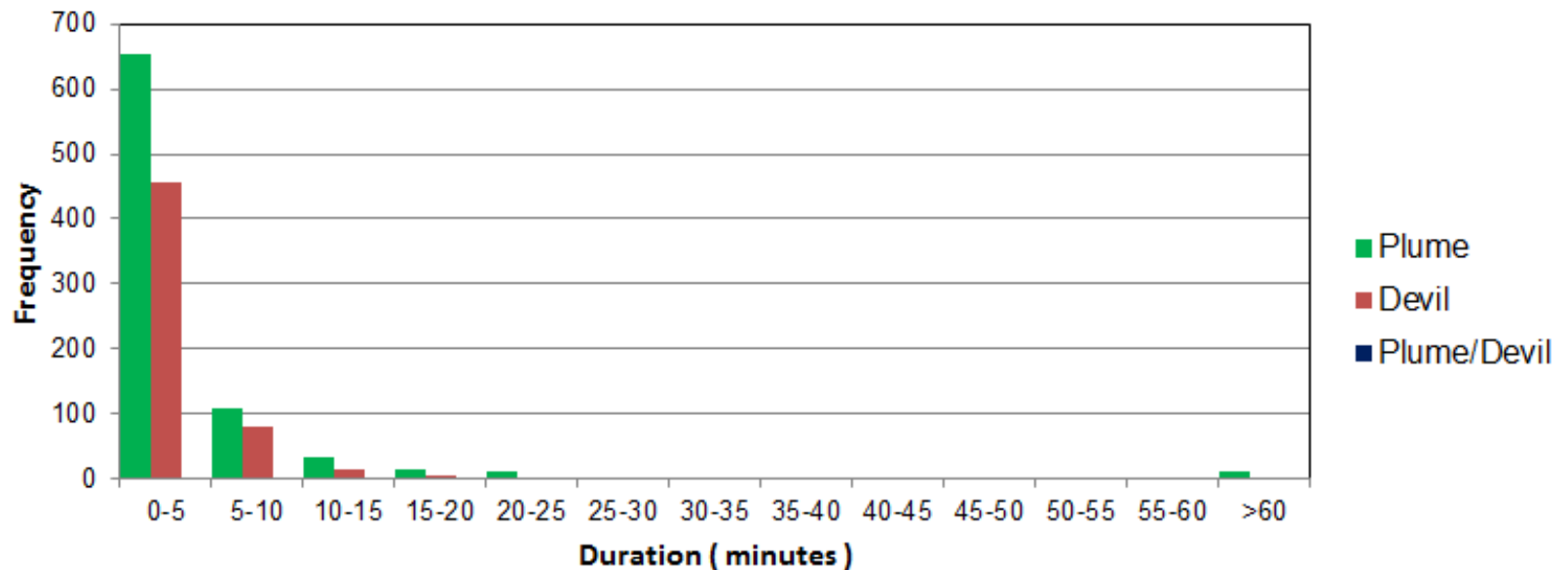
- Plumes most frequent in the afternoon but can occur throughout the day



Over all 5 locations. Time in local mountain time

# Playa Dust Event Durations

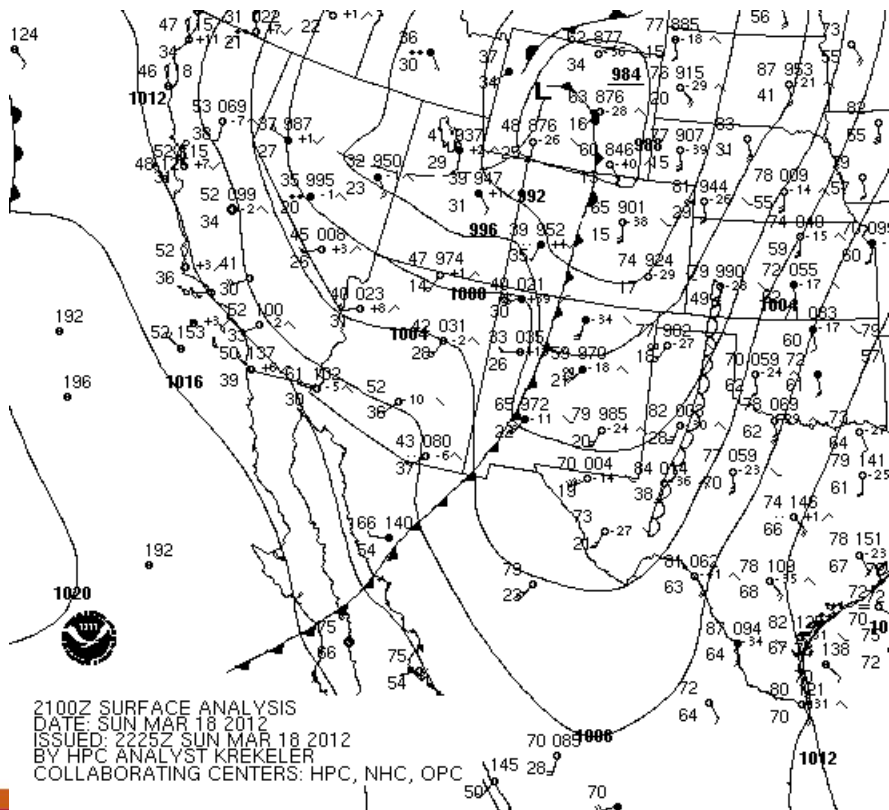
- Most are short < 5 min but small and significant fraction are 10s of minutes



# Example Synoptic Storm

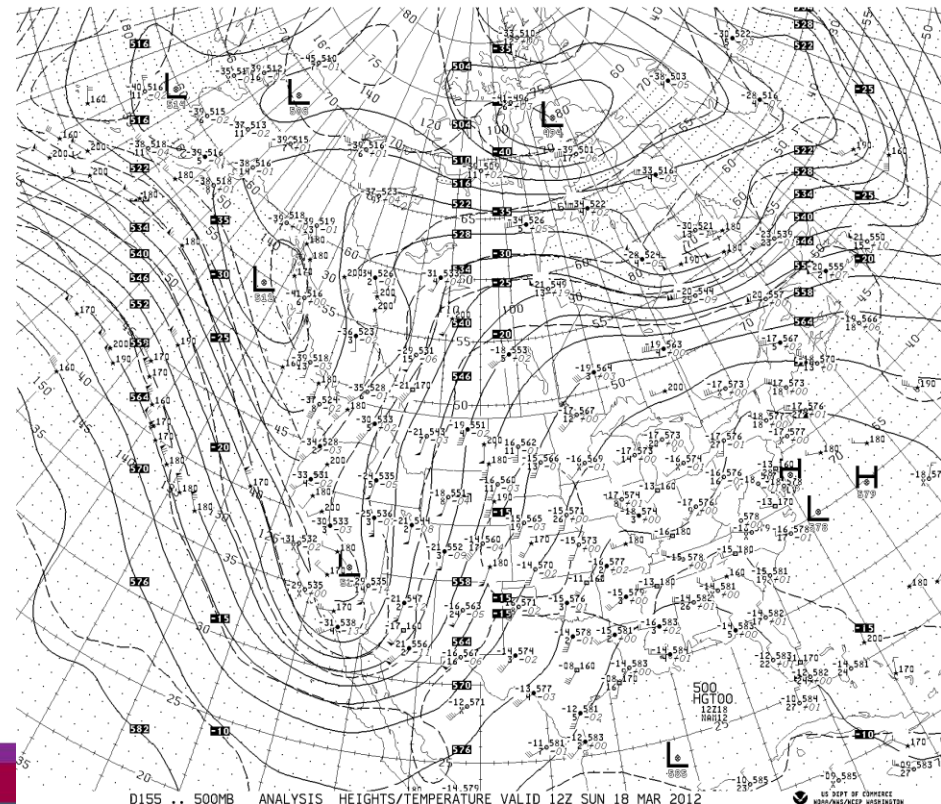
- Upper level trough, surface front, 3/18/2012

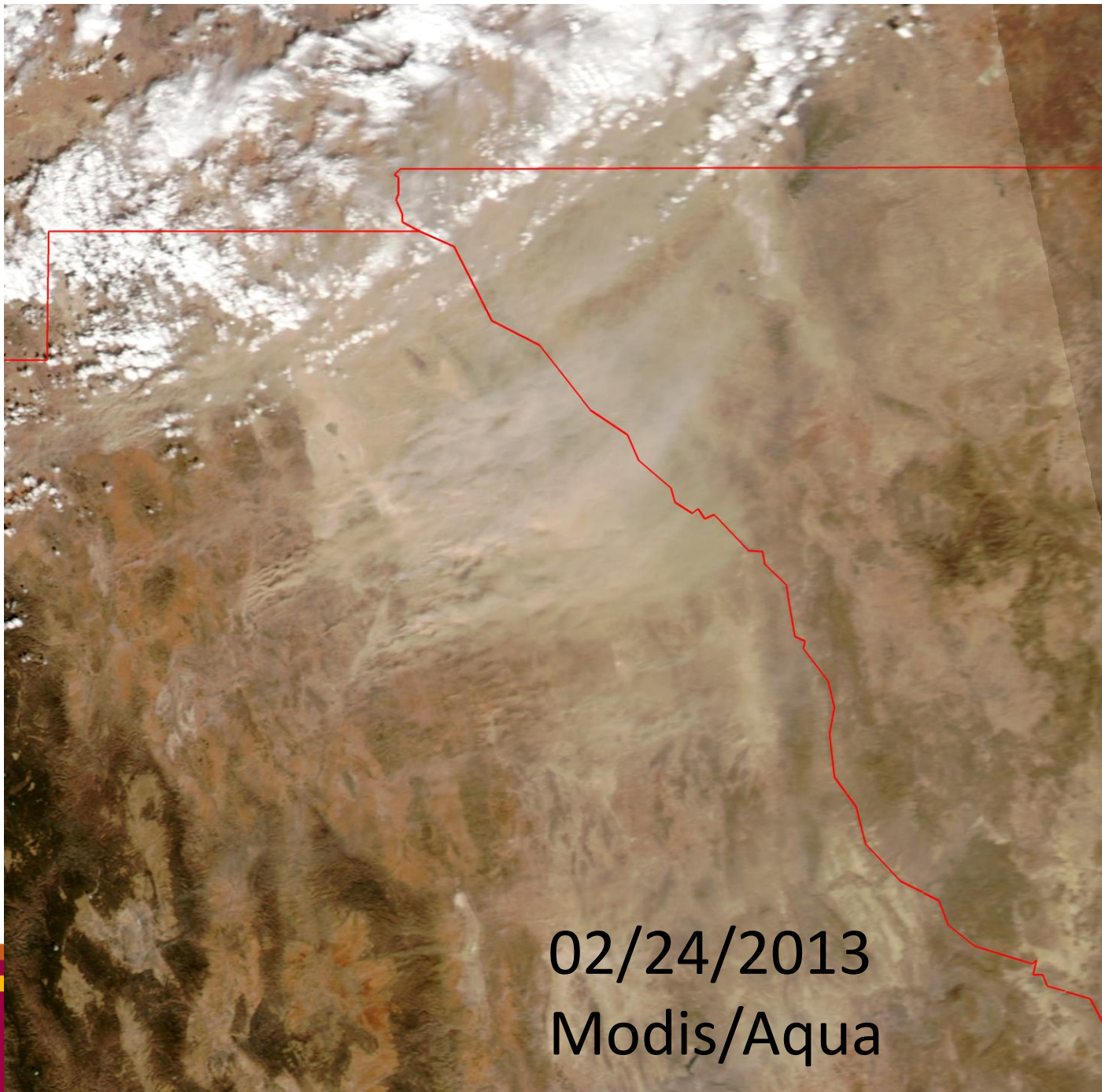
surface



2100Z SURFACE ANALYSIS  
DATE: SUN MAR 18 2012  
ISSUED: 2225Z SUN MAR 18 2012  
BY HPC ANALYST KREKLER  
COLLABORATING CENTERS: HPC, NHC, OPC

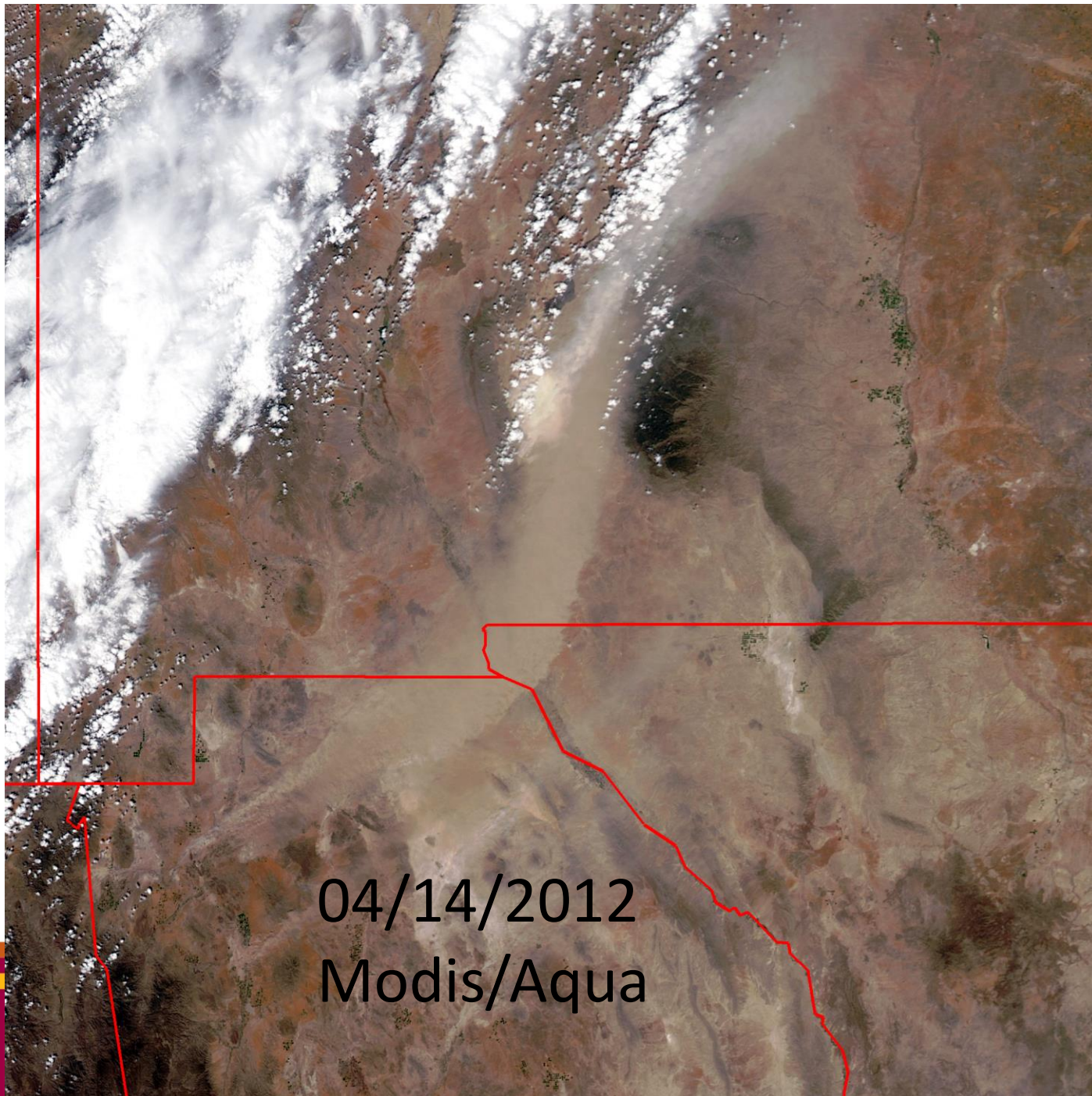
500 mb





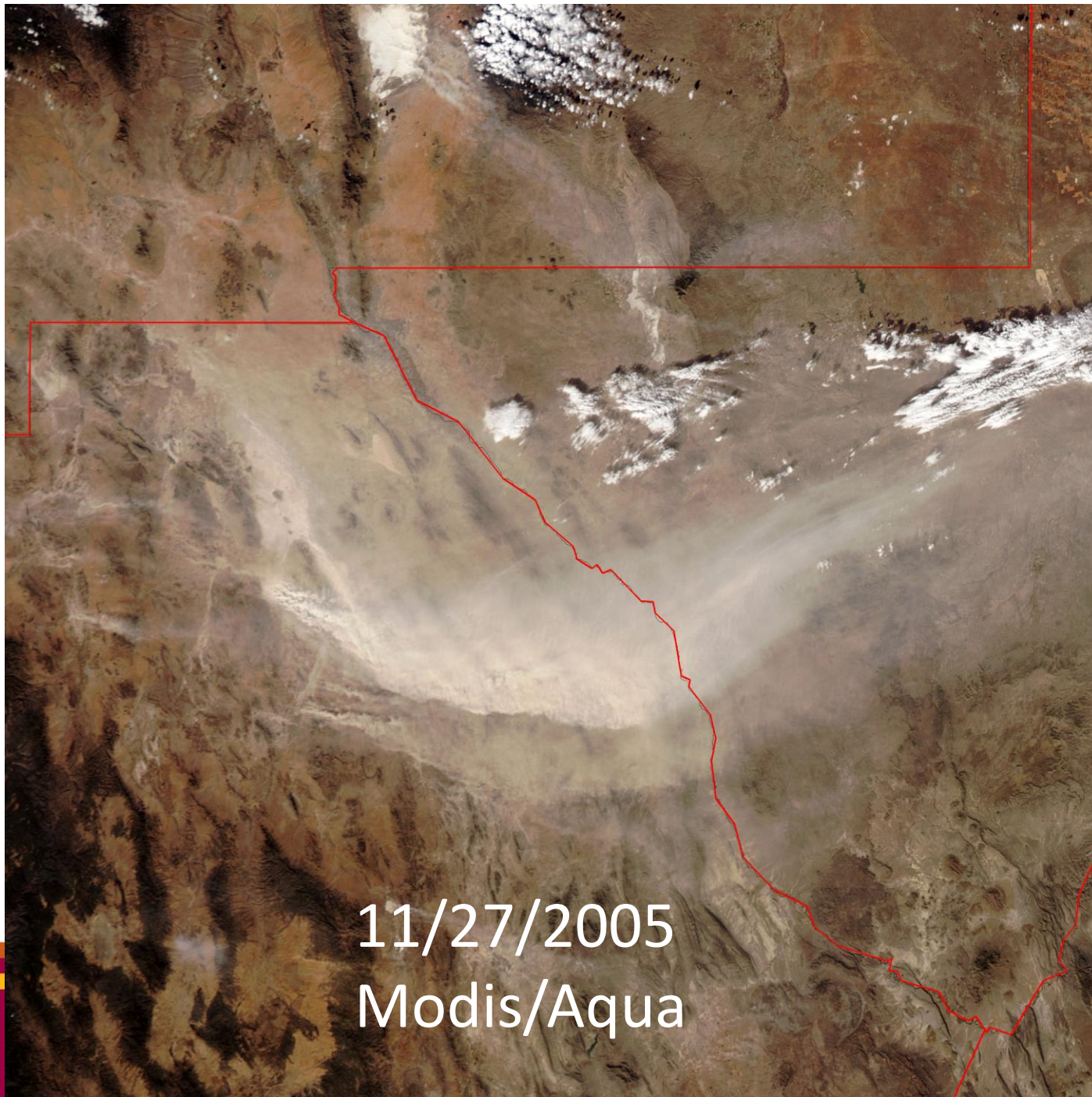
02/24/2013  
Modis/Aqua





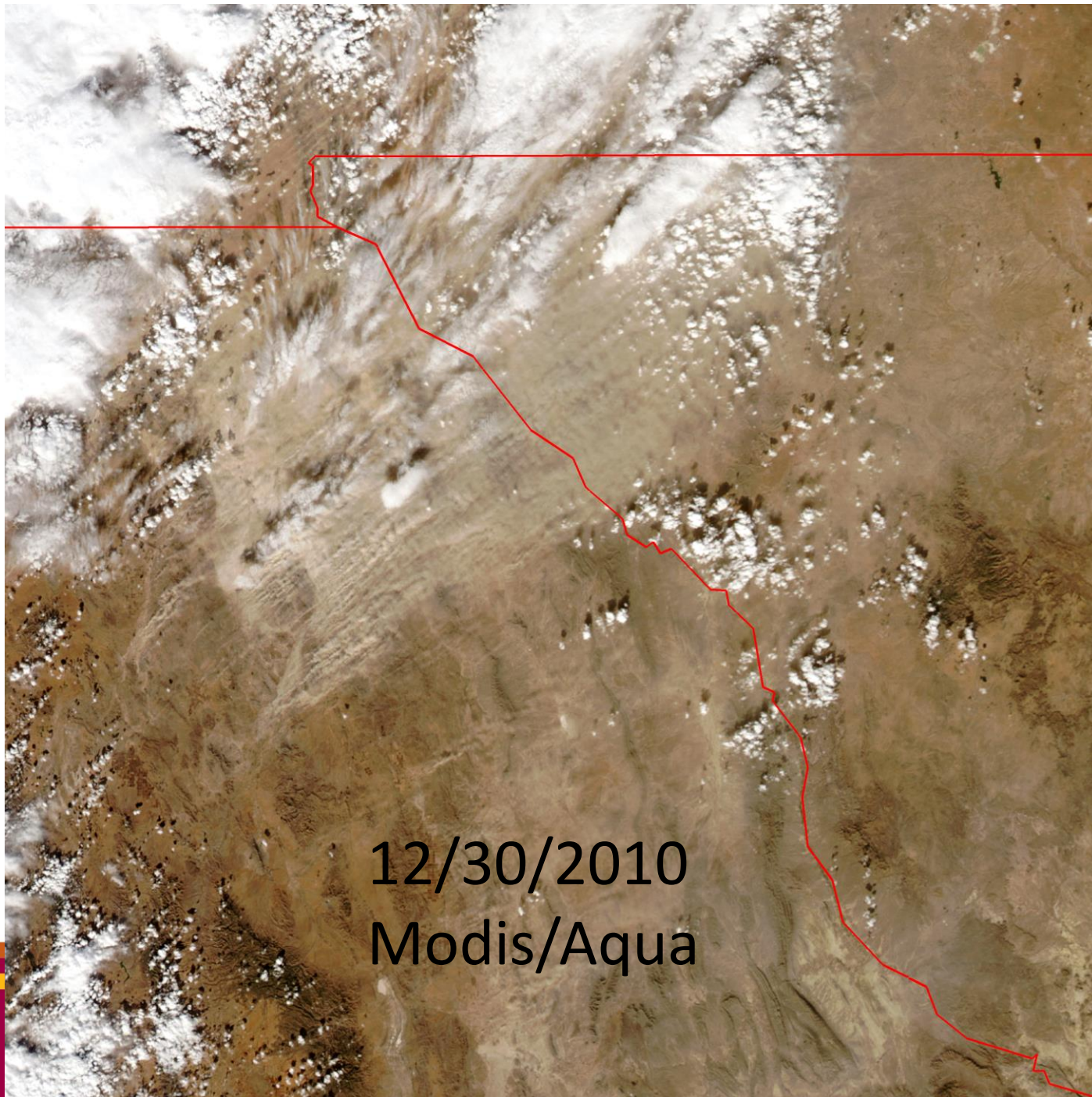
04/14/2012  
Modis/Aqua





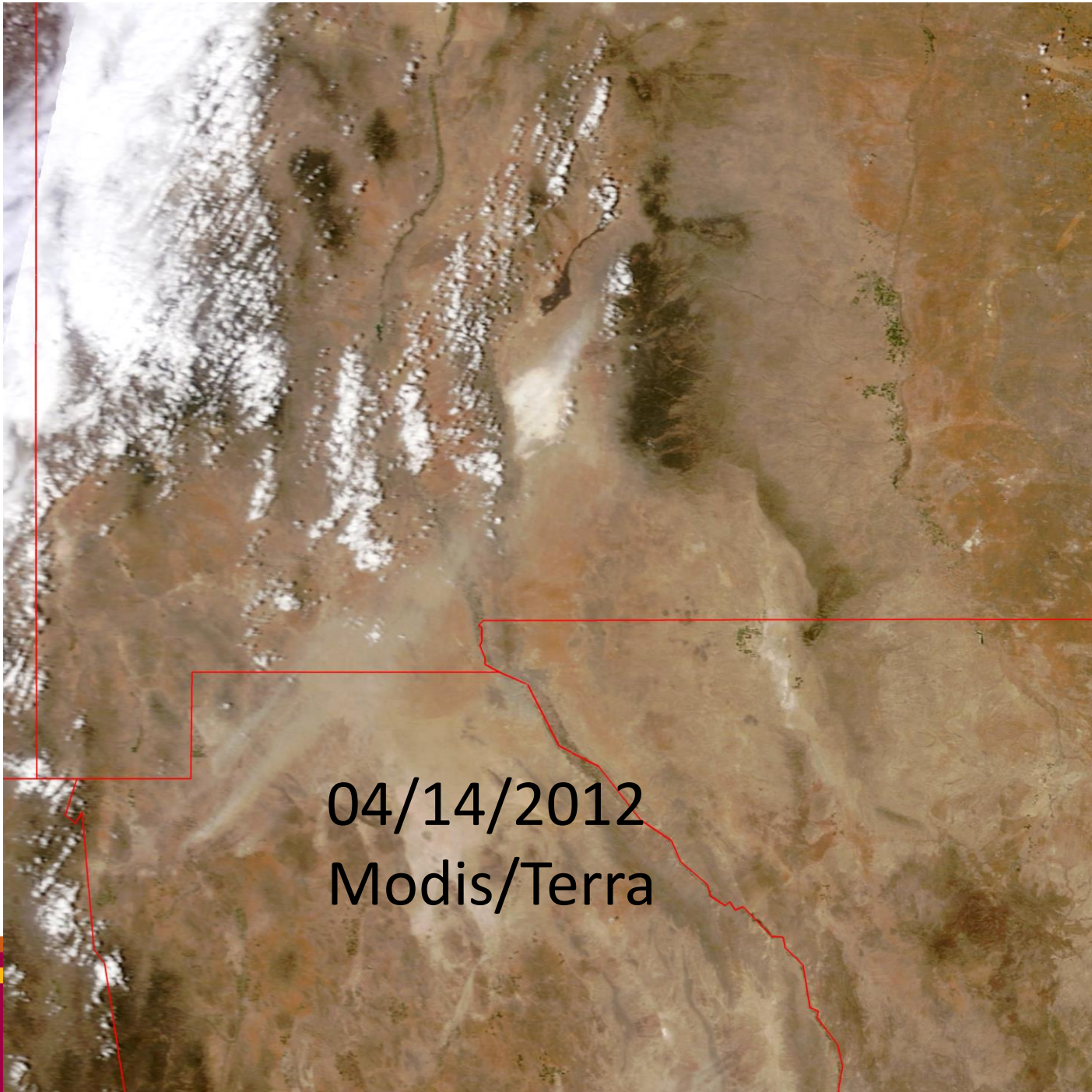
11/27/2005  
Modis/Aqua





12/30/2010  
Modis/Aqua

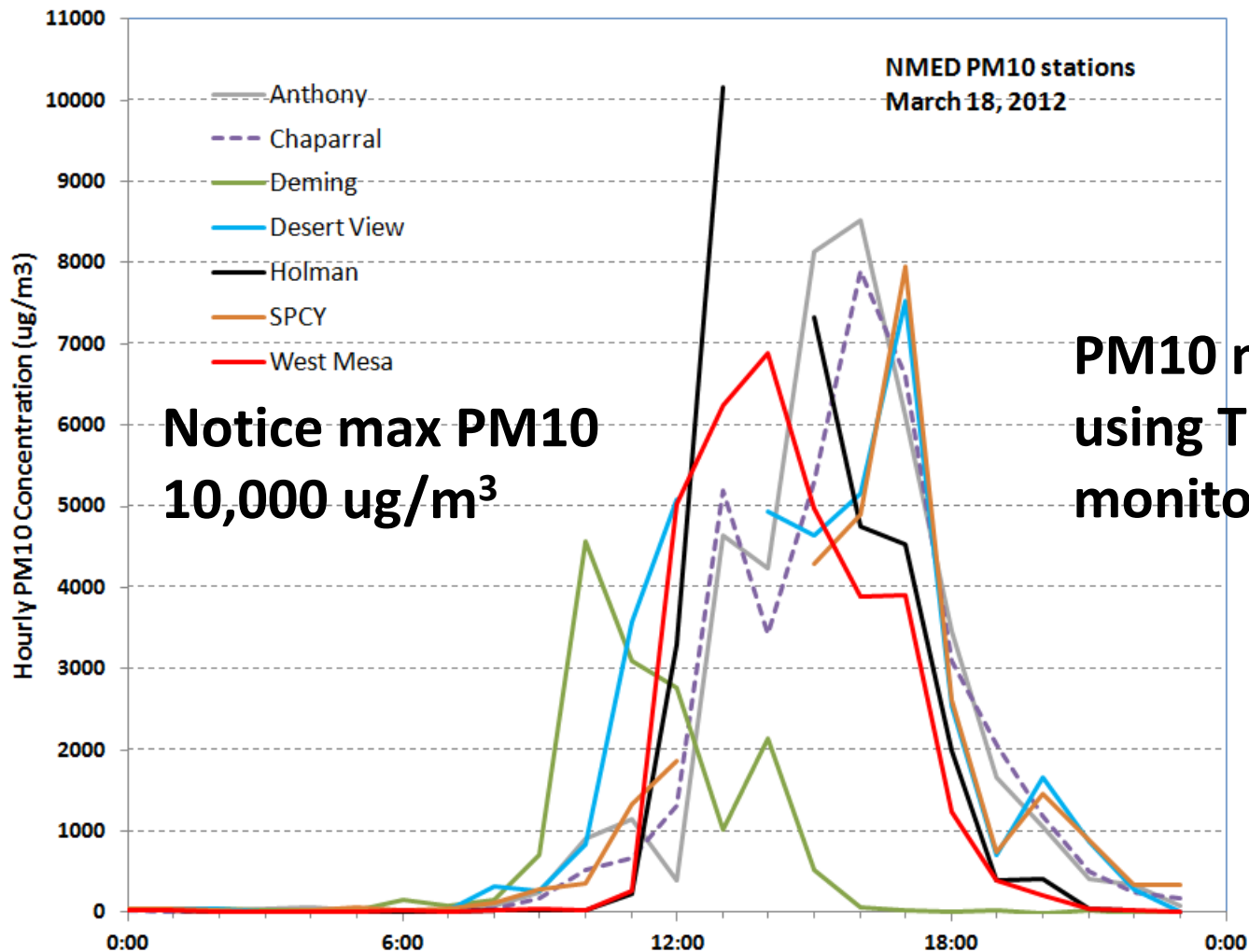




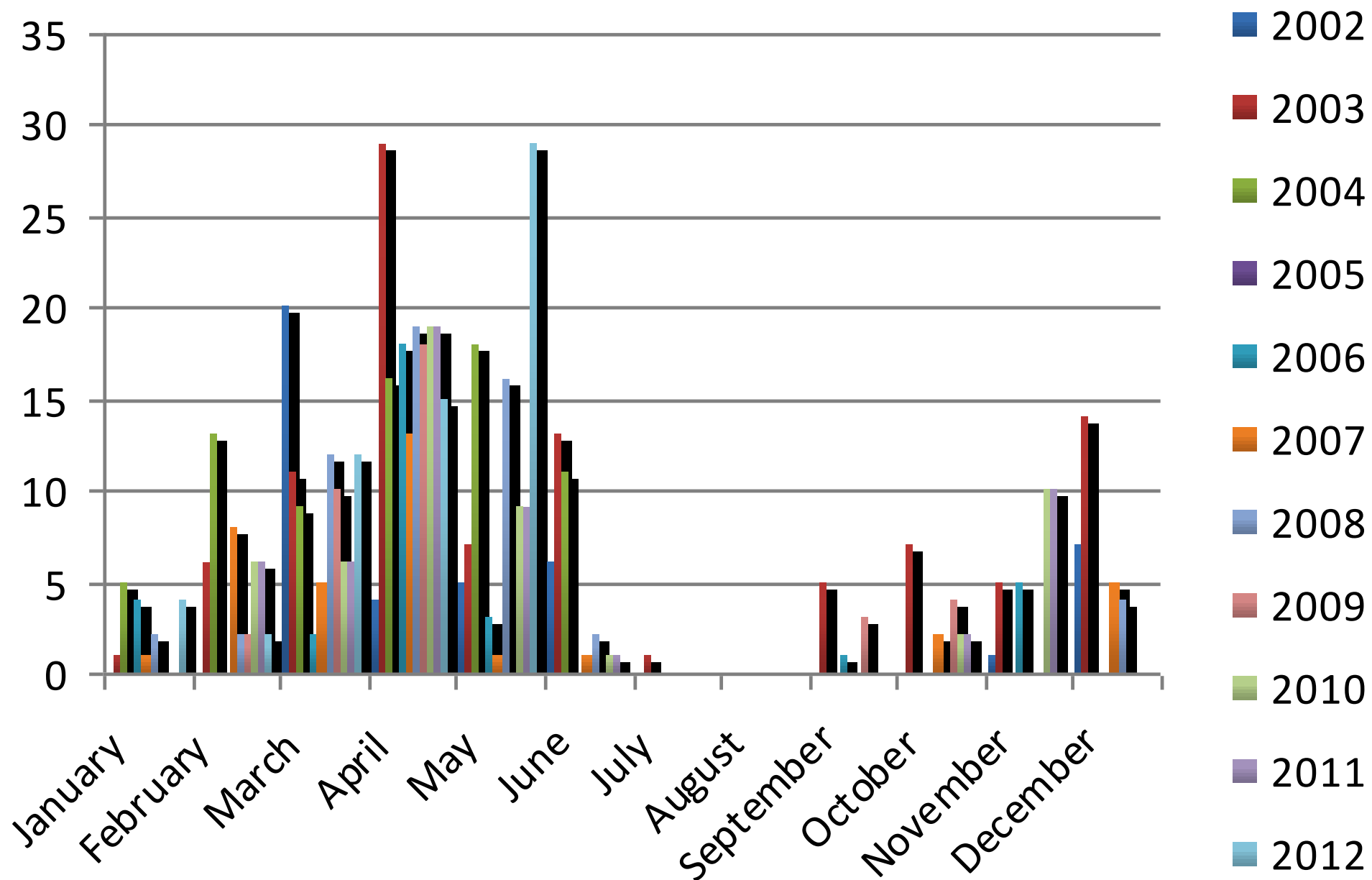
04/14/2012  
Modis/Terra

# Impacts from synoptic storm

- Duration: most of day



# Synoptic dust storm frequency based on imagery





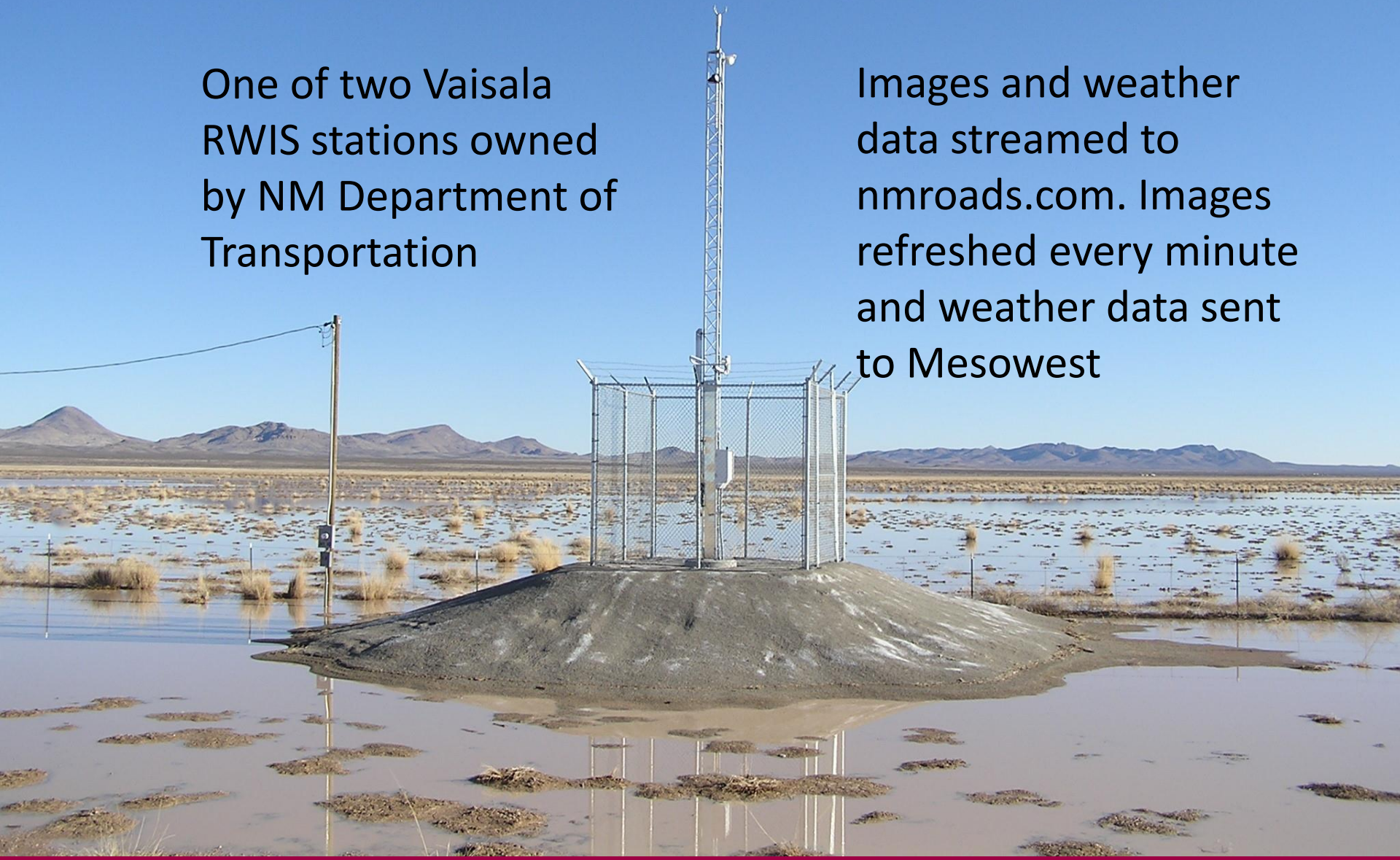
# Sources of Information

- Satellite imagery
  - GOES, AVHRR, MODIS, VIIRS, etc.
- Ground based observations
  - Visibility, PM<sub>10</sub> and PM<sub>2.5</sub> data
  - Mesonets
  - Weather radar
  - Weather cams & social media posts
- Forecasts
  - Meteorological model & dust models

# Mesonets: weather + visibility

One of two Vaisala  
RWIS stations owned  
by NM Department of  
Transportation

Images and weather  
data streamed to  
[nmroads.com](http://nmroads.com). Images  
refreshed every minute  
and weather data sent  
to Mesowest



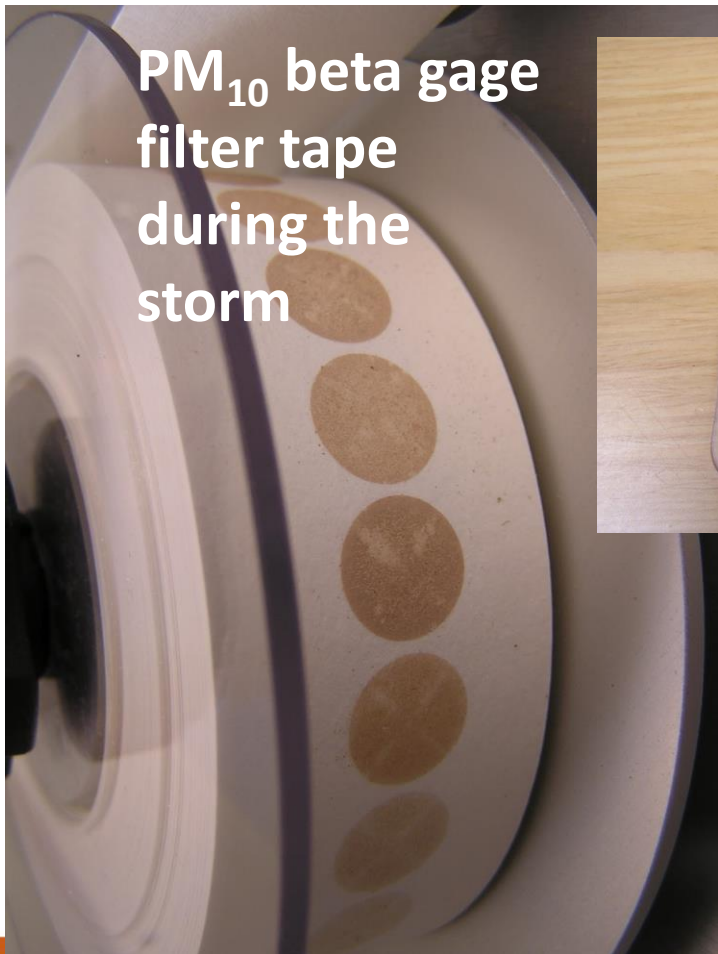
camera + precipitation +  
temperature + dust sensors





# Frontal Storm

PM<sub>10</sub> beta gage  
filter tape  
during the  
storm



47mm PM<sub>10</sub> filter  
collected over the 24-  
hour period

3/18/2012 storm

Las Cruces, NM  
at 1pm

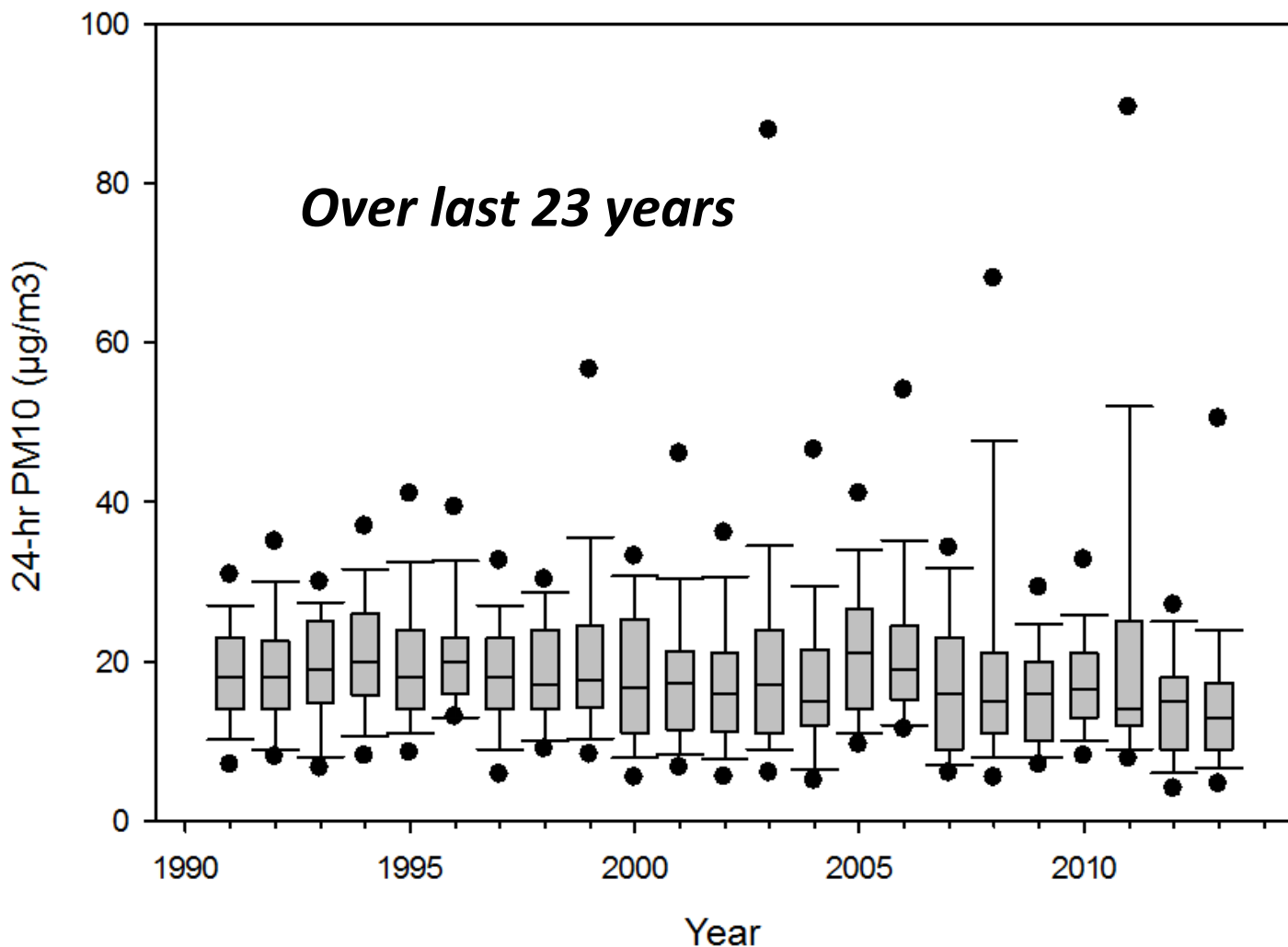


# PM<sub>10</sub> in Deming

Monitor sits on top of post office building in Deming, an urban setting

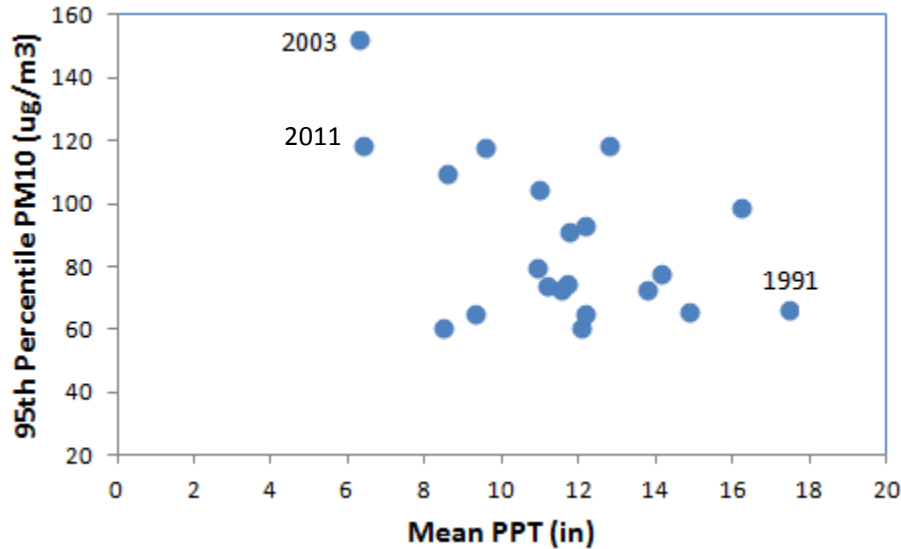
Dots show highest concentrations

Median PM<sub>10</sub> shows statistically significant decrease over time



However, 95<sup>th</sup> percentile show a statistically significant increase

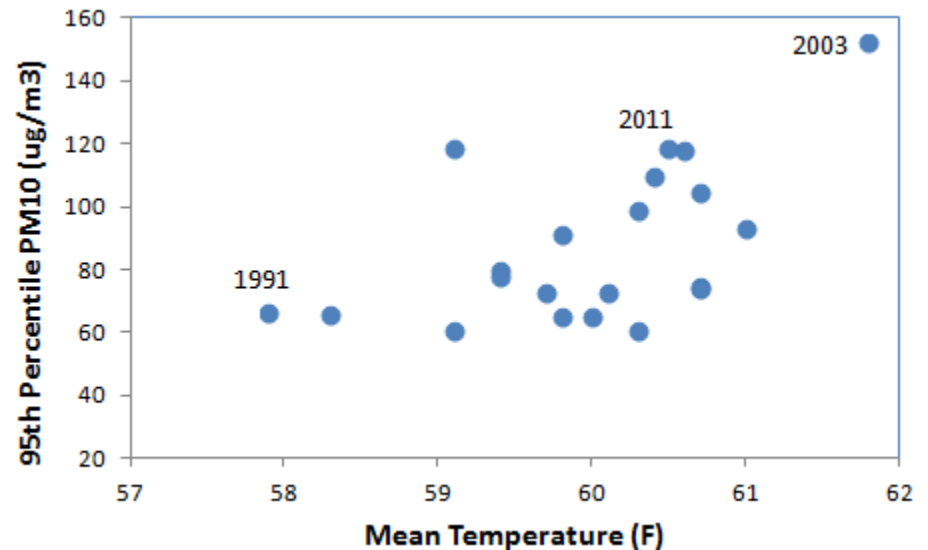
# Climate and Dust Levels



Our highest PM10 occurs during our driest years

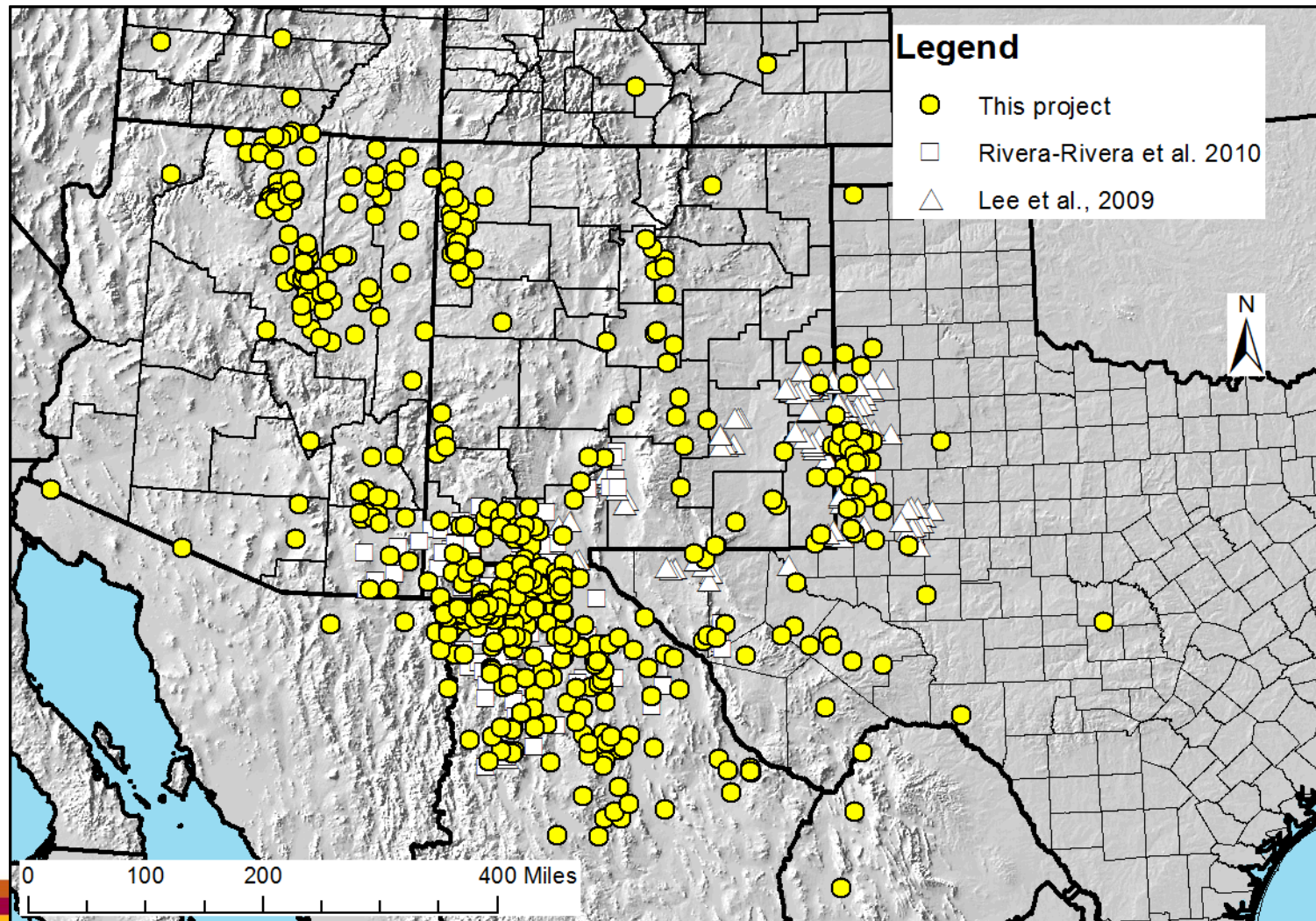
*Over last 21 years in climate division 8*

...and during our warmest years



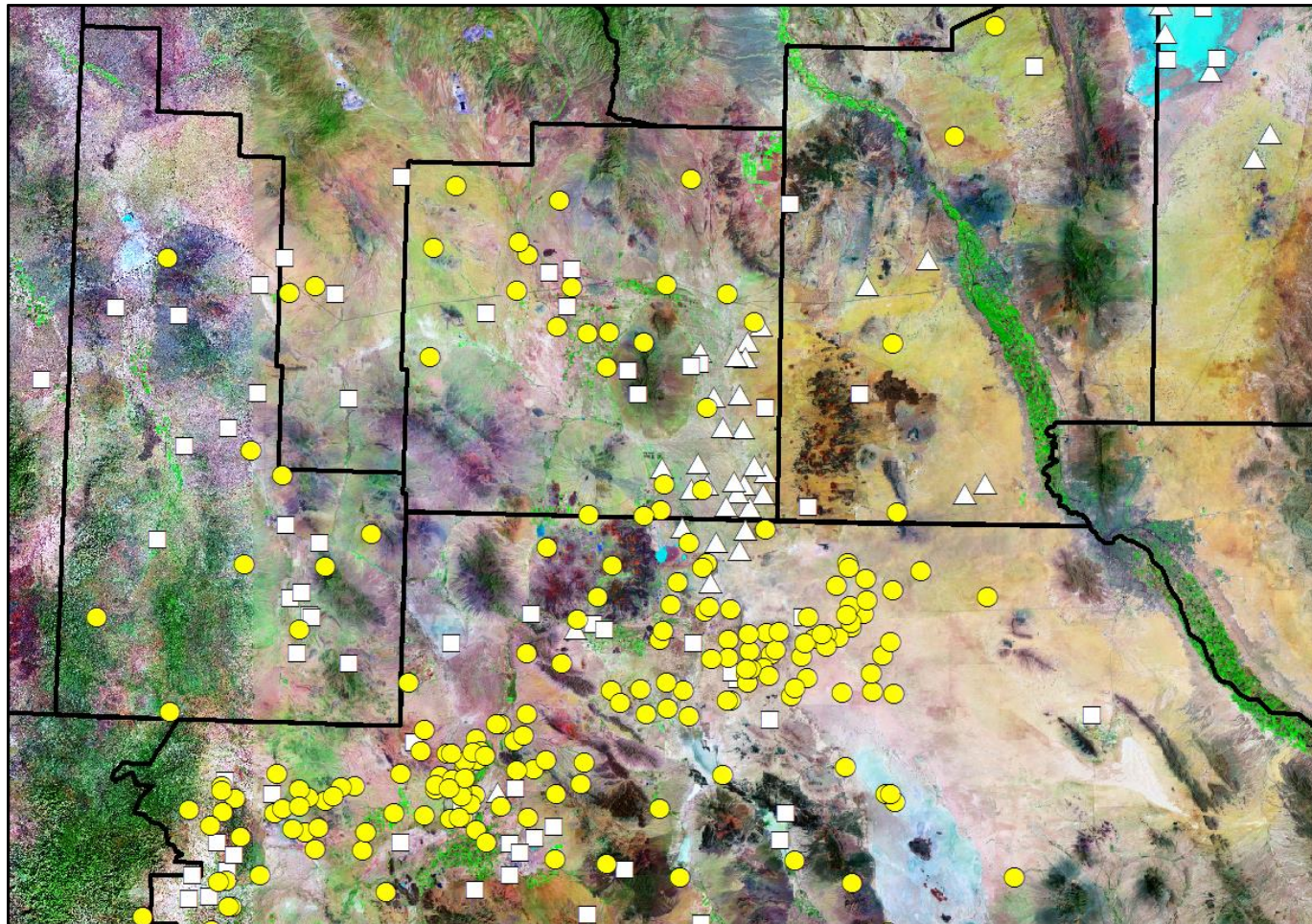


# Dust Source Areas





# Status of source areas in Southern NM



## Legend

- Sources determined from this study
- Rivera-Rivera et al. 2010
- △ Lee et al., 2009



0 12.5 25 50 Miles





On-site visits to source regions in Mexico in 2014

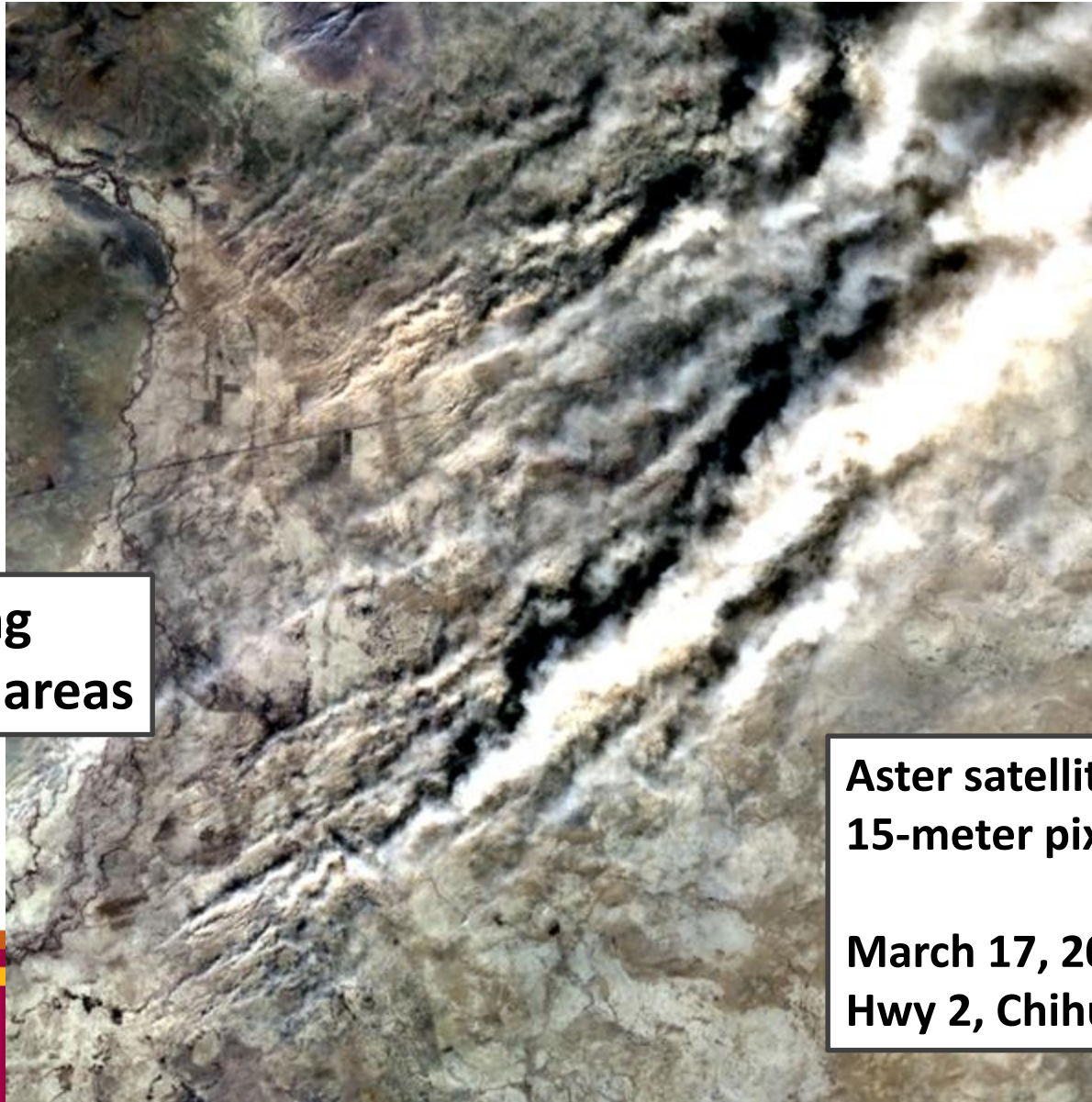




Return visit to source regions in Mexico in 2016



# High resolution satellite image



**Dust coming  
from small areas**

**Aster satellite  
15-meter pixel**

**March 17, 2012  
Hwy 2, Chihuahua, Mexico**



Contact

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**[@nmclimate](#)**