



# OHIO RIVER BASIN CLIMATE CHANGE REPORT FINDINGS

February 7, 2018

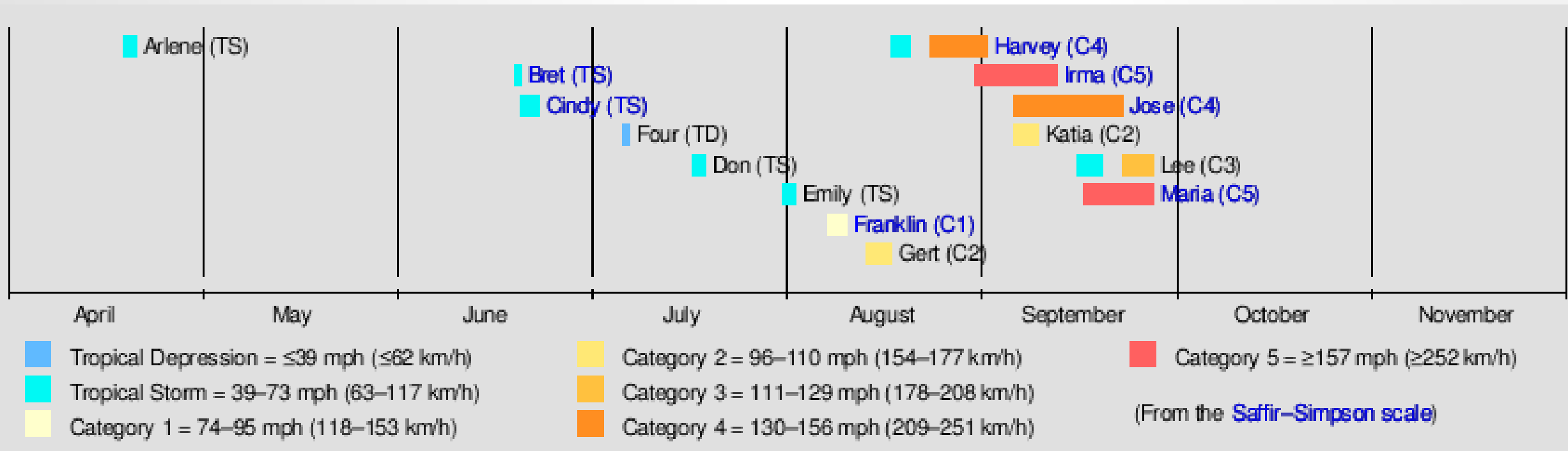
Mark D Kessinger, PMP  
DLZ National, Inc.



*"The future just ain't  
what it used to be."*

Houston has had a 500-year flood event each of the last 3 years.





First Season on Record for 3 Hurricanes  
to hit the U.S. at Category 4 or greater.  
Harvey (C4), Irma (C5) & Jose (C4)



NASA Photo  
September 8, 2017

Irma

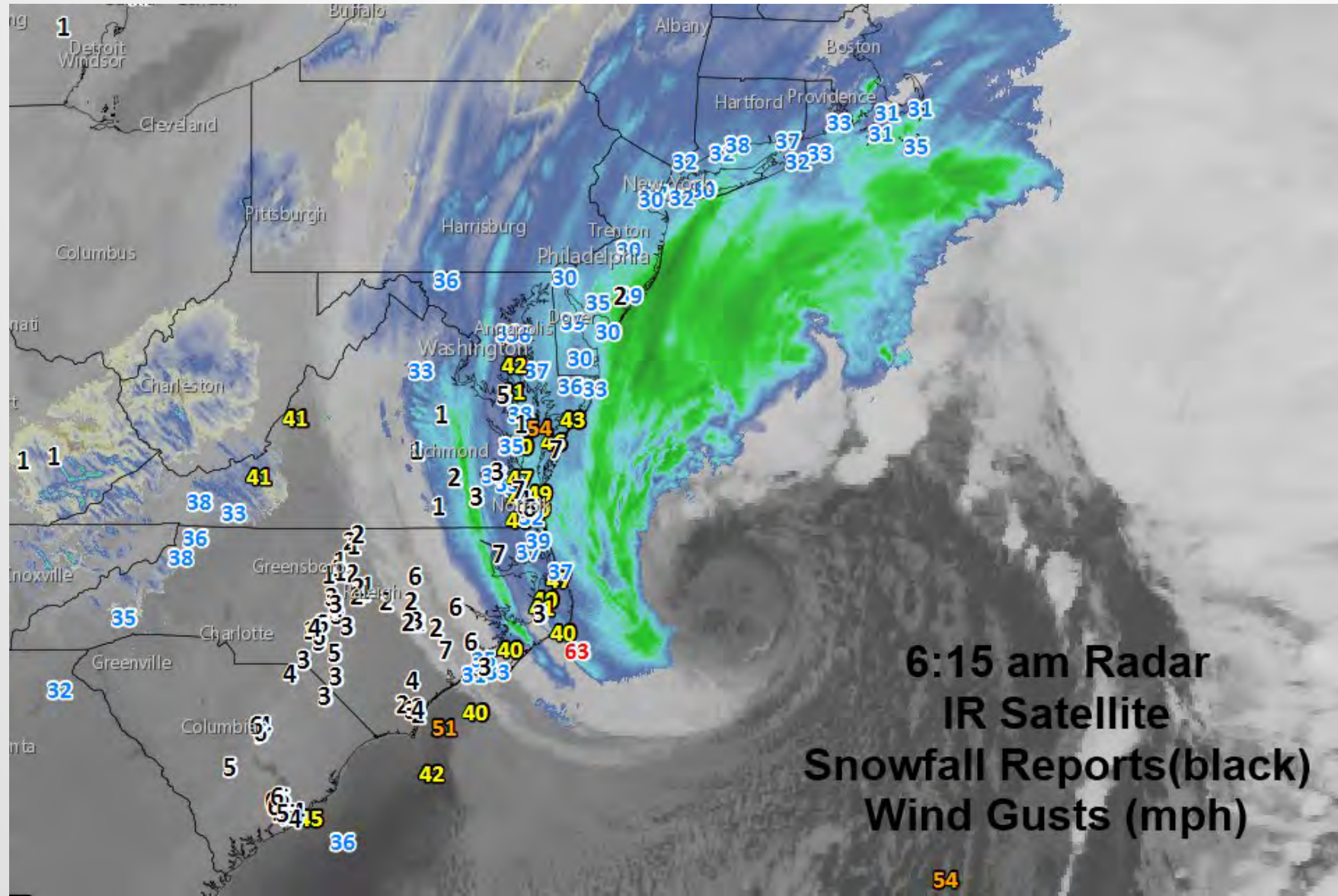
Jose

Katia





“A rapidly-intensifying winter storm system known as a "bomb cyclone" is targeting the Northeast with snow, ice, and bone-chilling winds” – NWS, January 4, 2018







# SEA LEVEL RISE VIEWER

Enter an address or city



SEA LEVEL RISE



LOCAL  
SCENARIOS



MAPPING  
CONFIDENCE



MARSH  
MIGRATION



VULNERABILITY



FLOOD  
FREQUENCY



WATER  
LEVEL

6ft

7ft

8ft

9ft

10ft

11ft

Current  
MHHW

UNITS

7ft

## MAPPING CONFIDENCE

- High Confidence
- Low Confidence
- Area Not Mapped
- Leveed Areas

6 ft sea level rise impacts to Charleston, SC



CWTS report 2017-01, May 2017

# OHIO RIVER BASIN— Formulating Climate Change Mitigation/Adaptation Strategies through Regional Collaboration with the ORB Alliance

U.S. Army Corps of Engineers and Ohio River Basin Alliance  
Institute for Water Resources, Responses to Climate Change Program



Sunrise on the Ohio River, January, 2014



US Army Corps  
of Engineers®



# REPORT AUTHORS

R. Gus Drum, USACE (Team Lead)

Dr. Jeffrey Kovatch, Marshall University

John Stark, The Nature Conservancy

Jim Noel, NWS, Ohio River Forecast Center

Dr. Lilit Yeghiazarian, University of Cincinnati

Dr. Paul Kirshen, University of New Hampshire

Erich Emery, USACE

Joseph Trimboli, USACE

Dr. Harry Stone, Battelle

Dr. Elly Best, USEPA

Dr. David Raff, Institute of Water Resources

Dr. Jeff Arnold, Institute of Water Resources



# REPORT CONTRIBUTORS

Kurt Buchanan, USACE

Dick Bartz, USGS

Jim Morris, USGS

Juan Barrios, Marshall University

Doug Kluck, NOAA

Dr. Beth Hall, NOAA

Dr. Kate White, Institute of Water Resources

Deborah Lee, USACE

Joy Broach, USACE

Dr. Harry Stone, Battelle

David Moore, Tetra Tech

Tom Maier, USACE

Ramune Morales, USACE

Mark Kessinger, USACE



# PRIMARY PURPOSES OF STUDY

- Investigate climate change effects that could impact Civil Works water resources infrastructure (locks, dams, levees, etc.)
- Investigate potential effects of climate change on basin ecosystems that can be influenced by the operation of Civil Works infrastructure.





# OHIO RIVER BASIN FACTS



204,000 square miles

14 states – as far north as New York and as far south as Alabama

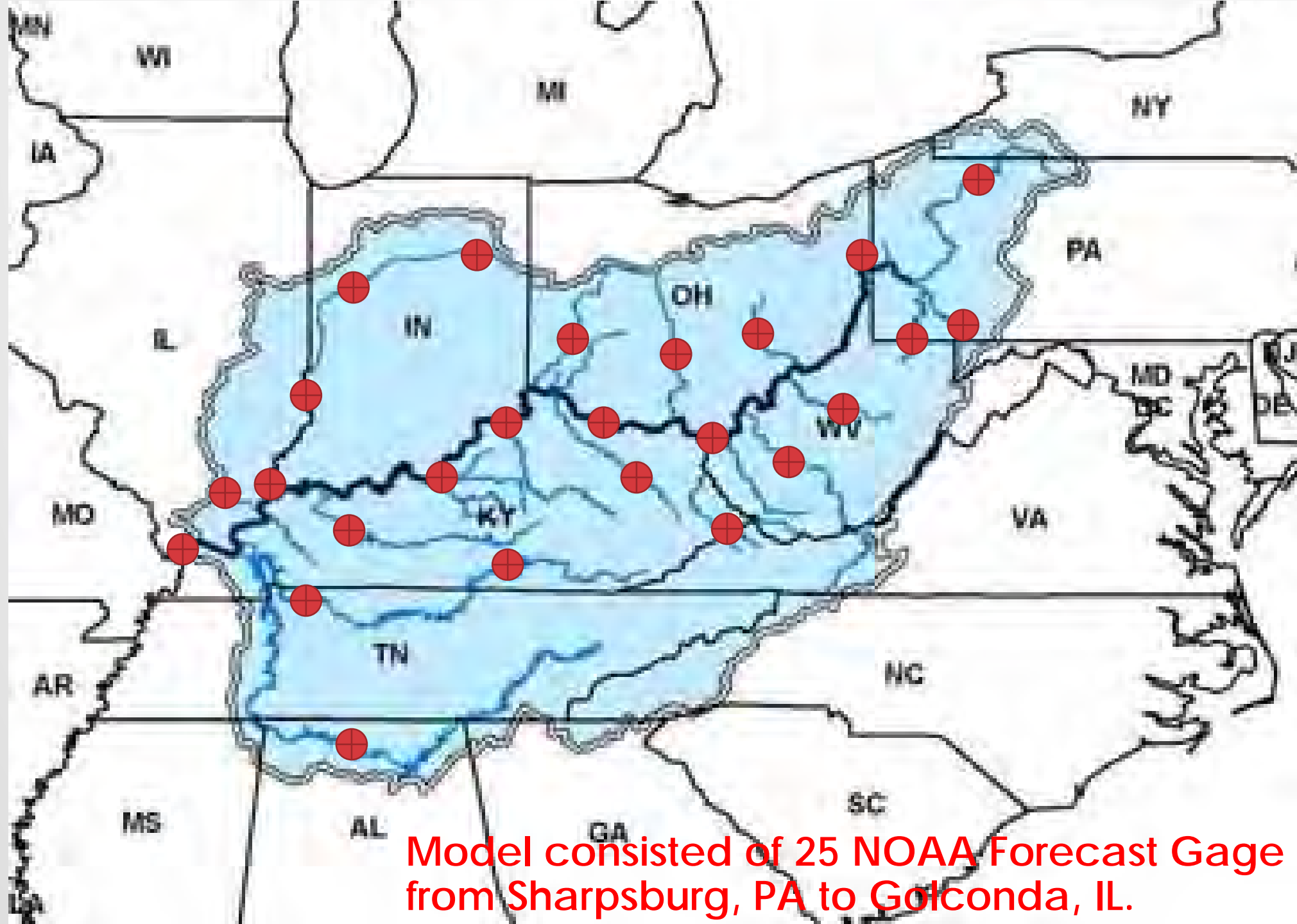
Home to 27 million people

5 million rely on water from Ohio River

# MODELING APPROACH

- Based on the Global Climate Change Model
  - Produced by the International Panel on Climate Change
  - Adapted by an interagency water resources group comprised of:
    - the U.S. Geological Survey
    - the National Oceanic and Atmospheric Administration.
  - *Modeled temperature and precipitation over three 30-year periods:*
    - 2011-2040
    - 2041-2070
    - 2071-2099
- NOAA – Ohio River Forecast Center
  - Modeling produced
    - Runoff/Streamflows – Monthly river discharges at 25 gage points throughout Basin
    - Monthly mean air temperature changes through 2099 at 25 gage points
  - *Back-casted model to 1952-2001 period – output data was within 2% of observed in all 25 data points throughout the basin.*





Model consisted of 25 NOAA Forecast Gage Points from Sharpsburg, PA to Golconda, IL.

# ESTIMATE OF AT-RISK MONETARY VALUES

Power Plant Withdrawals	\$1,070B Annually
Agricultural Land Food Production	\$ 181B Annually
Freshwater for Water & Wastewater	\$ 105B Annually
Wetlands-Related Flood Reduction	\$ 76B Annually
Forested Land Use	\$ 66B Annually
Navigation	\$ 29B Annually
Water-Related Recreation	\$ 13B Annually
Medicinal Herbs	\$ 1B Annually
<b>TOTAL</b>	<b>\$1,541B Annually</b>



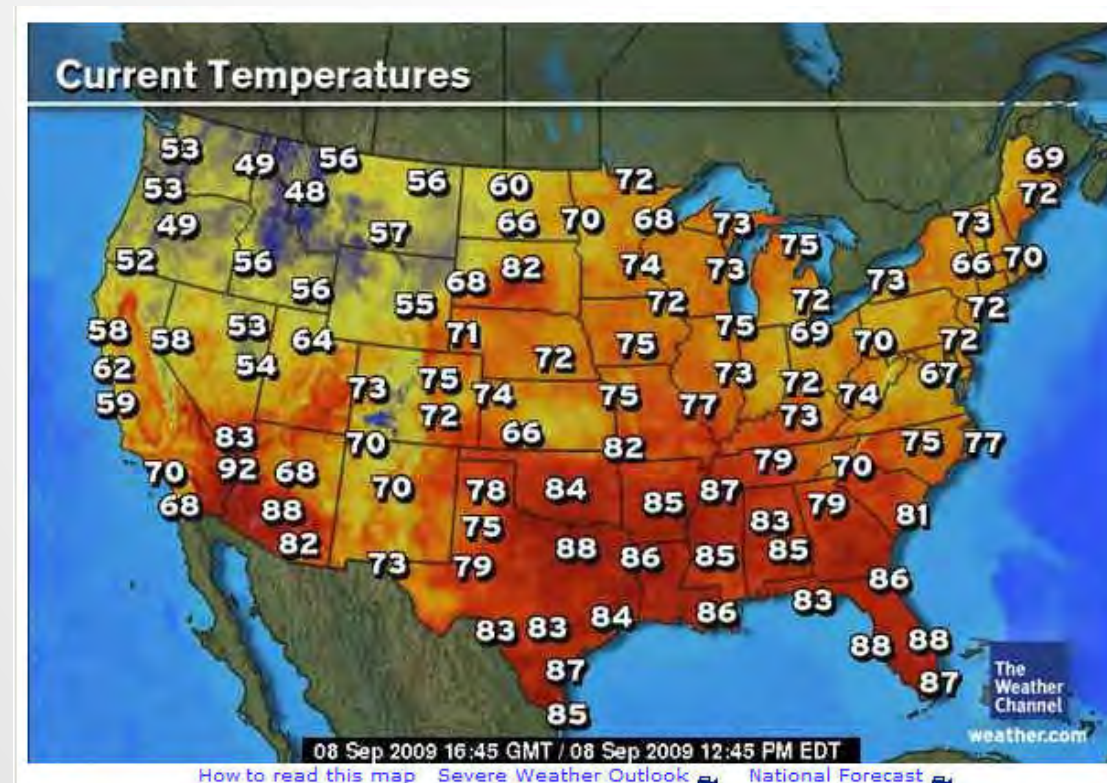
# STUDY FINDINGS – TEMPERATURES

2011-2040

Estimate temperatures increase 0.5 degrees F per decade

2041-2099

Estimate temperatures increase 1 degree F per decade



# STUDY FINDINGS – RAINFALL

2041-2099      Northeastern and eastern portions of the basin will experience greater rainfall and river discharges

As much as 35%-50% greater during spring flows within the Allegheny, Monongahela, Kanawha and Big Sandy River sub-basins.

2041-2099      The Northwestern and western portions of the basin will experience **greater** rainfall and river discharges in the **spring** season, but the **fall** season will bring significant **reductions** in rainfall and thus **decreased** river flows.

As much as 25%-35% less flows during the fall within the Great Miami, Wabash, East Fork of the Wabash, White, Scioto and Muskingum Rivers.





# STUDY FINDINGS – STREAMFLOWS

- 2011-2040      Mean, Maximum and Minimum flows are within the historical range
- 2041-2099      Minimum flows likely to *decrease* and peak spring floods likely to *increase*.

*“LOWER MINIMUM FLOWS AND HIGHER PEAK FLOWS”*



# ADAPTATION STRATEGIES

Restore Wetlands

Reconnect Floodplains

Reduce Consumptive Use of Water

Harvest Precipitation and Flood Flows

Enact Drought Contingency Planning

Increase Mgt of Nutrients and AMD

Modify Power Plant Cooling Systems

Reduce Flood Damages thru Non-structural

Increase Water Quality and Discharge Monitoring

Promote Wise Land Use Management

Modify Reservoir Operations

Manage Ecosystem Stress

Copy of Report: [www.lrh.usace.army.mil](http://www.lrh.usace.army.mil)

Then Search: "Ohio River Basin Climate Change Report"





# QUESTIONS







# Ohio River Basin falls within 2 climate zones – Humid Continental (north) and Humid Subtropical (south)

