

A sunset over a lake with ice floes in the foreground. The sky is a mix of orange, red, and yellow, with the sun low on the horizon. The water is dark, and the ice floes are scattered across the foreground.

What Lake Ice Seasonality Tells us about Lakes and Climate

John J. Magnuson
Center for Limnology
University of Wisconsin-Madison

Illinois Lake Management Association
30th Annual Meeting
DeKalb, IL
February 20, 2015

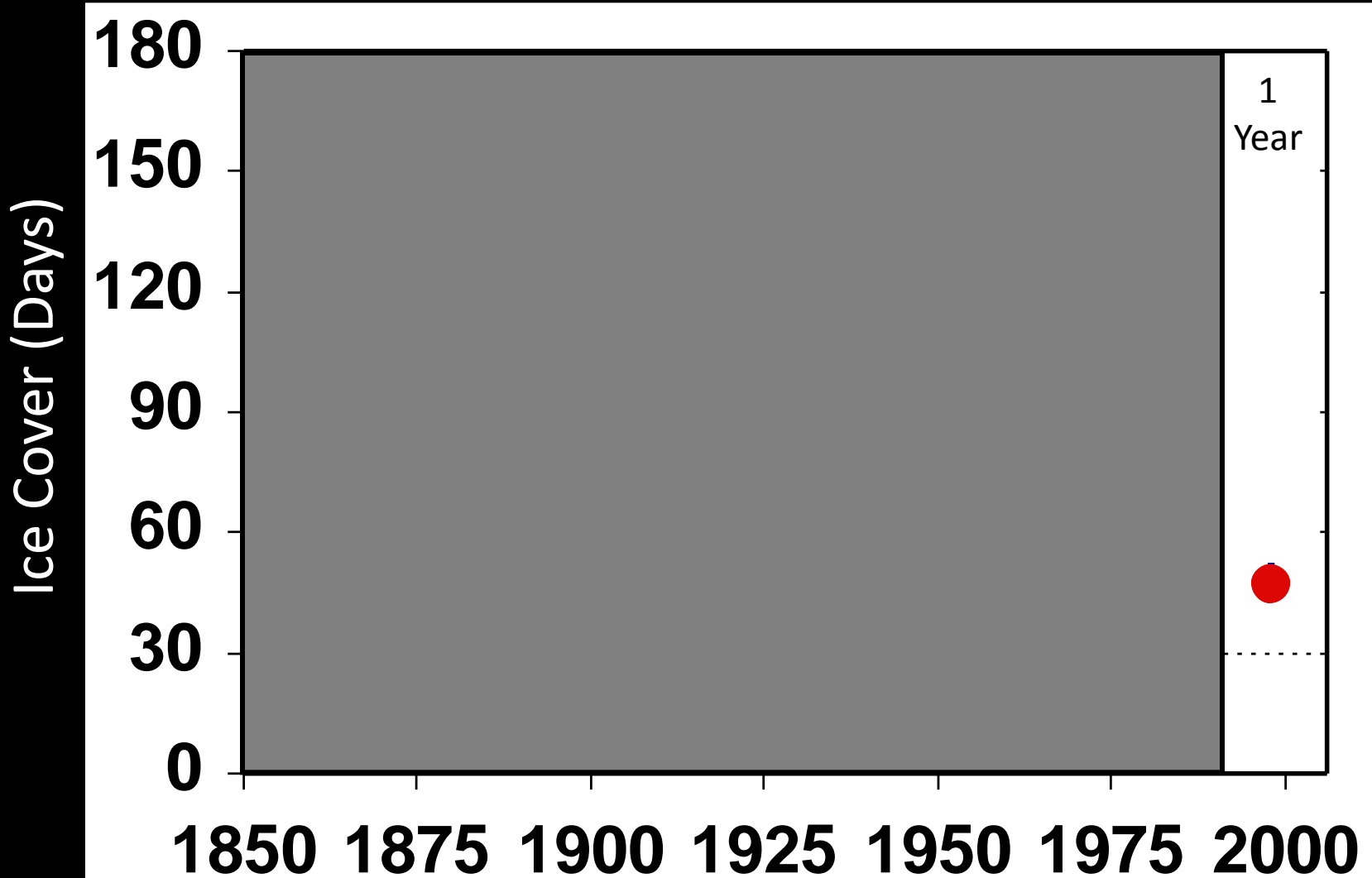


- Invisible Present
- Lake Ice Trends in Northern Hemisphere
 - Trends versus Variability & Extremes
- Multi-Century Records
 - Today in Illinois?

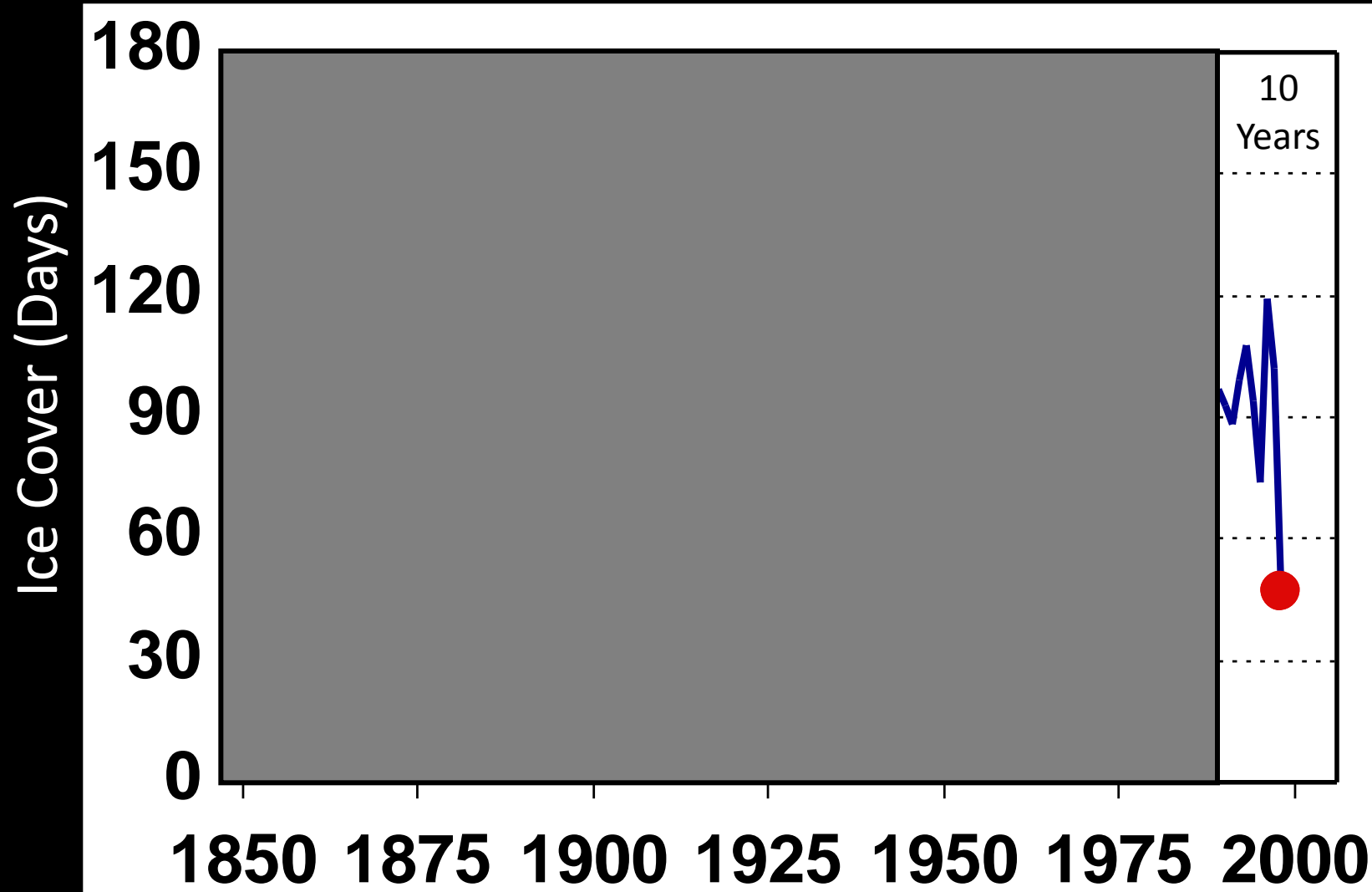


The Invisible Present

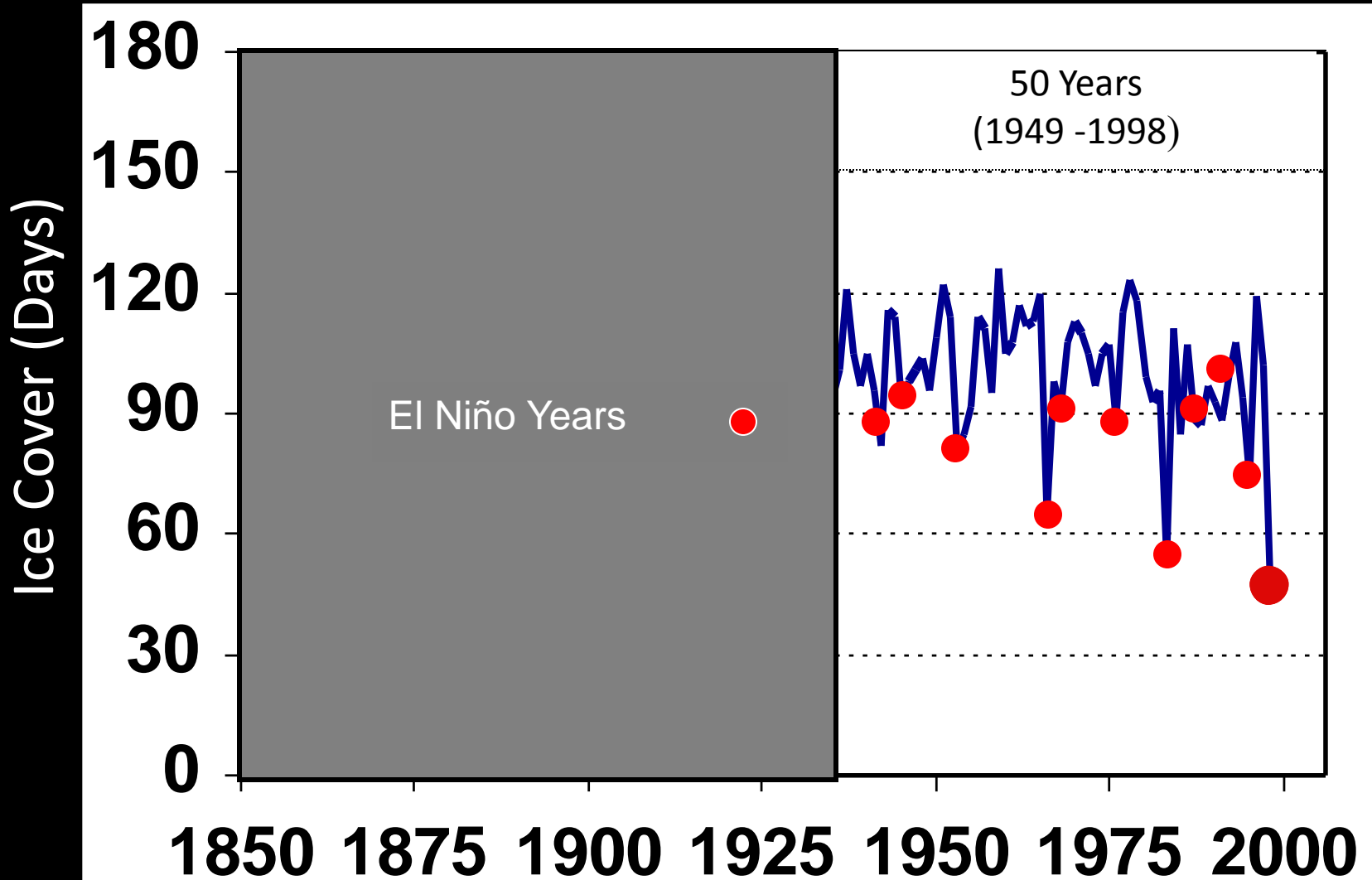
Lake Mendota, Wisconsin



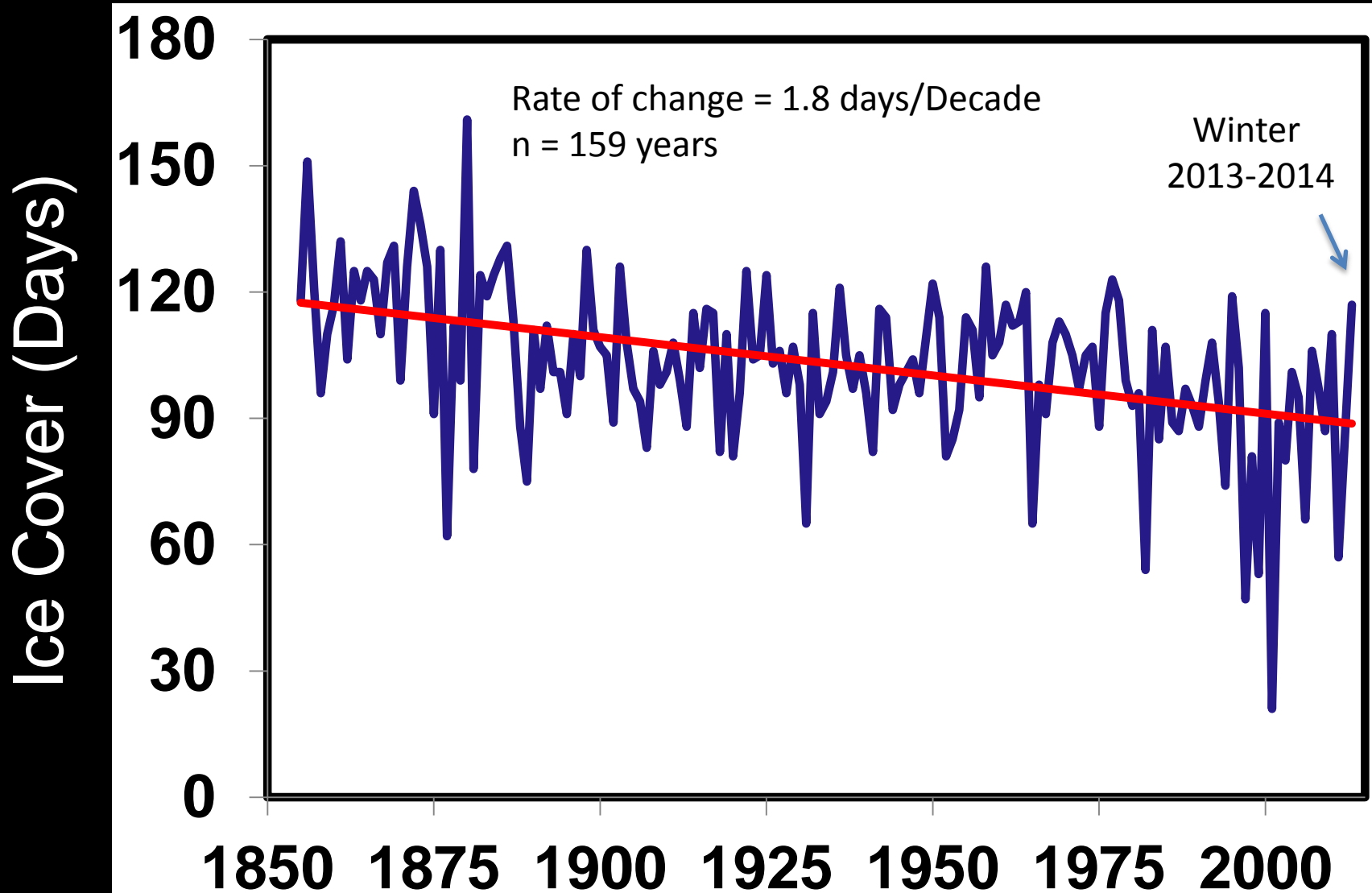
Interannual Variability



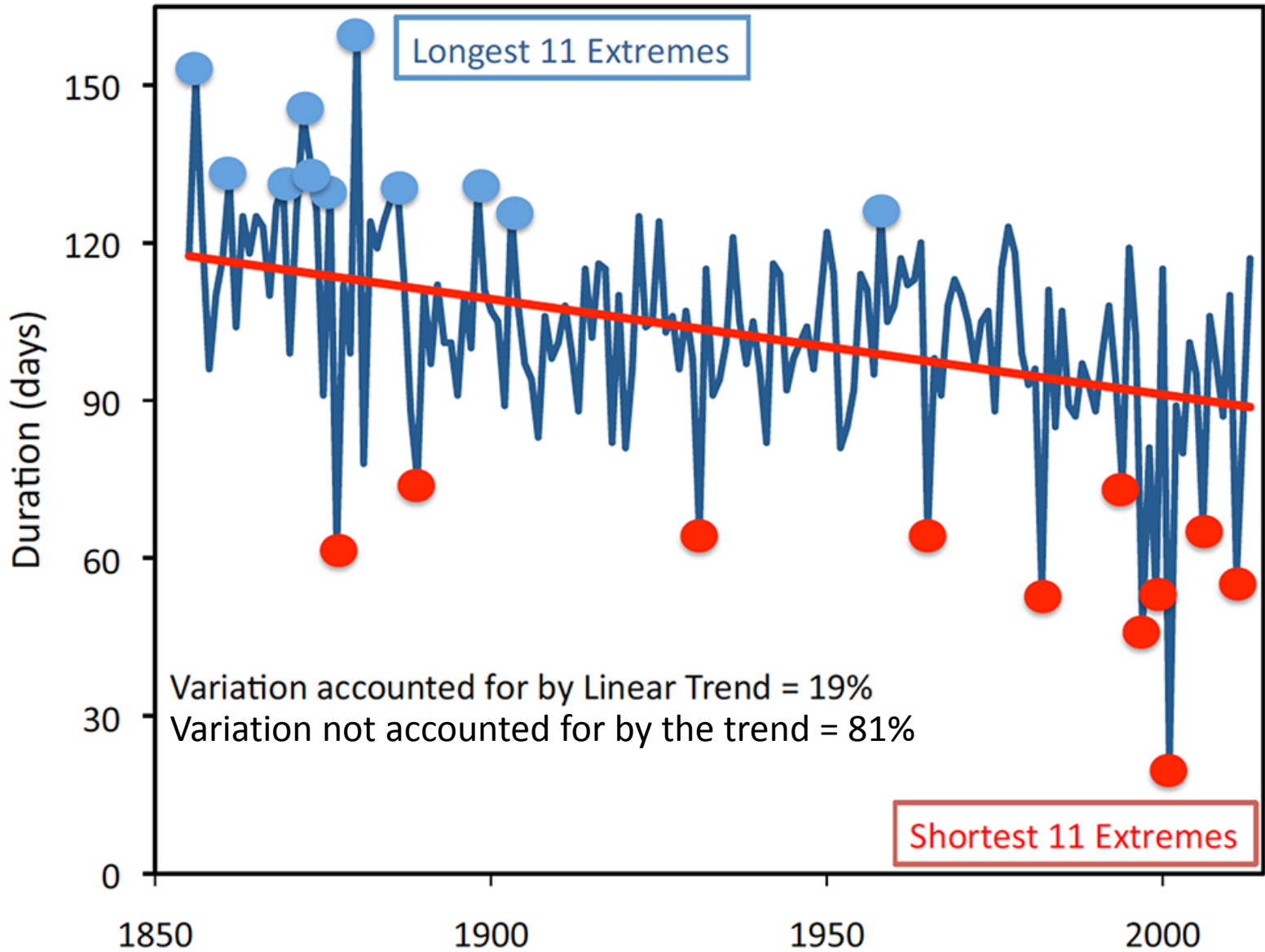
Dynamics from the Central Pacific



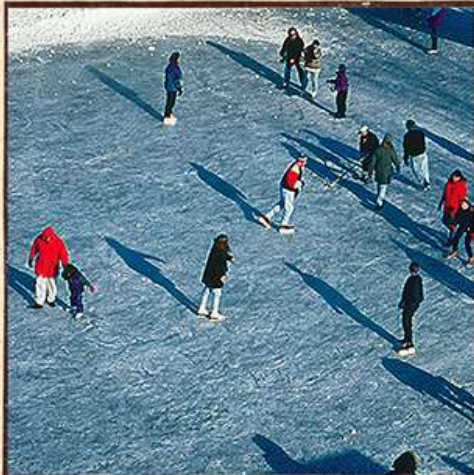
Climate Change and Variability



Climate Change and Extremes



Lake Monona, Wisconsin - 1878 Lithograph & Today



Today, the ice season is
29 days shorter
on average (a 25 % loss).



R. M. Comly.

Frank Barnes. Lake Monona.

Jerome.

Glide.

Git.

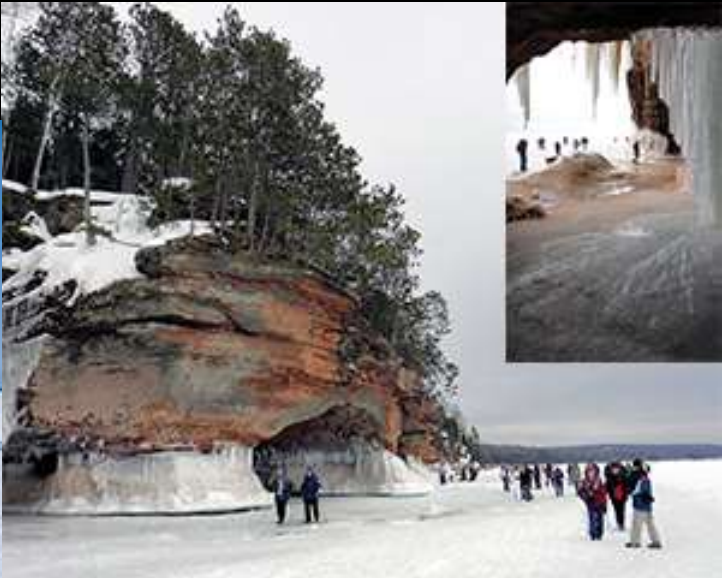
Arctic.

W. P. NYDER

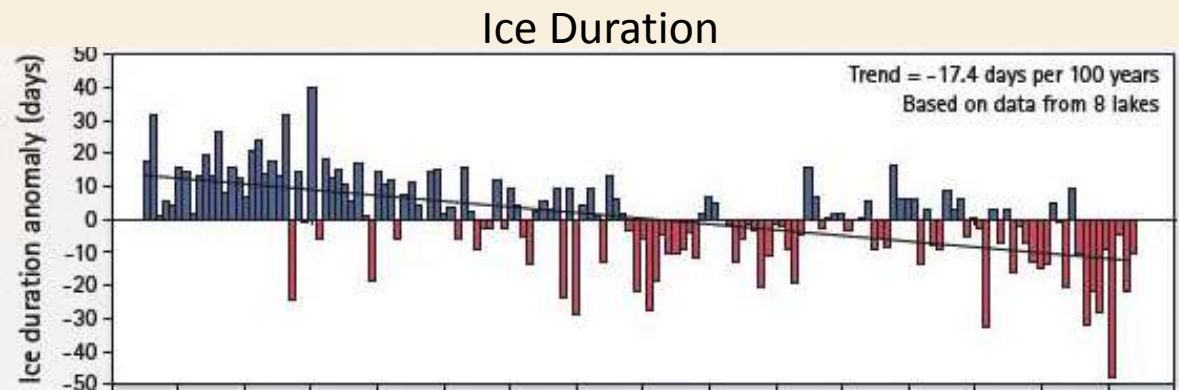
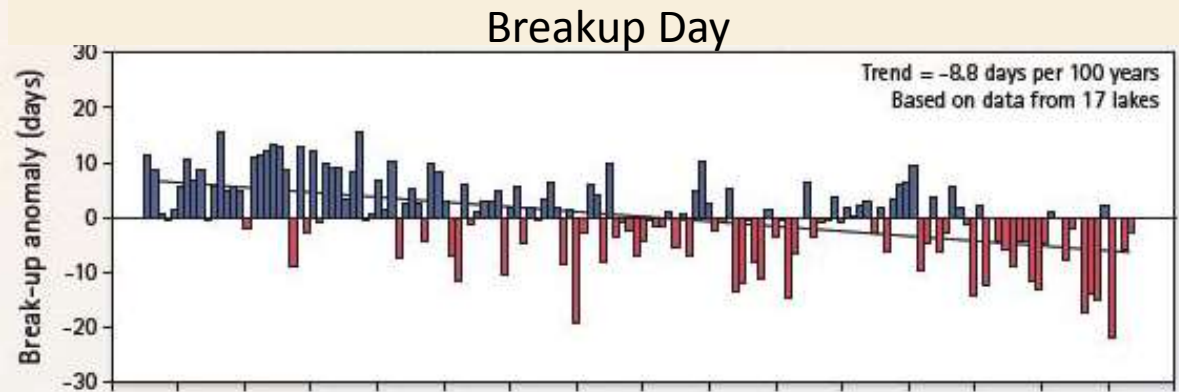
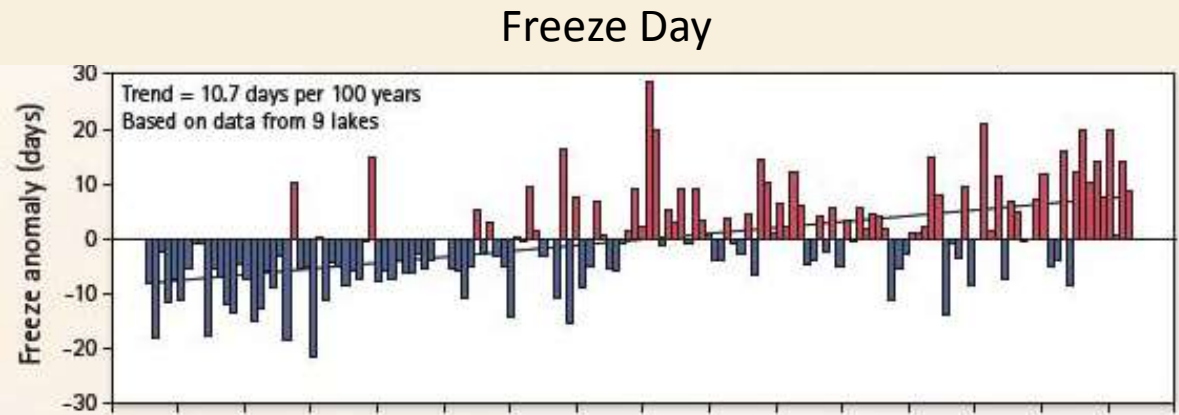
ICE-BOATING AT MADISON, WISCONSIN.—FROM A SKETCH BY N. A. GREENBACK.—[SEE PAGE 191.]

1878

Recreational Values are Declining



Changes in Lake Ice Cover around the Northern Hemisphere



1850

1900

1950

2000

So what about the remaining 80% of the variation?

- Measurement error?
- Weather variability?
- Variability in solar radiation?
- Large-scale climate drivers?
- Unknown uncertainty?
- What is your favorite?

Three papers to discuss by Sapna Sharma & Friends

Large-Scale Climate Drivers & Their Periods

Quasi-biennial (QBO)

- Equatorial zone wind - **periods of 1.7 to 3 years**
- Impacts hurricanes, cyclones, monsoons, & warming of winter in the Northern Hemisphere

El Niño / Southern Oscillation (ENSO)

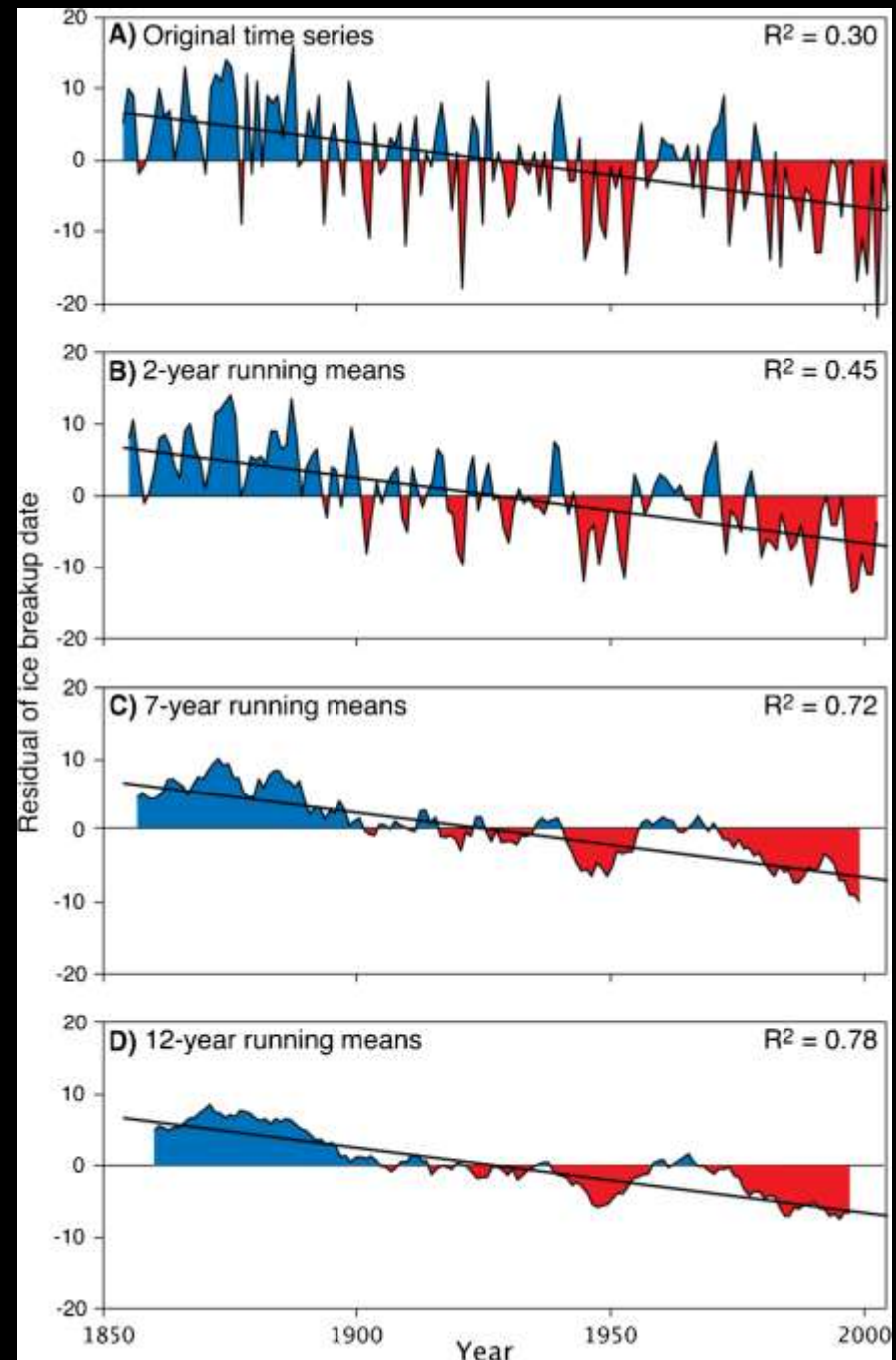
- Variation in surface water temperature of tropical eastern Pacific Ocean - **periods of 3 to 7 years**
- El Niño – warmer and drier winters in North America

Large-Scale Climate Drivers & Their Periods

- Solar sunspot cycle
 - Sunspot activity on sun - magnetic activity can impact ultraviolet and soft x-ray emissions - **period of 11 years**

- Atlantic Multidecadal Oscillations
 - Changes in sea surface temperature of North Atlantic Ocean - **period of 20-50 years?**
 - Impacts hurricanes, Florida rainfall, & air temperatures of the Northern Hemisphere

Higher Frequency
Oscillations (QBO &
ENSO)
contribute more to
residual variation from
the linear trend than do
the 11-year sunspot
cycle or multi-decadal
oscillations.



5-7 Centuries of Human Observations on Lake and River ice seasonality

- Lake Suwa, Japan. 1443-2004 (561 year extent)
- River Torino, Finland. 1692-2013 (321 year extent)

How did climate and variability change with the onset of the Industrial Revolution?

The Longest Lake Ice Record

Suwa Ko, Japan



Omiwatari on Suwa Ko



Mendota's ice ridges mirror the complex dynamics.



Closing thoughts

Do ice dates exist for Illinois Lakes and Rivers

None are in the archives
of NOAA's Snow and Ice Data Center

Illinois waters are
at the southern edge ice cover in the US

Changes are occurring and
they are affecting human use and safety

A publication of the North American Lake Management Society

LAKE LINE

Volume 34, No. 4 • Winter 2014



Magnuson & Lathrop
Winter 2014

Lake Ice
Winter
Beauty
Value
Change
&
a Threatened Future

Lakes in Winter