The Development of a Dust Event Climatology of the US/Mexico Border Region Including the Four Corners Region and the Panhandle of Texas During the Period 2000-2012

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Motivation for the Climatology

- Dust storms are a significant health hazard
- Dust storms occur throughout the year in the region
- Establish baseline for use in health studies
- Assess climate extremes
- Build database for forecasting
- Support local regulatory programs
Our Process

• Literature review
• Build database of satellite imagery and ground data
• Standardize data processing
• Process imagery
• Meteorological attributes during storms
• Create geodatabase
Sources of Data

- AVHRR, MODIS, GOES imagery
- PM$_{10}$ and PM$_{2.5}$ data
- Surface weather stations: ASOS/AWOS
- Meteorological model output: RUC & NARR
- Weather maps
- Personal documentation
Processing Satellite Imagery

• Analyzed archive of AVHRR imagery at NMSU (2000 to present, +some earlier)
• Used GOES high temporal resolution to extract timing and incorporate AVHRR and MODIS
• Evaluated dust source locations manually
  – Trained students to look for signature
Sources of Ground based Dust Data

• Agencies and Networks
  – New Mexico Environment Department
  – Texas Commission on Environment Quality
  – City of Albuquerque Air Quality Division
  – IMPROVE

• Daily PM$_{10}$ data going back to 1988
• Hourly PM$_{10}$ data going back to 1996
Dust Source Areas
Status of source areas in Southern NM
Metadata

• Goal to document wx conditions during storm
• Use local weather data when possible
• Use models otherwise
• Storm typing: local vs synoptic
  – Local: convective
  – Synoptic: frontal
• Generate statistics on season, time of day, duration, wind direction, source locations
Storm Typing

- Thunderstorm Outflow

![Image: Shows up in IR imagery and radar](Image courtesy of College of DuPage)
Storm Typing

- Frontal Example 3/18/2012
Frontal Storm

• Duration: most of day

PM10 measured using TEOM monitors
Frontal Storm

PM$_{10}$ beta gage filter tape during the storm

Las Cruces, NM at 1pm

3/18/2012 storm

47mm PM$_{10}$ filter collected over the 24-hour period
Public Outreach

• Post on NM Border Air Quality website
  – For general public and scientific community
  – http://nmborderair.nmsu.edu

• Post data on our THREDDS website

• Post noteworthy episodes on our Unidata RAMADDA server
Future Work

• Continue analysis of imagery over region

• Expand climatology to earlier dates
  – 70s and 80s with Total Suspended Particulate data
  – Limited airport data

• Research sources of dust storm information from historical documents
  – NWS Cooperative Observer comments
  – Monthly weather review publications
  – Others
Future Work

• Support dust emission study in spring 2013
• Portable wind tunnel (PI-SWERL)
Contact

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