



# **Climate Change Predictions for Virginia Virginia Coastal Partners Workshop November 16, 2016**

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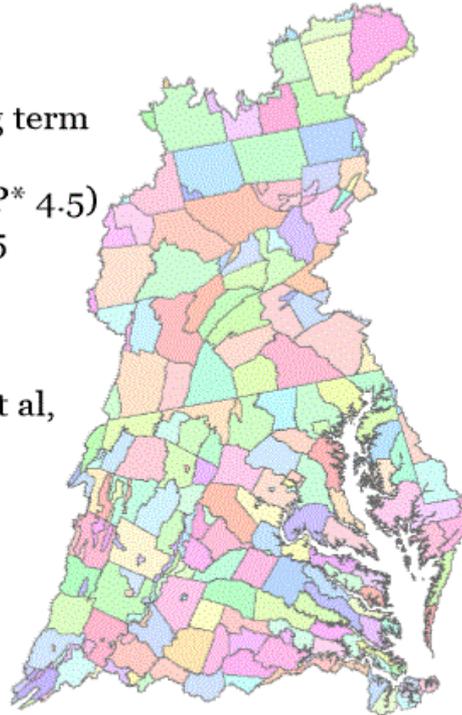
# Climate Change Predictions for Virginia



## Model Climate Inputs

Model inputs were consistent with STAC Workshop and Climate Resiliency Workgroup Guidance

- Precipitation Volume
  - 2025: +3.1% (long term trends)
  - 2050: +7.3% (RCP\* 4.5)
- Temperature: RCP 4.5
  - 2025: +1.05 °C
  - 2050: +2.08 °C
- CO<sub>2</sub> Concentration: Meinhausen, Malte, et al, (2011)
  - 2025: 427 ppm
  - 2050: 487 ppm



- Sea Level Rise: CRWG\*\*
  - 2025: +0.3 m
  - 2050: +0.5 m
- Temperature: RCP 4.5
  - 2025: +0.95 °C
  - 2050: +1.86 °C

\*RCP 4.5 signifies a specific Representative Concentration Pathway scenario as defined by the Intergovernmental Panel on Climate Change

\*\*Based upon guidance provided by the Climate Resiliency Workgroup

## Climate Change Predictions for Virginia

### What are the climate-change effects in the Chesapeake Bay region?

- **Sea level rise**
  - **Ocean warming → thermal expansion.**
  - **Due to glacier and ice sheet melt.**
  - **Aggravated by land subsidence.**
  - **Bay waters have risen ~ .3 m over the past century.**
  - **Predicted to rise another 1 to 15.8 m over next 100 years. Low and high limits are considered extreme.**
  - **EPA Chesapeake Bay Program Climate Resiliency Workgroup recommended .2 to .4 m rise by 2025 and .3 to .8 m by 2050 for the Chesapeake Bay Water Quality Sediment Transport Model.**

# Climate Change Predictions for Virginia

- **Warming temperatures**

- **0.31 to 0.48 degrees F warming across contiguous US since the 1970s.**
- **2015 surpassed 2014 as warmest year on record since mid-to-late 19<sup>th</sup> century. 2016 may continue the trend.**
- **Warmer temperatures mean warmer water and subsequent changes in aquatic habitats and drops in dissolved oxygen.**
- **Stream water temperatures have increased 1.2 degrees F over past 50 years across all sites studied in the Bay region. 2.2 degrees F at sites with statistically significant trends.**
- **Approximate 1.9 degrees F air temperature warming expected in Bay watershed by 2025; approximate 3.7 degrees F warming expected by 2050.**

# Climate Change Predictions for Virginia

- **Extreme weather**

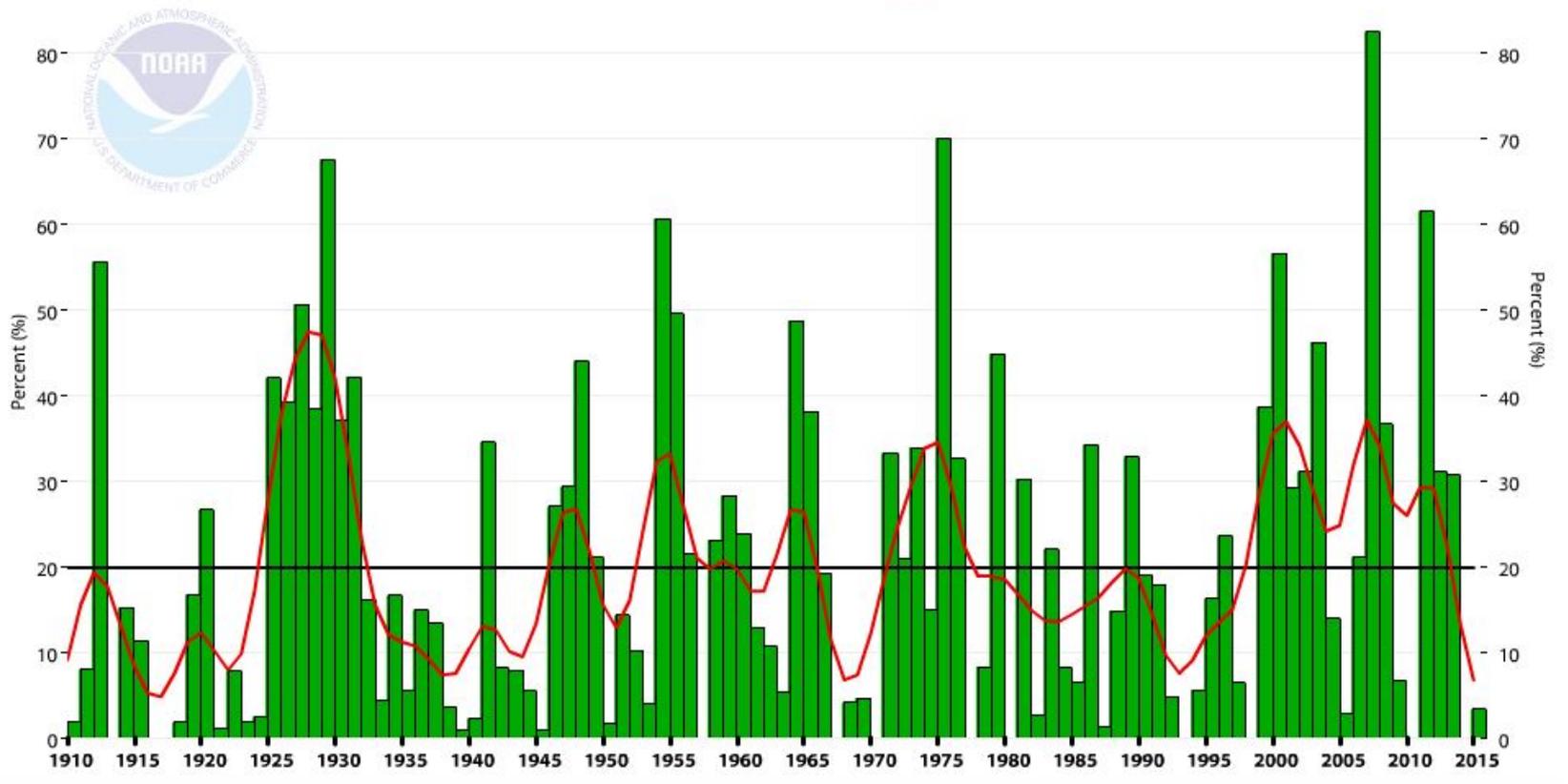
- **Annual precipitation totals in contiguous US have risen 0.5 percent per decade since 1901.**
- **Leads to flooding, damaged ports, marinas, and historical monuments.**
- **Approximate 3.1 percent increase in precipitation across the Bay watershed since 1991-2000 expected by 2025; approximate 7.3 percent increase by 2050.**

# Climate Change Predictions for Virginia

## Palmer Drought Severity Index

Southeast Extremes in PDSI (Step 3 Combined)  
Annual (January-December) 1910-2015

— 9-Point Binomial Filter    — Mean    ■ Actual Percent

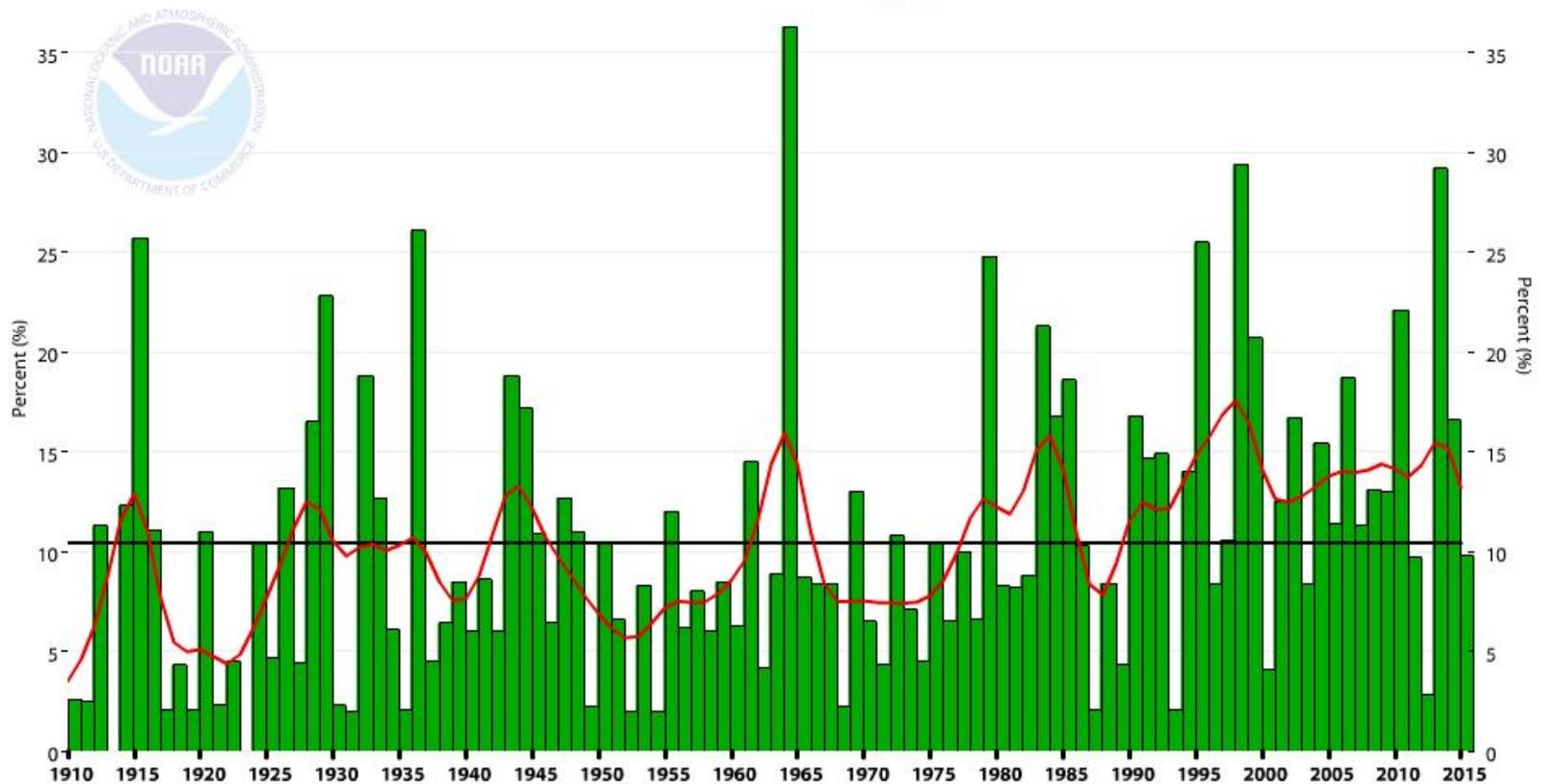


# Climate Change Predictions for Virginia

## One-day Precipitation Extremes

Southeast Extremes in 1-Day Precipitation (Step 4\*)  
Annual (January-December) 1910-2015

— 9-Point Binomial Filter    — Mean    ■ Actual Percent



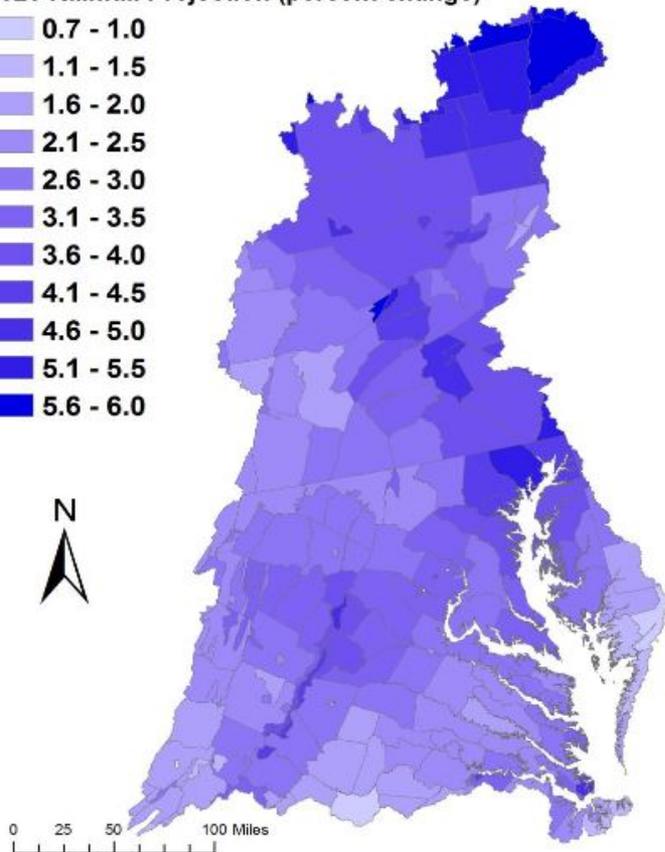
# Climate Change Predictions for Virginia

## Influence of 2025 Increased Precipitation Volume & Intensity

### Change in Rainfall using Annual Trend in PRISM data (88 Years)

Rainfall Trend based on 88 years of Annual PRISM Data

2025 Rainfall Projection (percent change)



### Change in Rainfall Volume 2021-2030 vs. 1991-2000

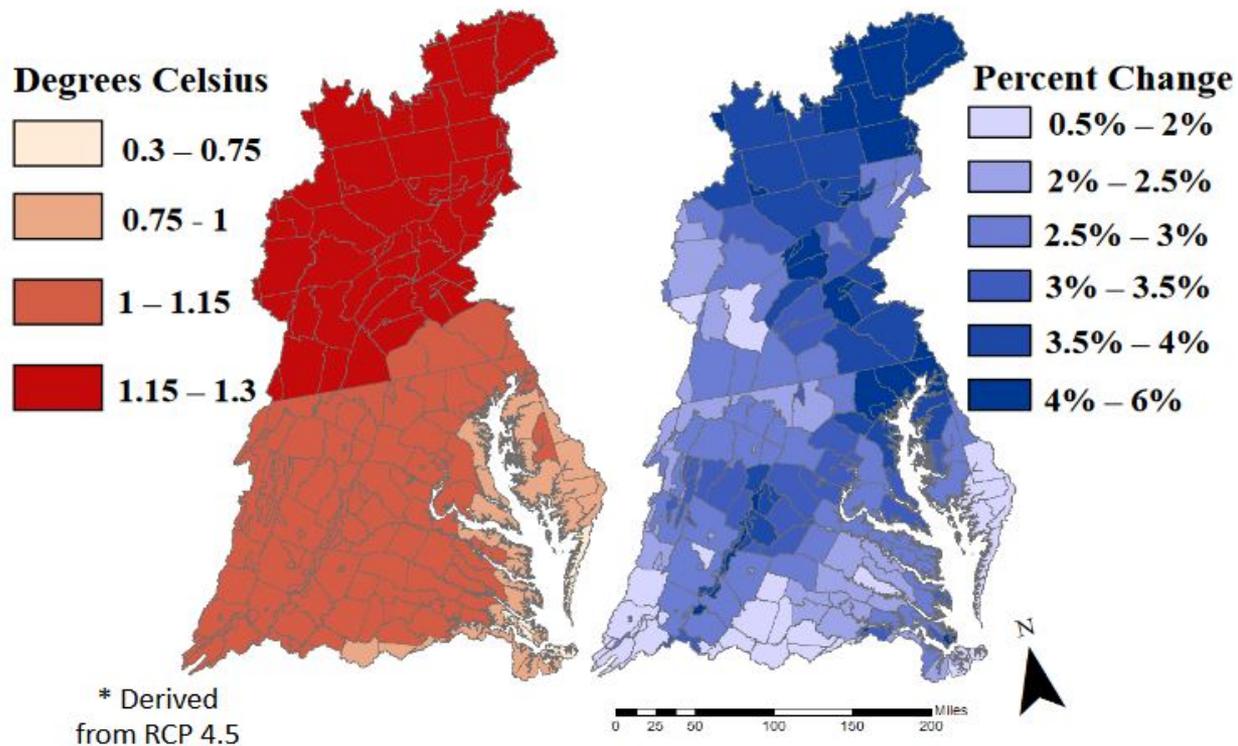
Major Basins	PRISM Trend
Youghiogheny River	2.1%
Patuxent River Basin	3.3%
Western Shore	4.1%
Rappahannock River Basin	3.2%
York River Basin	2.6%
Eastern Shore	2.5%
James River Basin	2.2%
Potomac River Basin	2.8%
Susquehanna River Basin	3.7%
<b>Chesapeake Bay Watershed</b>	<b>3.1%</b>

Source: Gopal Bhatt, Penn State and Kyle Hinson, CRC

# Climate Change Predictions for Virginia



## CB Watershed 2025 Changes in Temperature\* and Precipitation



Source: Gopal Bhatt, Penn State and Kyle Hinson, CRC

## Climate Change Predictions for Virginia

- **Hurricanes and tropical storms** (source: National Climate Assessment)
  - **By late 2000s, models project slight decrease in the annual number of tropical cyclones, but an increase in the number of the strongest (Category 4 & 5) hurricanes.**
  - **Almost all models project greater rainfall rates in hurricanes in a warmer climate.**
  - **Changes in length and positions of Atlantic storm tracks are also associated with regional climate variability.**
  - **Fewer storms have been observed to strike land during warmer years even though overall activity is higher than average, which may explain the lack of any clear trend in landfall frequency along the U.S. eastern and Gulf coasts.**

# Thank you!

