

Changing Precipitation Intensity and Lake/Groundwater Interactions

Midwest Ground Water Conference
October 2, 2012



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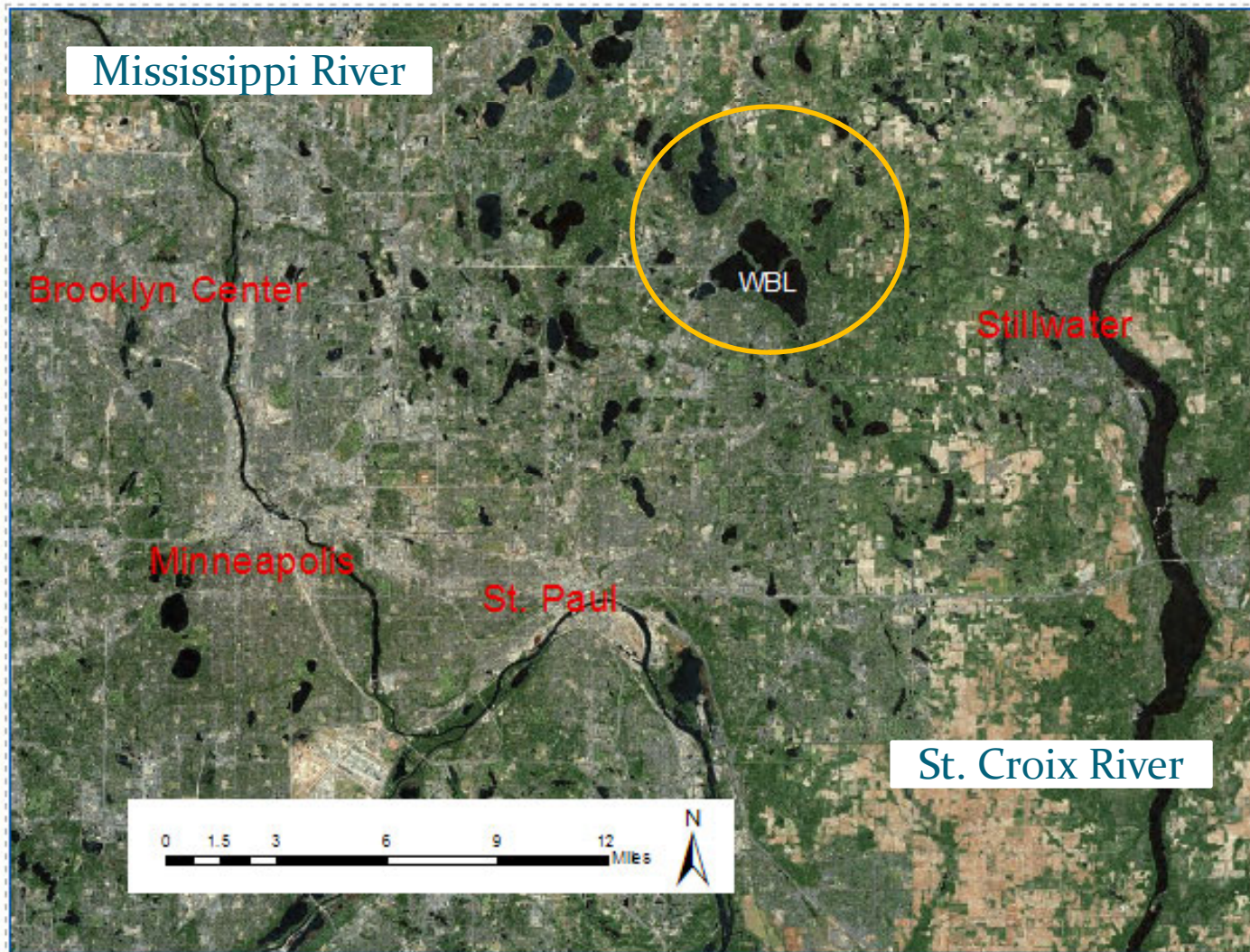
Minnesota Pollution Control Agency



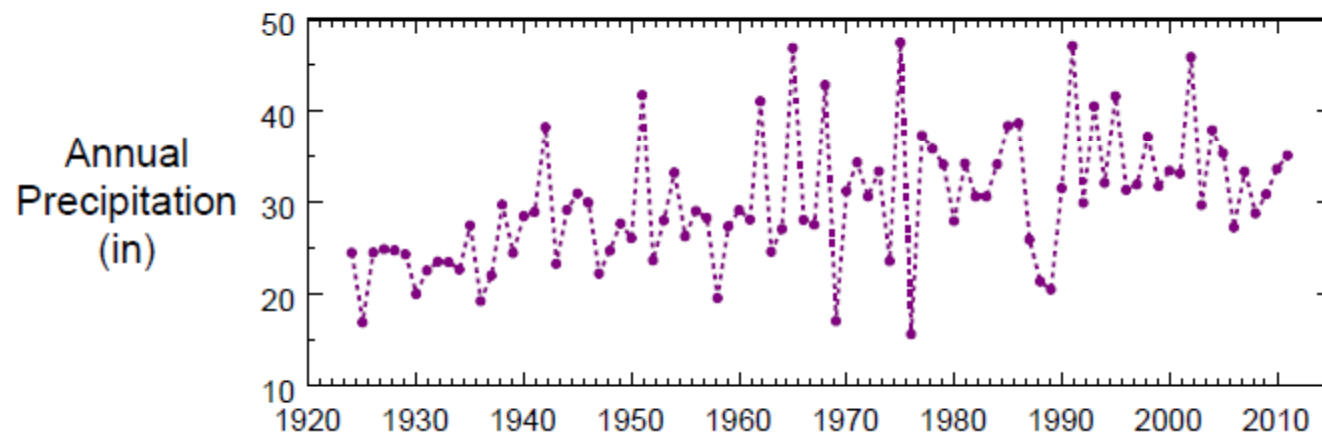
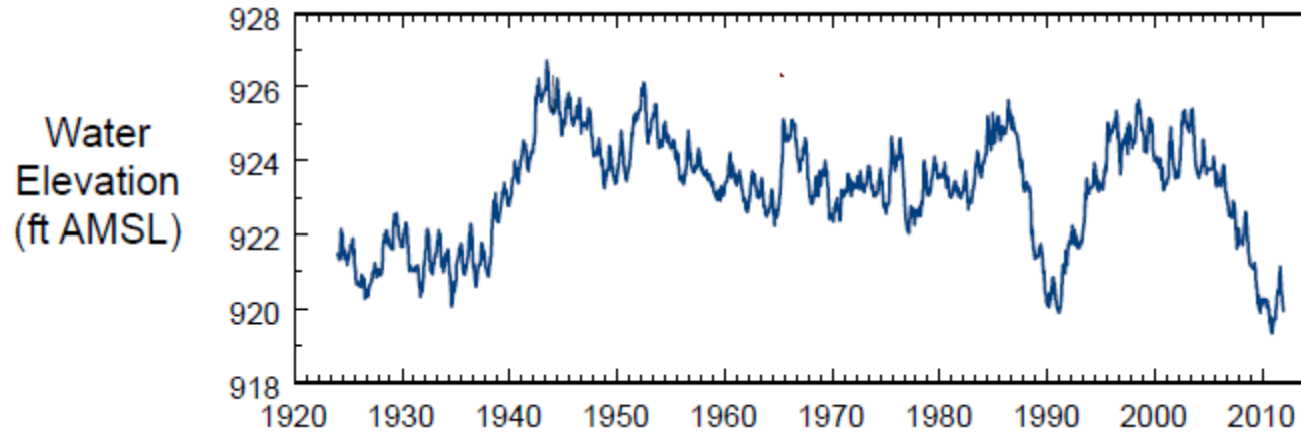
Outline of Today's Talk

- The White Bear Lake watershed to lake ratio is a very small 3 to 1.
- Total Annual Precipitation does not appear to be the cause of recent declines in lake levels.
- The frequency of large, daily precipitation events correlates well with lake levels.
- This relation may be a function of the small watershed.

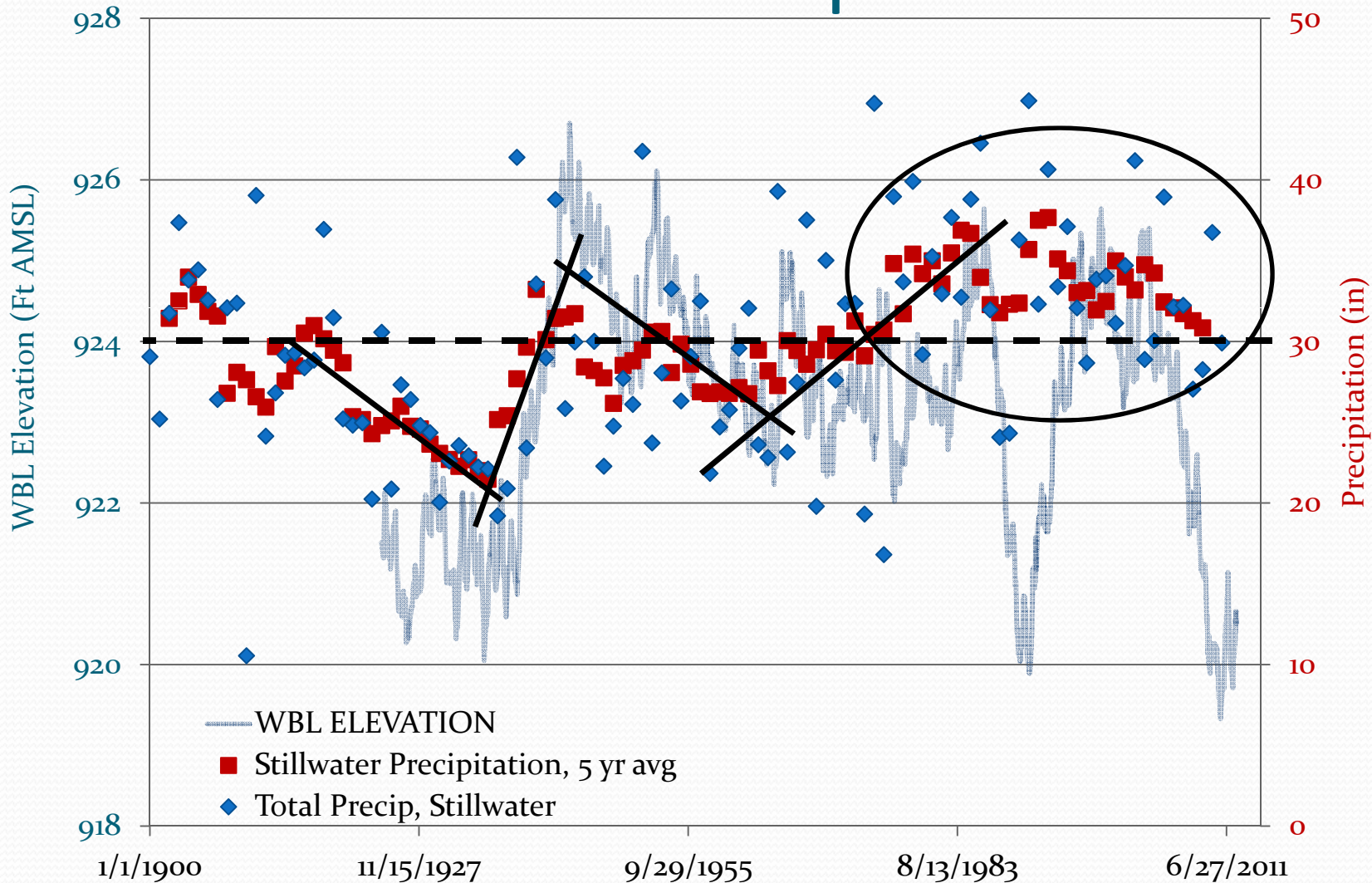
Location of White Bear Lake



White Bear Lake Water Elevation and Precipitation 1924 - 2011



WBL Elevation vs. Precipitation



Ratio 3

DOUBLED TROUBLE

MORE MIDWESTERN EXTREME STORMS



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MOUNTAIN
CLIMATE
Organization



May 2012

Frequency of Storms by Size in the Midwest Changes by Decade, 1960s Through 2000s, Compared to 1961-1990

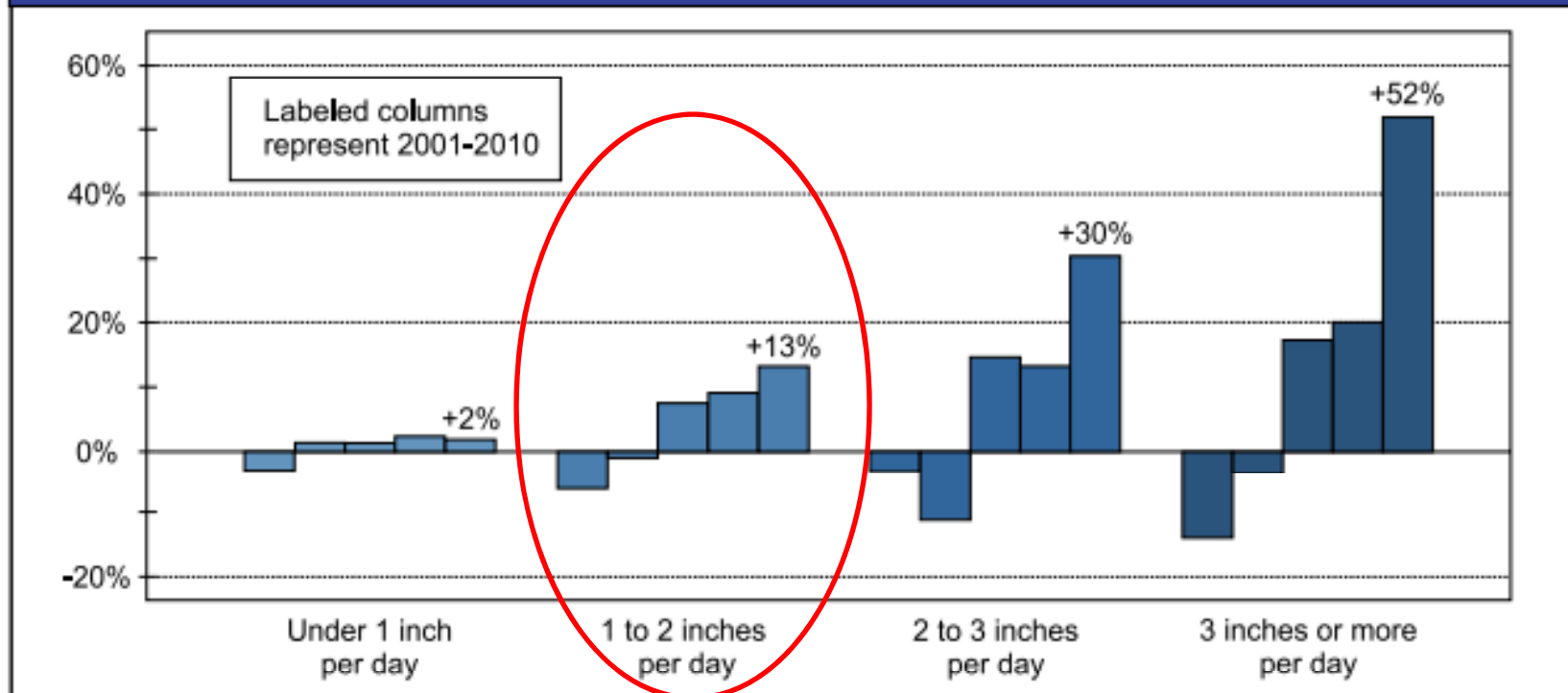
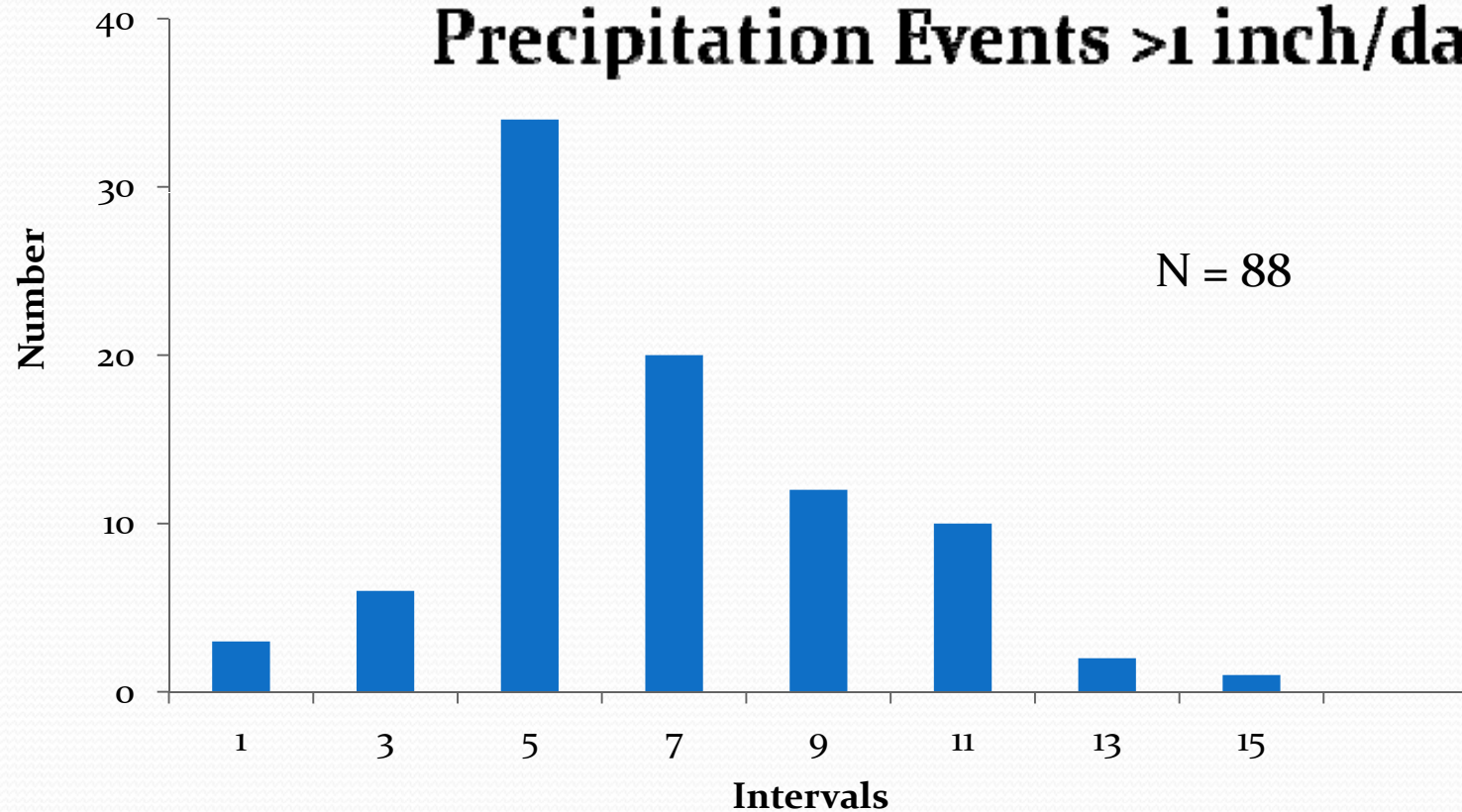


Figure ES-1. Changes by decade in the annual frequencies per station of storms of different sizes, compared to 1961-1990. Storms are grouped by days with less than 1 inch of precipitation, at least 1 inch but less than 2 inches, at least 2 but less than 3 inches, and 3 inches or more. In each group, the columns from left to right represent 1961-1970, 1971-1980, 1981-1990, 1991-2000, and 2001-2010.

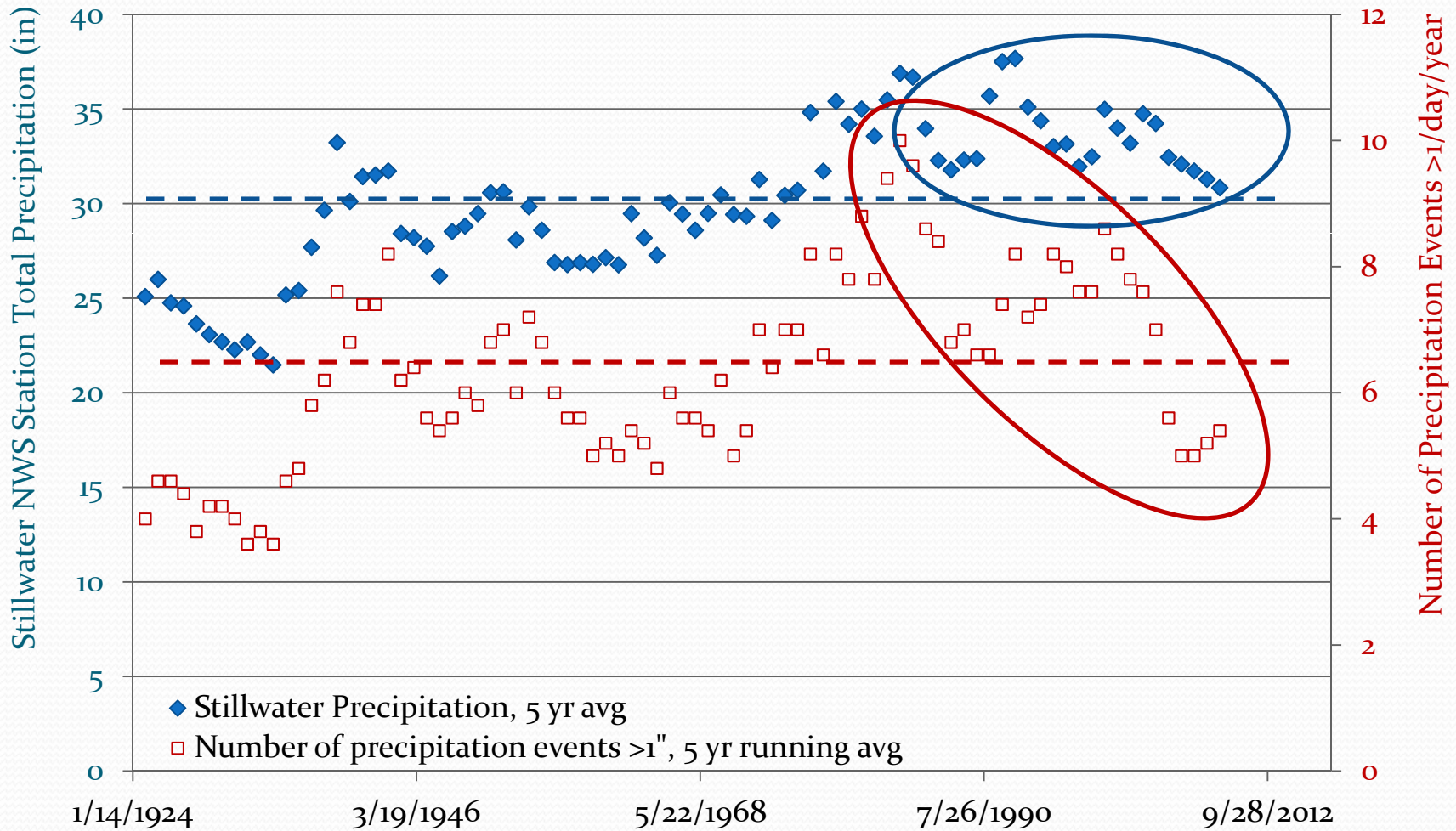
Intensity Frequencies

The Frequency of Precipitation Events >1 inch/day

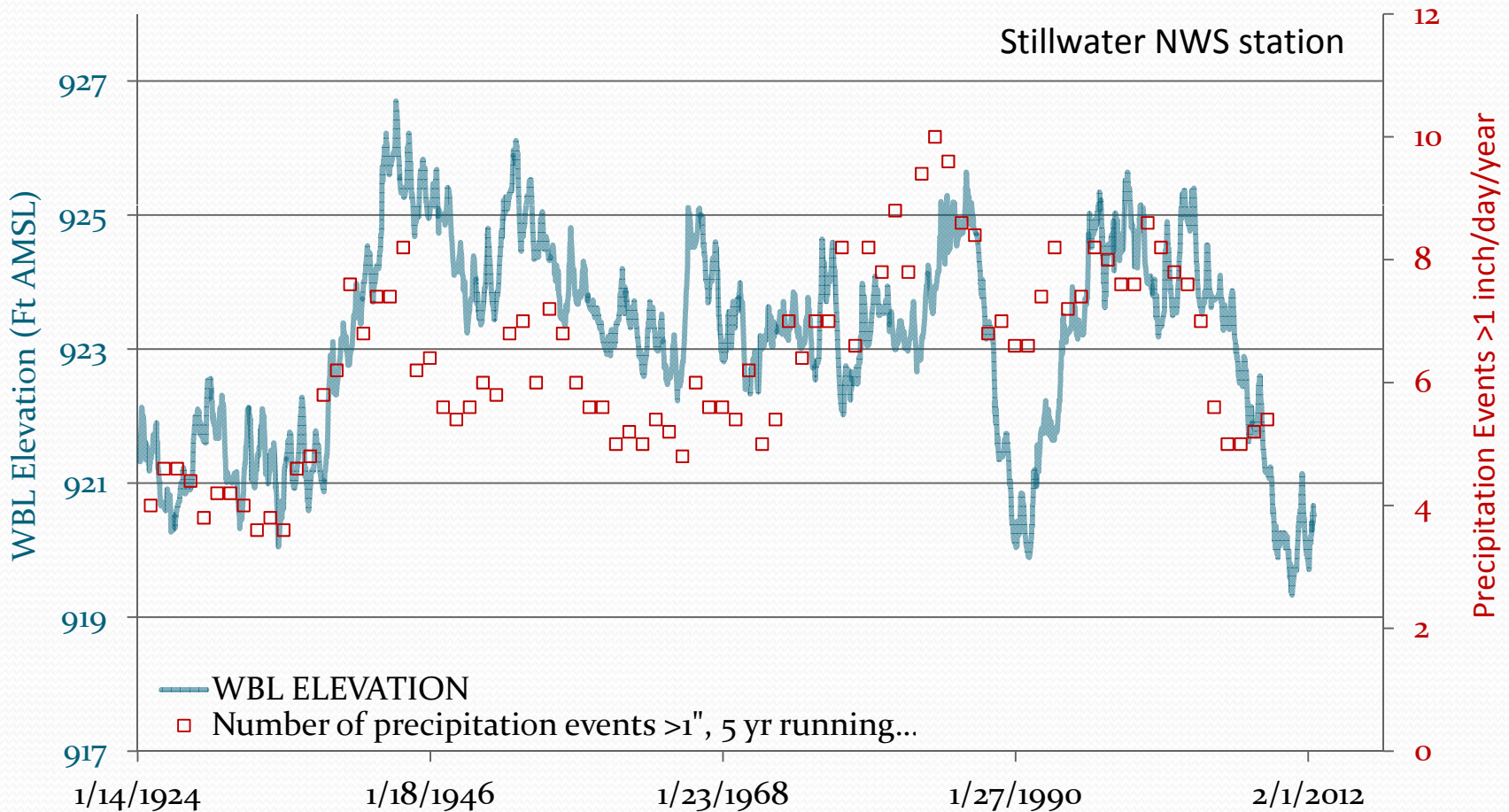


Stillwater MN National Weather Service Daily Precipitation records 1924 - 2011

Total Precipitation vs. Intensity

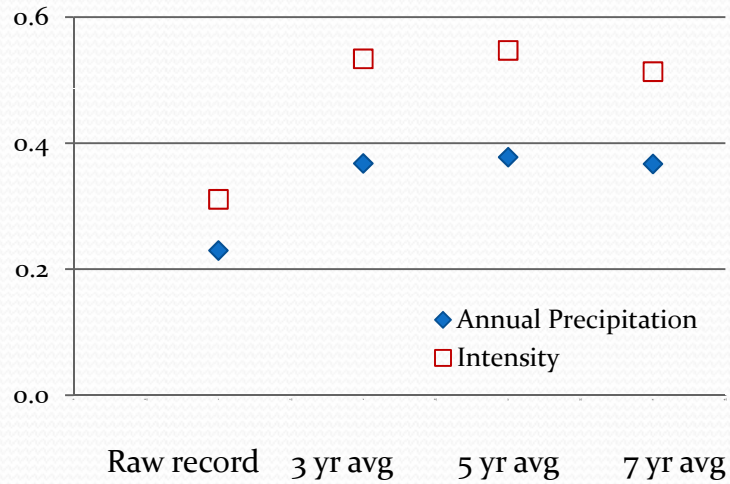


WBL Elevation vs. Precipitation Events >1 inch/day

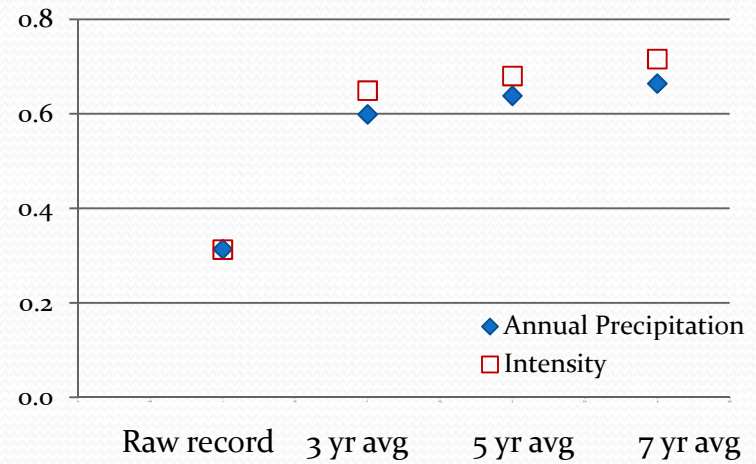


Correlations: White Bear Lake Levels Vs. Total Precipitation & Vs. Intensity

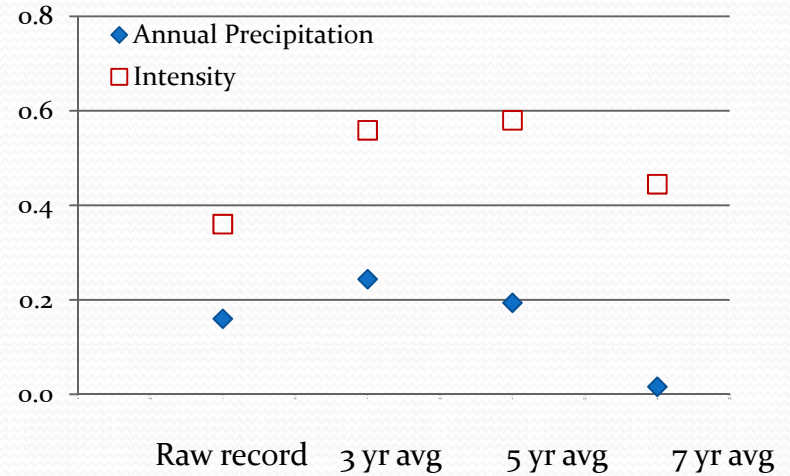
Correlations 1924 - 2011



Correlations 1924 - 1979

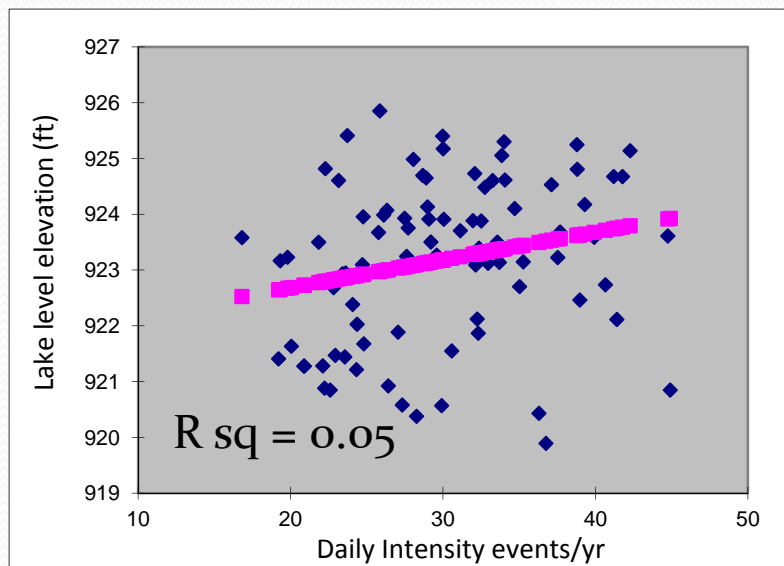


Correlations 1980 - 2011



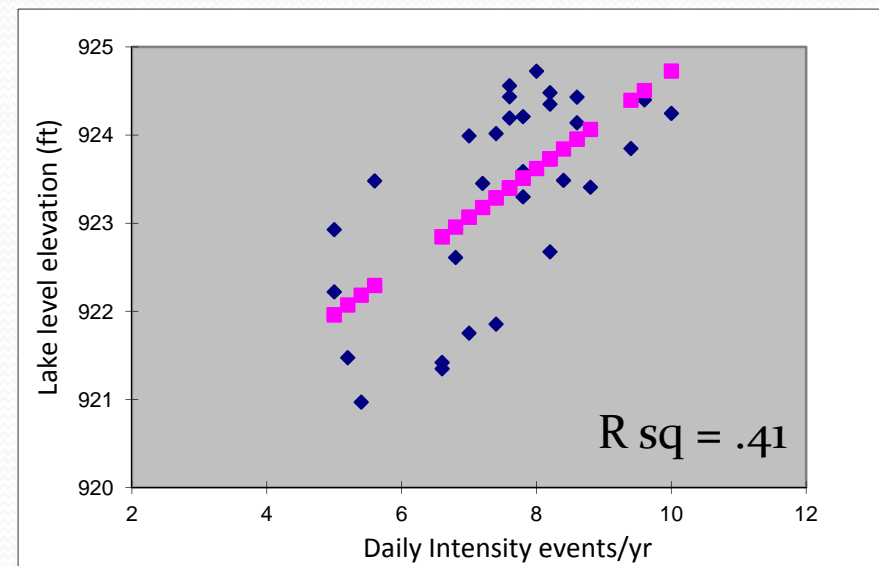
Regression: Predicting Lake Levels with Precipitation

Total Precipitation (Y)
Lake Level (X)



1924 - 2011

Intensity 5 yr avg (Y)
Lake Level (X)



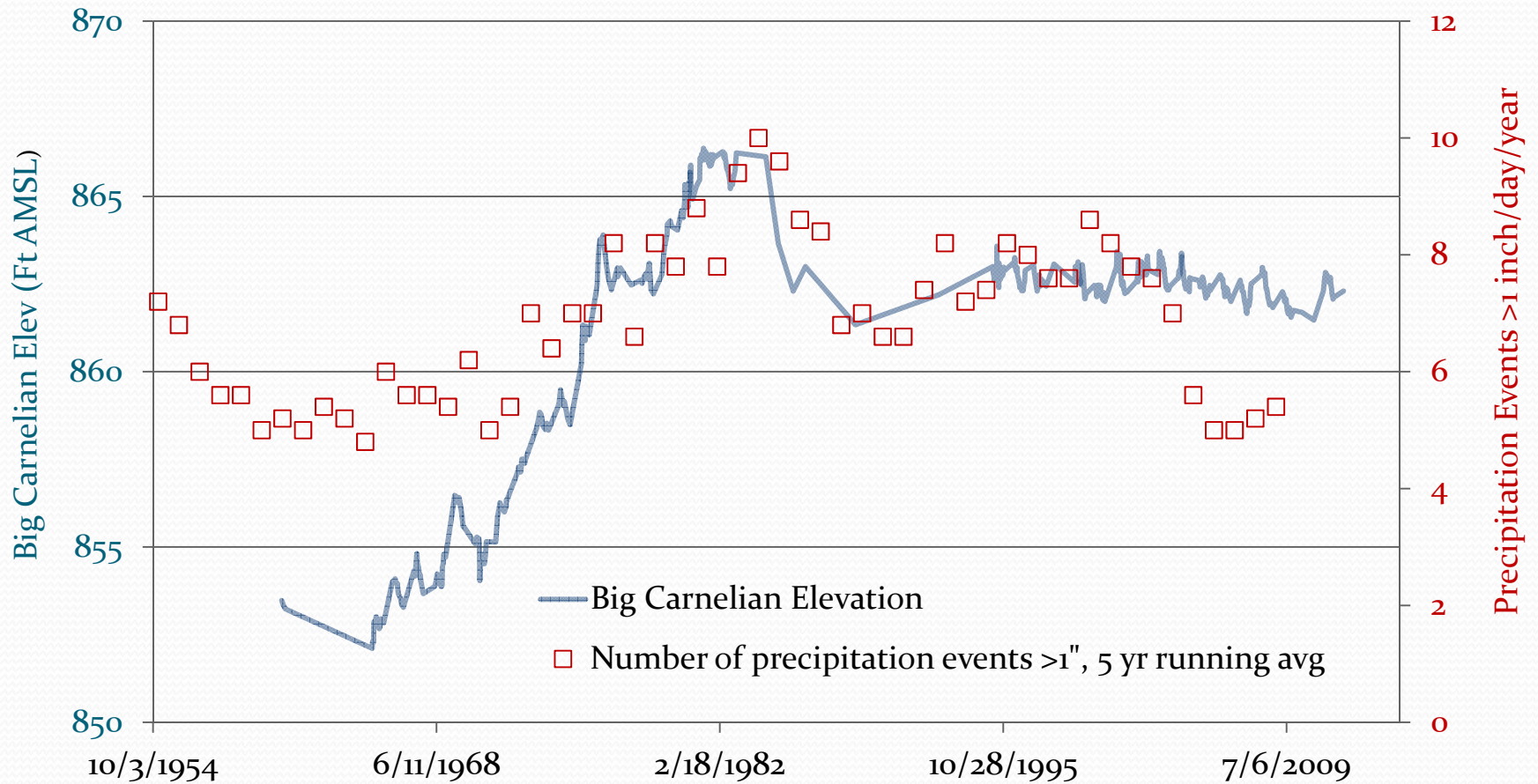
1980 - 2011



Other Factors

- Precipitation is highly variable, locally discontinuous.
- What about other lakes in the area?

Big Carnelian Lake vs Intensity events



Ratio 36



Summary

- Total annual precipitation levels correlate badly with White Bear Lake levels;
- Large, daily precipitation events correlate well with White Bear Lake water levels;
- The relation between precipitation intensity events and lake levels may be related to the small size of the watershed;
- Precipitation intensity levels may be less of a factor in lakes with larger watershed/lake ratios.



The End