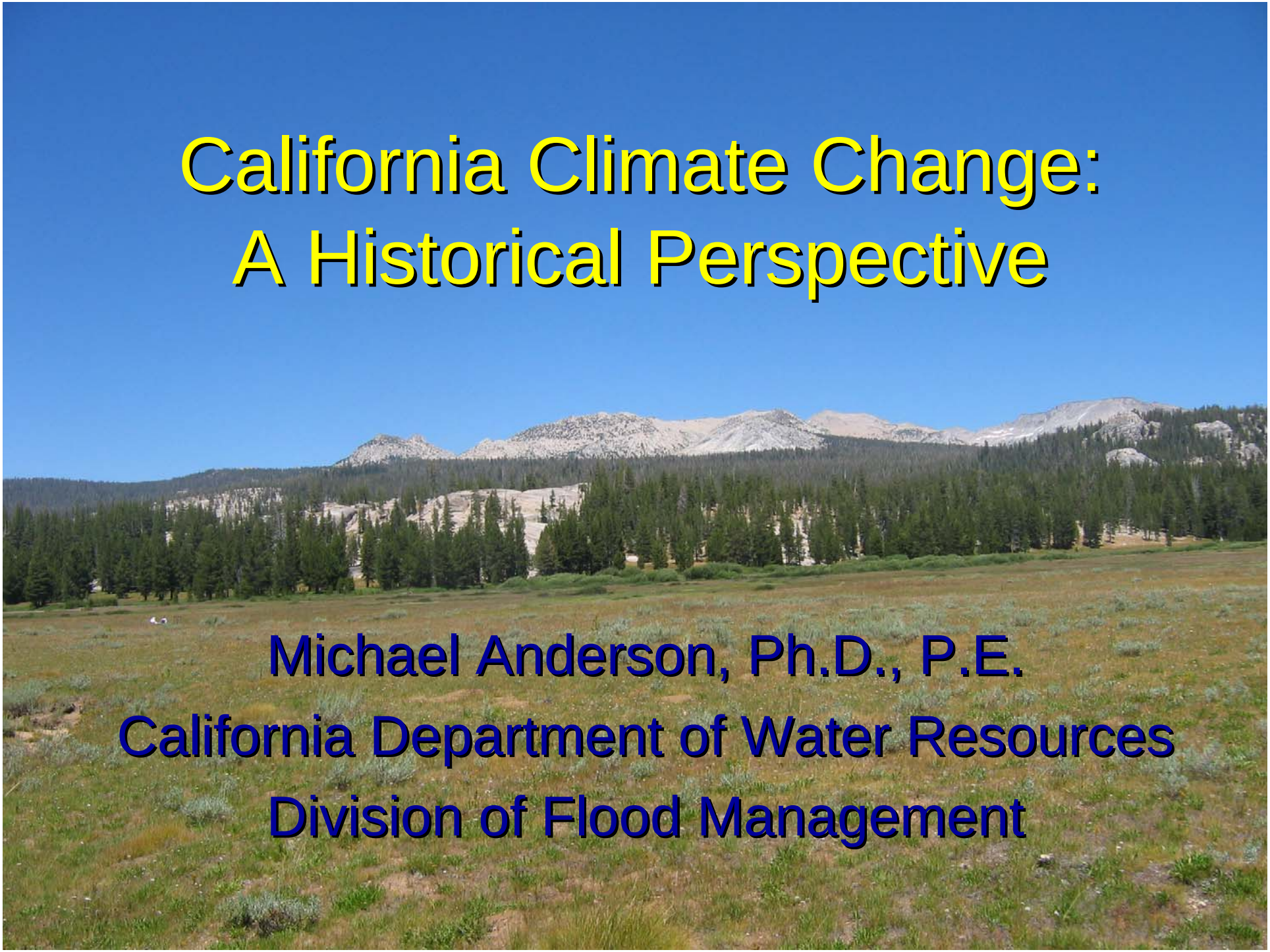
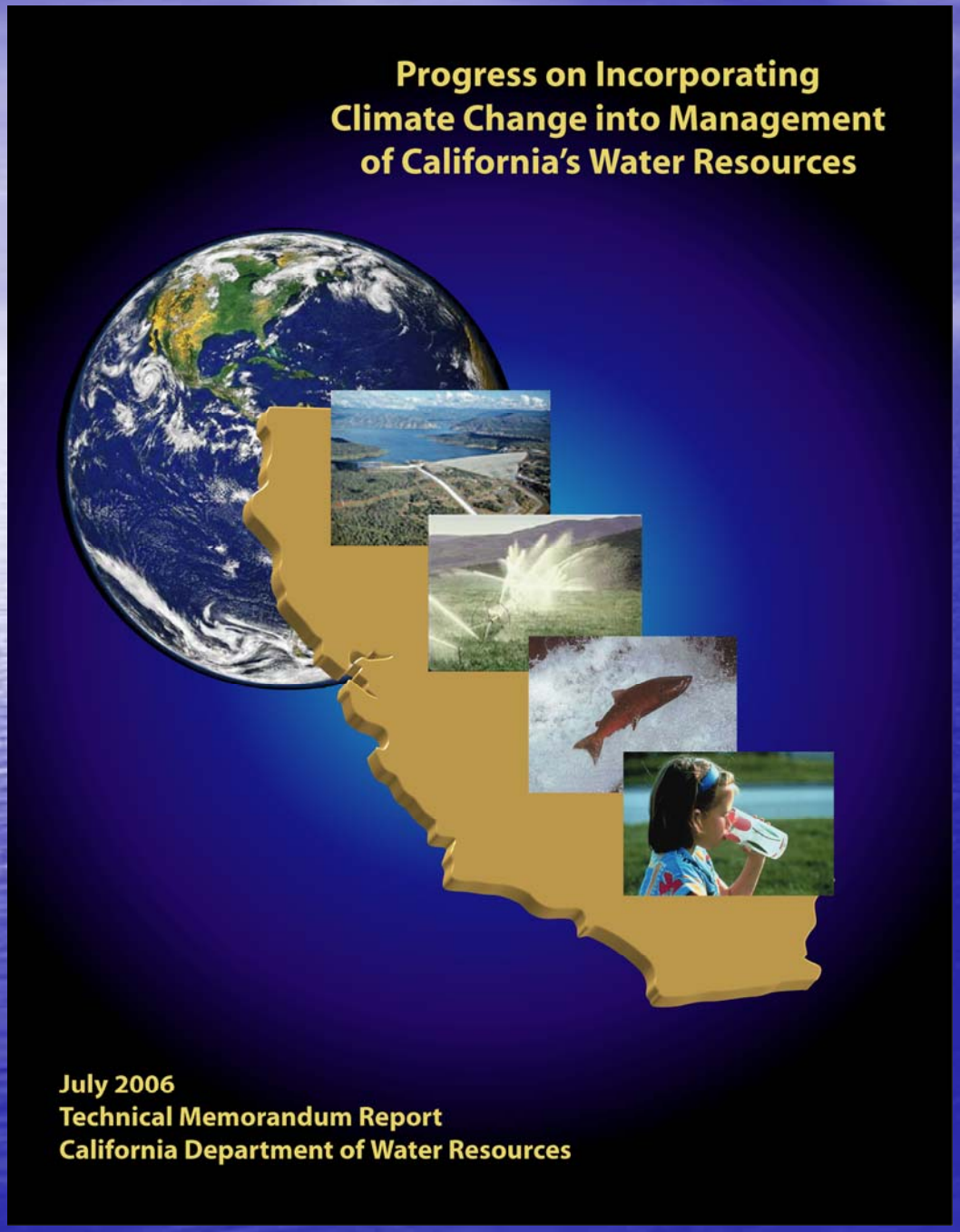
California Climate Change: A Historical Perspective



Michael Anderson, Ph.D., P.E.
California Department of Water Resources
Division of Flood Management



CH1 Introduction

CH2 Background

CH3 DWR Studies

CH4 SWP-CVP Impacts

CH5 Delta Impacts

CH6 Flood Management

CH7 Evapotranspiration

CH8 Future Directions

Peer reviewed chapters

Acknowledgments

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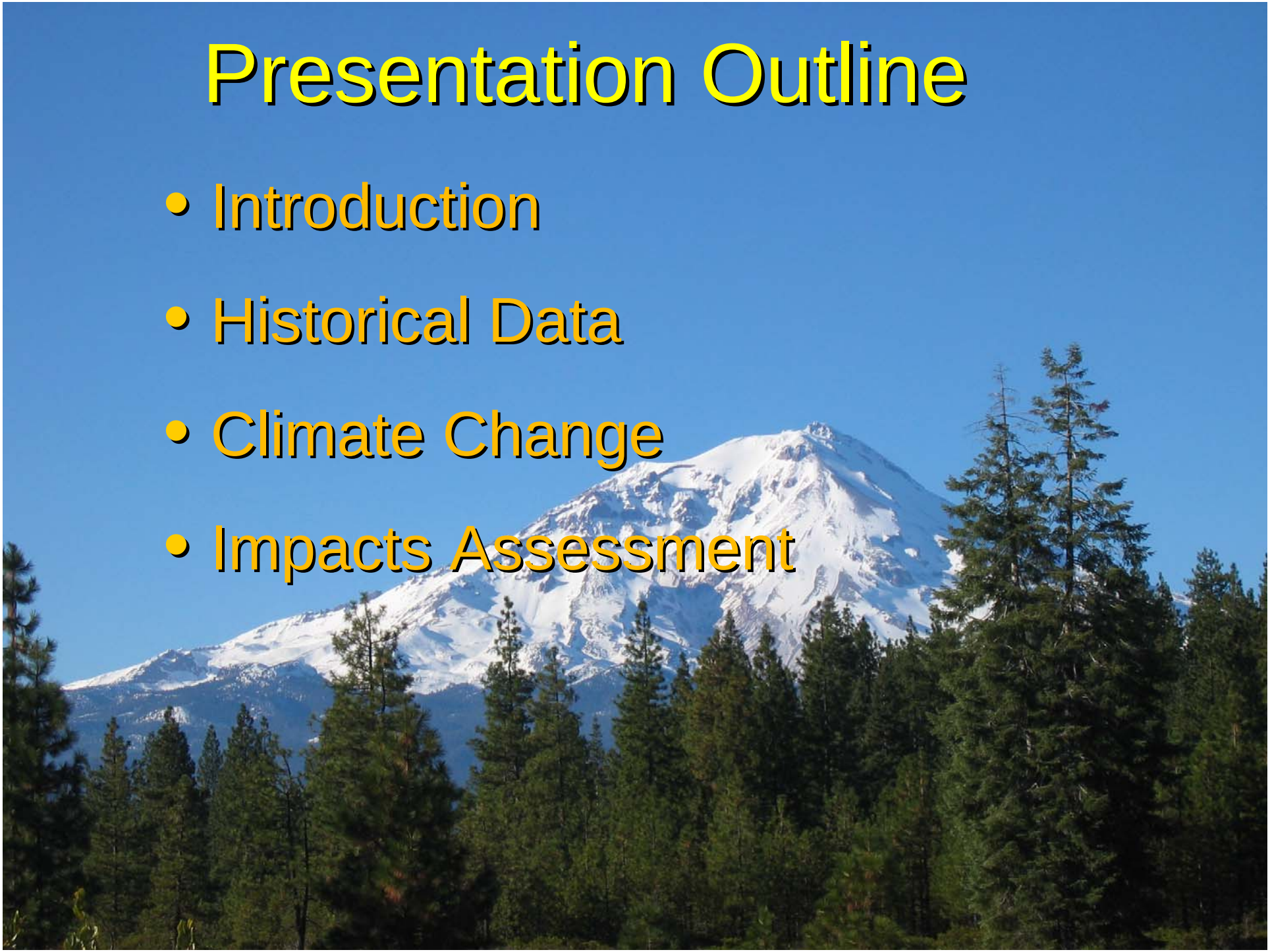
Presentation Outline

- Introduction
- Historical Data
- Climate Change
- Impacts Assessment



Introduction

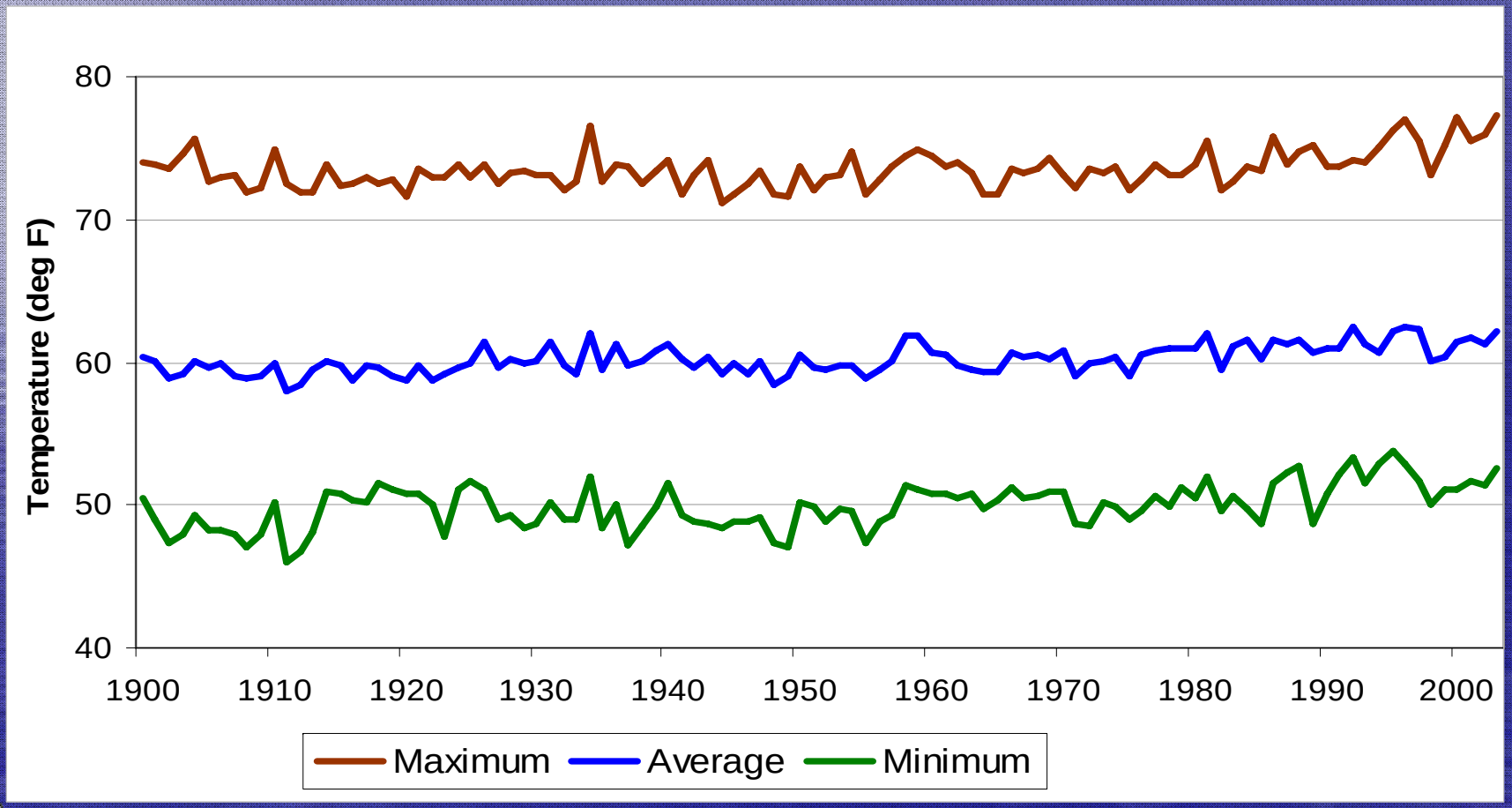
- Climate vs. Weather – “Climate is what you expect and weather is what you get” Mark Twain
- Global Climate Models aim to predict climate not weather
- Individual weather events may vary greatly for a given climate

Introduction

- Looking back to frame a look ahead
- Examine historical record for trends and variability
  - Temperature
  - Precipitation
  - Runoff
  - Flood Peaks
  - Sea Level Rise
- How does variability compare to trends?

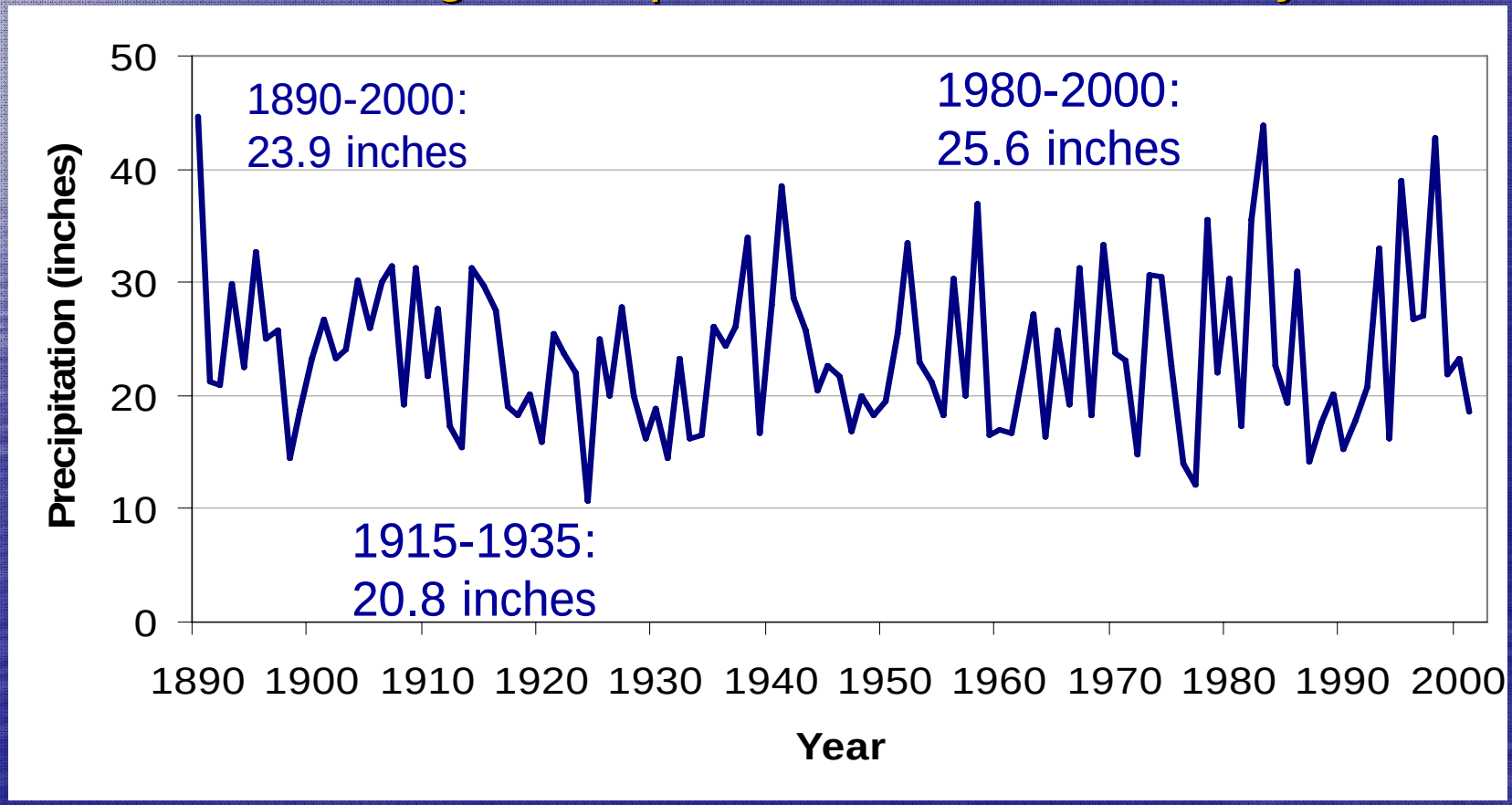
Historical Temperature

- Statewide average observed warming of about 0.5 °C (1 °F)



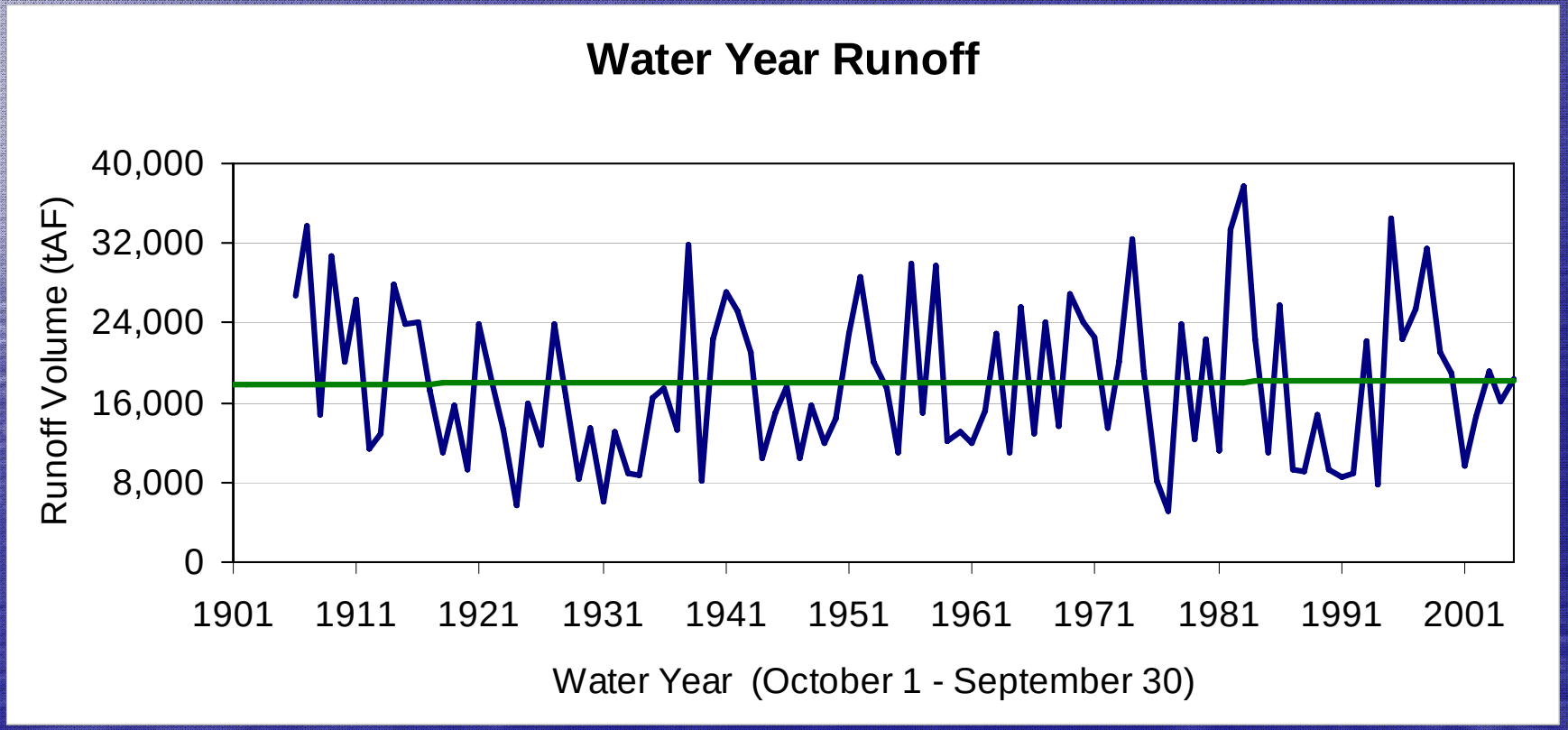
Historical Precipitation

- Statewide Average Precipitation: Lots of variability, no trend



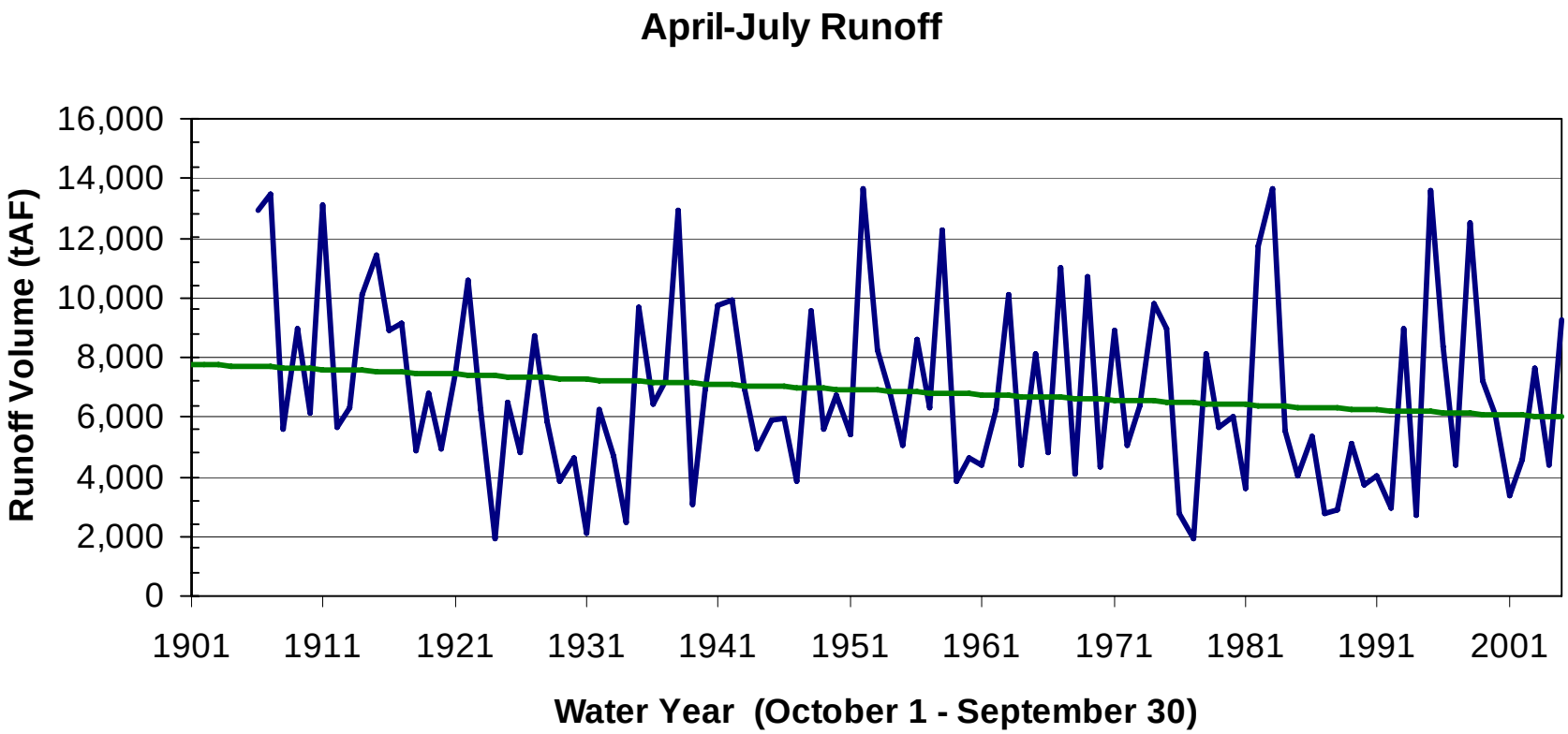
Historical Runoff Timing

Sacramento River System



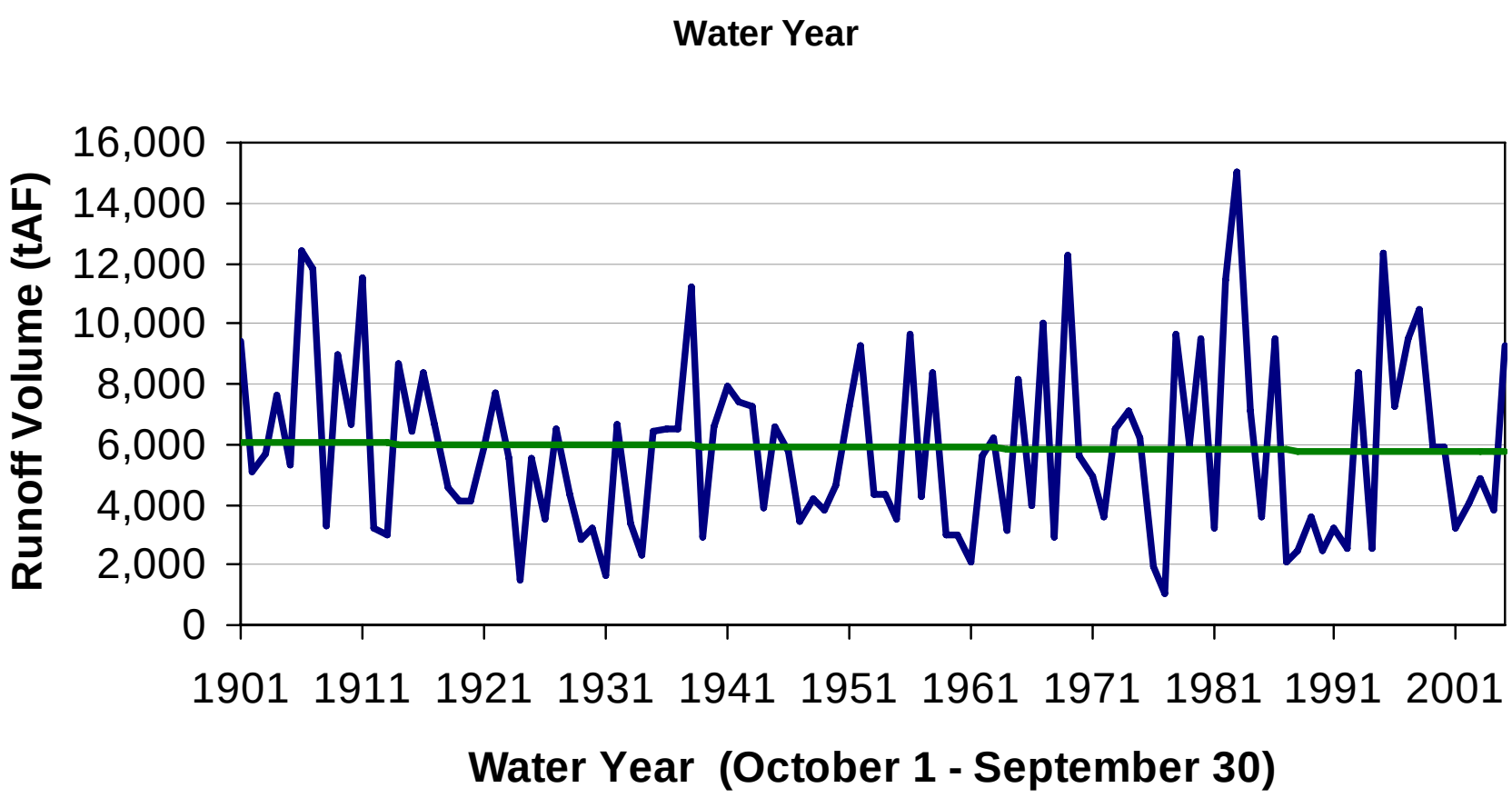
Historical Runoff Timing

Sacramento River System



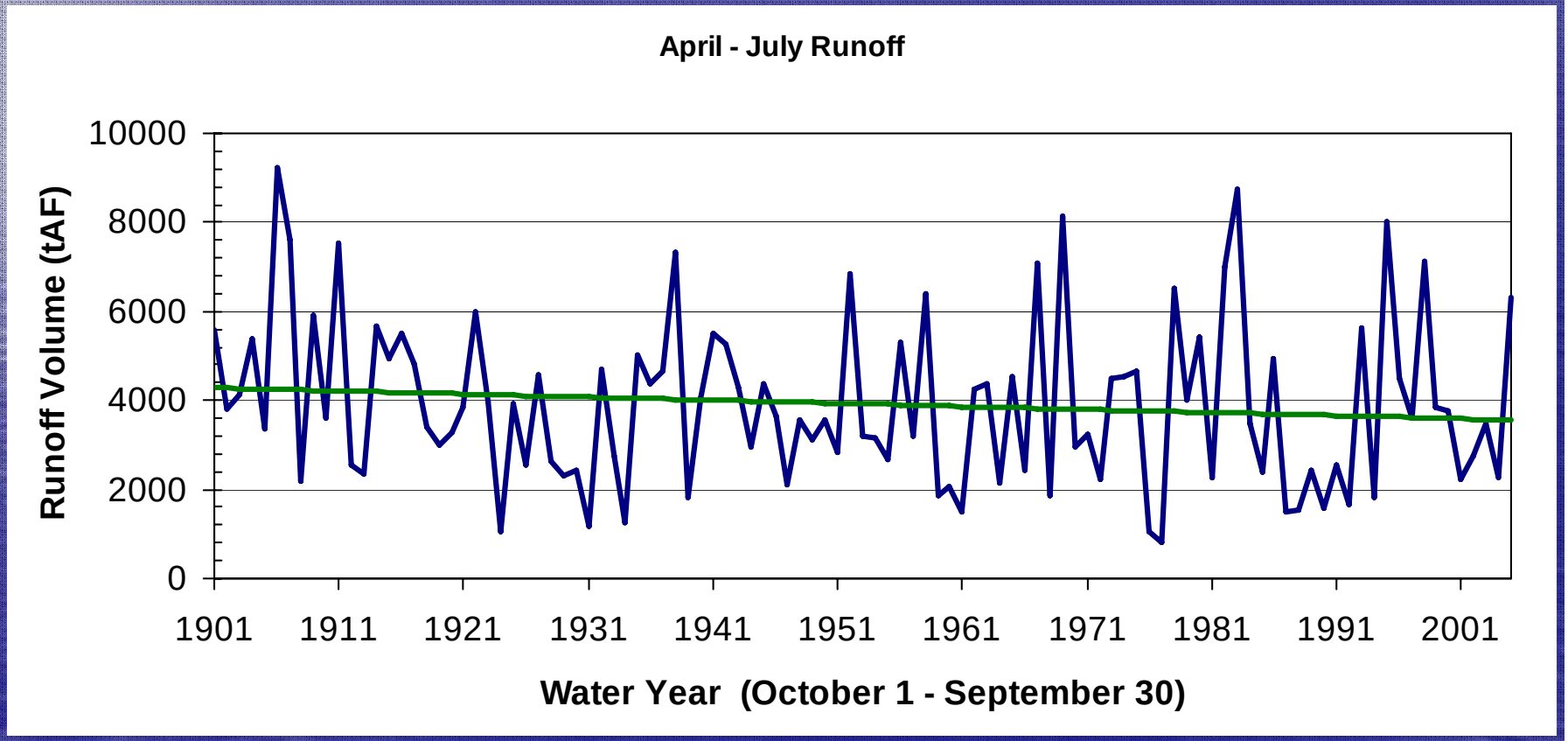
Historical Runoff Timing

San Joaquin River System



Historical Runoff Timing

San Joaquin River System



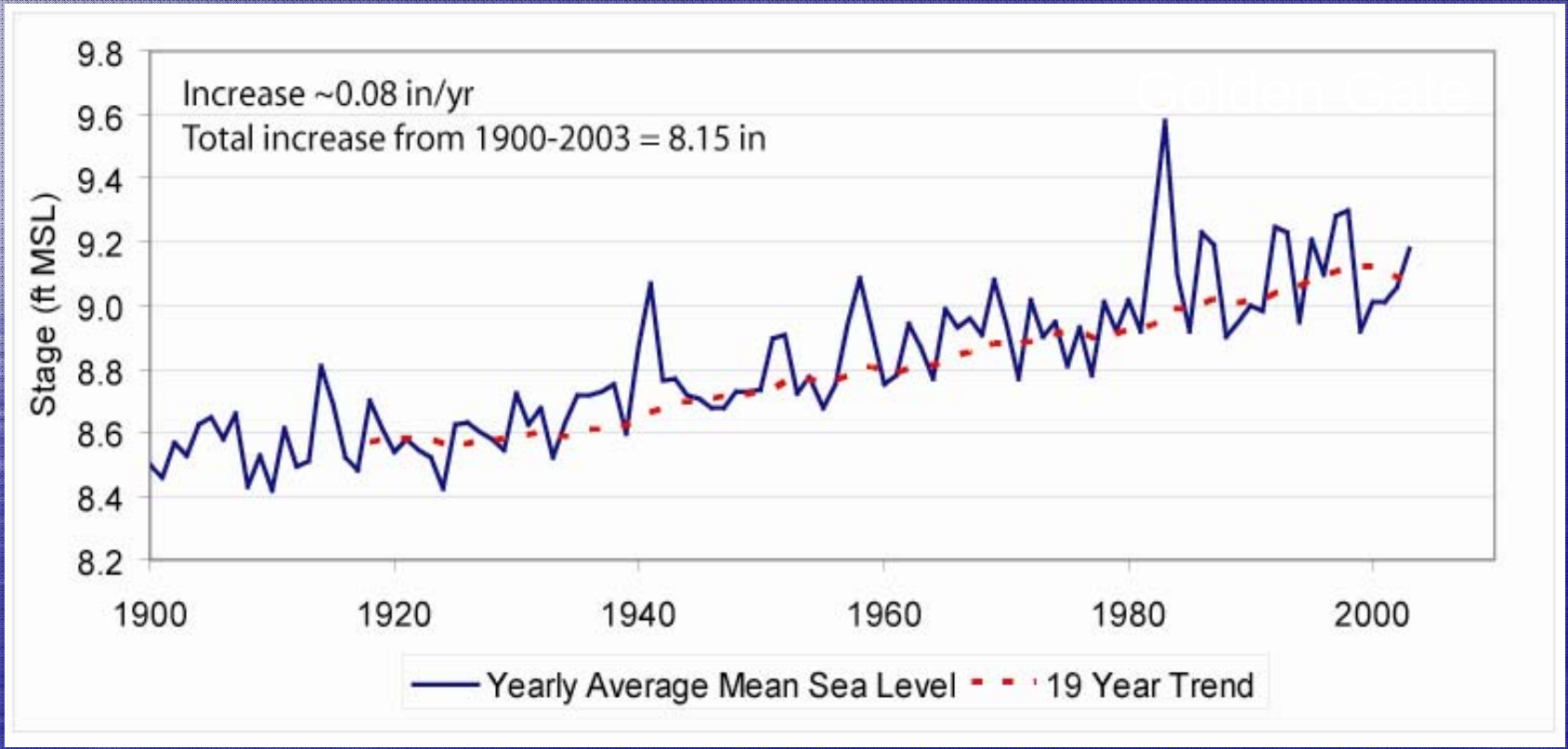
Changes in Annual Peak Runoff

Pre/Post 1955	Feather	Tuolumne	Eel
Mean	42/52	12/17	93/123
Standard Deviation	33/50	11/19	48/84
Range	145/232	52/91	165/489

Values in 1000 cfs for annual peaks of 3-day average flows
1904-2004 data used for analysis
Range is maximum-minimum values for time period

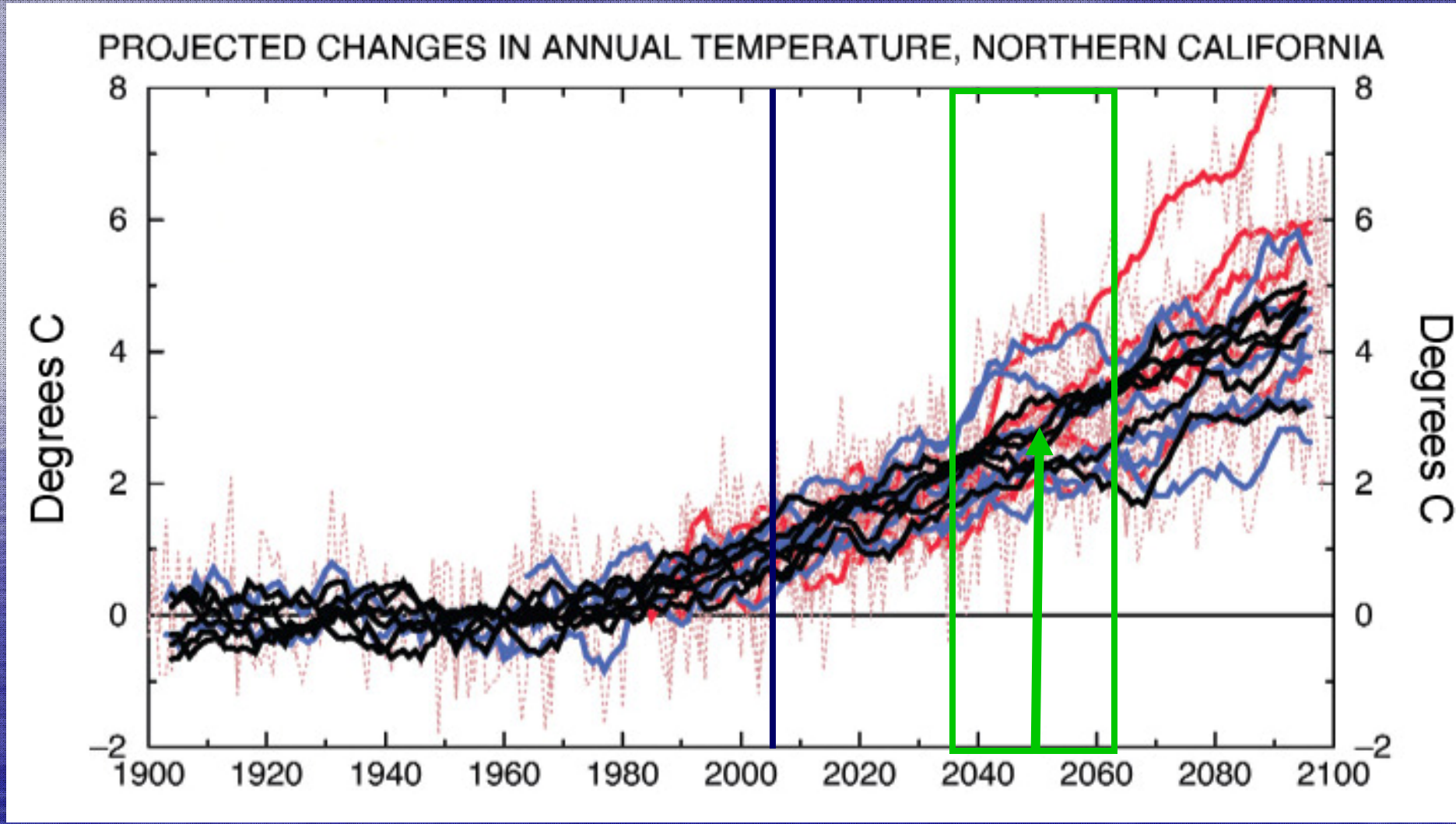
Sea Level Rise

Golden Gate




A look ahead…
Climate change model information
from Global Climate Models

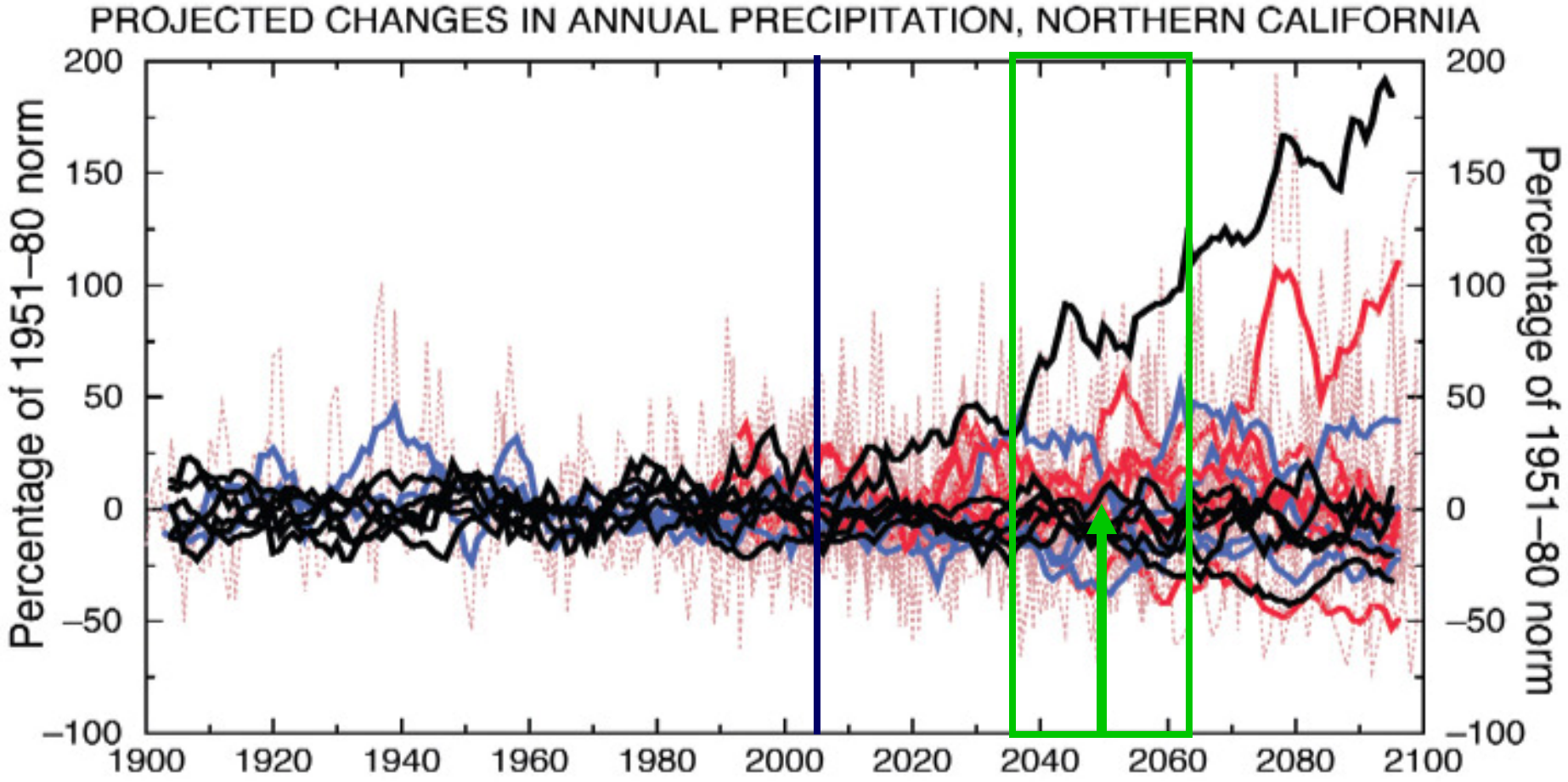
Projected Changes Temperature



Some Uncertainty

From Dettinger, 2005

Projected Changes Precipitation

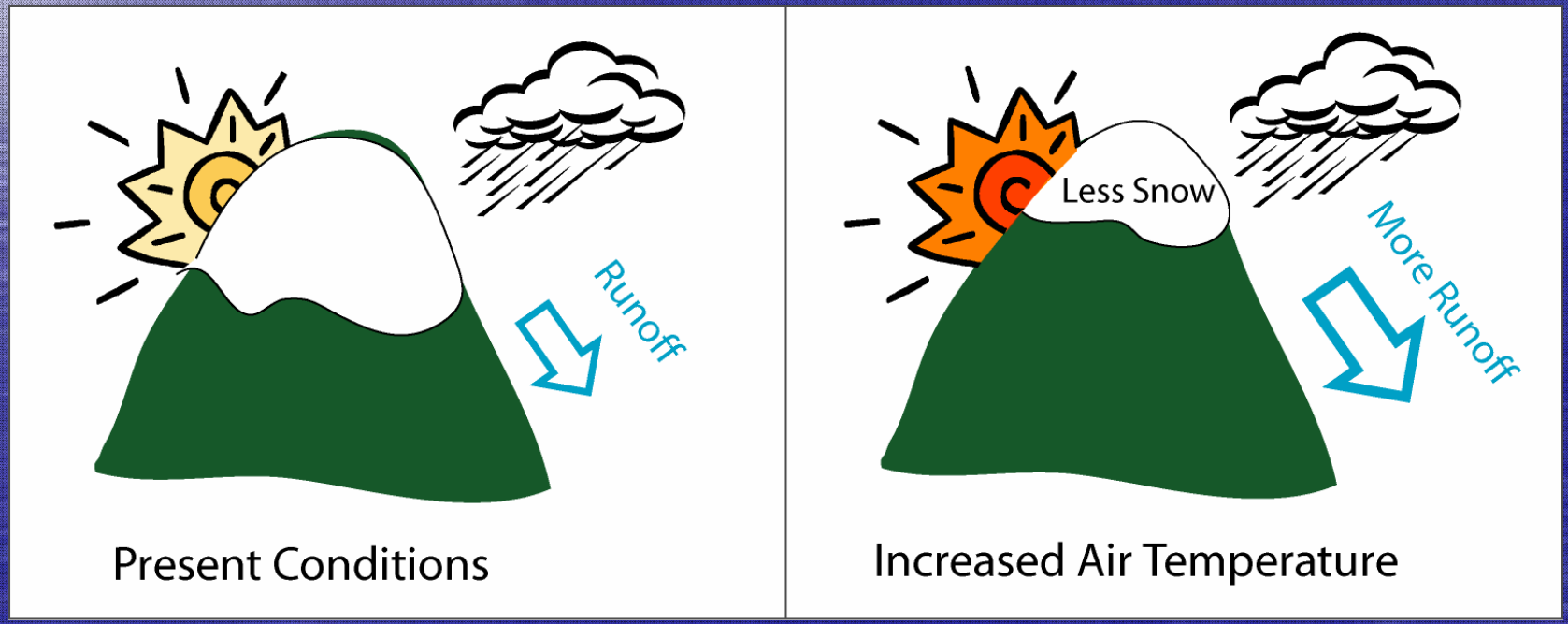


Lots of Uncertainty !

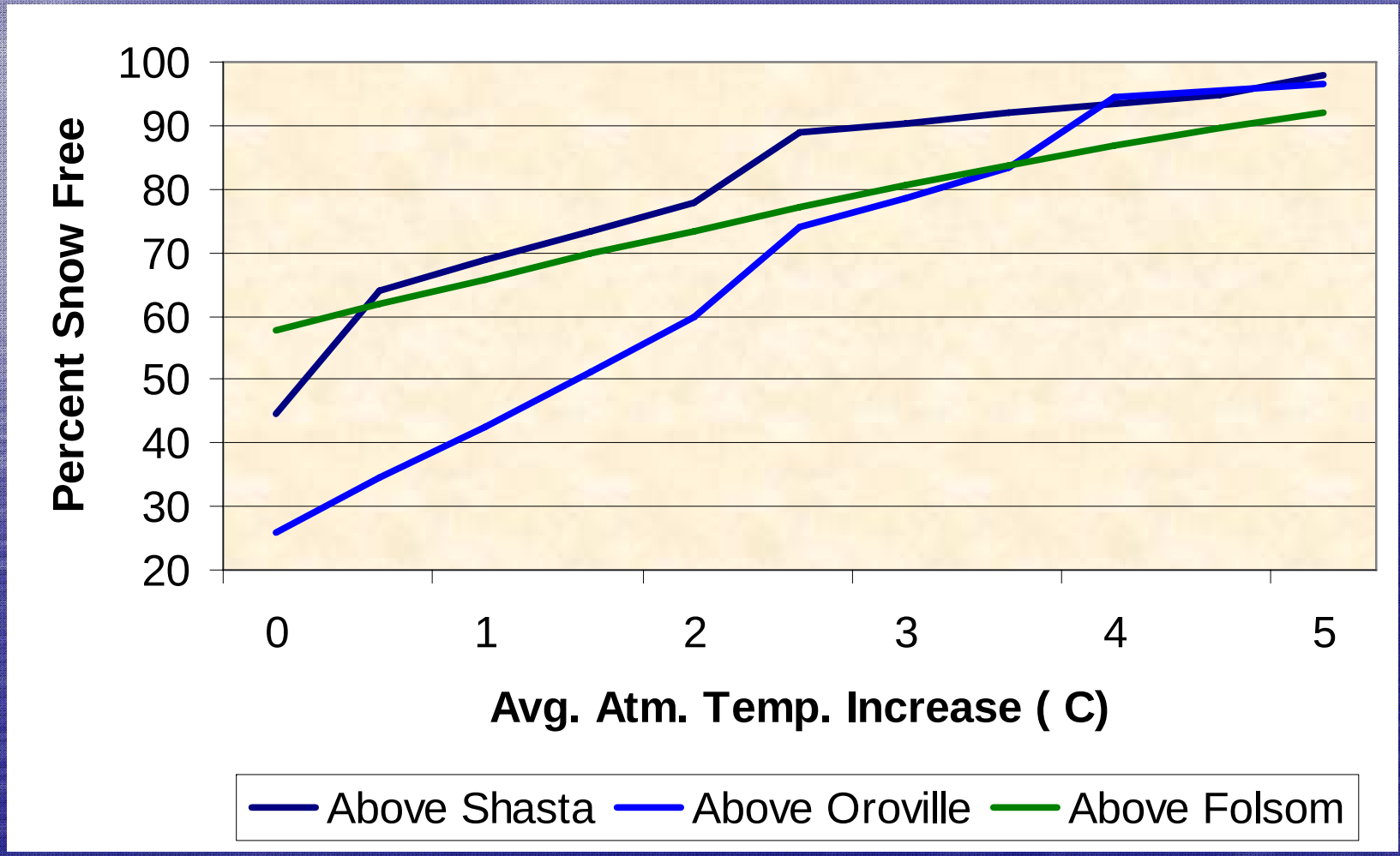
From Dettinger, 2005

Impacts Assessment - Hydrology

- Examine possible impacts of increases in mean atmospheric temperature of 1-5° C
- Assume snowpack retreats at 500 feet per 1° C

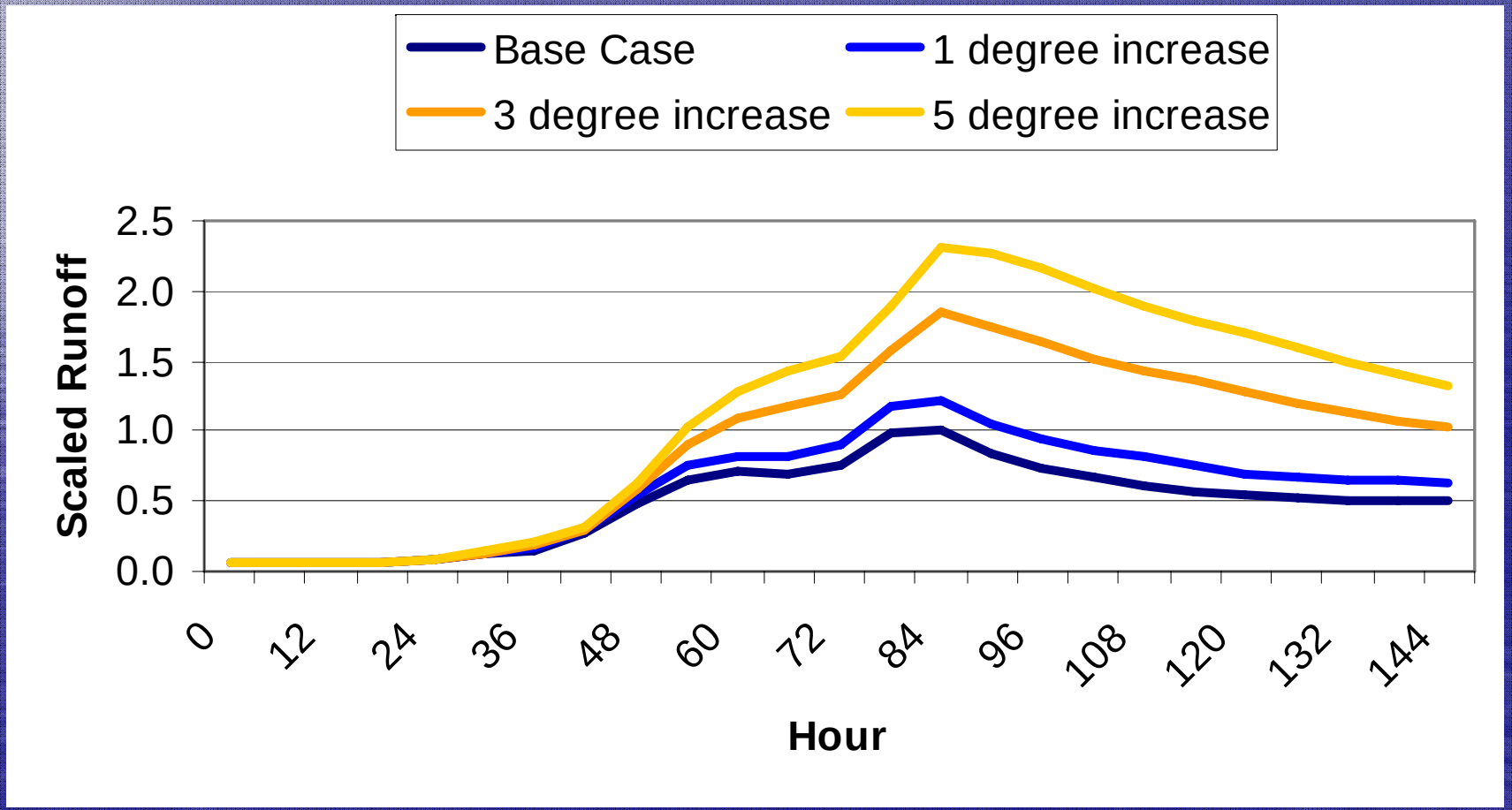


Snowpack Reduction Impacts



Storm Runoff Impacts

- Higher snow levels yield more direct runoff per storm



Impacts Assessments

- Initial Assessments
  - CVP/SWP Operations – Dan Easton (DWR)
  - Delta Issues – Jamie Anderson (DWR)
- Ensemble Methods – The next step
  - CVP/SWP Operations Impacts with Ensemble Analysis – Levi Brekke (USBR)
  - Weighted Estimation of Projection Distributions – Levi Brekke (USBR)


Questions ?
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