

POTENTIAL IMPACTS OF CLIMATE CHANGE ON FLOODING IN WISCONSIN

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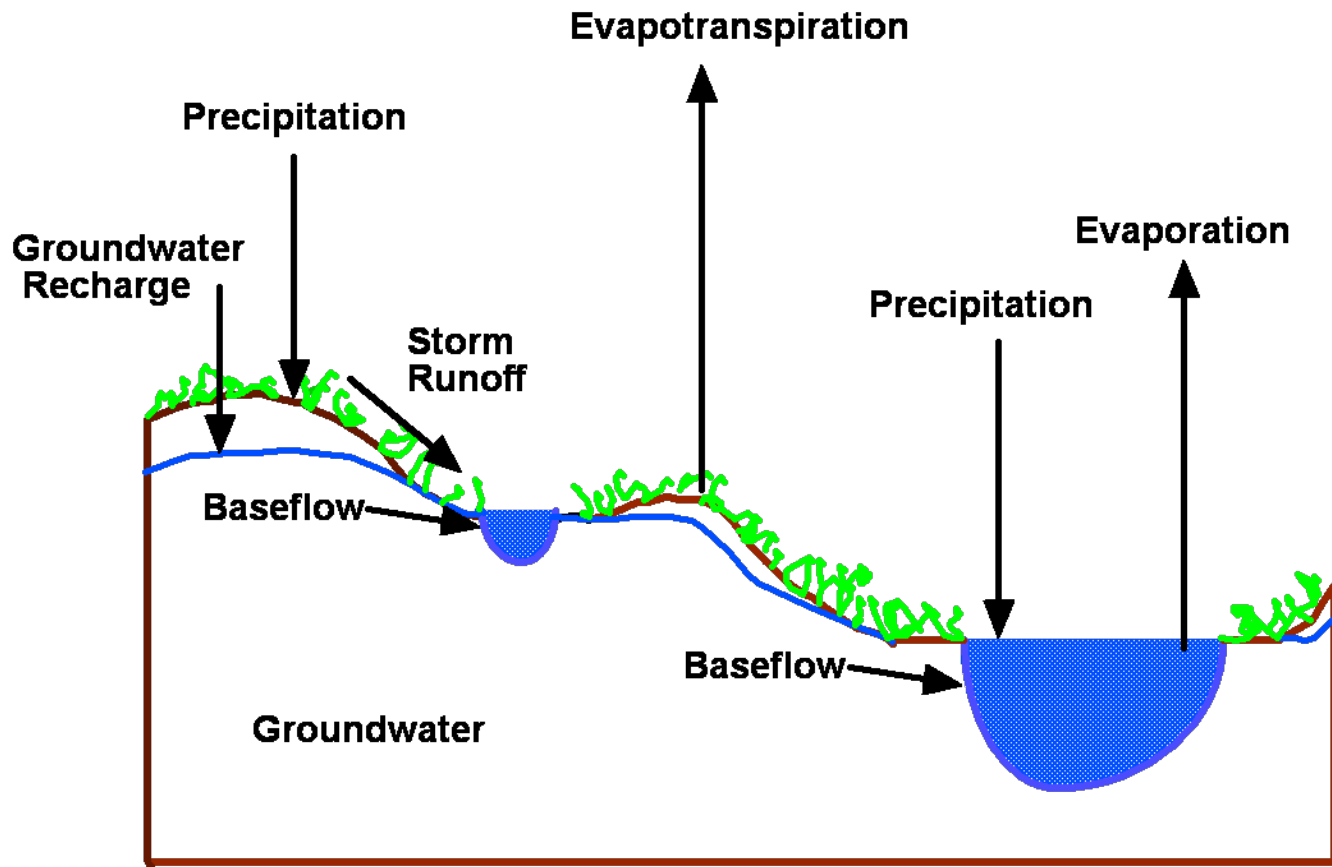
Madison, WI



OUTLINE

- **Typical flood scenarios in Wisconsin**
- **Potential impact of climate change on Wisconsin flooding**
- Ongoing changes in land use and management
- Adaptation strategies
- Critical gaps in Wisconsin policies on land use and land management

HYDROLOGIC CYCLE



TYPICAL FLOODING SCENARIOS IN WISCONSIN

- **Local storm water flooding (extreme rainfall over minutes to hours)**



Gordy Stephenson
Madison
Dane County
July 27, 2006



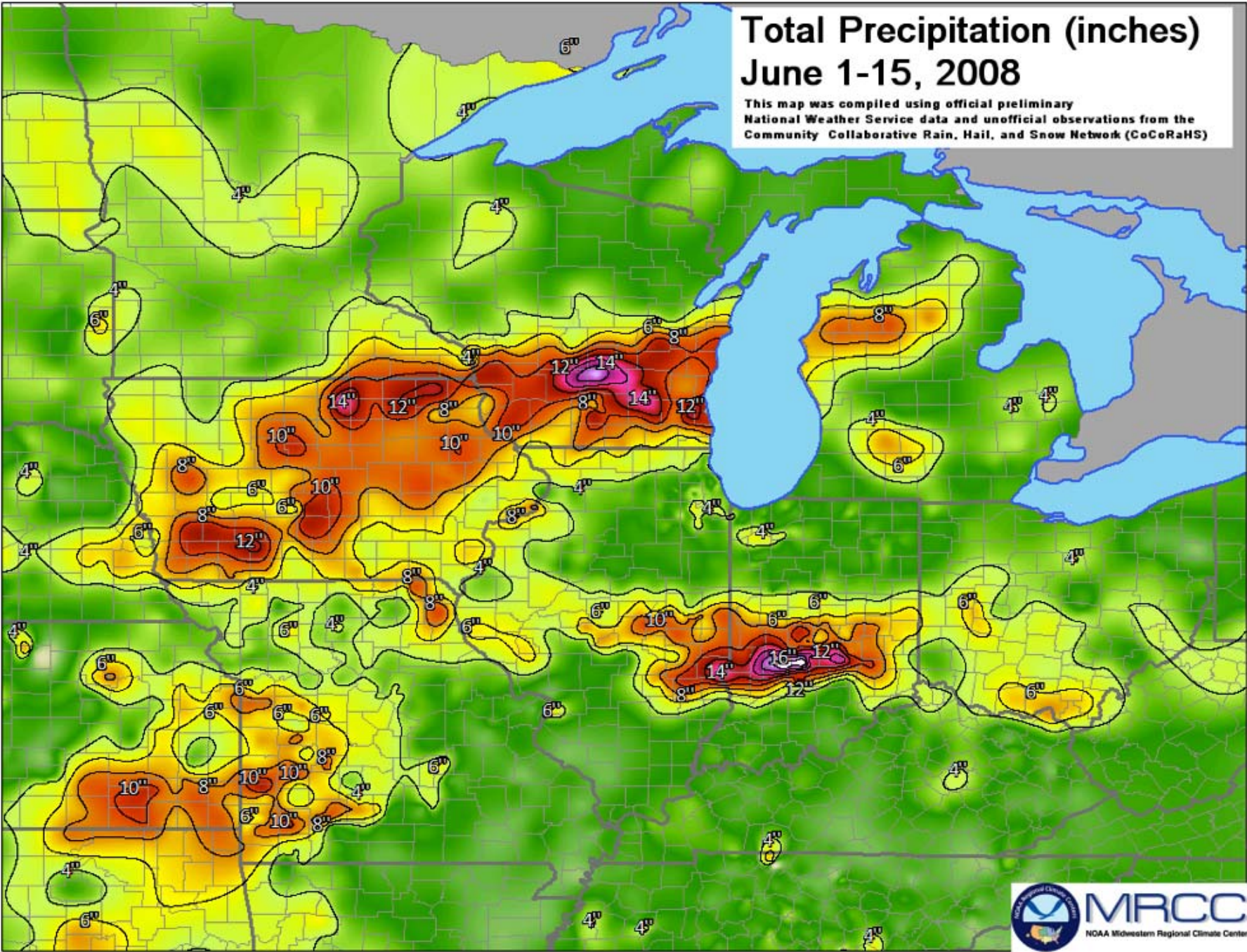
Madison, WI, July 27, 2006: 4 inches of torrential rain deluged the UW-Madison campus in a half hour, flooding nearby streets, parking lots, and walkways.

TYPICAL FLOODING SCENARIOS IN WISCONSIN

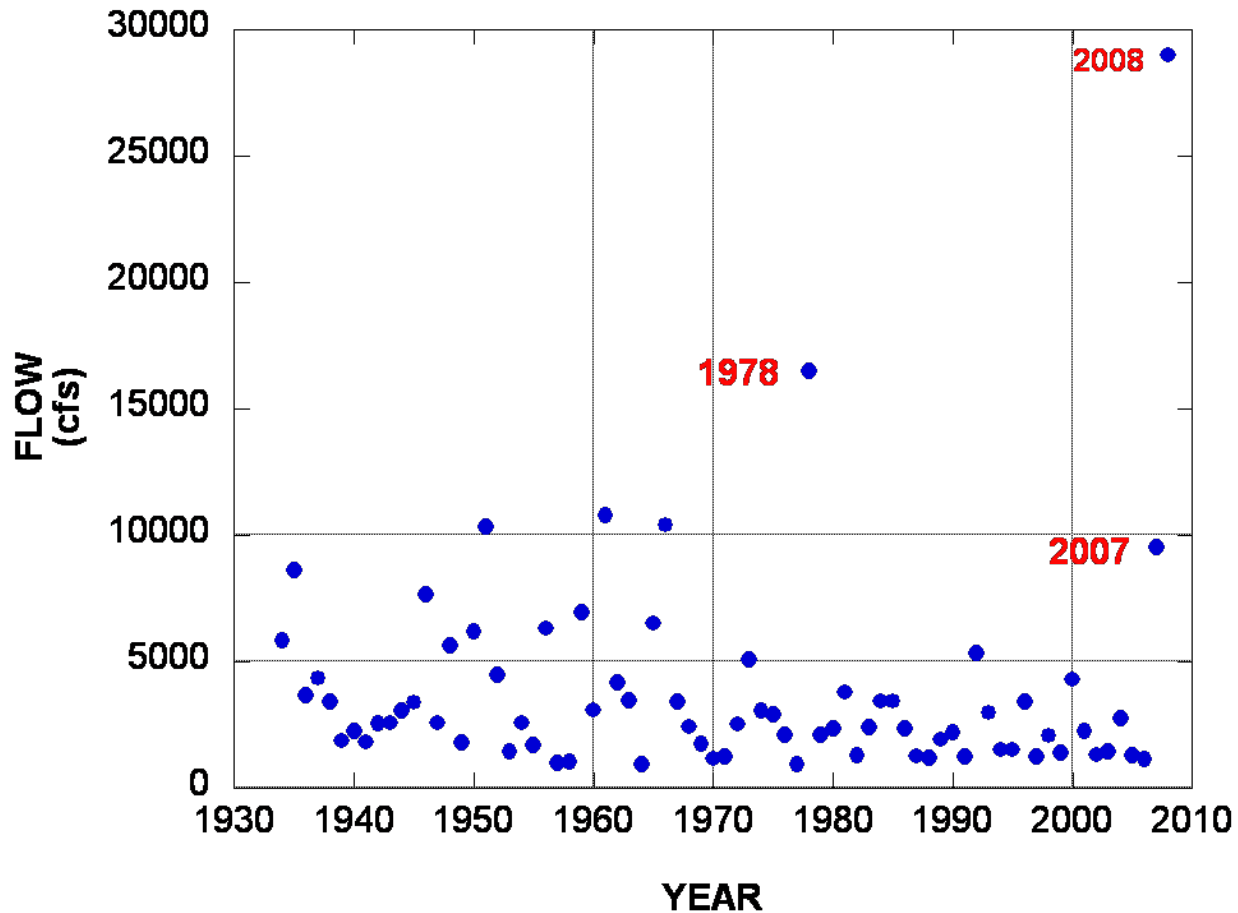
- Local storm water flooding (extreme rainfall over minutes to hours)
- **Stream/river flooding (extreme rainfall over hours to days, often preceded by significant rainfall over weeks and/or snowmelt)**

Total Precipitation (inches) June 1-15, 2008

This map was compiled using official preliminary National Weather Service data and unofficial observations from the Community Collaborative Rain, Hail, and Snow Network (CoCoRaHS)



HISTORICAL FLOOD RECORD KICKAPOOO RIVER AT STEUBEN



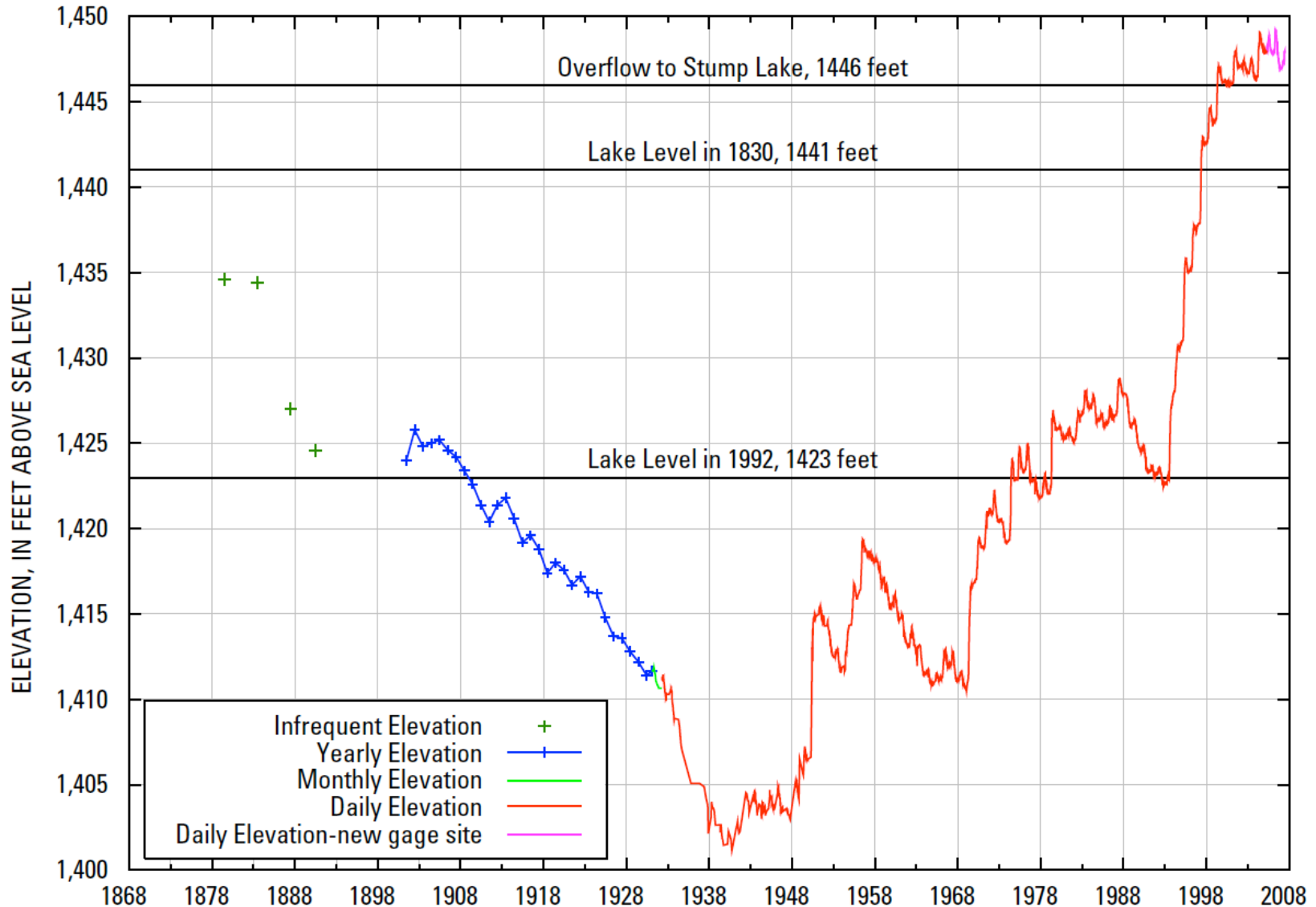
TYPICAL FLOODING SCENARIOS IN WISCONSIN

- Local storm water flooding (extreme rainfall over minutes to hours)
- Stream/river flooding (extreme rainfall over days, preceded by significant rainfall over weeks and/or snowmelt)
- **Lake flooding (extreme amount of rainfall over a wide range of time scales)**



Lake Delton, Wisconsin
2008

DEVILS LAKE, NORTH DAKOTA



TYPICAL FLOODING SCENARIOS IN WISCONSIN

- Local storm water flooding (extreme rainfall over minutes to hours)
- Stream/river flooding (extreme rainfall over days, preceded by significant rainfall over weeks and/or snowmelt)
- Lake flooding (extreme rainfall over weeks to months)
- **Groundwater flooding (extreme amount of rainfall and snow over months or years)**

SPRING GREEN, 2008



Peter Gorman

WISCONSIN INITIATIVE ON CLIMATE CHANGE IMPACTS

- Partnership between the University of Wisconsin and the Wisconsin Department of Natural Resources
- Goals are to assess climate change impacts in Wisconsin, evaluate potential economic affects, and recommend adaptation strategies.
- More information available from

<http://wicci.wisc.edu/>

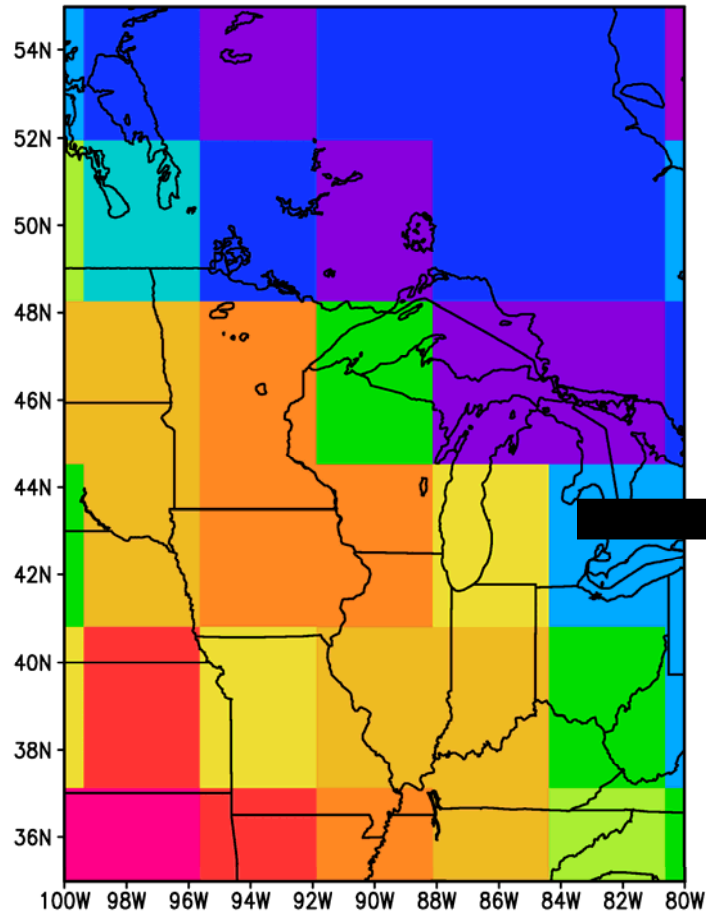
DOWNSCALED CLIMATE MODEL DATA FOR WISCONSIN

- Based on climate predictions produced for the latest IPCC assessment report based on 14 climate models and the “business as usual emissions scenario” (A1B).
- Statistically downscaled by UW climate researchers and released to the public on 9/15/09.
- Downscaling produces high-resolution de-biased data from low resolution climate model output.

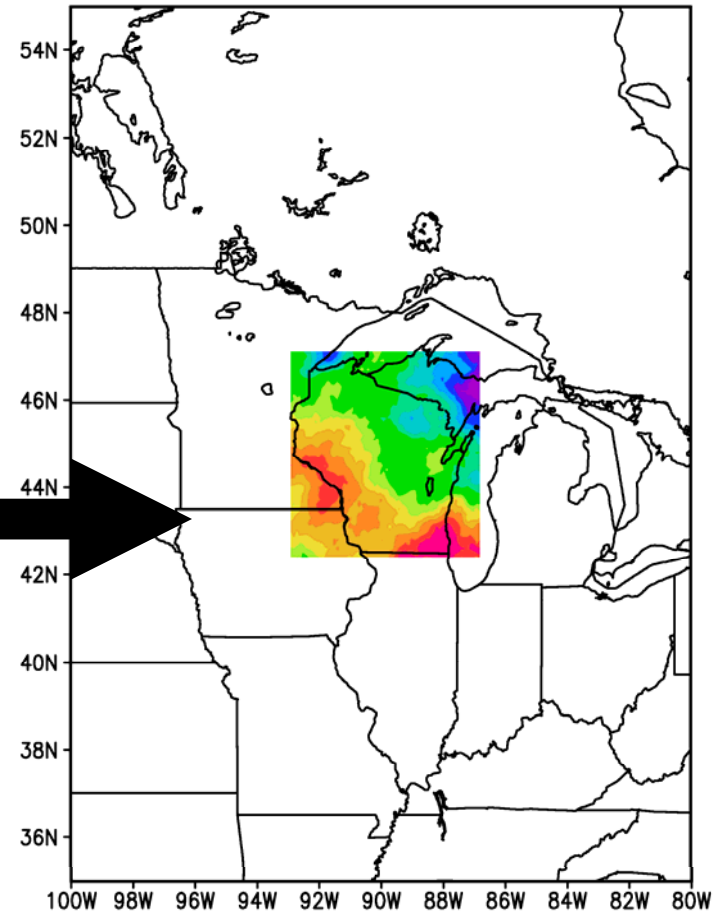
CLIMATE MODEL DOWNSCALING

Maximum Temperature on July 15 1999

Climate Model



Downscaled

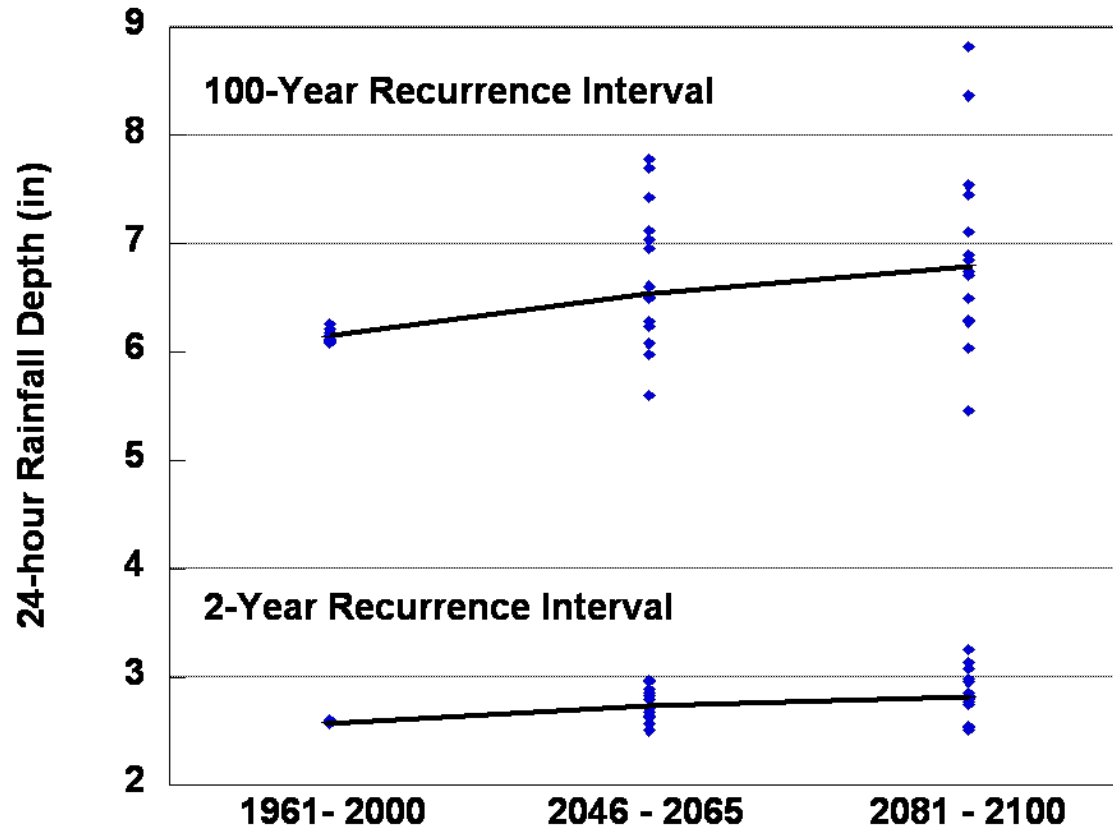


Kucharik, Lorenz, Notaro and Vimont)

EXPECTED CHANGES IN PRECIPITATION IN WISCONSIN BASED ON GLOBAL CLIMATE MODELS

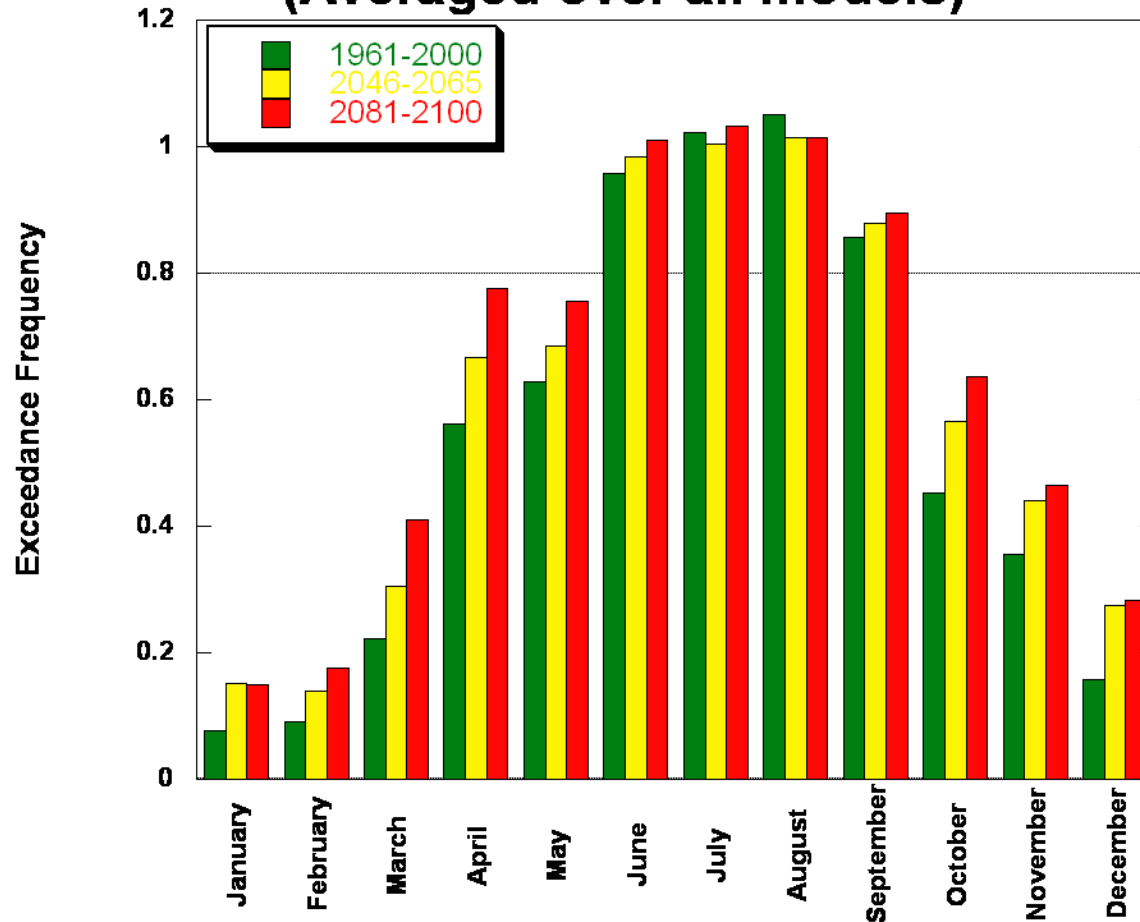
- **Increases in the magnitude and frequency of large rainfall events**
- **Increases in total monthly rainfall in spring and fall**
- **Increases in amount of rainfall in winter and spring (vs. snowfall)**
- **Changes in soil frost**

PREDICTED ANNUAL RAINFALL QUANTILES MADISON, WI



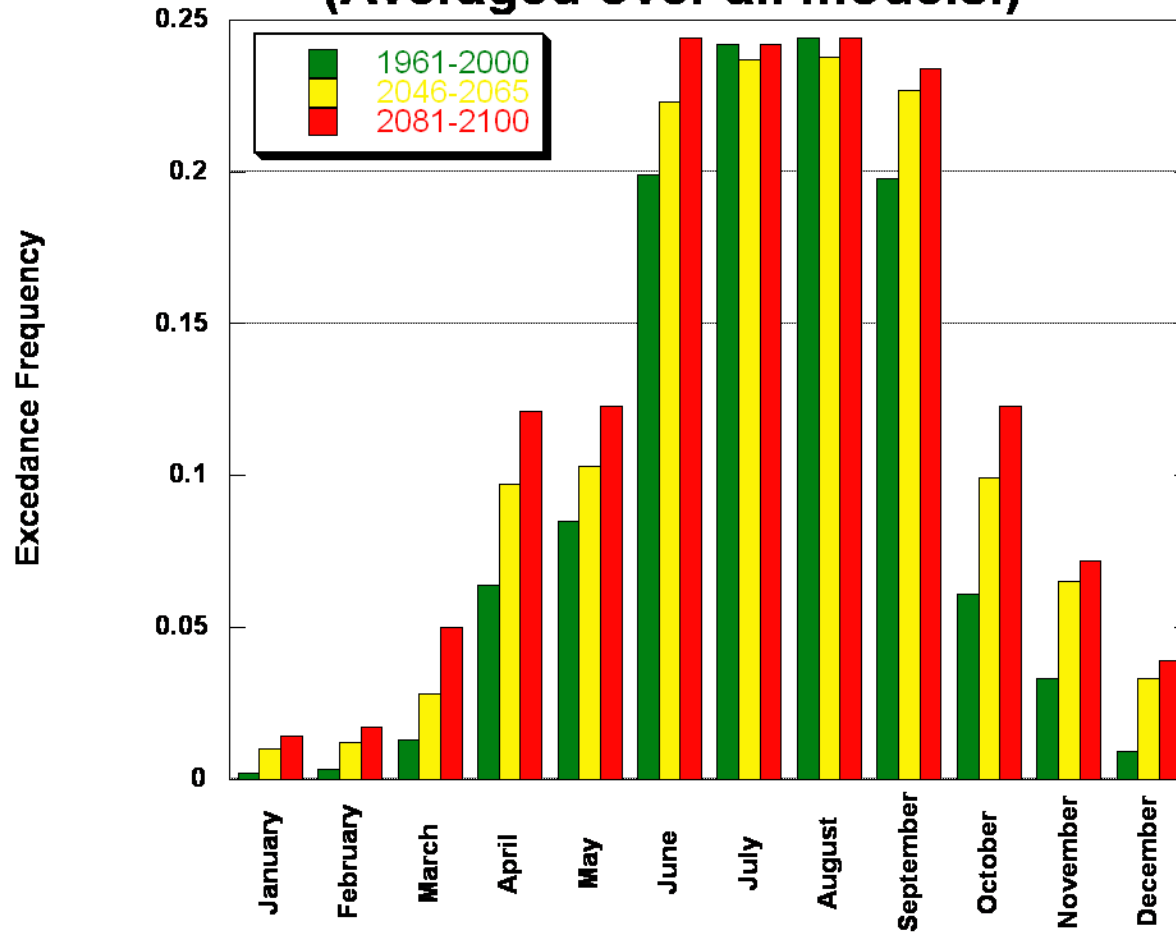
Based on statistically downscaled data developed by Kucharik, Lorenz, Notaro, and Vimont, UW Madison.

PREDICTED MONTHLY FREQUENCY OF EXCEEDING 1 INCH IN 24 HOURS MADISON, WI (Averaged over all models)



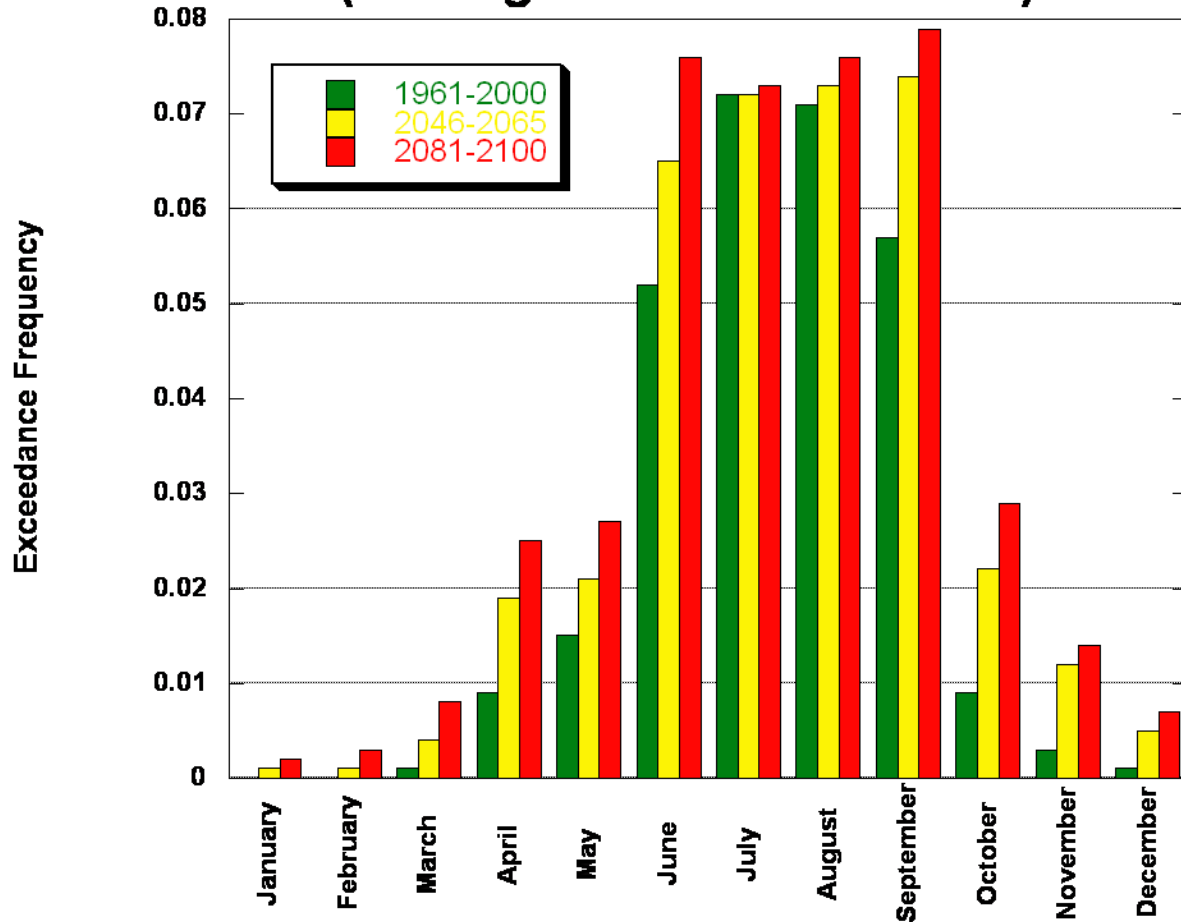
Based on statistically downscaled data developed by Kucharik, Lorenz, Notaro, and Vimont, UW Madison.

PREDICTED MONTHLY FREQUENCY OF EXCEEDING 2 INCHES IN 24 HOURS MADISON, WI (Averaged over all models.)



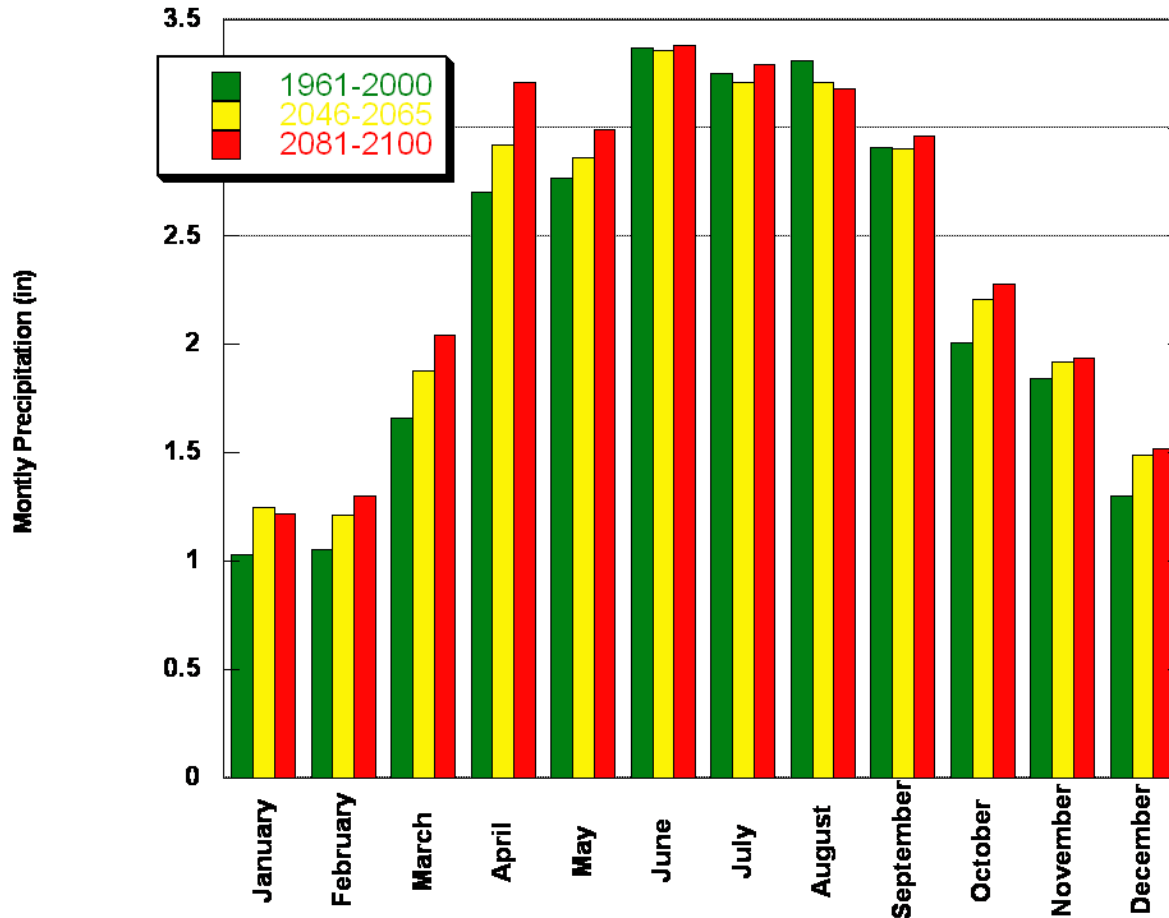
Based on statistically downscaled data developed by Kucharik, Lorenz, Notaro, and Vimont, UW Madison.

PREDICTED MONTHLY FREQUENCY OF EXCEEDING 3 INCHES IN 24 HOURS MADISON, WI (Averaged over all models.)



Based on statistically downscaled data developed by Kucharik, Lorenz, Notaro, and Vimont, UW Madison.

PREDICTED MONTHLY PRECIPITATION MADISON, WI (Averaged over all models.)



Based on statistically downscaled data developed by Kucharik, Lorenz, Notaro, and Vimont, UW Madison.

SUMMARY OF PREDICTED PRECIPITATION CHANGES

- Modest increases in the magnitude of large rainfalls
- Significant increases in the frequency of large daily rainfalls in late spring
- Significant increases in average monthly precipitation in winter and spring
- Note, however, large variations across models

IMPLICATIONS FOR FLOODING

- Predictions do not support major increases in urban storm water flooding.
- However, predicted increases in spring rainfall do indicate potential increases in flood risk for rivers, lakes, and groundwater.
 - The details will depend on the soils, land use, and land management as well as and how soil frost changes.
 - Hydrologic modeling will help us understand this better.

LAND USE AND MANAGEMENT

Historically, changes in land use and land management have been the most important factors affecting flood damages in Wisconsin.

- Agricultural development, particularly in southwest Wisconsin, led to huge increases in flooding and flood damage; partially mitigated by adoption of land conservation practices by Wisconsin farmers.
- Urbanization has greatly increased local flooding as well as flooding on streams and lakes.

ADAPTING TO CHANGES IN CLIMATE AND LAND USE AND MANAGEMENT

- Develop technical capacity to estimate impact of climate change on flood potential *in specific places*
- Assess vulnerabilities to changes in climate and land use/management
- Develop and apply appropriate strategies to reduce vulnerability to acceptable levels
- Modify policies and rules regarding the design and development of new infrastructure affected by or controlling storm and flood waters

GAPS IN WISCONSIN POLICY

- There are no statewide requirements for managing storm water to prevent increases in flooding due to urban and suburban development.
- At all levels of government there is little to prevent development in areas susceptible to ground water flooding.
- Land conservation in agricultural areas is largely voluntary unless cost-sharing funds are available. Under those conditions it is difficult to prevent adoption of land uses and management practices that drastically increase floods.

GAPS IN WISCONSIN POLICY

Failure to close these gaps will increase floods and flood damages in the future, independent of climate change.