Perspectives in Sub-Seasonal and Seasonal Forecasts in NM

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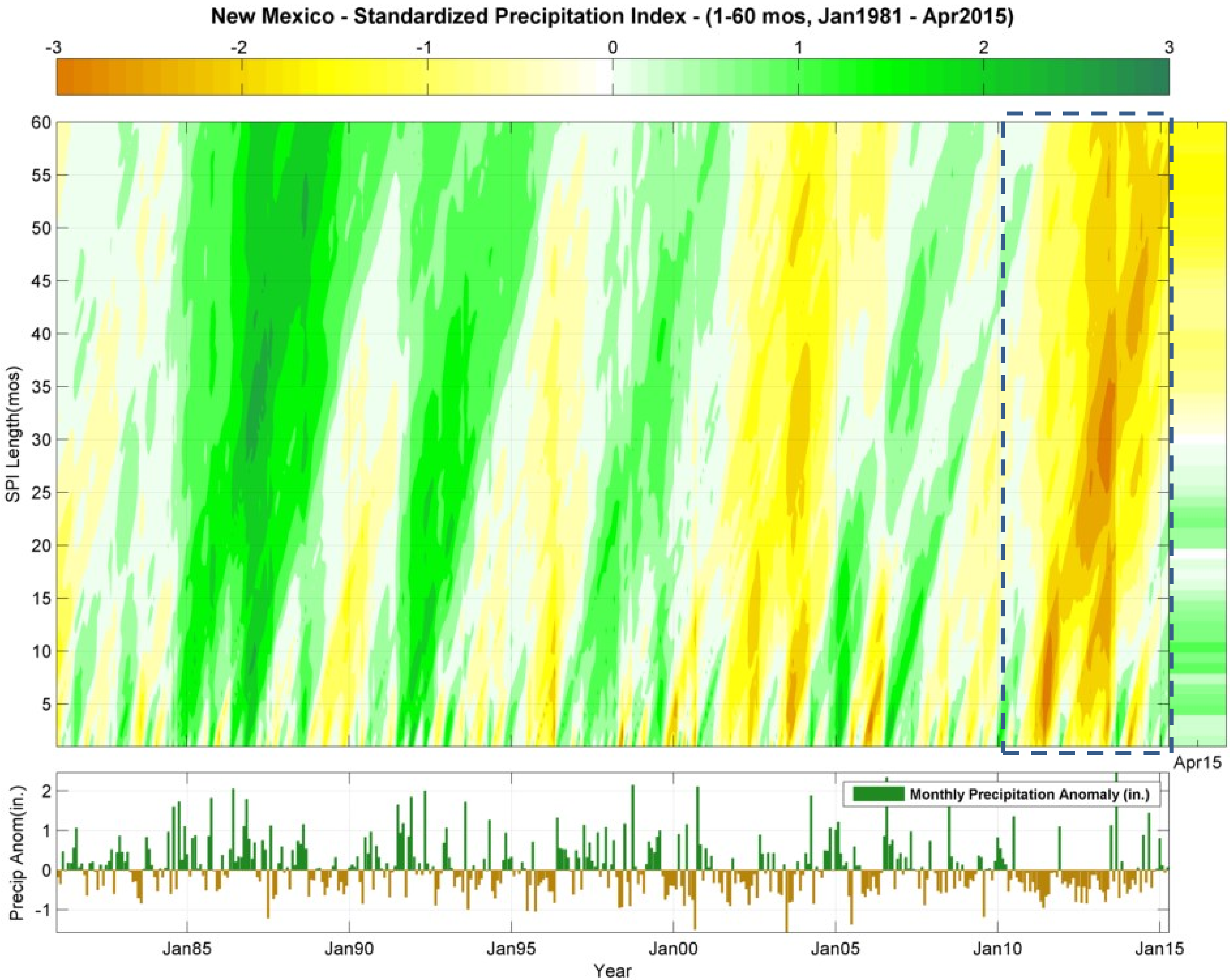
topics

- What we seen since last El Niño
- ENSO
- Monsoon
- What we learned from NAME: dynamics, flash flooding, surge
- Tropical systems
- Radar coverage
- Other external drivers

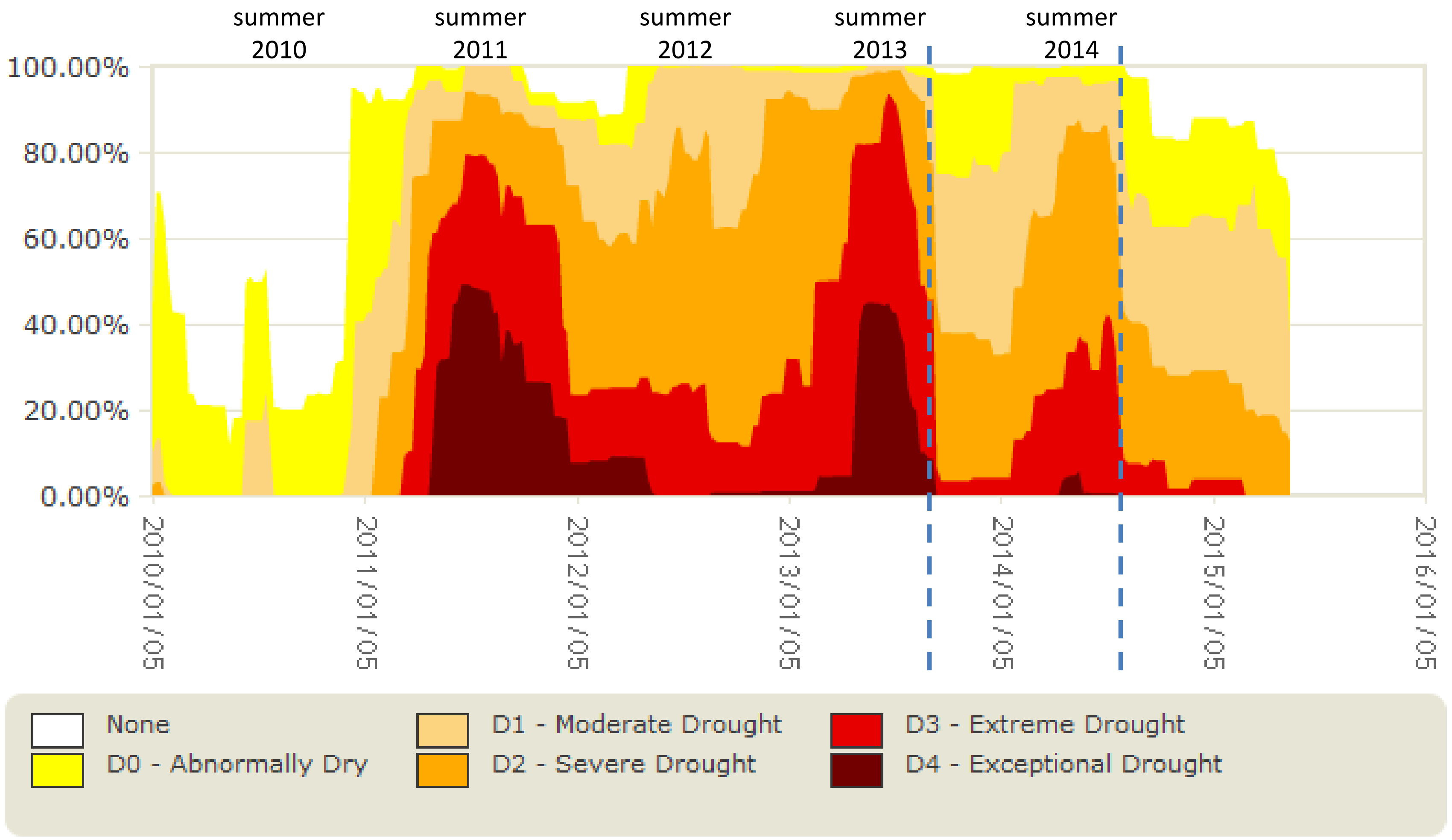


Climate Science Applications Program
University of Arizona Cooperative Extension
http://cals.arizona.edu/climate

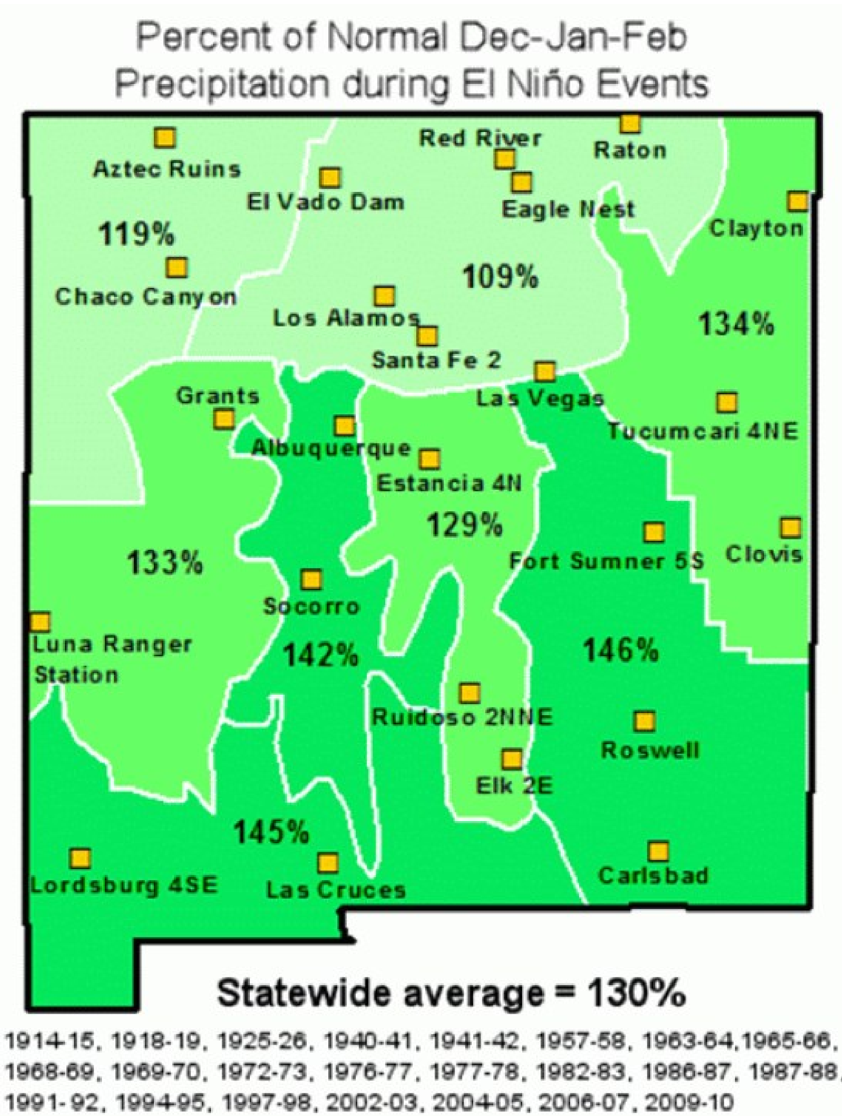
NM State-wide SPI

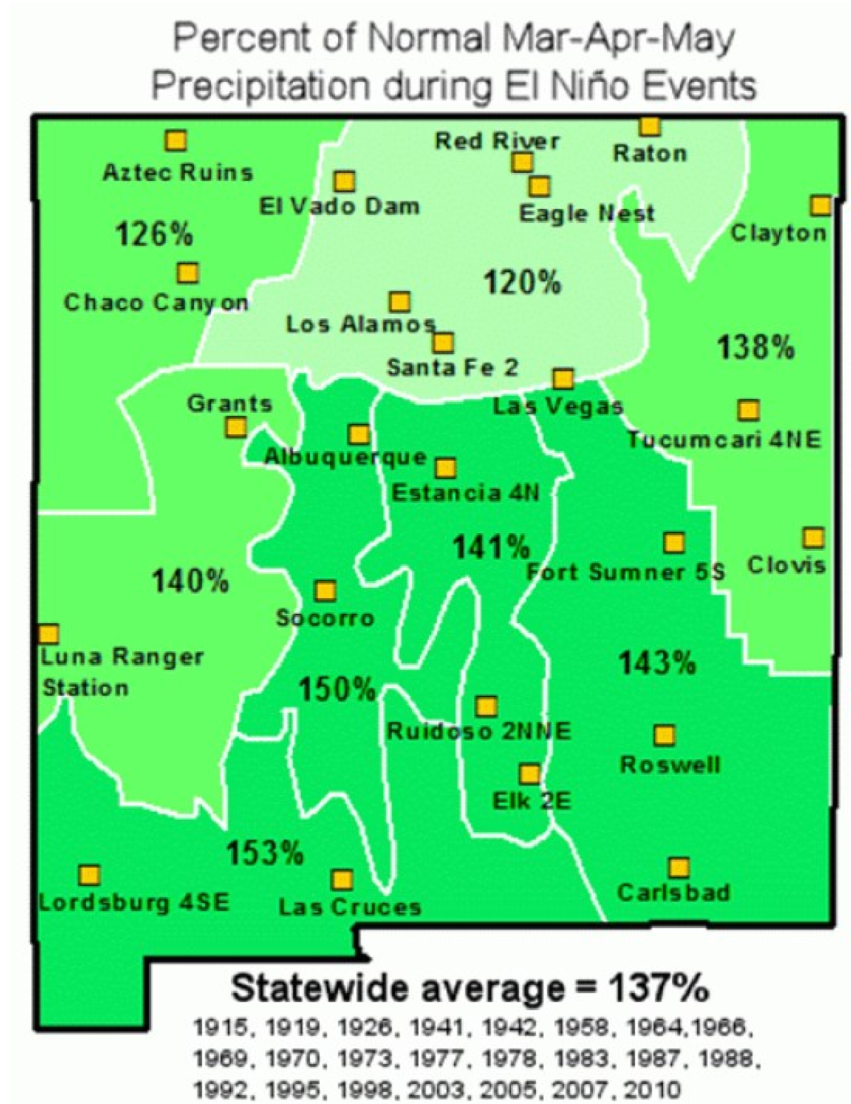
Data source: NOAA National Climatic Data Center
ftp://ftp.ncdc.noaa.gov/pub/data/cirs/climdiv
Base Period= 1900-2015 Date created: 20-May-2015

State-wide in NM since last El Niño



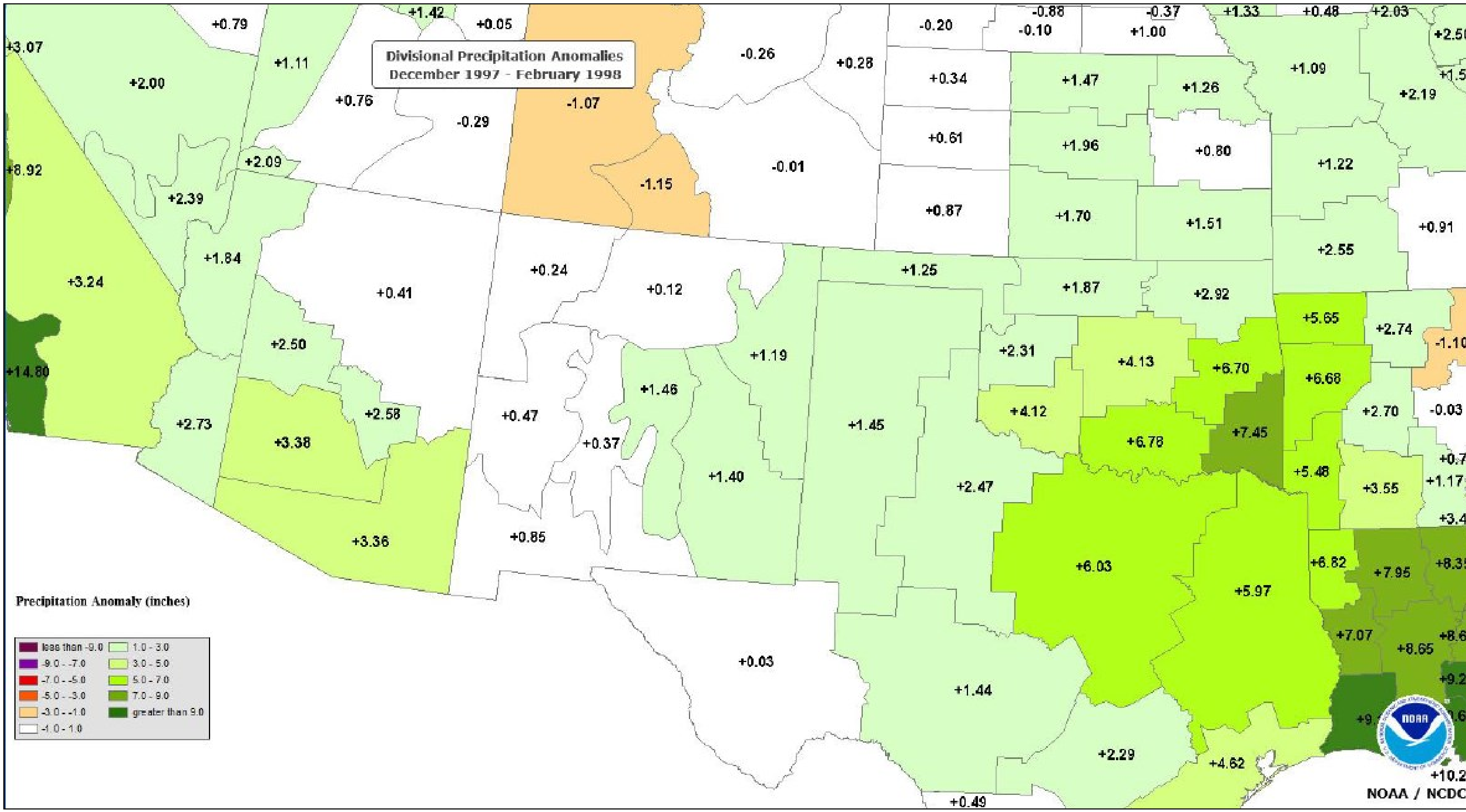
Impacts of El Nino Events





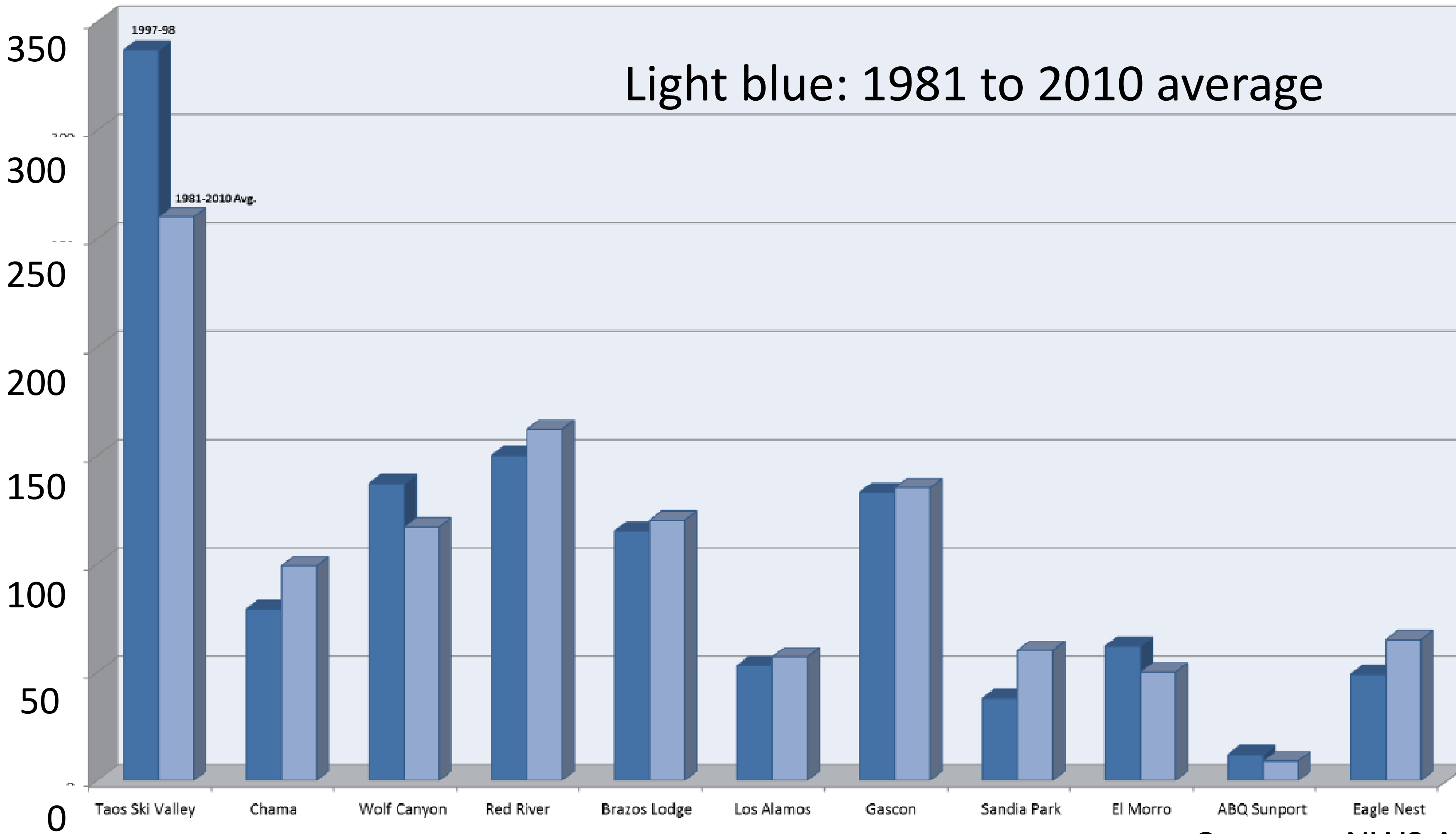
Courtesy NWS ABQ

Dec. 1997 to Feb. 1998 Departures



Look back at 1997-1998 strong El Niño

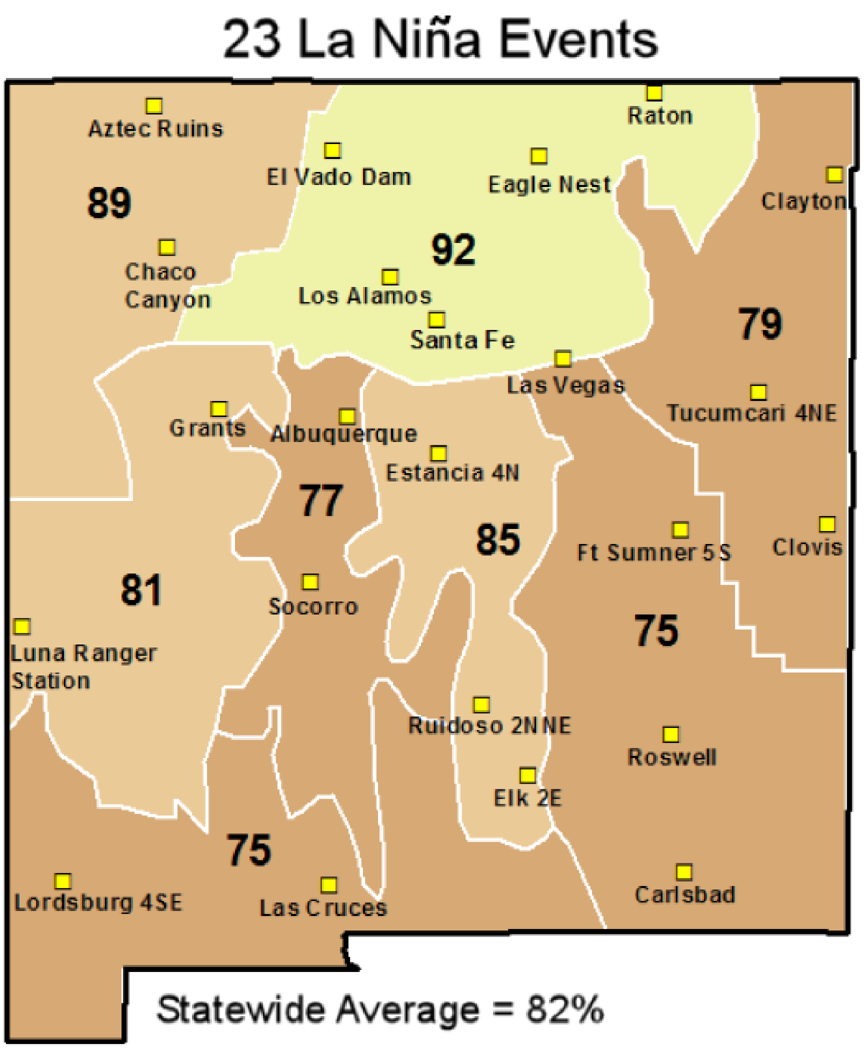
- Oct. 1997 to May 1998 snowfall percent of ave.

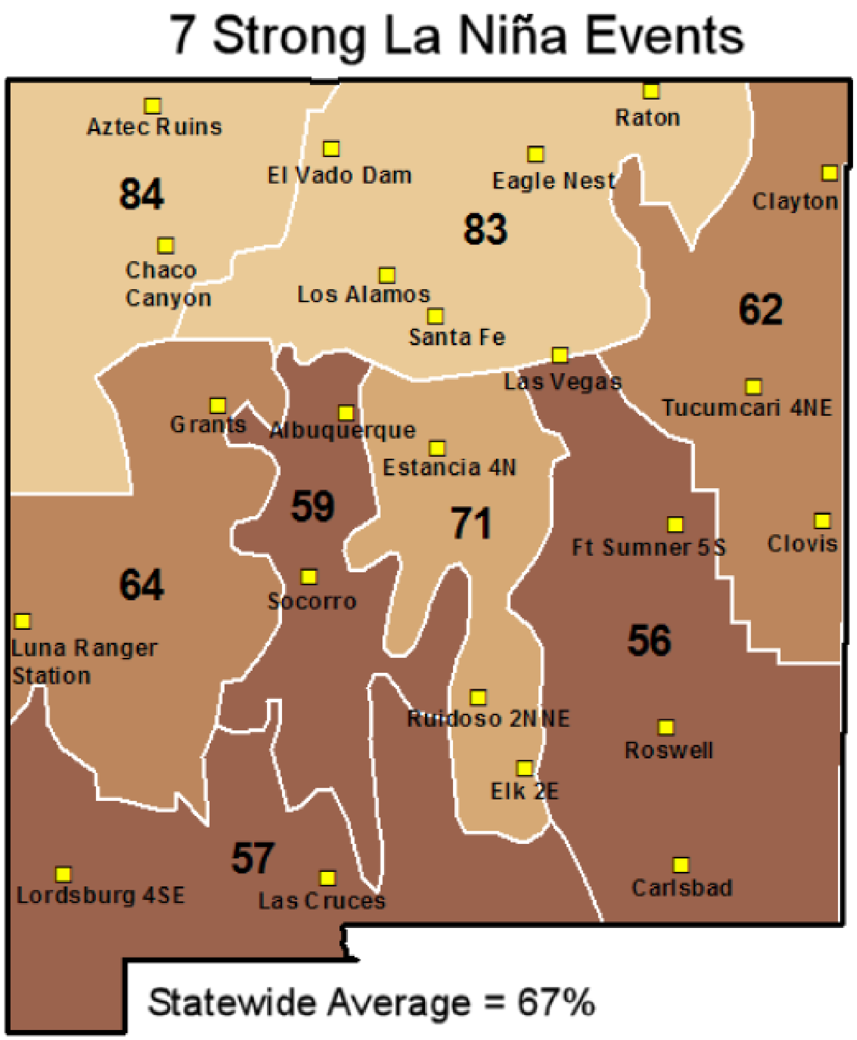


Courtesy NWS ABQ

Impacts of La Nina Events

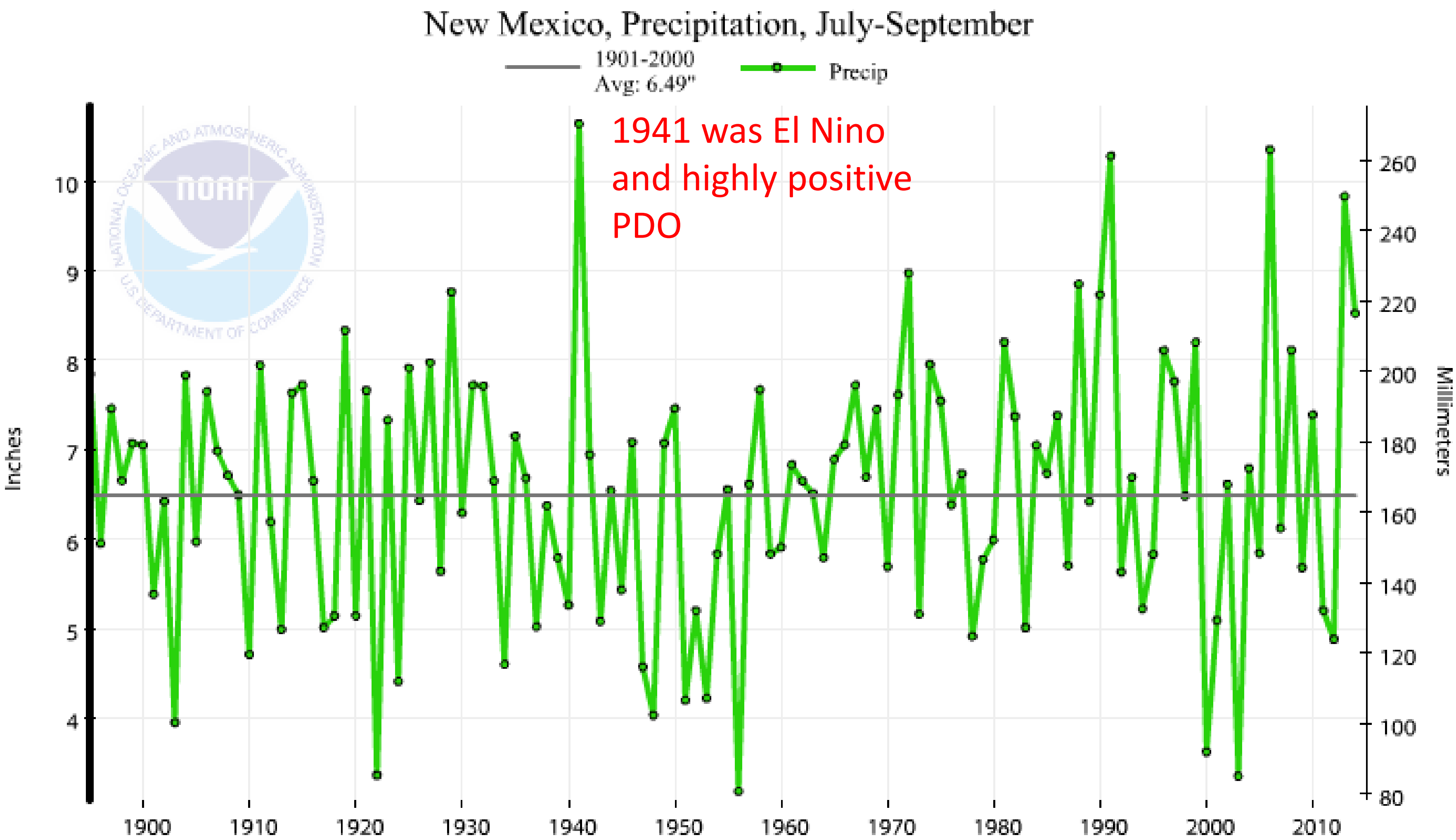
Percent of normal for DJF





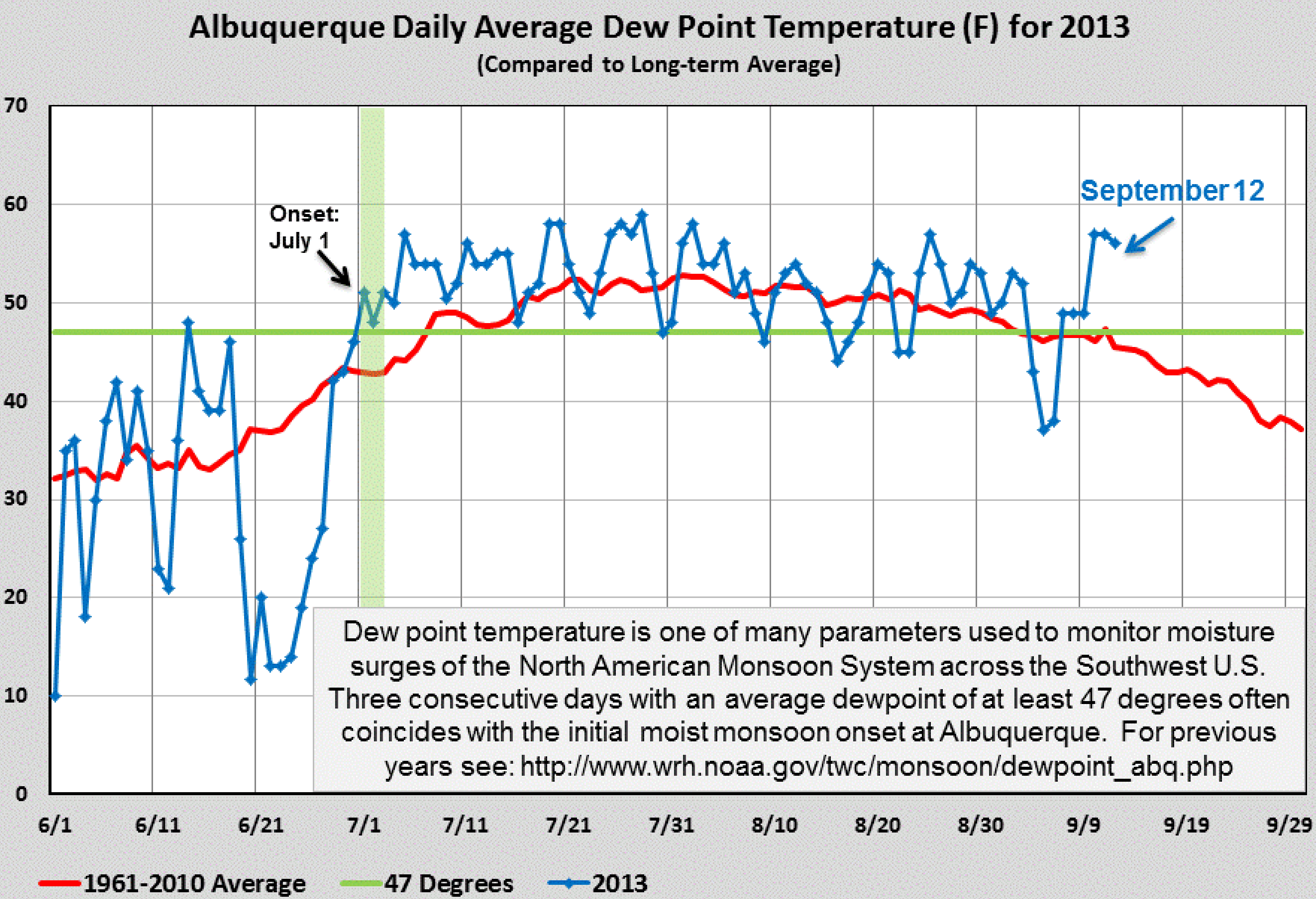
Courtesy NWS ABQ

State-wide JAS precip. since 1895



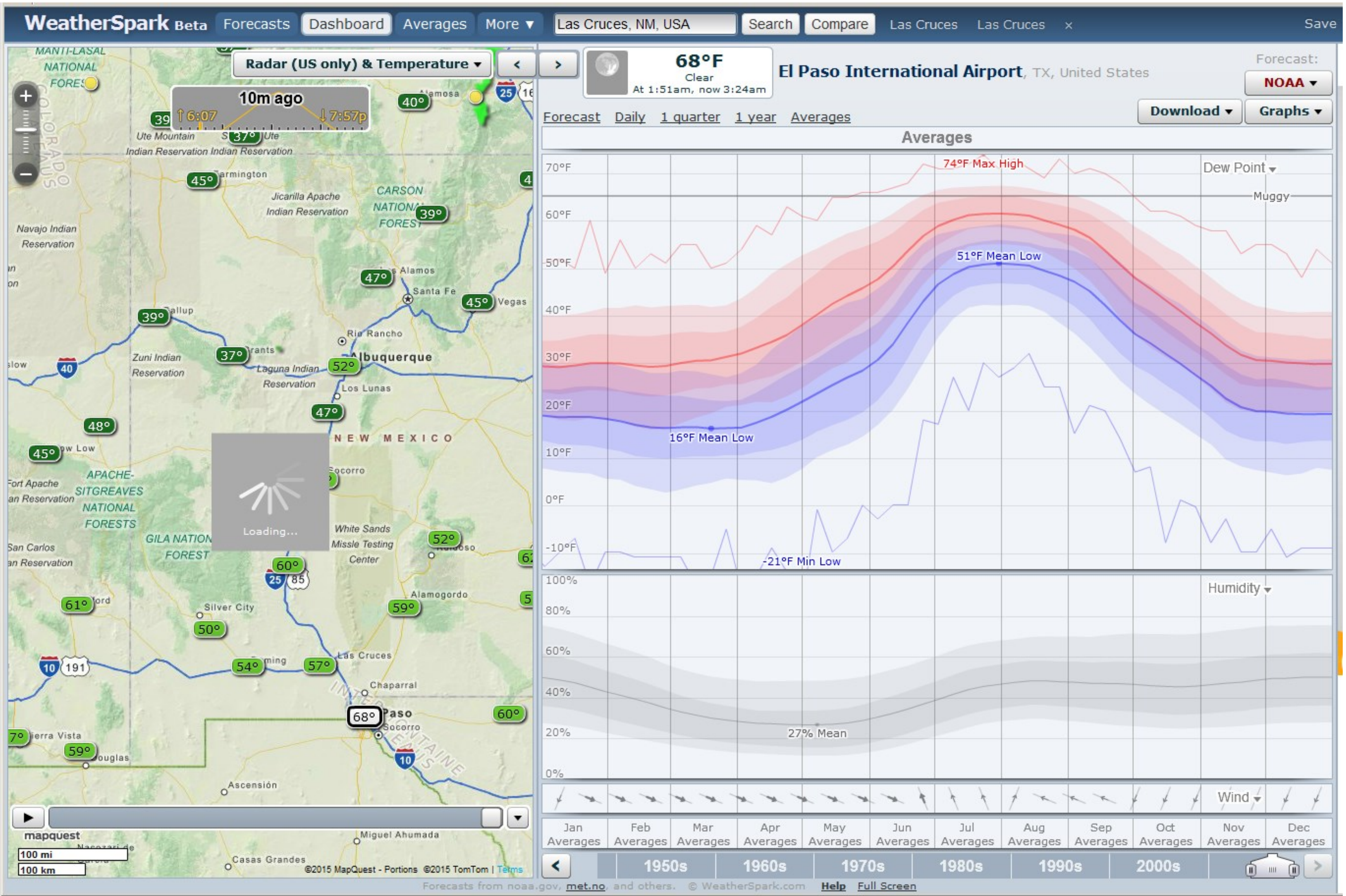
annual average 13.99"

JAS represents 46% of annual state-wide precipitation



Courtesy NWS ABQ

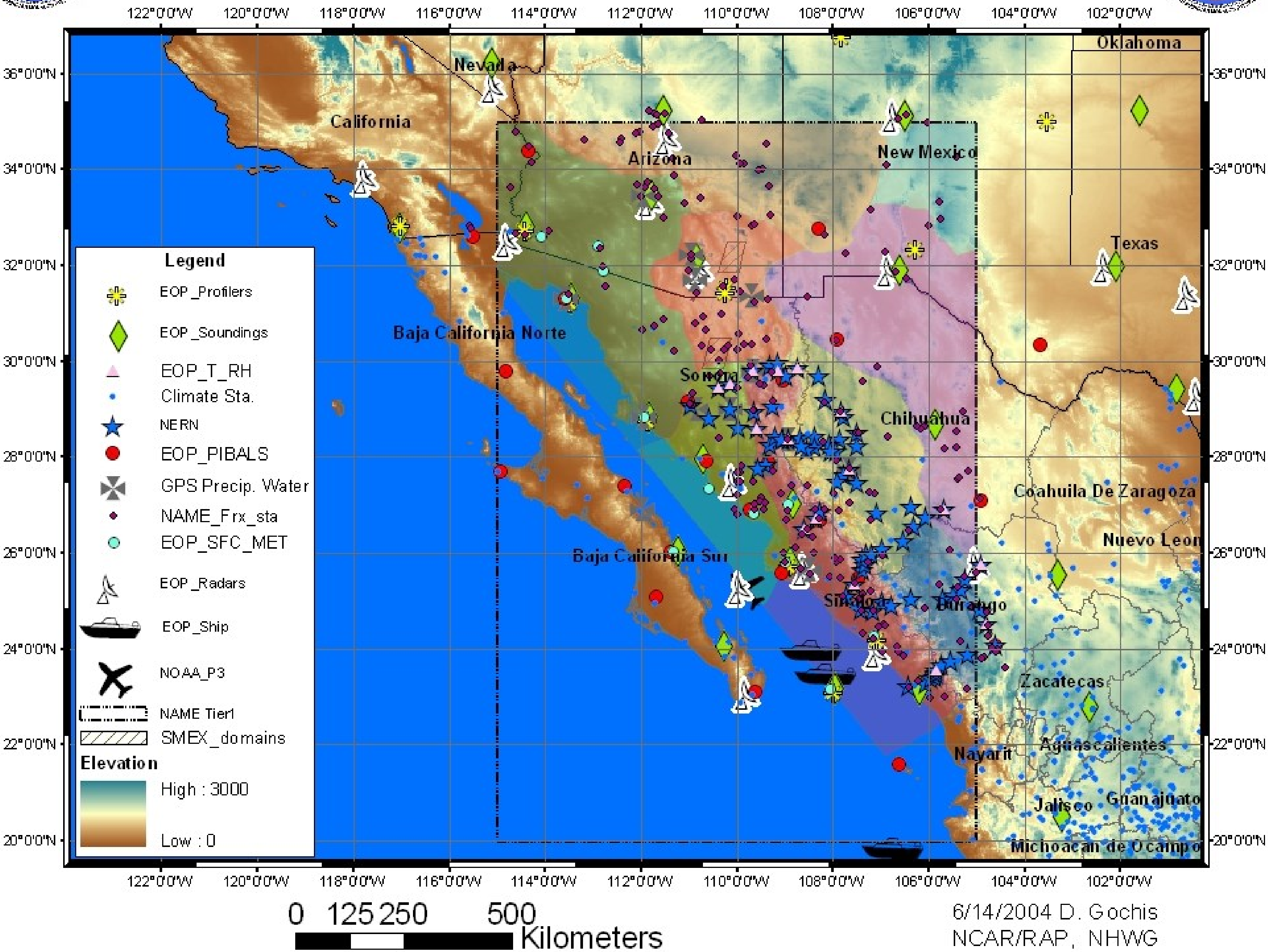
Dewpoints in El Paso, TX



NAME project: 2000-2010

- Improve characterization of warm season convective processes in complex terrain (Tier 1)
- Describe and improve simulation of mechanisms controlling intraseasonal variability of the monsoon (Tier 2)
- Define the response of the warm season circulation and precipitation to slowly varying boundary conditions (Tier 3)
- Improve simulation and prediction of the North American Monsoon System and its variability

2004 NAME EOP Instrument Network



A few NAME results

- Produced a wealth of observations for modeling and continued assessment
- The need for more observations for models
- Model metrics: monsoon onset, PM precipitation maxima, nocturnal precip
- Important role of large-scale boundary conditions (e.g SST and land surface)
- Key Gulf moisture surge but importance of modeling of low level jet unclear

(Turner et al. 2013; Gutzler et al. 2005; Gutzler 2009; Vera et al. 2006)

More NAME results

- Possible ties to land surface (snowpack)
  - low snowpack, surfaces heats quickly, early onset, more precipitation
- Smoke inhibiting surface heating, less stable
- Teleconnections
- Importance of sea surface temperatures
- Ocean rainfall patterns
- Wind patterns over the Gulf of California
- Gulf surges initiated by upper level inverted troughs
- MJO and development of tropical cyclones

(Gutzler et al. 2005; Gutzler 2009; Vera et al. 2006)

CLIVAR Exchanges

No.66 (Vol 19 No.1) Jan 2015

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Special Issue on Monsoons: Advancing understanding of monsoon variability and improving prediction

Produced by the new jointly-sponsored CLIVAR and GEWEX Monsoons Panel

Emerging challenges in advancing predictions of the North American Monsoon

David Gochis

National Center for Atmospheric Research, USA

Introduction

Precipitation from the North American Monsoon (NAM) system provides critical water resources for Mexico, many Central American countries, several island nations in the Caribbean and parts of the southwest USA. Extreme rainfall and associated flooding events during the monsoon season, whether from local convective storms or land-falling tropical storms, form one of the most severe weather related risks to the region while, periodic drought, as a result of diminished monsoon precipitation, also can create widespread hardships that, historically, have been contributors to social and political unrest in the region. However, as in many monsoon systems around

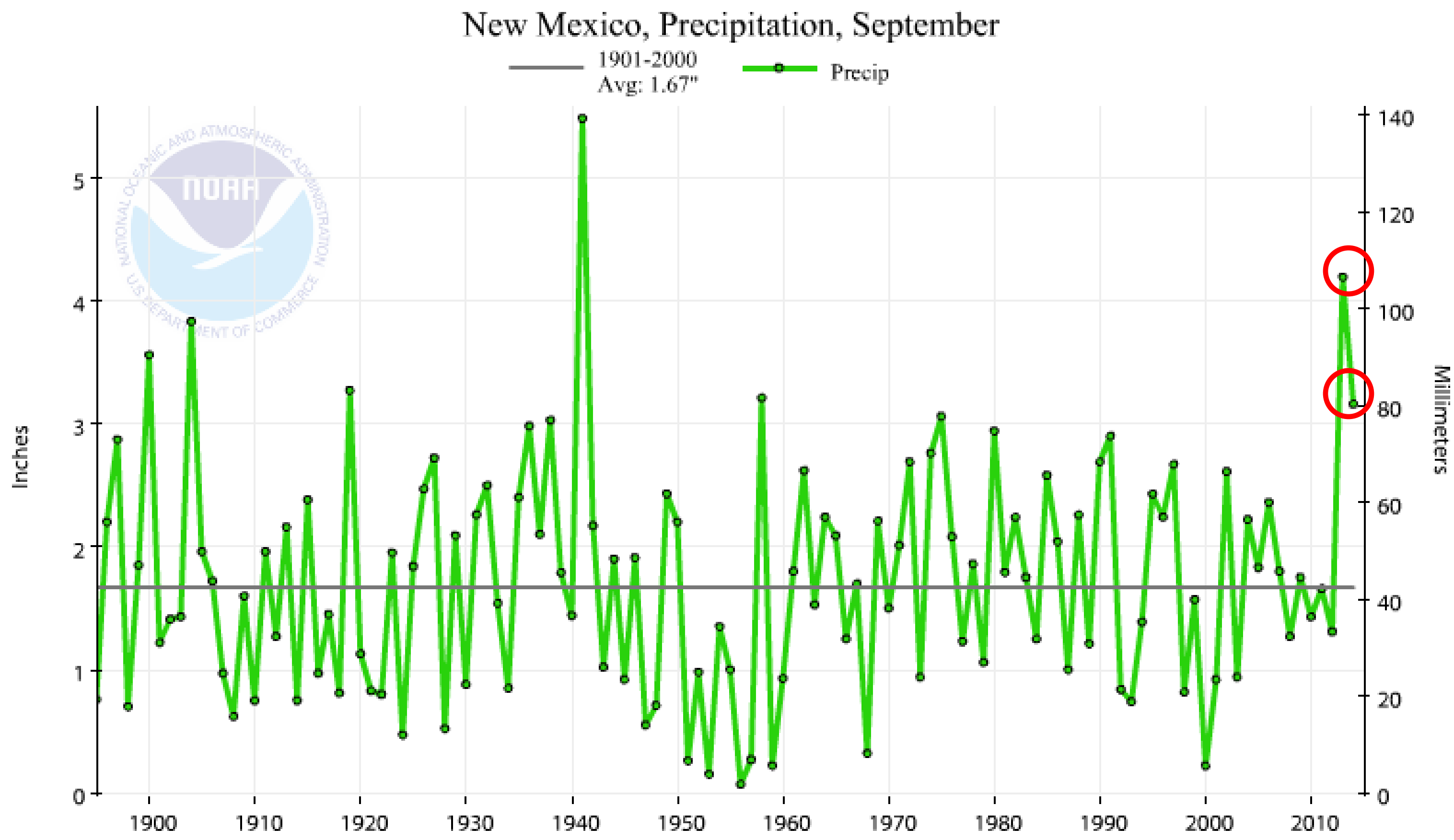
summarize the major research findings of these past programs but instead to highlight a few key recent findings that emerged from North American Monsoon research as well as identify an addressable set of remaining research challenges that can be addressed by a newly coordinated monsoon research effort under CLIVAR and GEWEX. The article finishes with a final statement on the need for improved collaboration and support mechanisms in order to transfer research effectively into national meteorological and hydrological prediction services.

Recent Findings

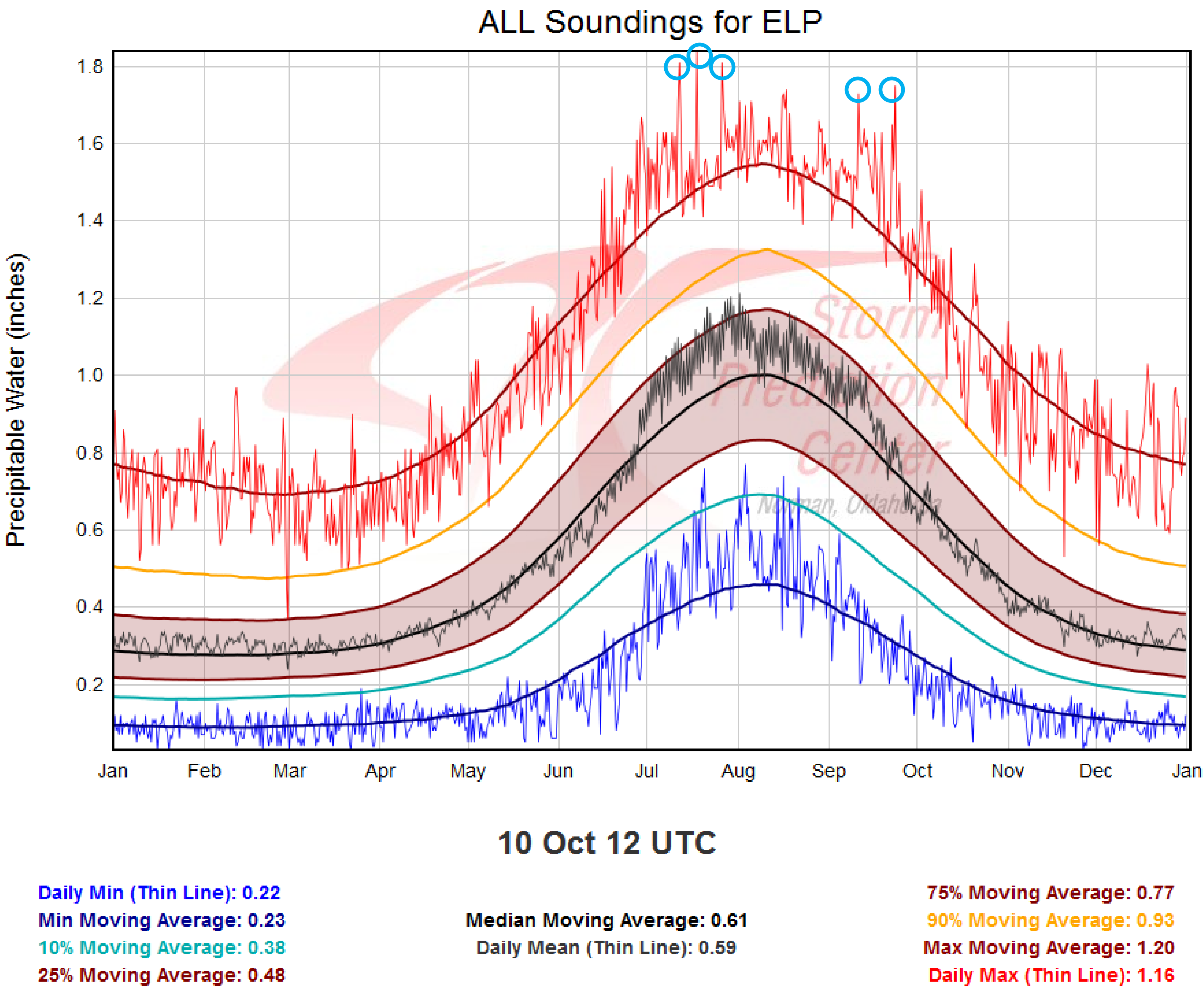
While several of the multi-scale controls on monsoon behavior have been elucidated, several outstanding questions still exist which are still greatly limiting our ability to produce skillful monsoon predictions across a range of time and space scales relevant for decision making, emergency preparedness and societal adaptation. Many of these questions center around how the seasonal and diurnal cycles of rainfall in the NAM region are and will continue to evolve in response to environmental changes such as a warming climate and continued land-use and land-cover changes. Of particular interest to CLIVAR and GEWEX is how fundamental exchange processes between the ocean and atmosphere and land and atmosphere, respectively, regulate both mean and variability structures of the NAM.

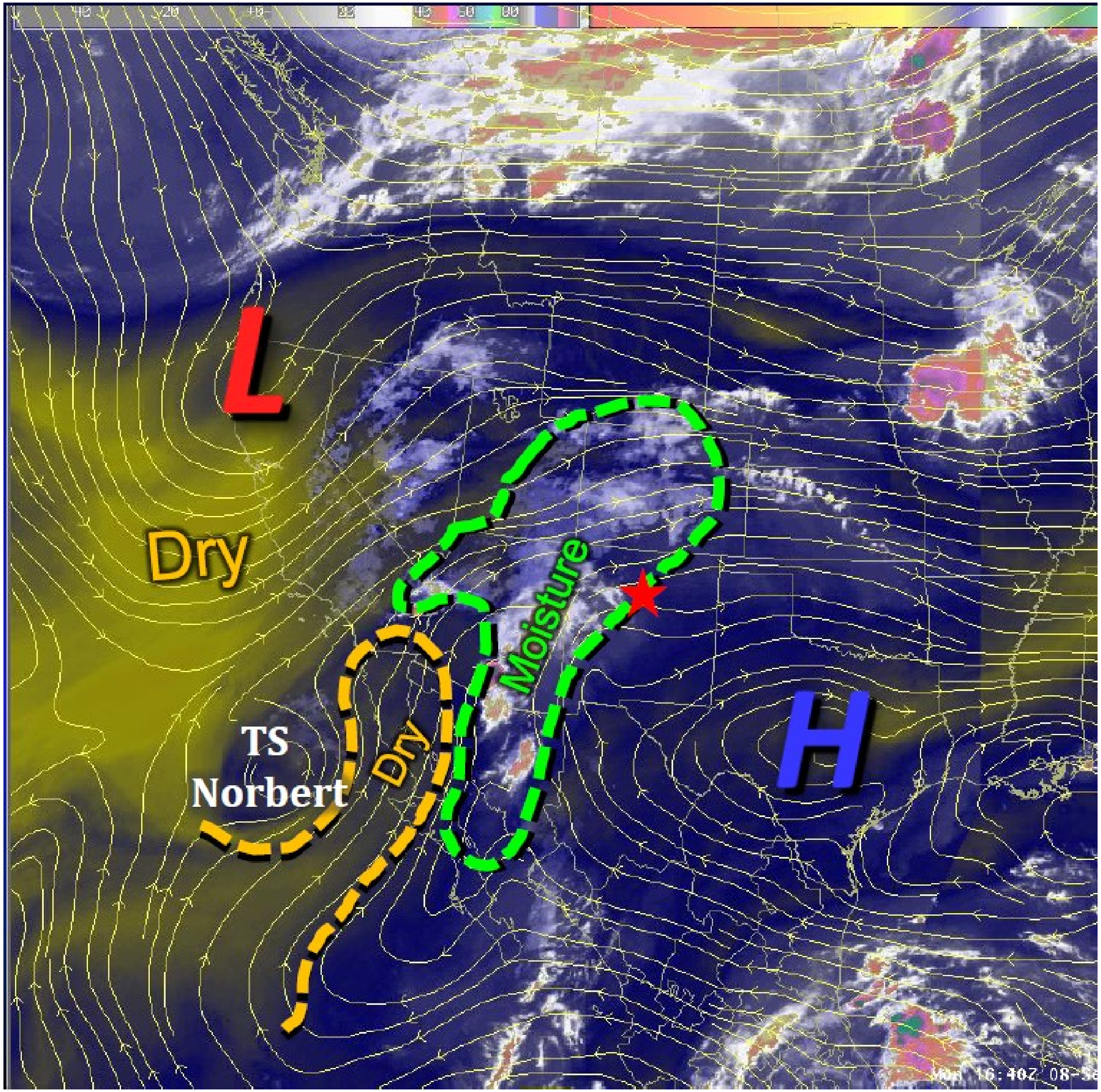
Prior research has documented how precipitation patterns and the occurrence of heavy rainfall episodes are strongly linked to orographic features and the proximity to coastlines (e.g., Cortez et al., 1999; Gochis et al., 2007; Nesbitt et al., 2008). More recently, it has been shown that statistically significant positive trends exist in extreme warm season rainfall events (95th and 99th percentiles)(Arriga-Ramirez and Cavazos, 2010).Part of the variability of trends in extreme precipitation are linked to natural variations resulting from the combined

Role of Sept. Tropical Systems in NM



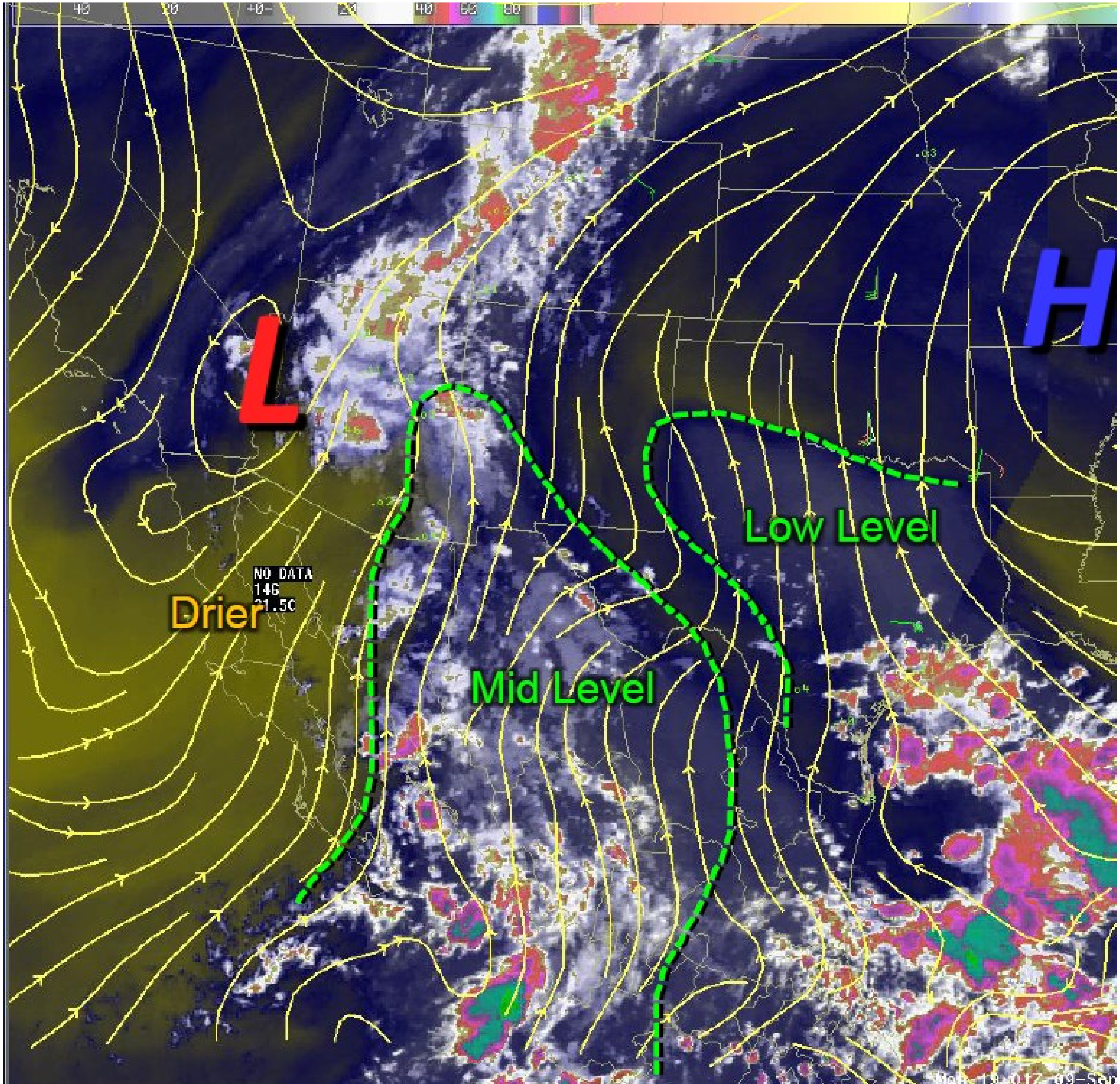
Both of these years were impacted by tropical systems


ALL Soundings for ELP
Precipitable Water (inches)
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Storm Prediction Center
Norman, Oklahoma
10 Oct 12 UTC
Daily Min (Thin Line): 0.22
Min Moving Average: 0.23
10% Moving Average: 0.38
25% Moving Average: 0.48
Median Moving Average: 0.61
Daily Mean (Thin Line): 0.59
75% Moving Average: 0.77
90% Moving Average: 0.93
Max Moving Average: 1.20
Daily Max (Thin Line): 1.16



TS Norbert Sept. 8, 2014

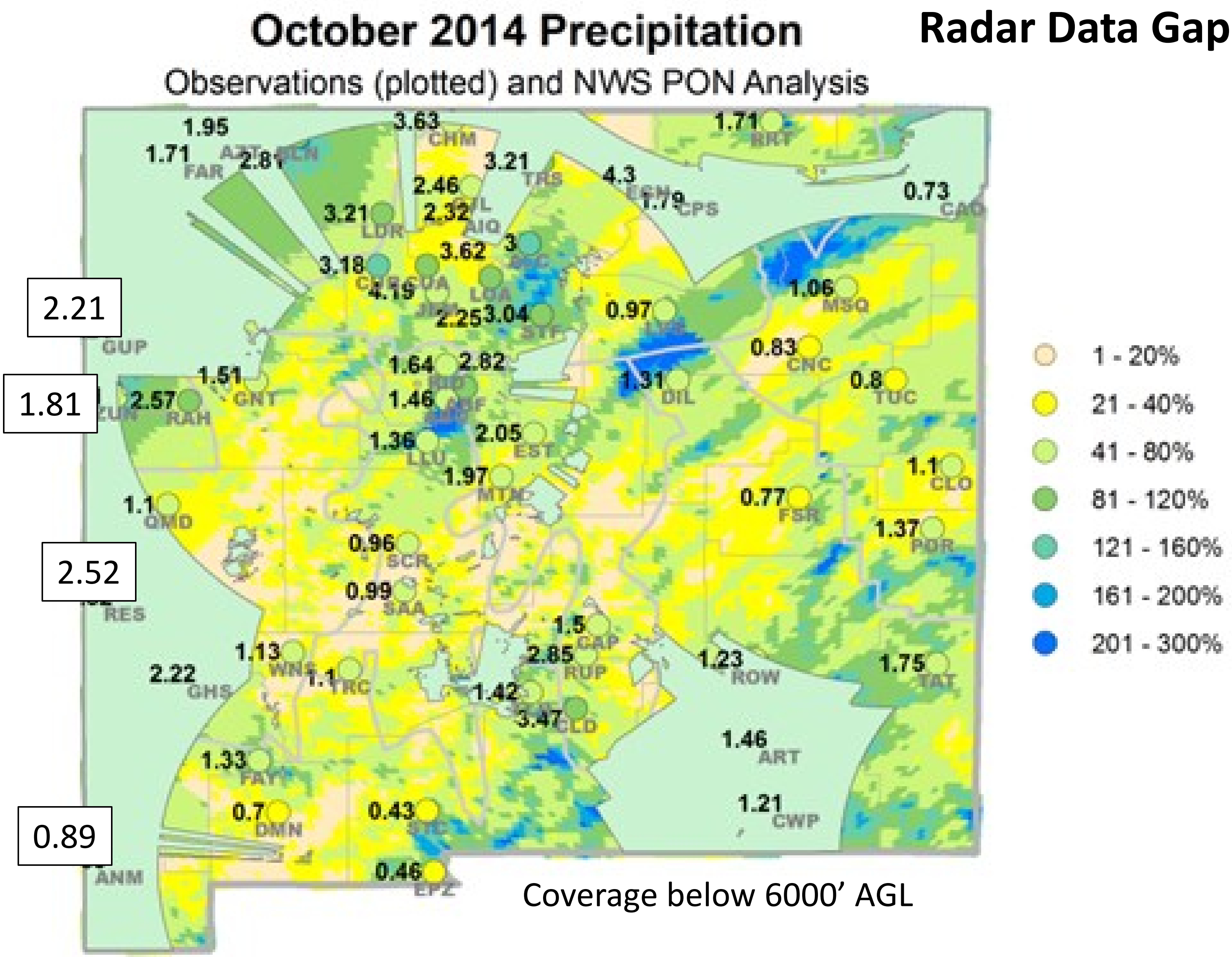
NWS ABQ briefing



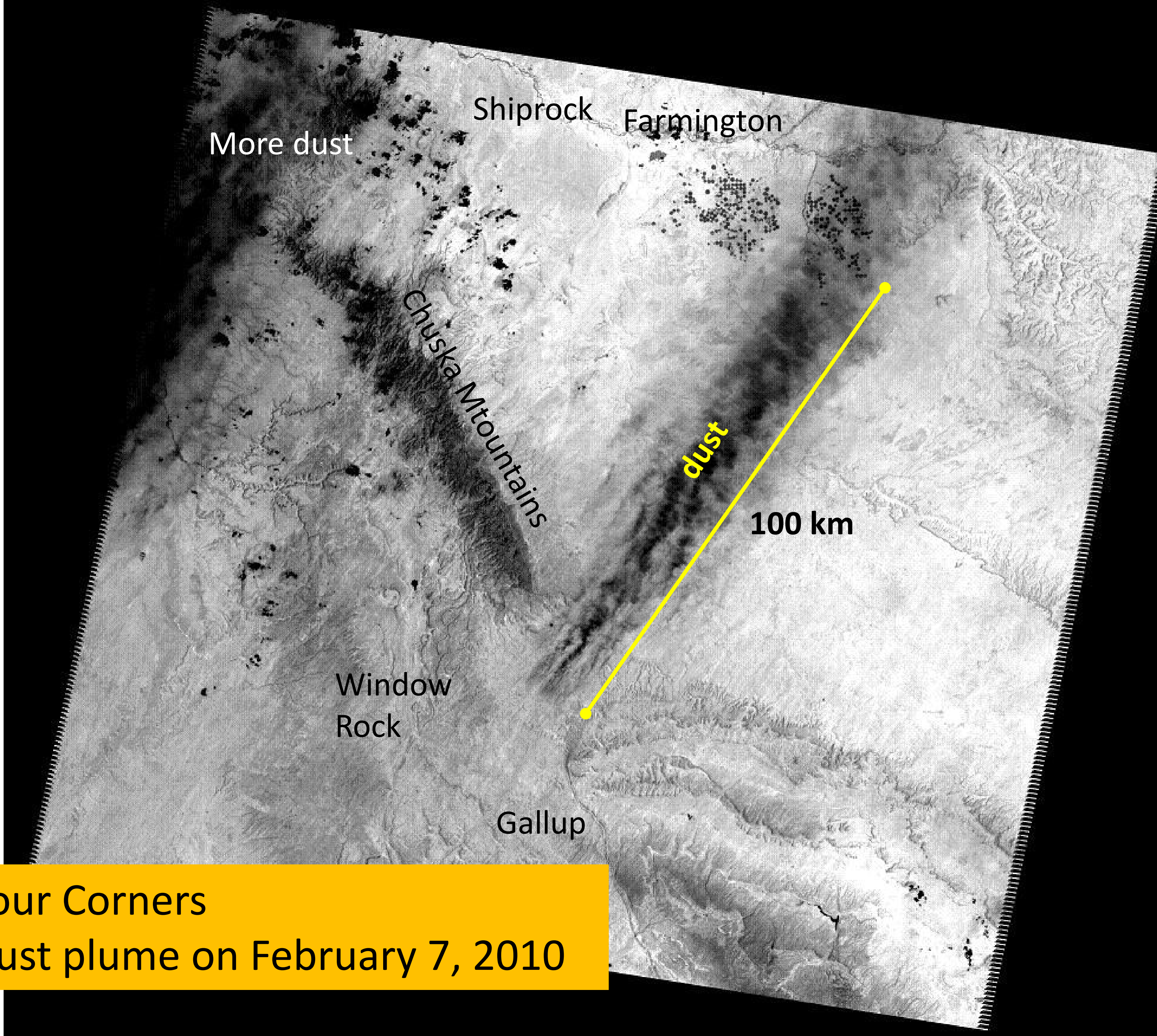
Sept. 9, 2013

NWS ABQ briefing

Radar Data Gaps



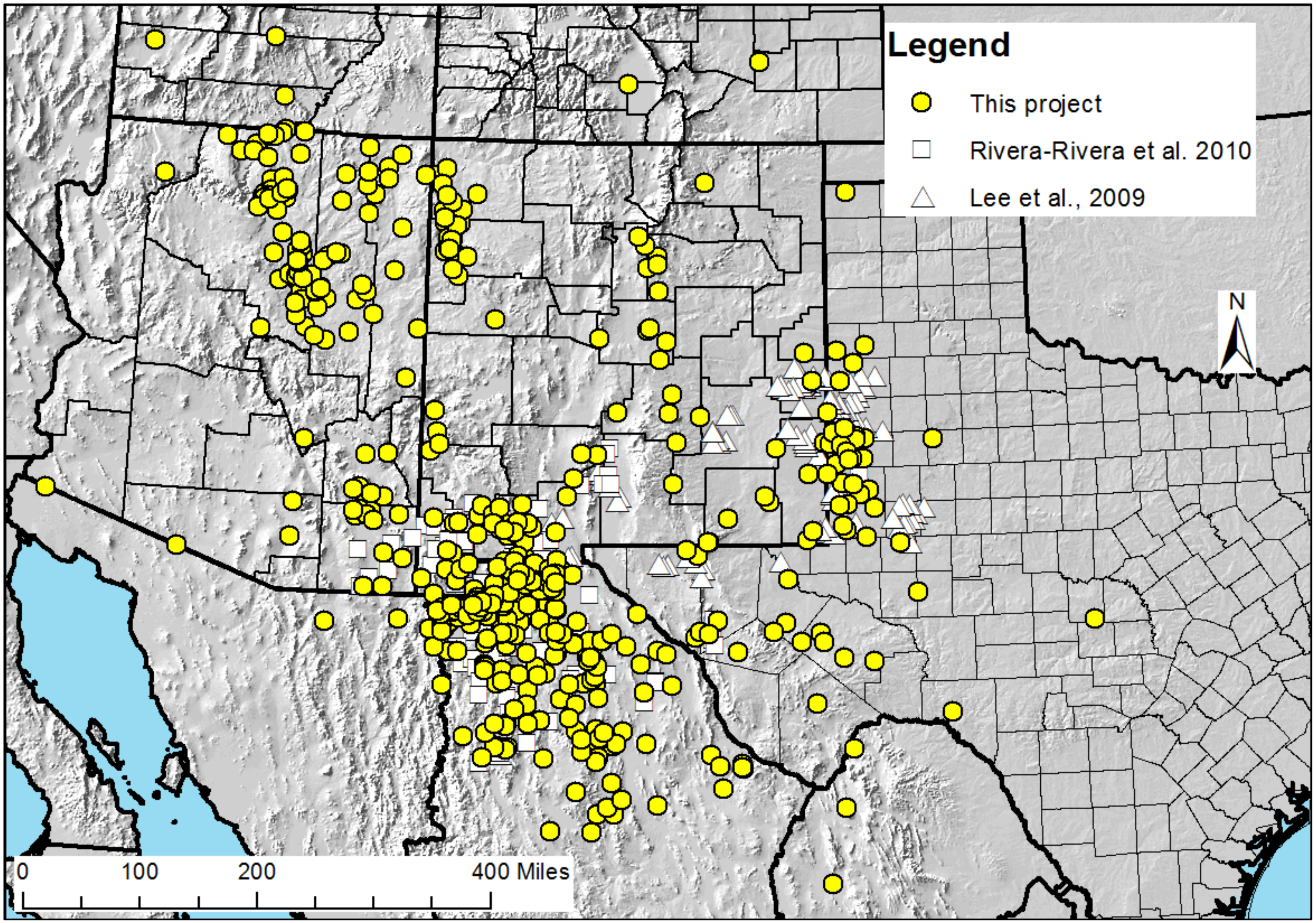
Courtesy D. Kann, NWS ABQ



Four Corners
Dust plume on February 7, 2010

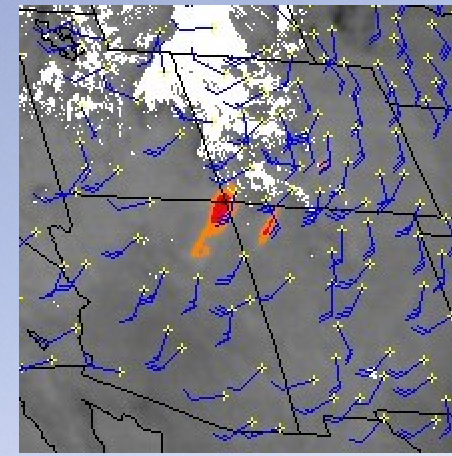
Developed dust source database

- 2000-2012 database from satellite imagery

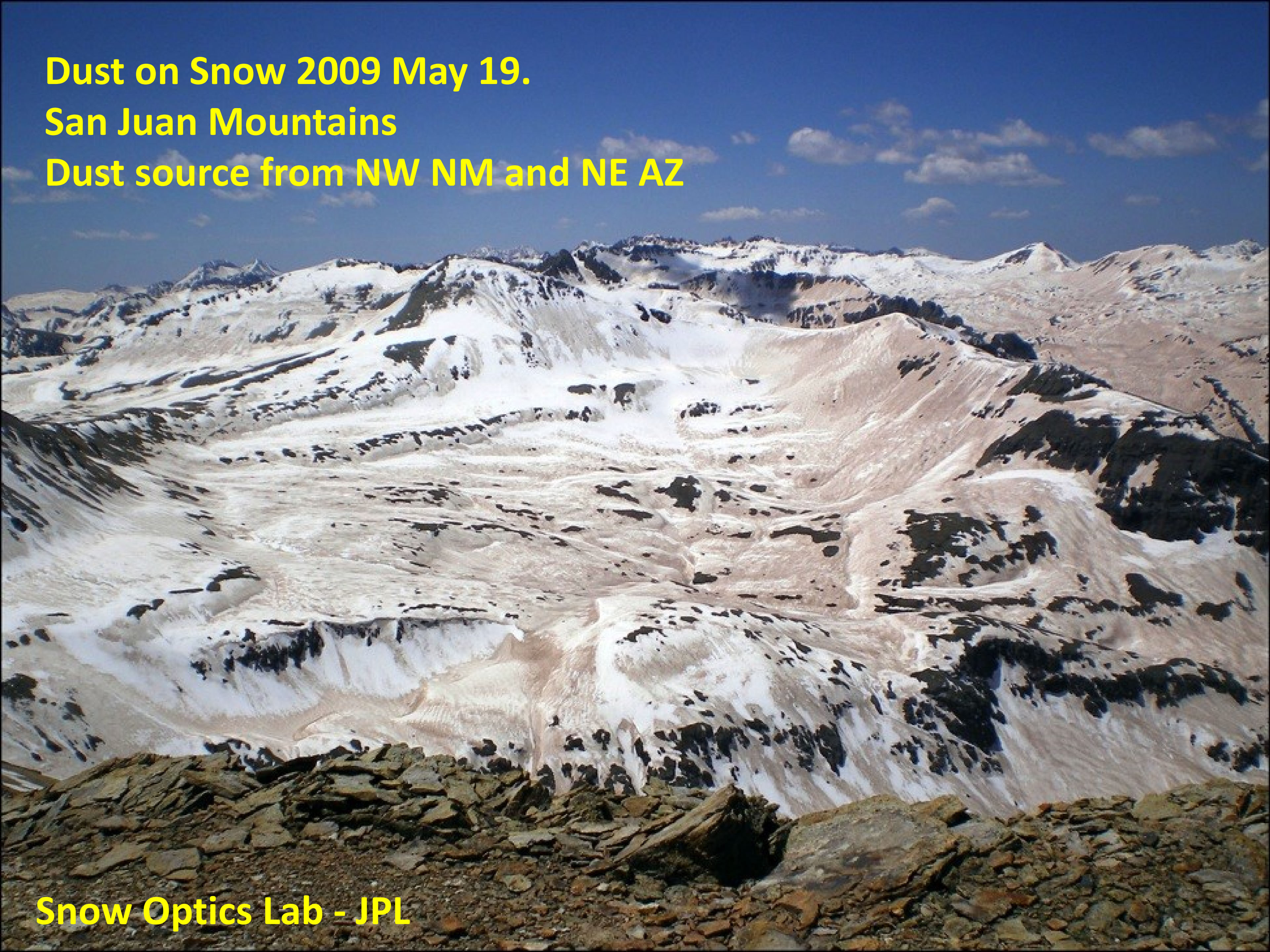


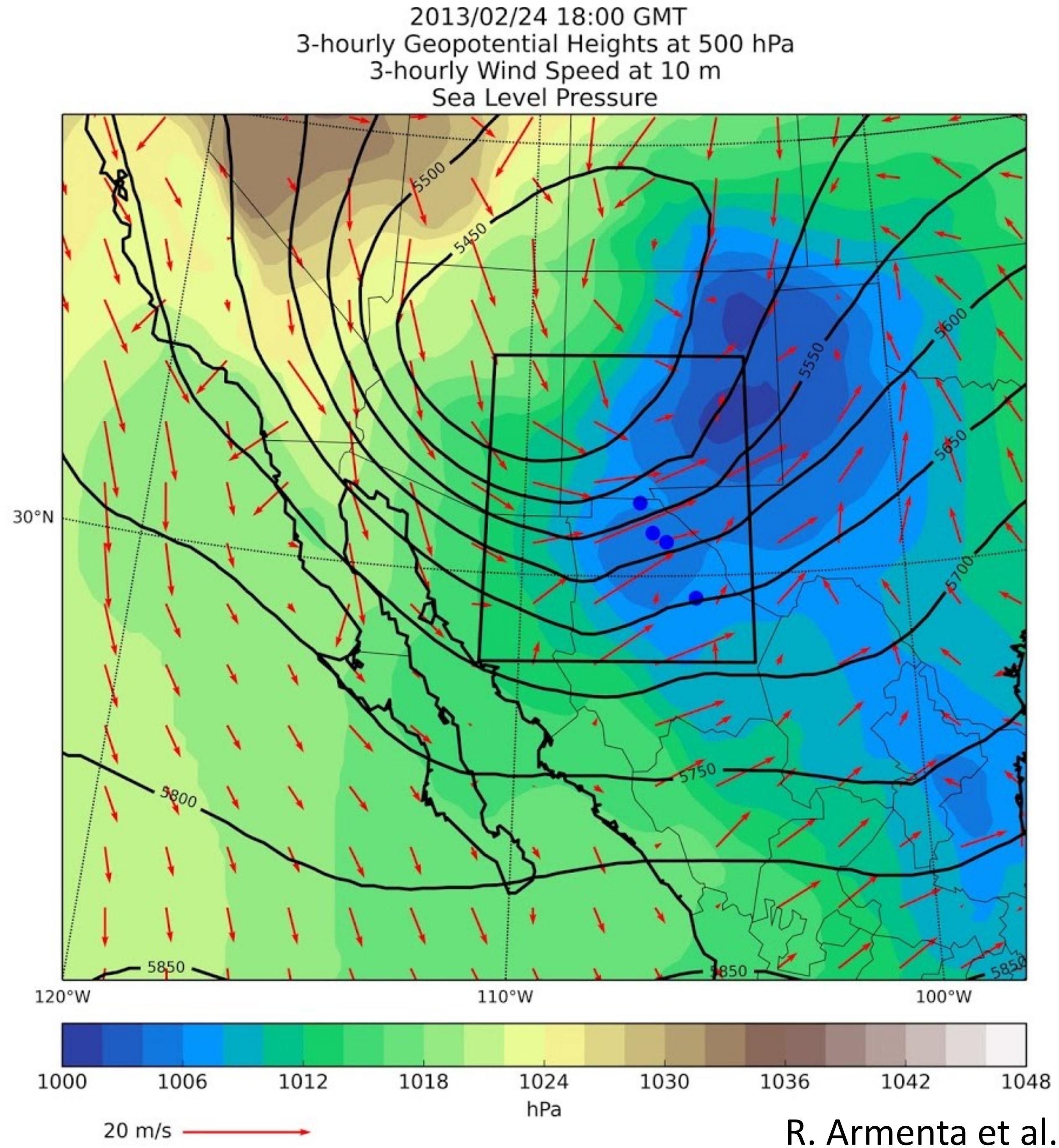
Dust storm lasted >6 hours and transported dust to San Juan Mountains in CO

<u>Very</u> erodible rangeland near Newcomb, NM during the May 22, 2010 dust storm

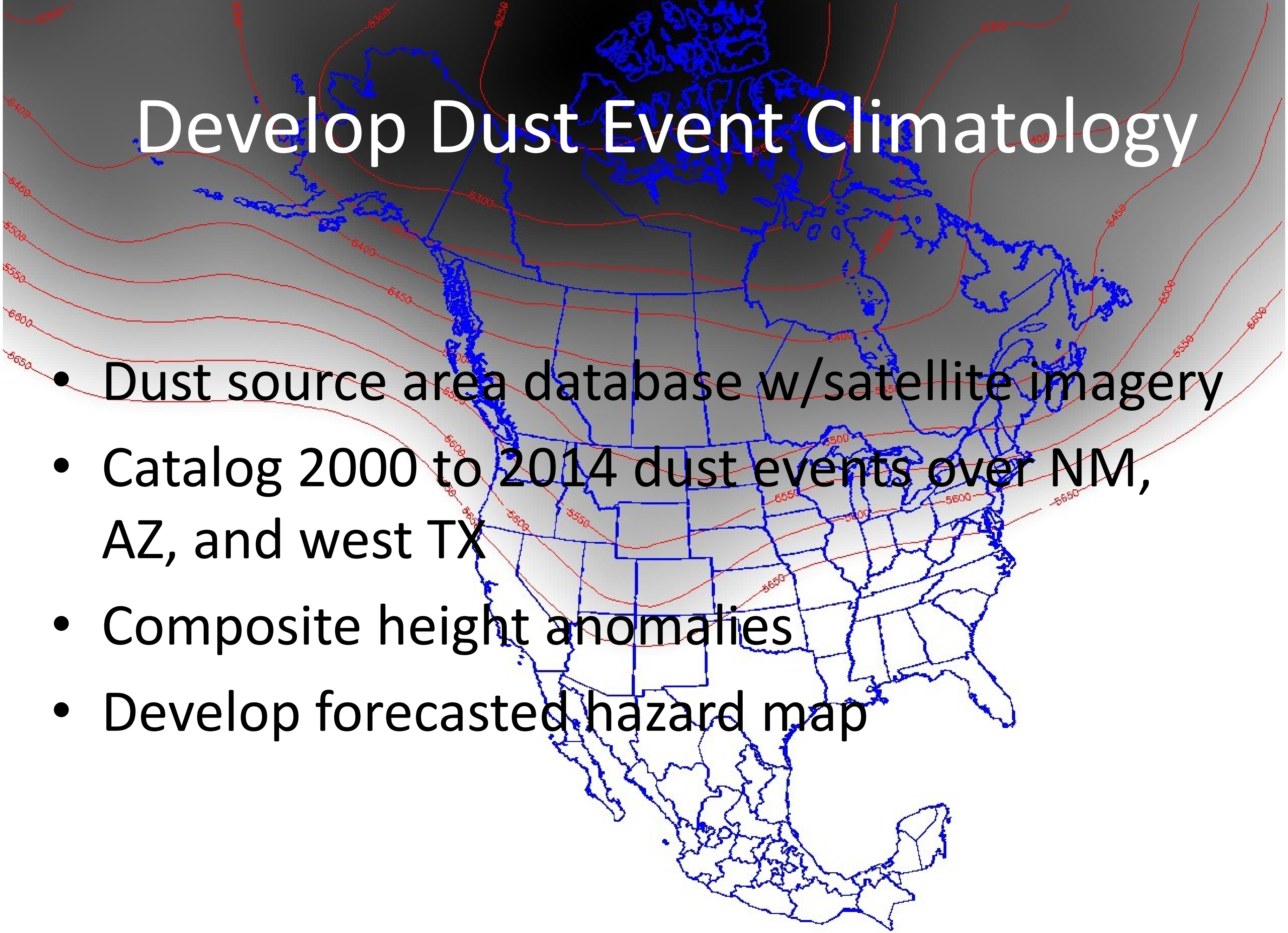


Above: Longwave IR difference image shows dust plumes


Dust on Snow 2009 May 19.
San Juan Mountains
Dust source from NW NM and NE AZ
Snow Optics Lab - JPL



R. Armenta et al. In preparation



Develop Dust Event Climatology

- Dust source area database w/satellite imagery
- Catalog 2000 to 2014 dust events over NM, AZ, and west TX
- Composite height anomalies
- Develop forecasted hazard map