

Climate Variability and Drought: An Overview for the Pinal County LDIG

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Presentation Overview

- Background on Central AZ Climate and Drought
- Atmospheric Controls on AZ Climate
- Seasonality of Precipitation
- Interannual Climate Variability



Background on Central AZ Climate





Drought and Climate in Arizona:

**Top Ten
Questions
& Answers**



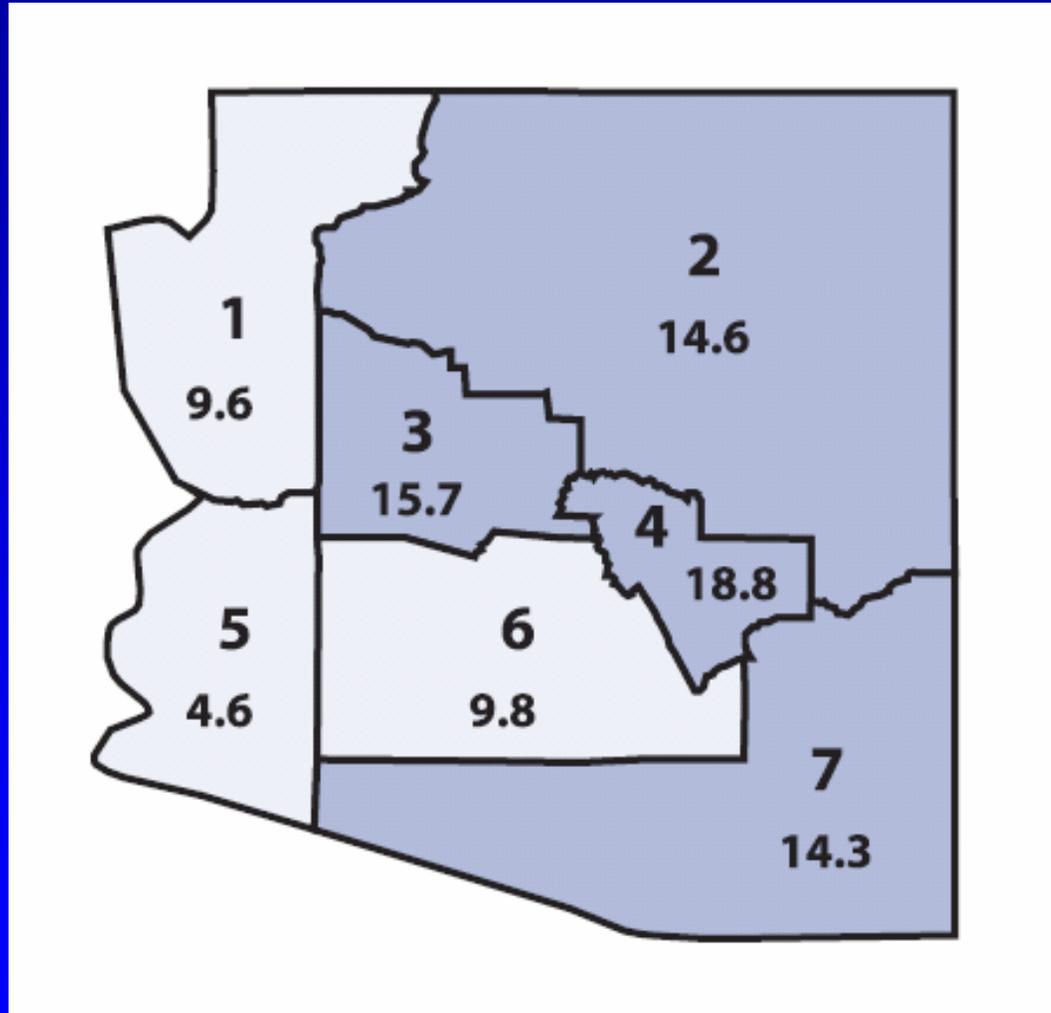
**Final Report
March 2004**

**Jenna McPhee,
Andrew Comrie,
and Gregg Garfin**

- <http://www.ispe.arizona.edu/climas/pubs/DroughtQ&A.pdf>

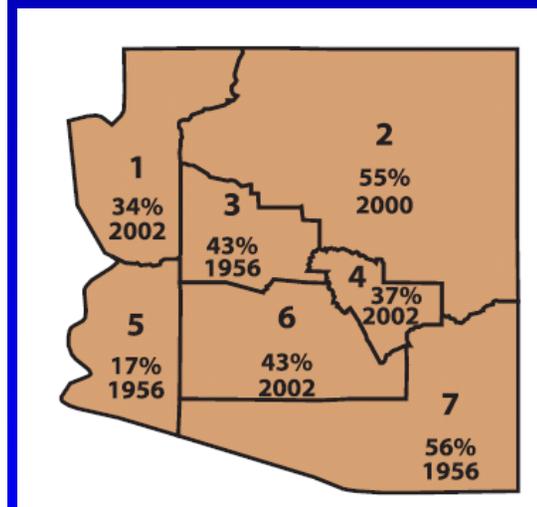
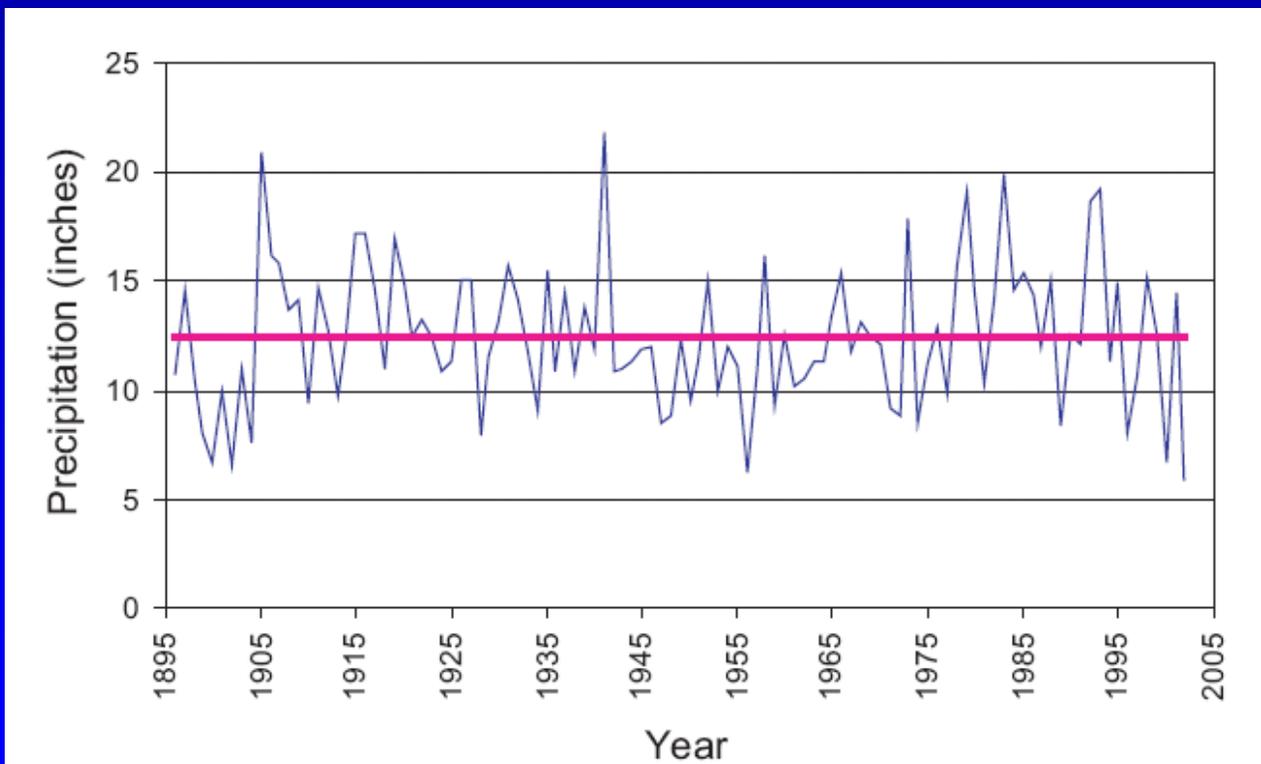


Long-term average annual precipitation (1896-2002)



McPhee et al. 2004

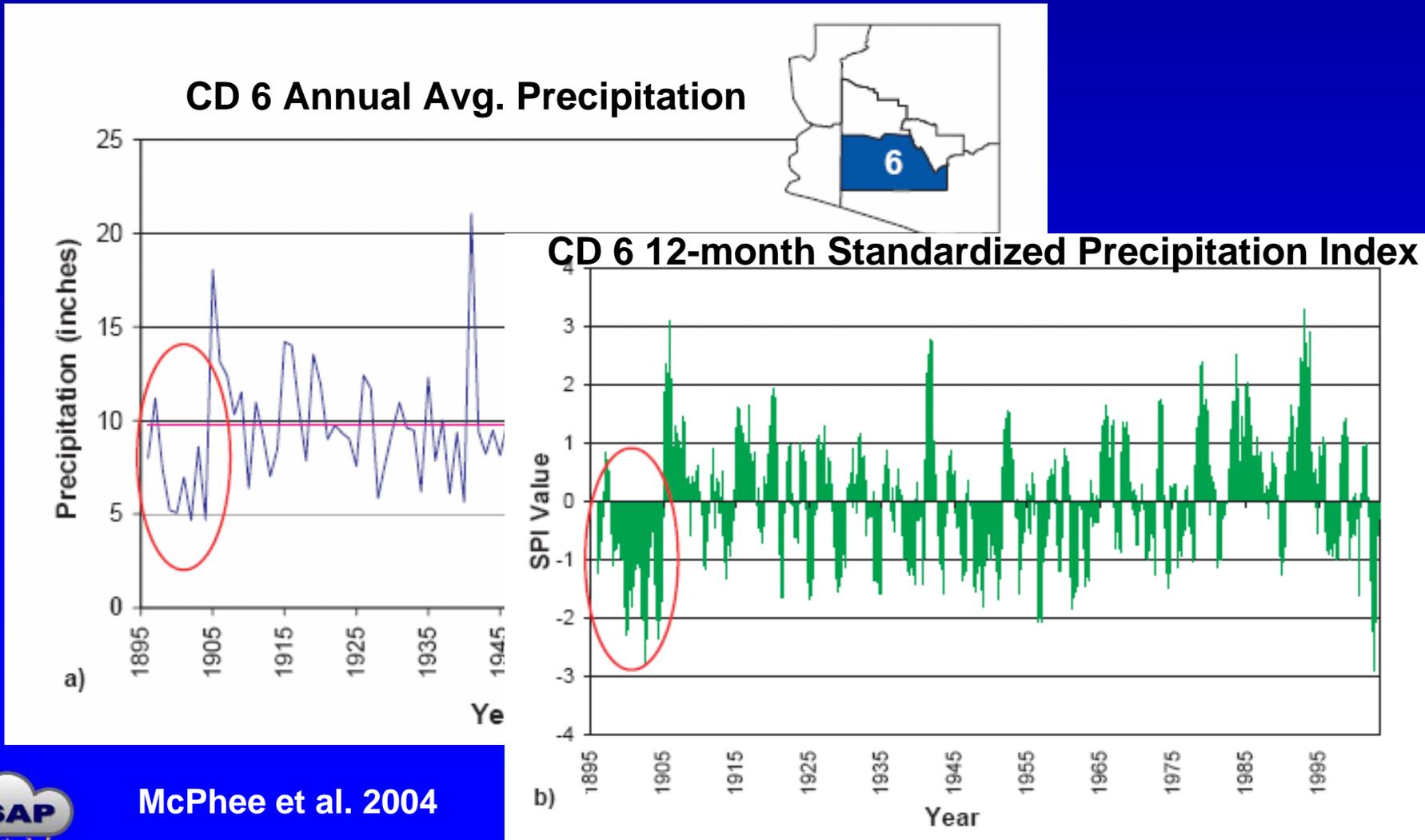
Statewide Annual Average Precipitation



Driest year & Percent of Ann. Avg.

McPhee et al. 2004

Long-term Precipitation Variability

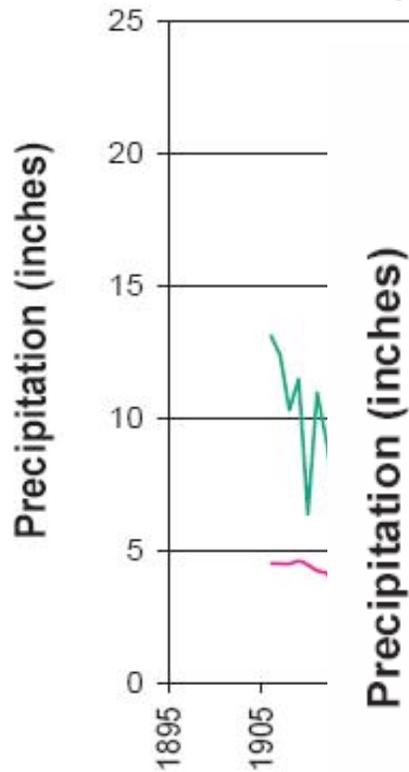


McPhee et al. 2004

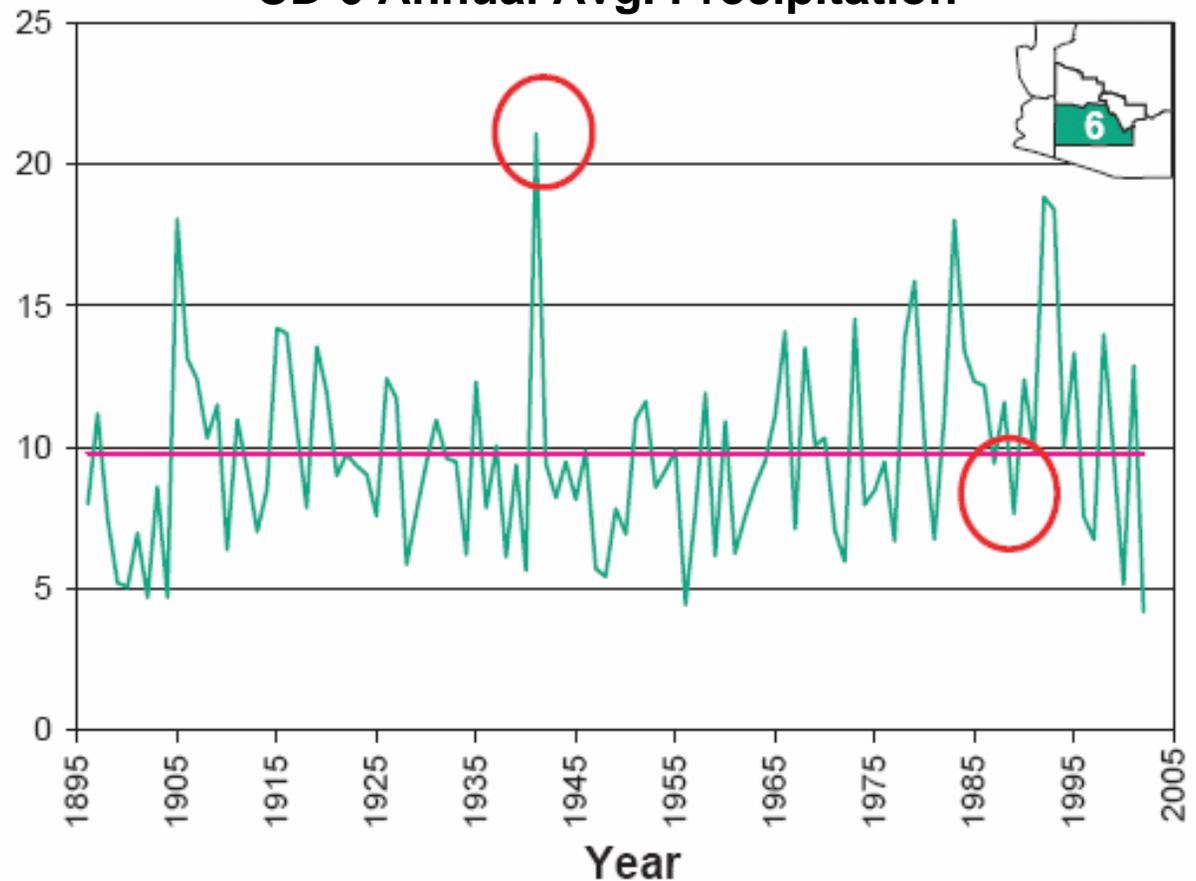


Long-term Precipitation Variability

CD 6 Annual Avg. Precipitation – 21-yr running Std Dev.



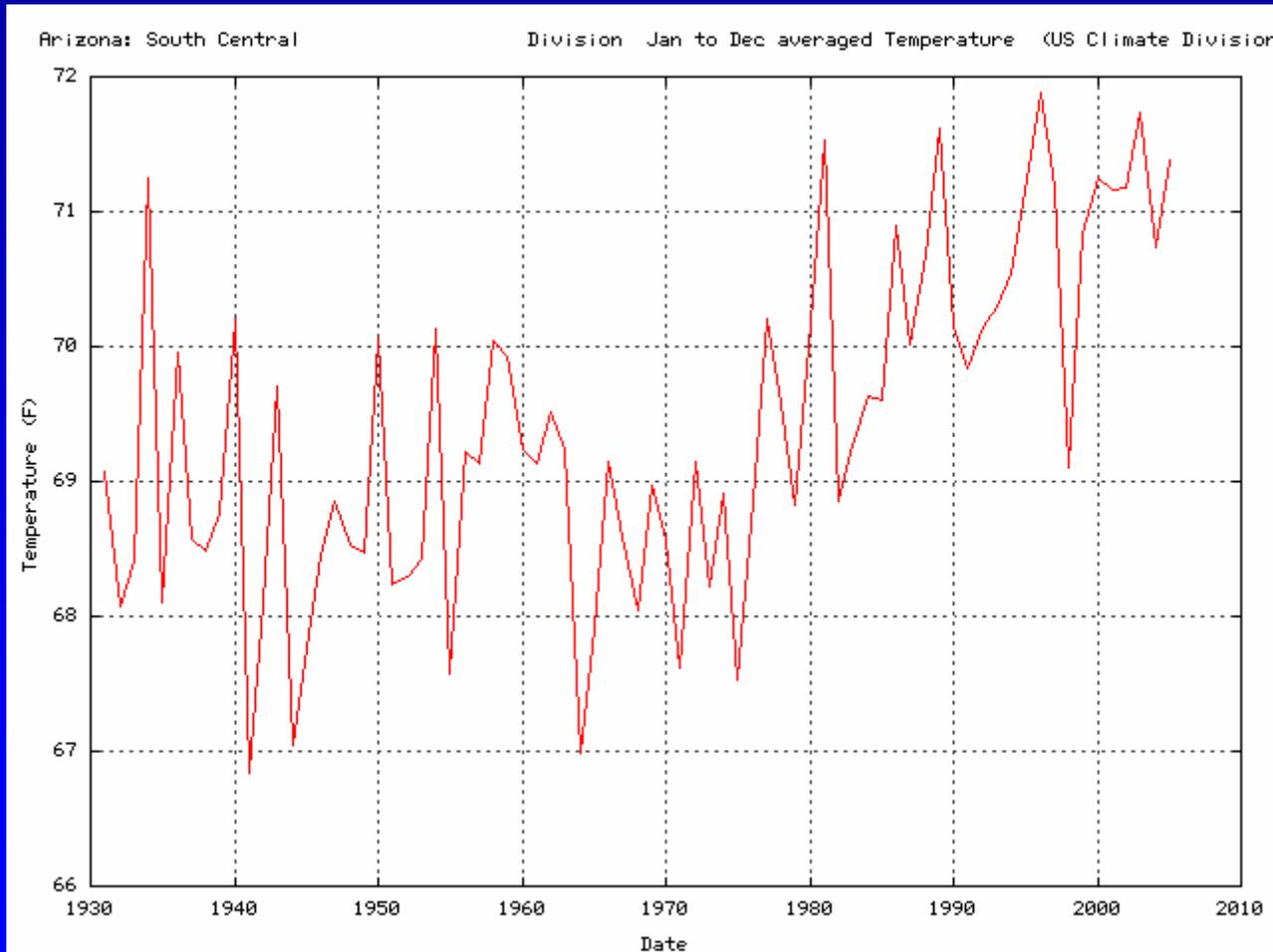
CD 6 Annual Avg. Precipitation



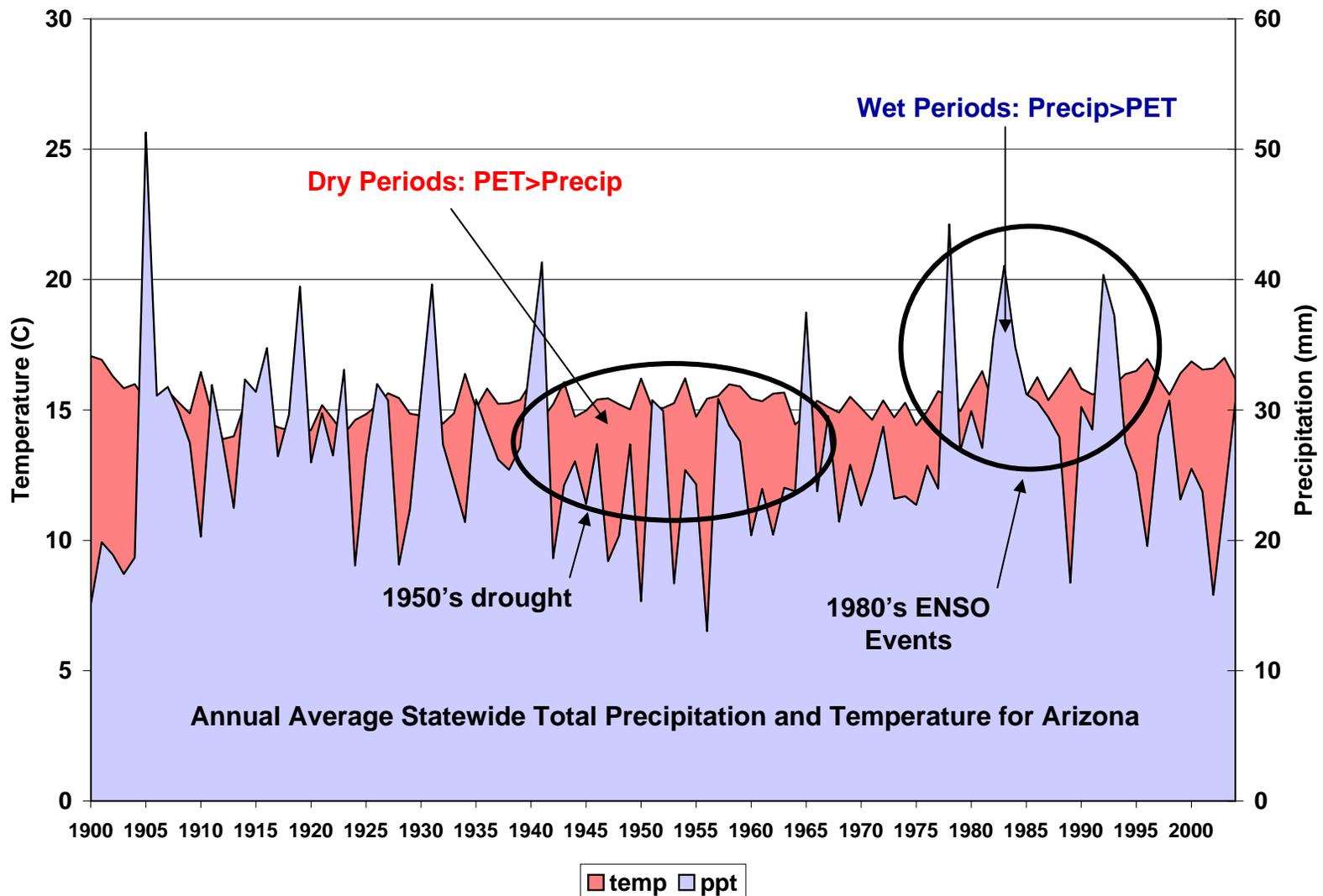
McPhee et al. 2004



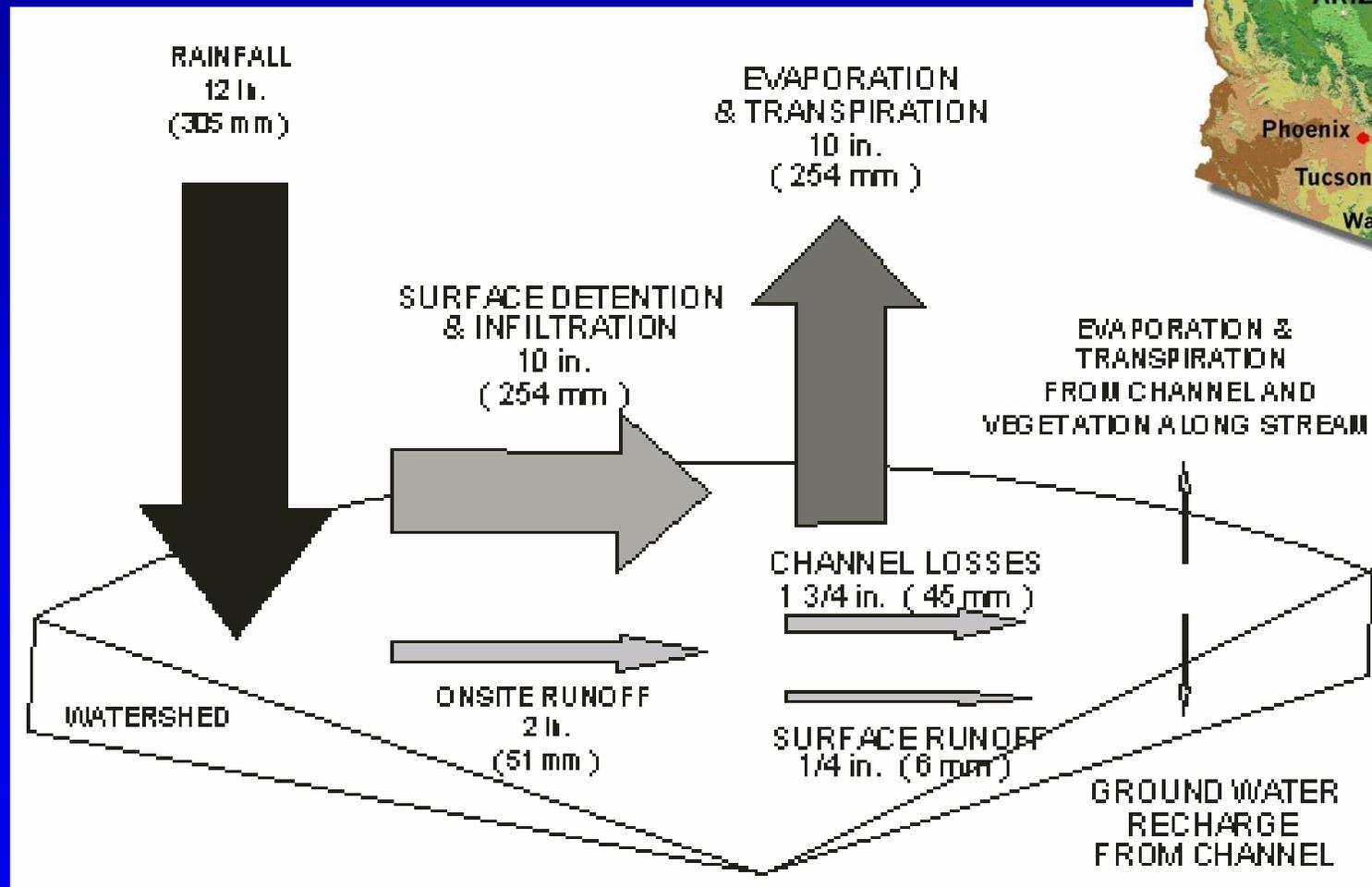
CD 6 Annual Avg. Temperatures



Evapotranspiration and Aridity



Example Water Balance: Walnut Gulch, Arizona



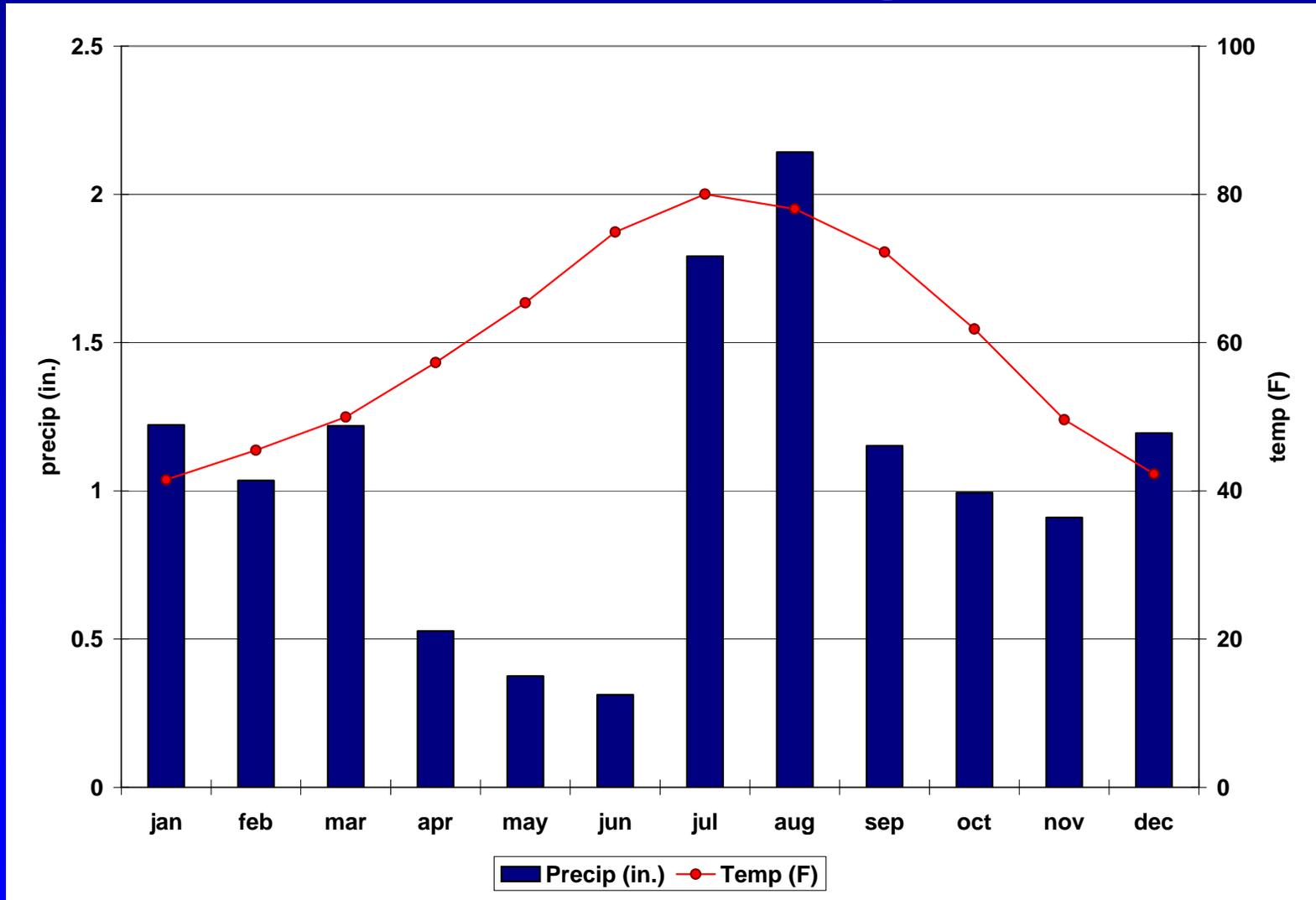
http://www.tucson.ars.ag.gov/dap/field_sites.htm



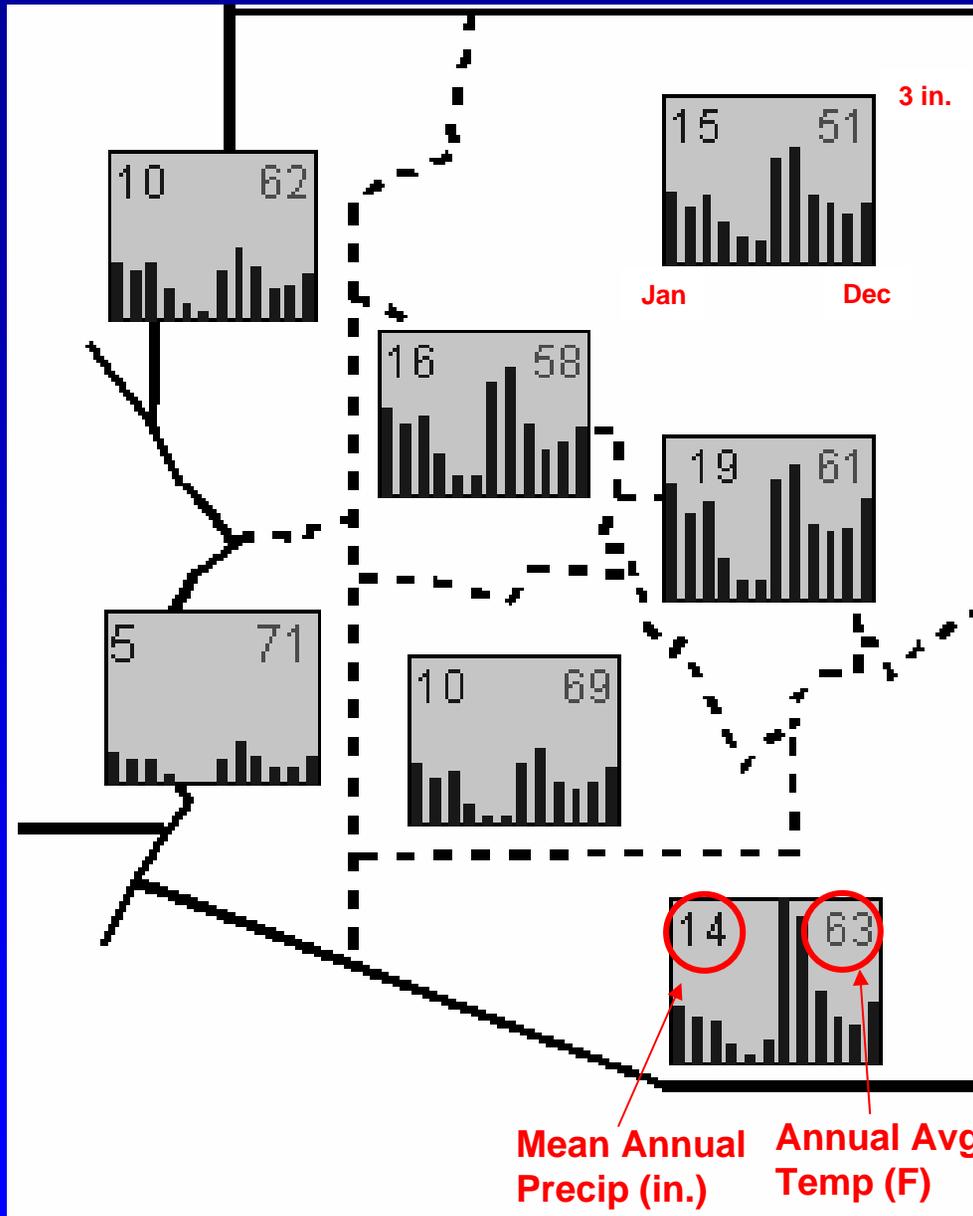
Atmospheric Controls on Arizona Climate



Arizona Climograph



Seasonal Distribution of Precipitation

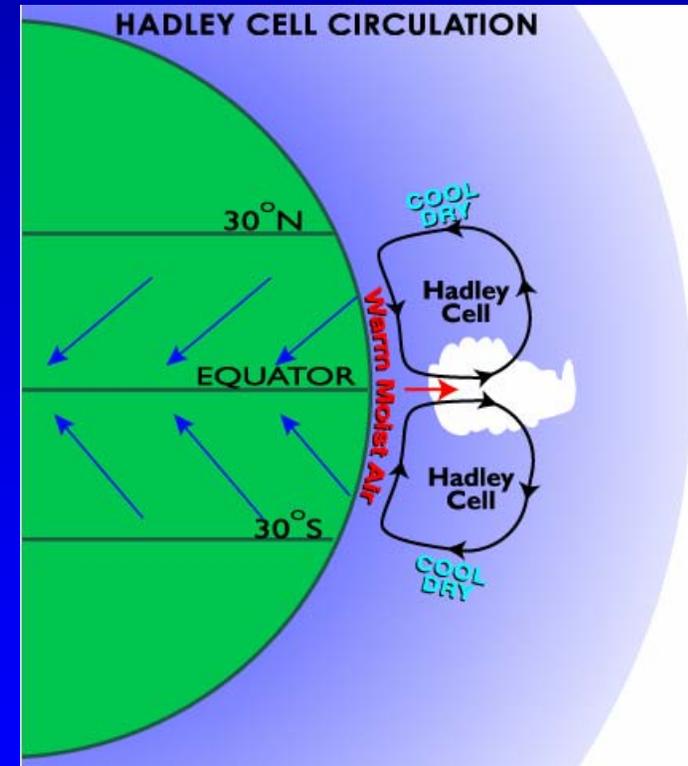


- More winter precip in northern AZ
- Stronger monsoon signal in southeast AZ (more summer precip)

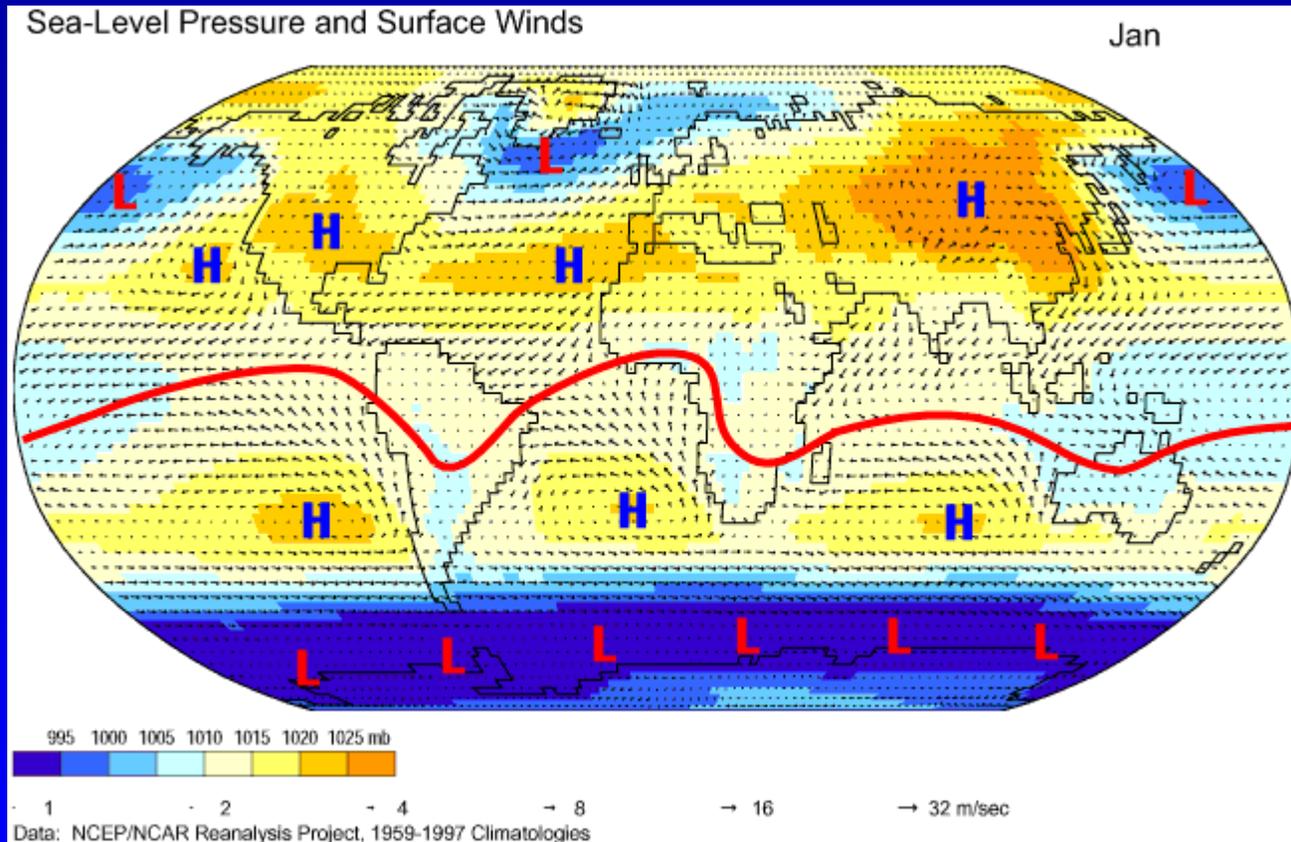
(graphic from Sheppard, et al. 2000)

Atmospheric Circulation and Arizona Climate

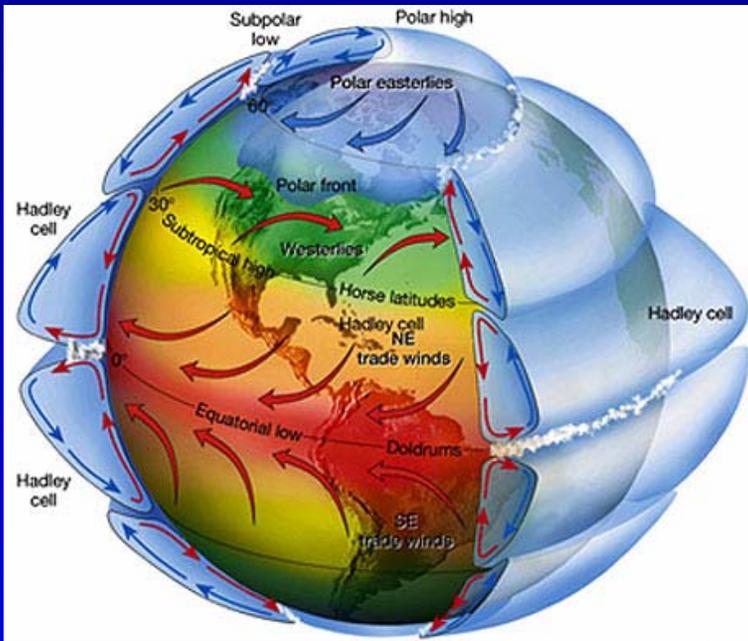
- Large-scale circulation patterns are an important determinant of local climate
- Arizona has a unique geographic position in northern hemisphere
 - Latitude of global belt of subtropical highs
 - Interacts with both mid-latitude westerlies in winter and subtropical high in summer
- Circulation patterns are tied to global ocean sea surface temperatures
- Patterns can persist for years and even decades



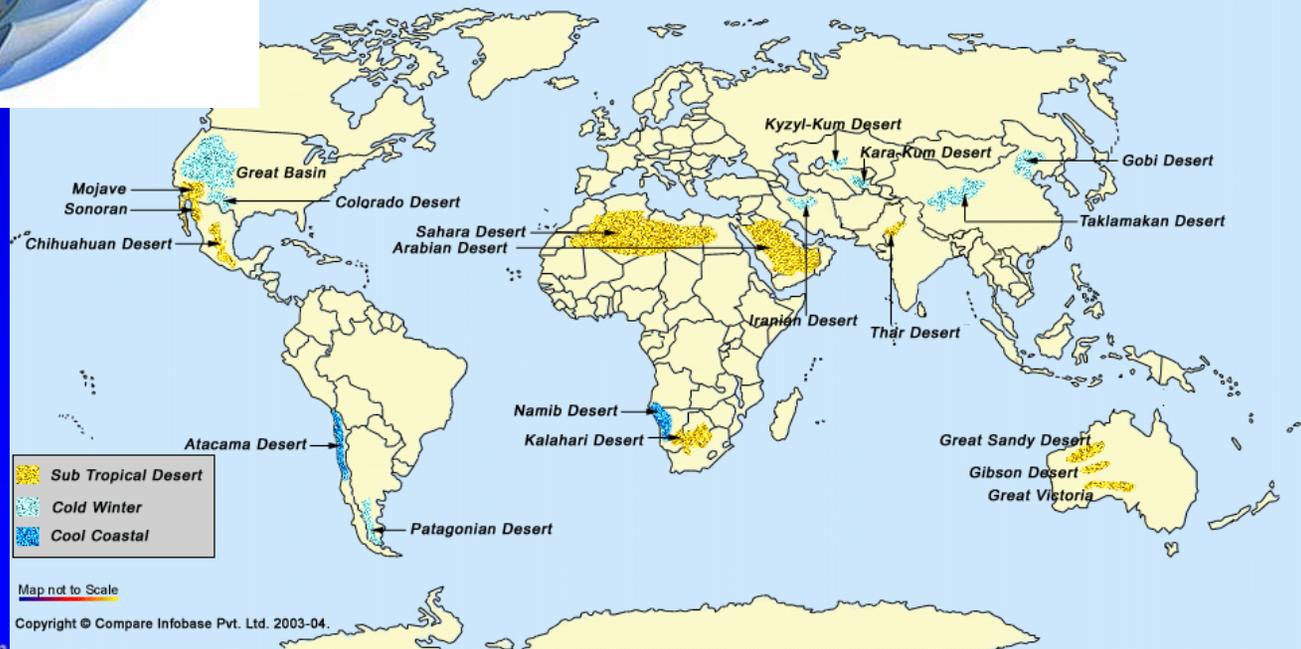
Seasonality of Circulation Patterns



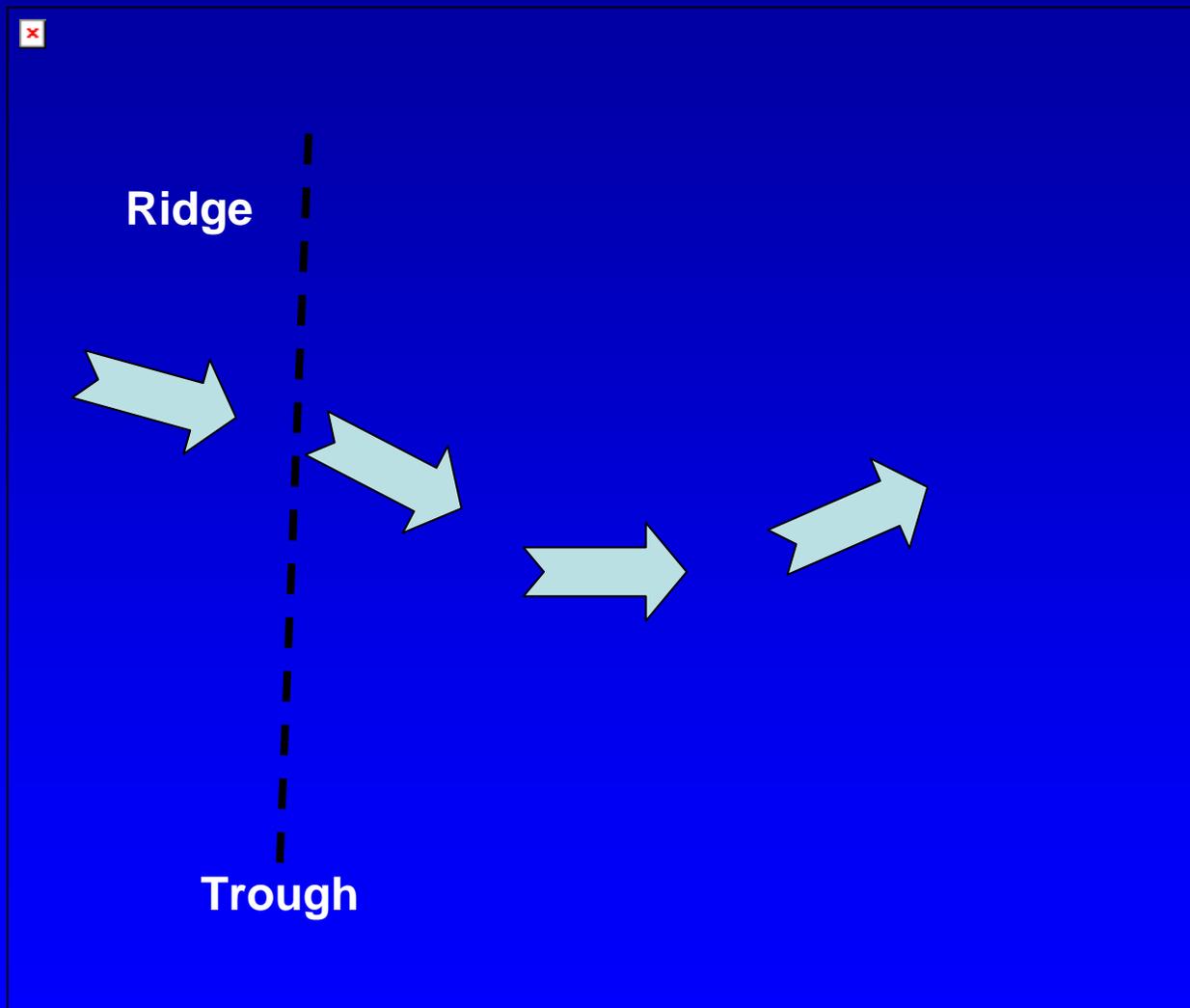
Global Circulations and Aridity



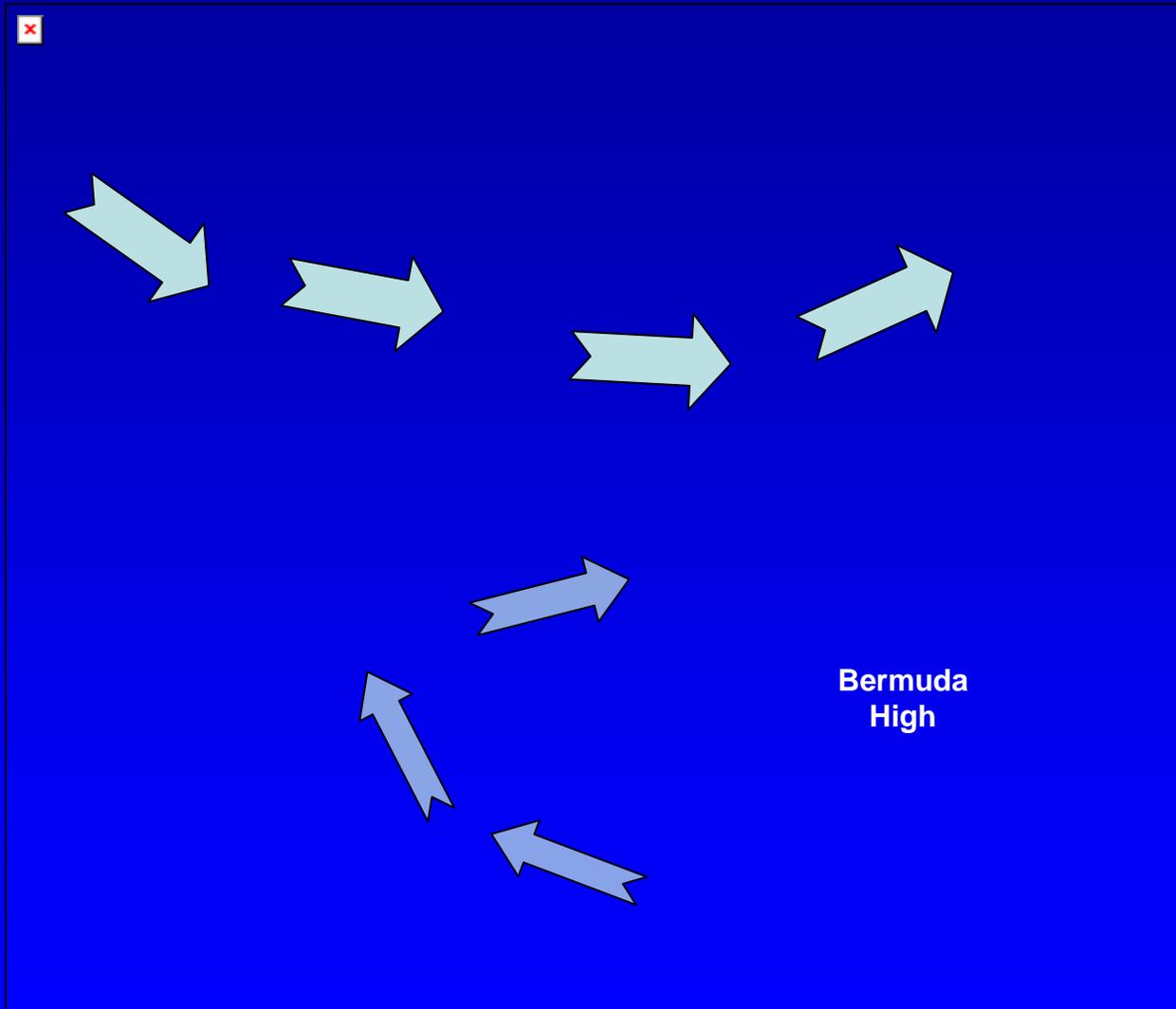
Deserts of the WORLD



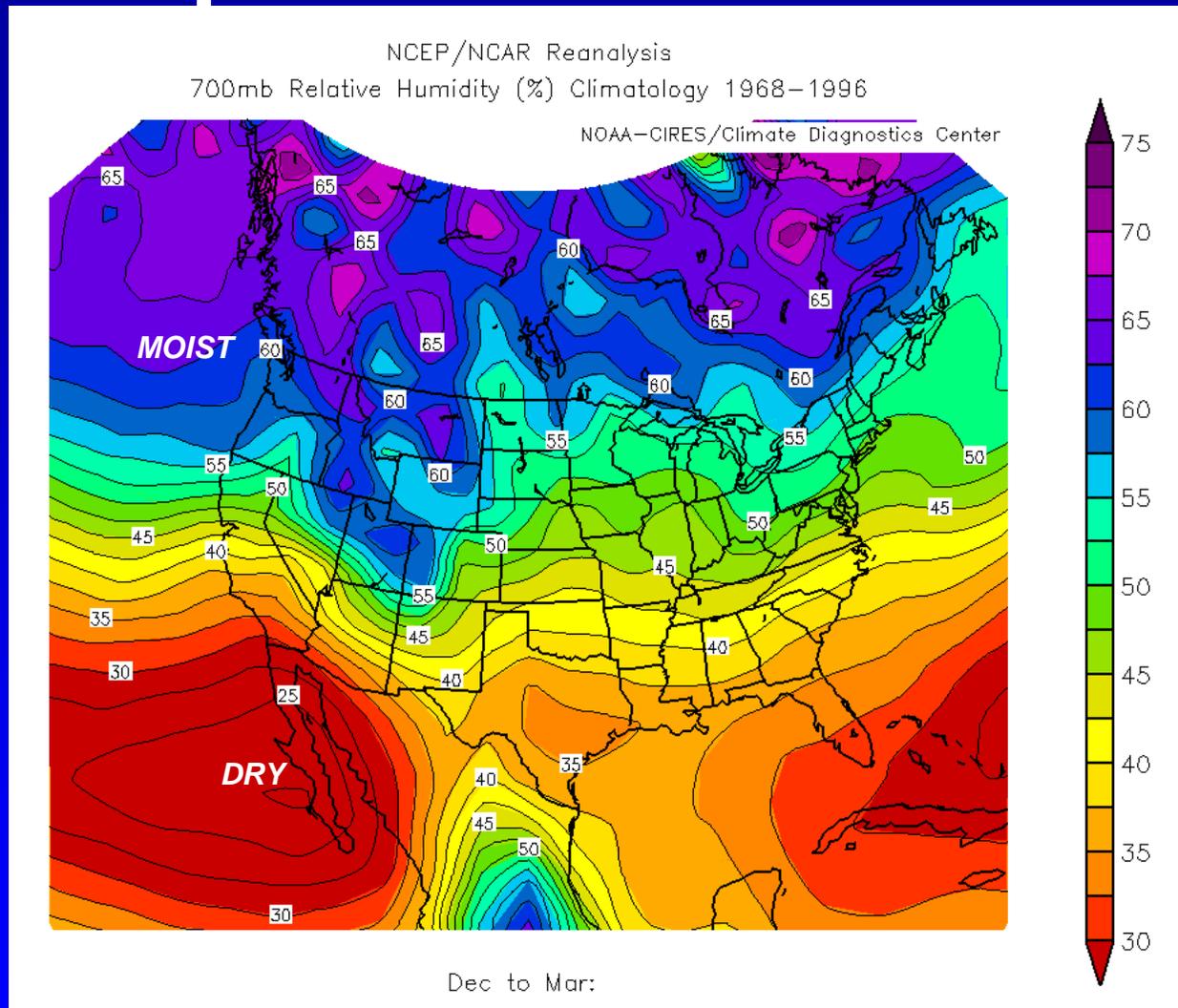
Atmospheric Circulation: Winter



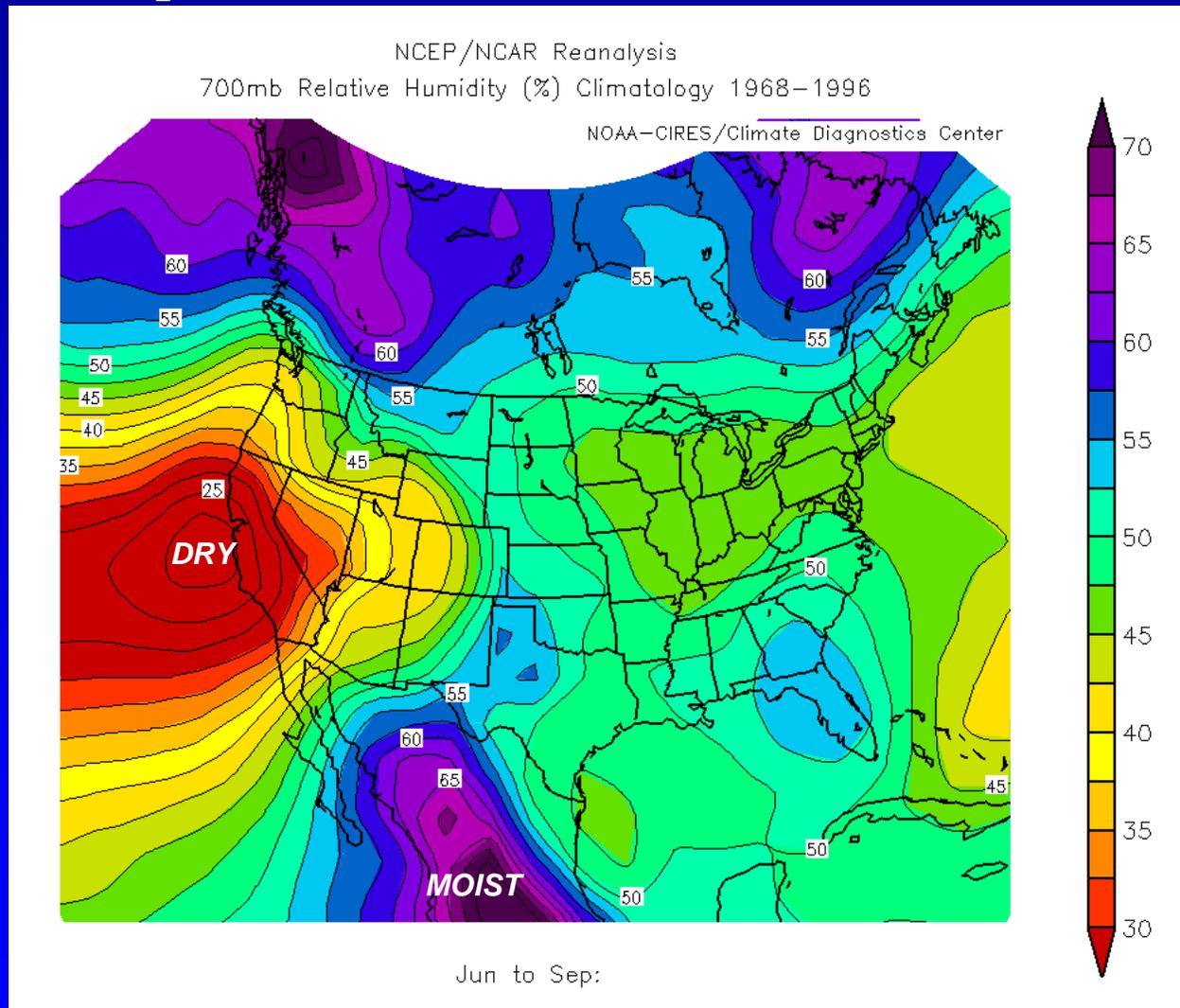
Atmospheric Circulation: Summer



Atmospheric Moisture: Winter

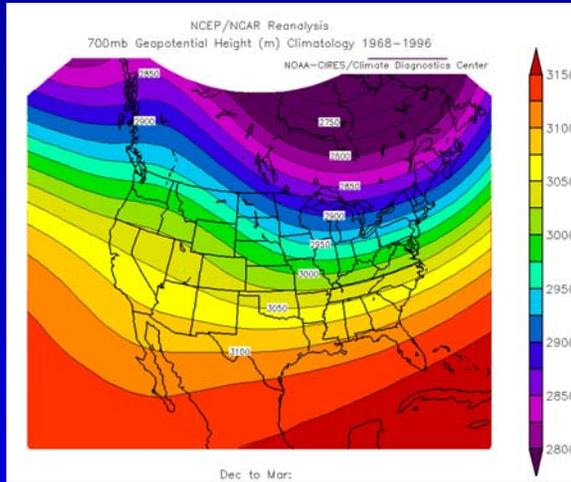


Atmospheric Moisture: Summer



Seasonal Atmospheric Changes

Flow

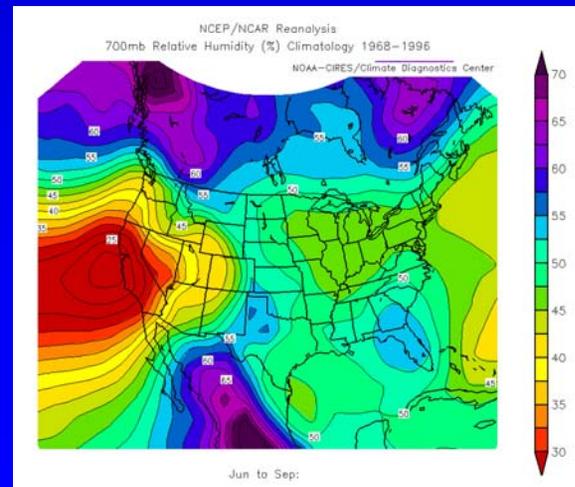
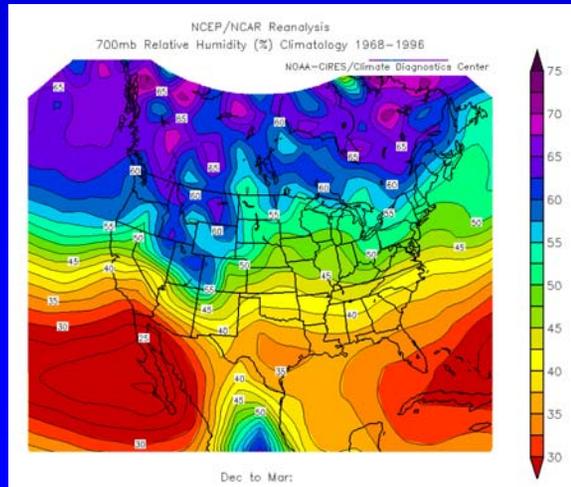


Winter



Summer

Moisture



Seasonality of Precipitation: CD 6

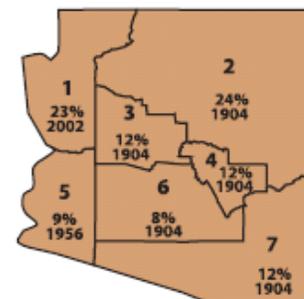
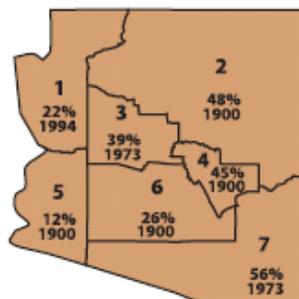
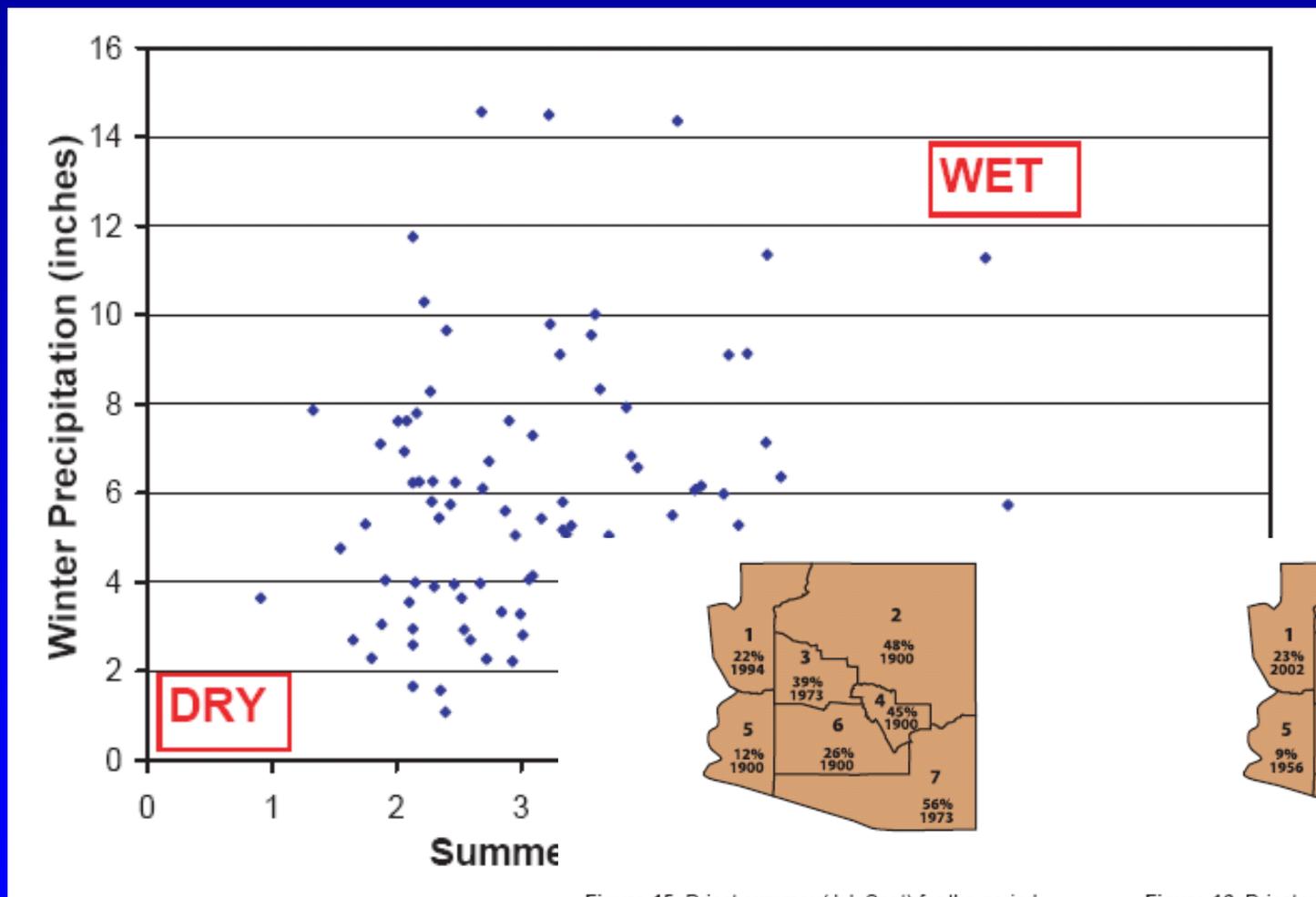


Figure 15. Driest summer (Jul–Sept) for the period 1896–2002.

Figure 16. Driest winter (Nov–Apr) for the period 1896–2003.

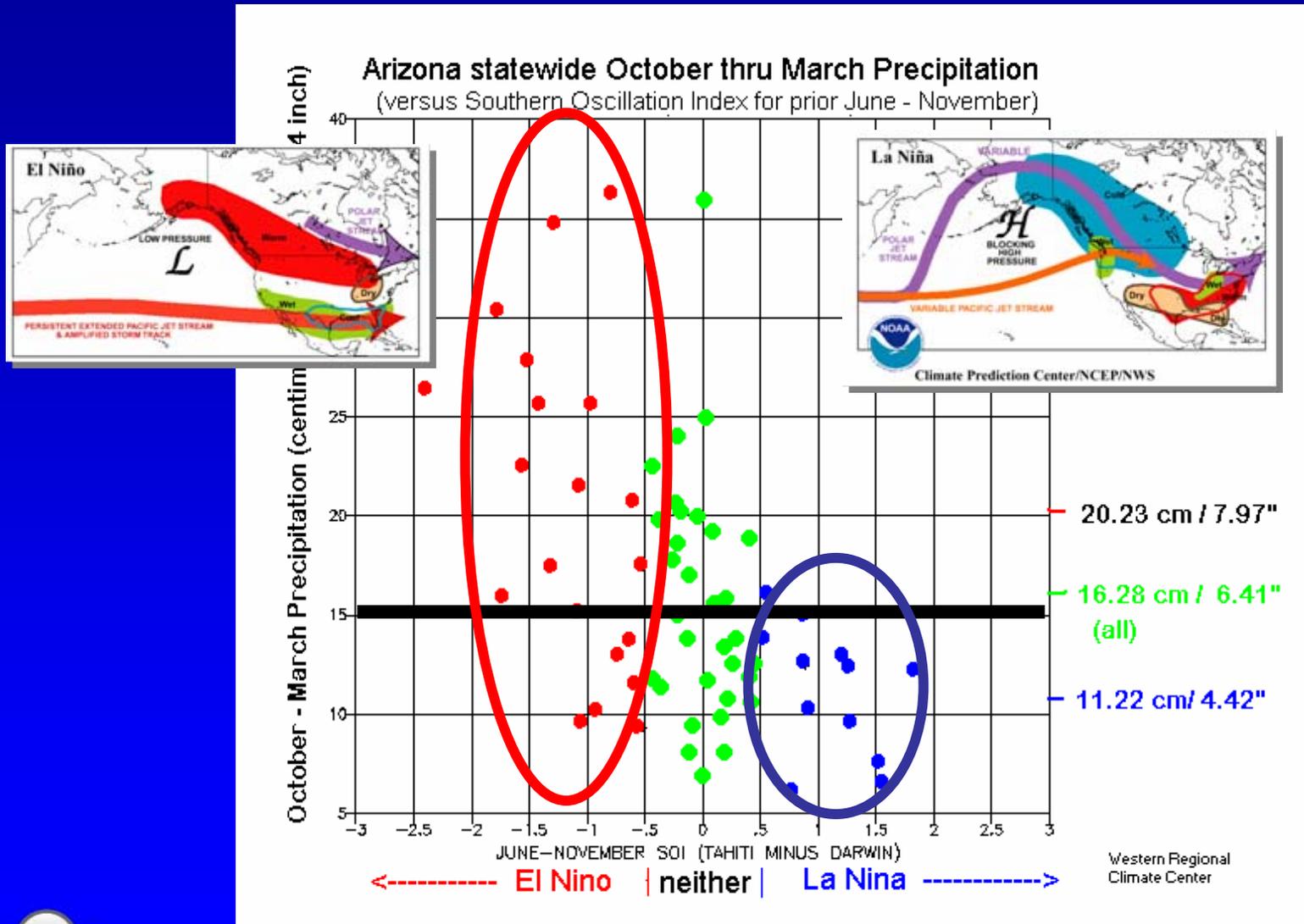
McPhee et al. 2004



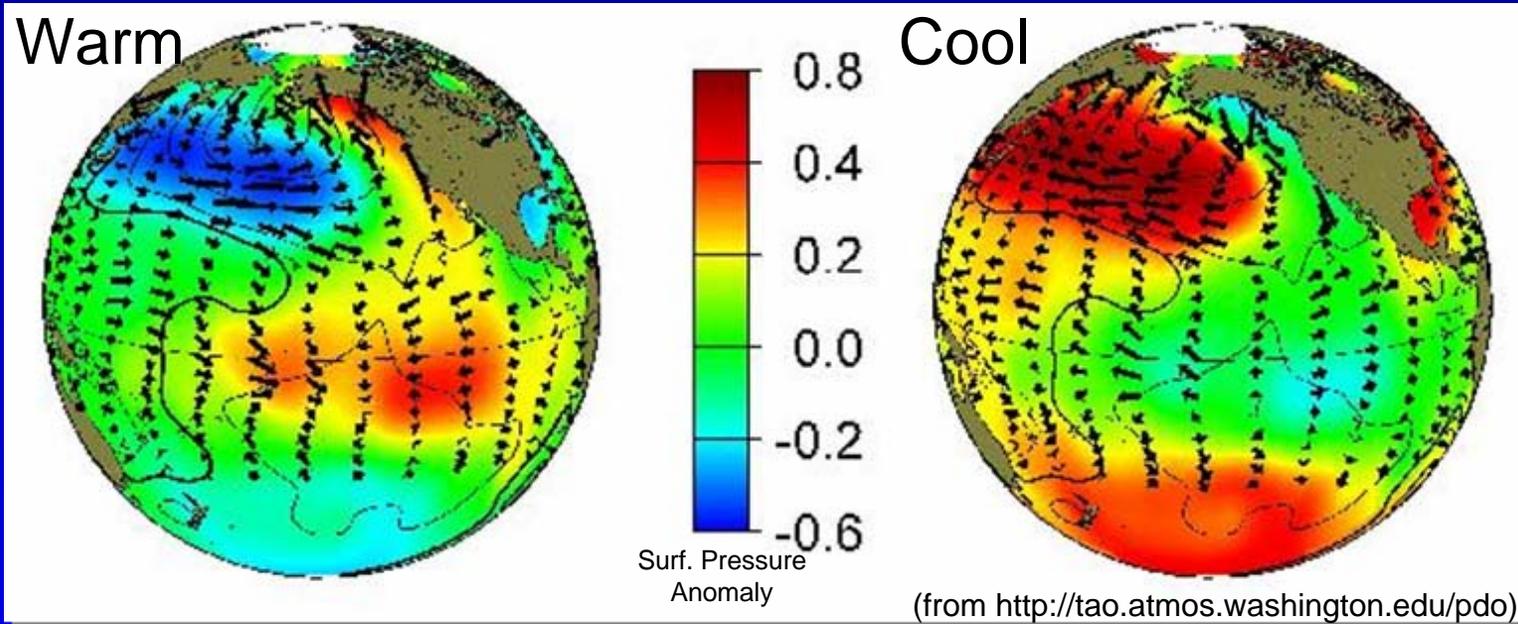
Interannual Climate Variability



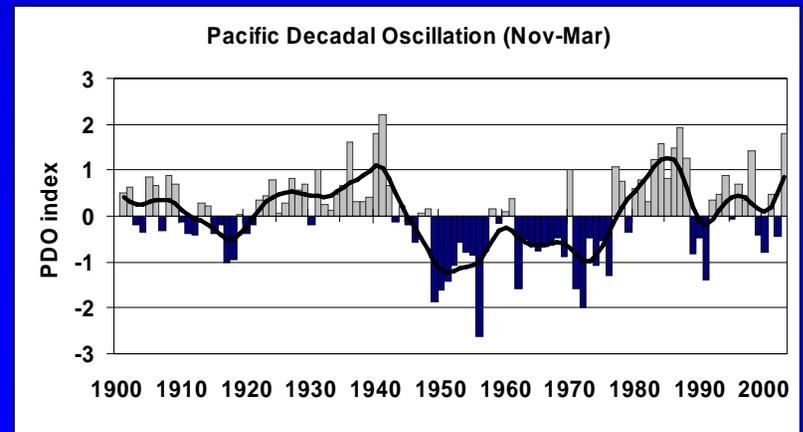
El Nino and AZ Precipitation



Pacific Decadal Oscillation



Period	North Pacific SSTs	Southwest Winters
1920s-1940s	Cold	Wetter
1940s-1970s	Warm	Drier
1970s-20??	Cold	Wetter
20??-????	Warm	Drier?



(from Pagano 1999)

Closing Points

- Arizona is Arid! (1980's wet period is not a good reference point)
- Precipitation inputs are generally small and highly variable
- Long-term wet/dry cycles occur over 3-30 year cycles in concert with ocean sea-surface temperature patterns
- Increasing aridity with increasing temperatures is a real concern



Resources

- Climate Assessment for the Southwest
(<http://www.ispe.arizona.edu/climas>)
- National Weather Service
(<http://www.weather.gov>)
- Climate Prediction Center
(<http://www.cpc.noaa.gov/>)
- Western Regional Climate Center
(<http://wrcc.dri.edu/>)
- National Drought Monitor
(<http://www.drought.unl.edu/dm/index.html>)
- **Climate Science Applications Program**
(<http://cals.arizona.edu/climate>)

