

Climate Change: Trends & Projections for the Potomac River Basin

Cherie Schultz, PhD

Director of Operations

Section for Cooperative Water Supply Operations on the
Potomac (CO-OP)

Interstate Commission on the Potomac River Basin



Climate change in the Potomac basin

- Global context
- Potomac basin projections
 - Getting wetter on average
- Water supply perspective
 - Understanding extremes is crucial



Making sense of a changing climate

Certainties

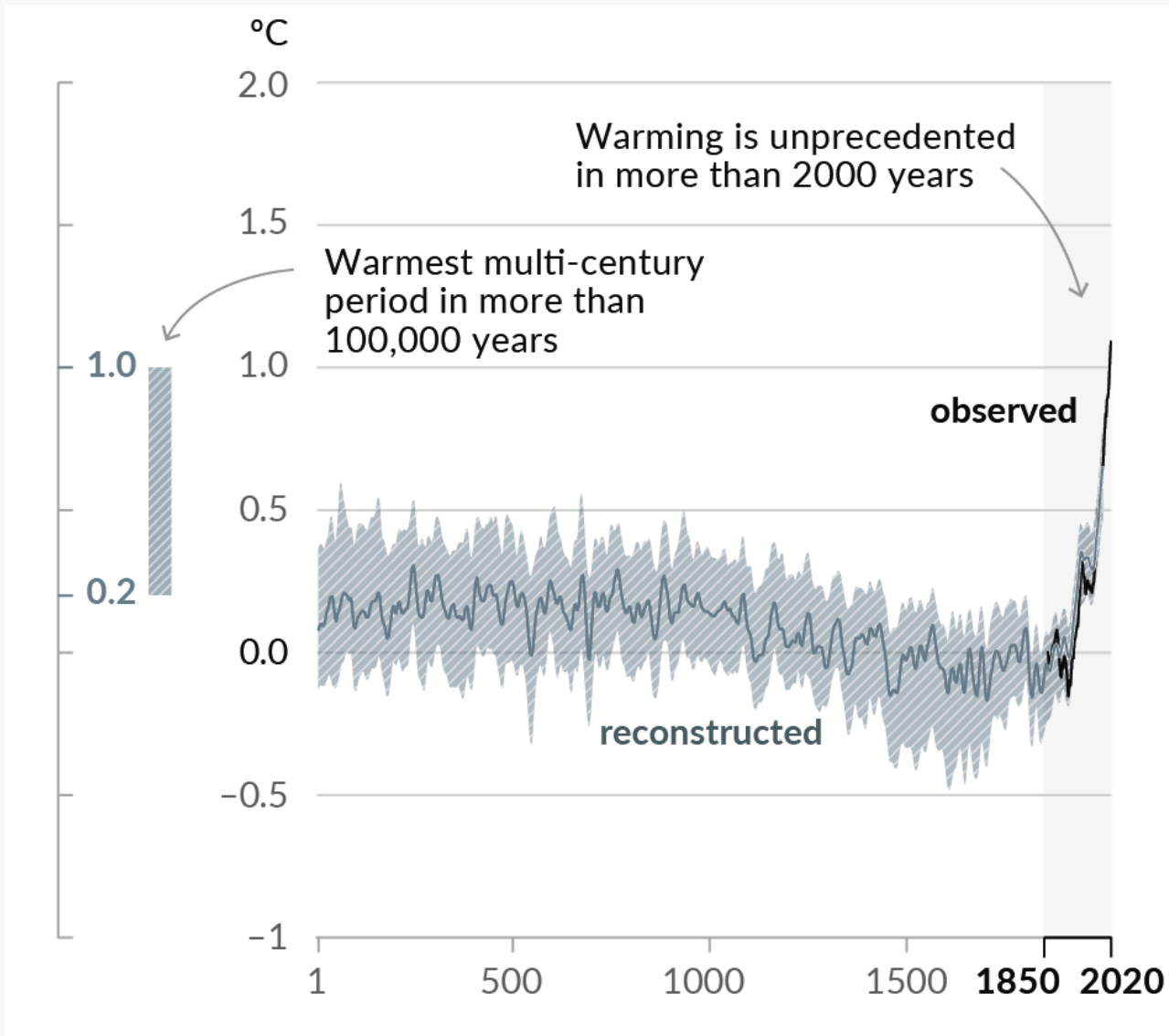
- Temperatures are rising
- Precipitation is becoming more variable
- Sea levels are rising

Uncertainties

- How far will temperatures increase?
- How will precipitation change in our region?
- How will river flows respond to the competing effects of rising temperatures and changing precipitation patterns?
- *How will societies respond to the challenge of climate change?*

Global surface temperature - historical

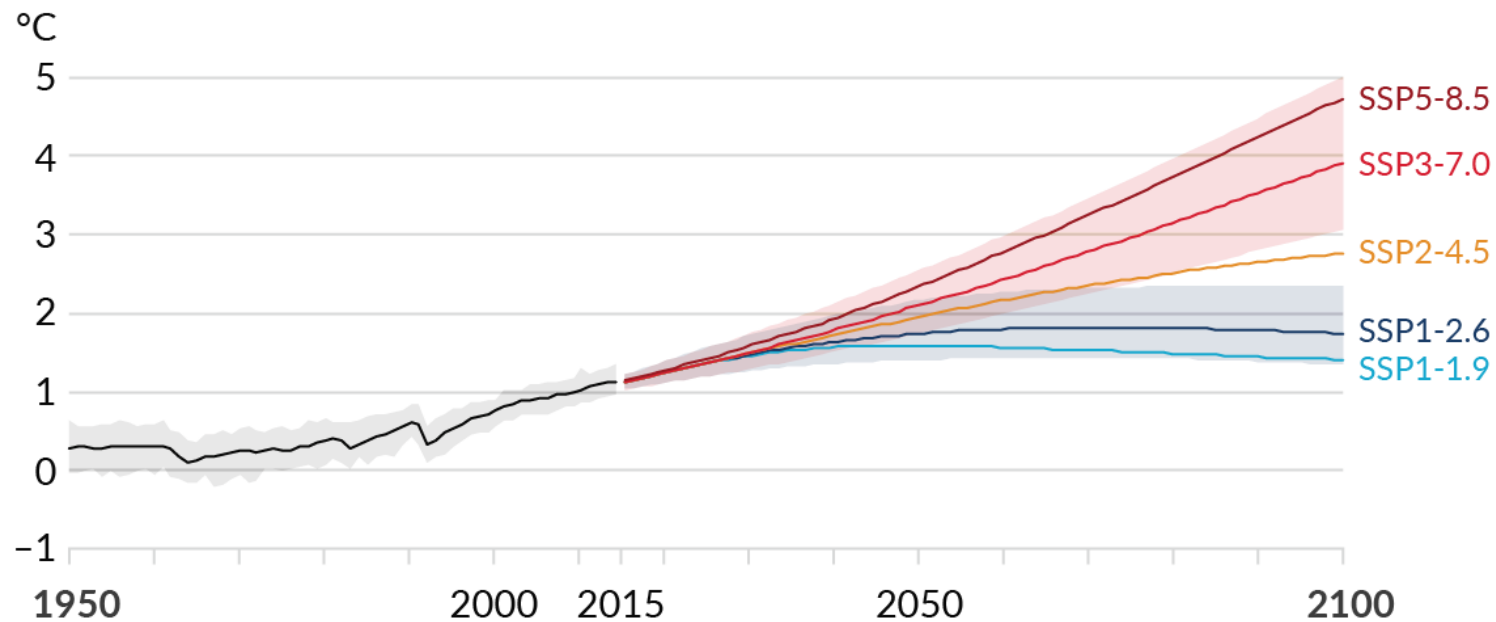
1.1° C rise from 1850-1900 (baseline period) to 2011-2020



From IPCC Sixth Assessment Report

Global surface temperature - projections

(a) Global surface temperature change relative to 1850–1900



How societies respond is represented by Shared Socio-economic Pathways (SSPs)

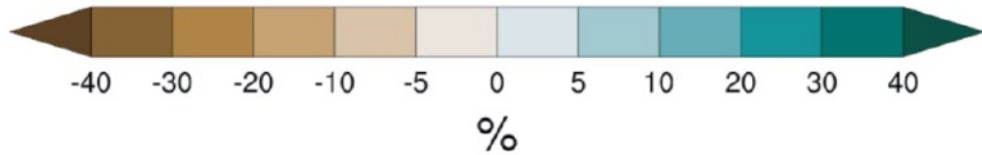
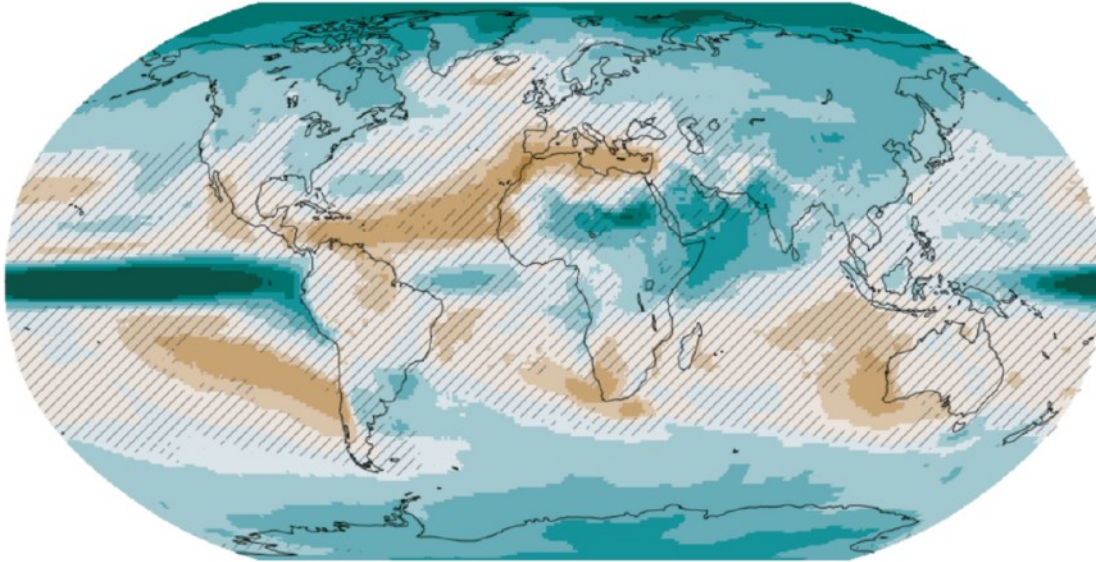
- SSP5-8.5 – Fossil-fueled development
- SSP3-7.0 – Regional rivalry
- SSP2-4.5 – Middle of the road
- SSP1-2.6 - Sustainability
- SSP1-1.9 – Sustainability

From IPCC Sixth Assessment Report

Long-term water cycle variables changes for SSP2-4.5 (2081–2100 vs 1995–2014)

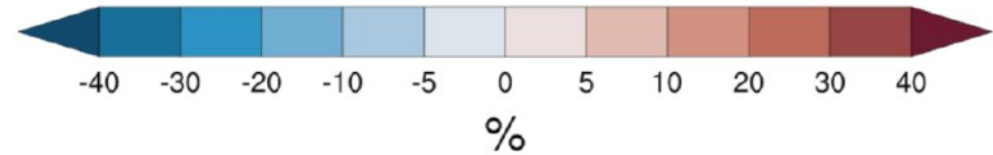
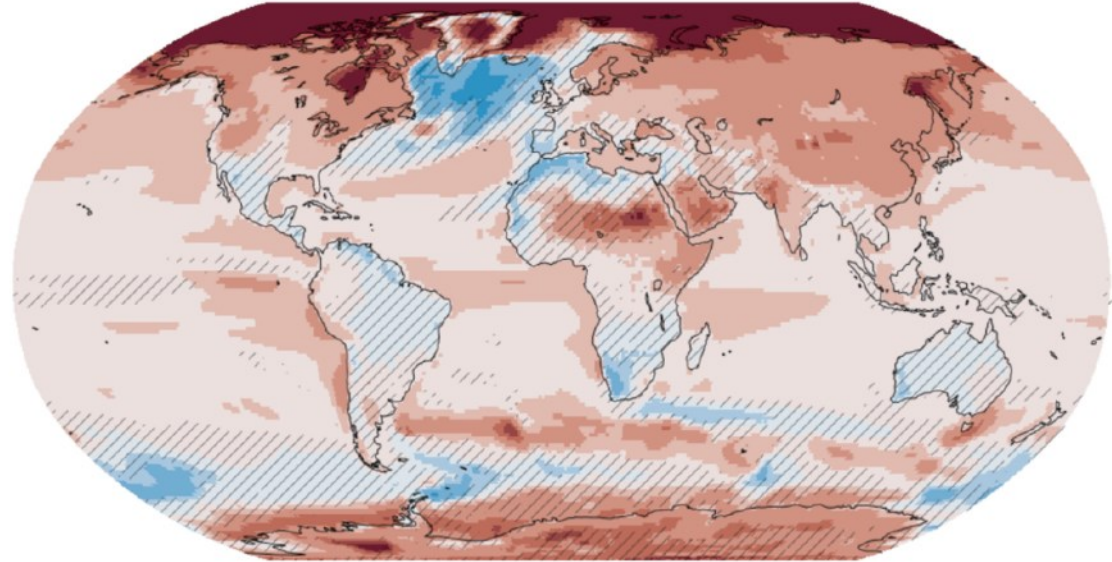
(a) Precipitation

38



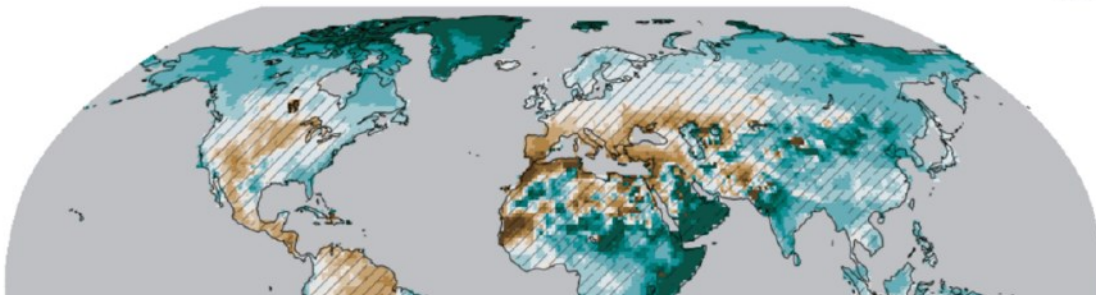
(b) Evapotranspiration

37



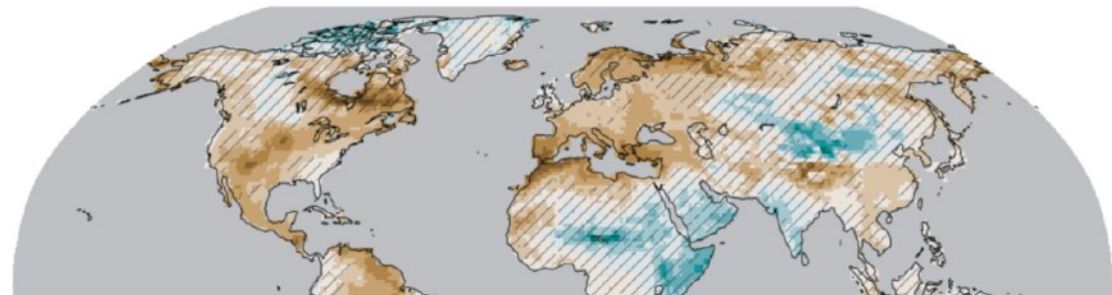
(c) Runoff

32



(d) Surface soil moisture

27

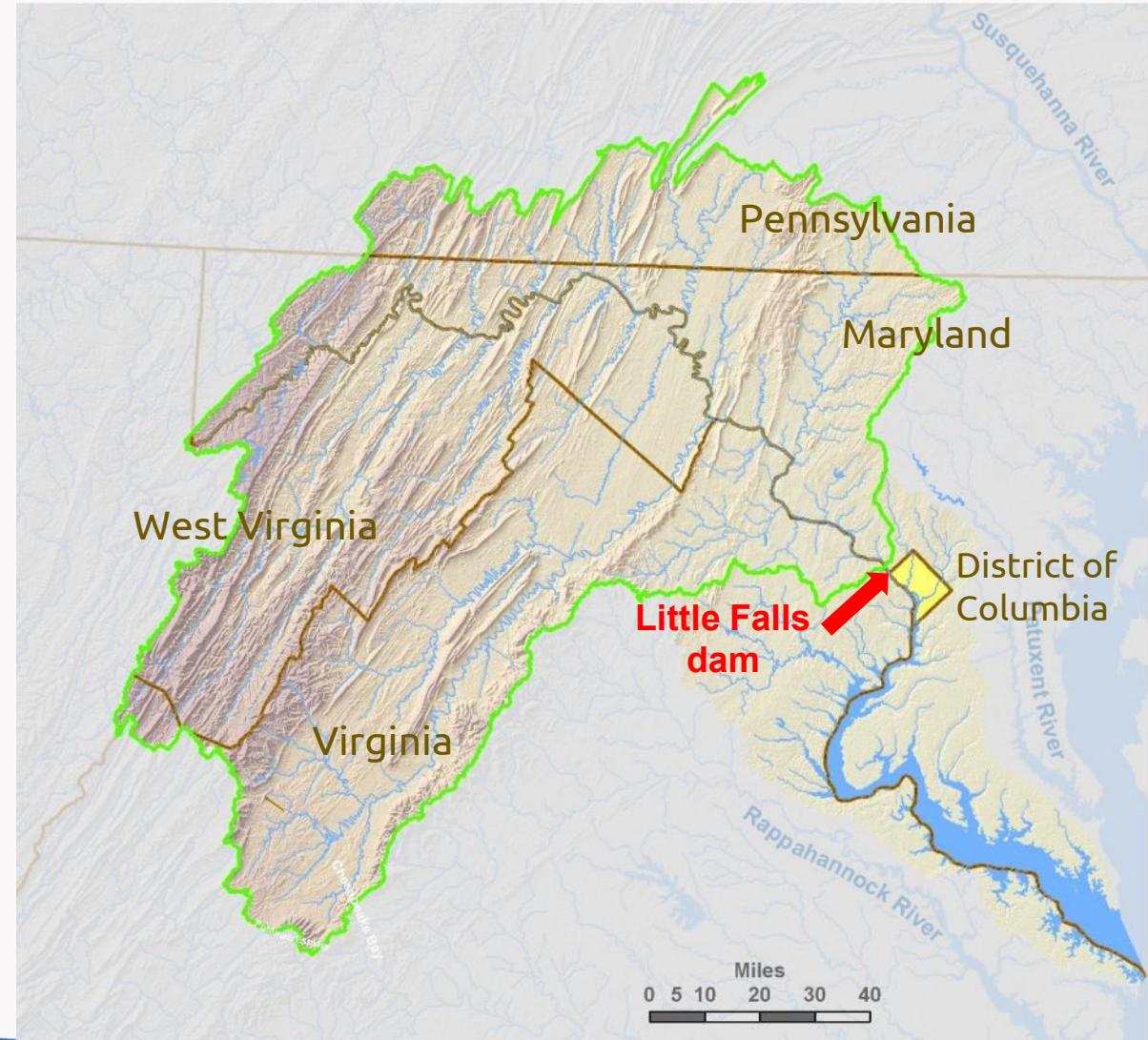


Potomac basin climate

- Our focus is on
 - River flow at Little Falls (78% of DC metro region's water supply!)
 - Annual time step
- Data used
 - Historical data from Oregon State's PRISM¹
 - Future projections from CMIP5²

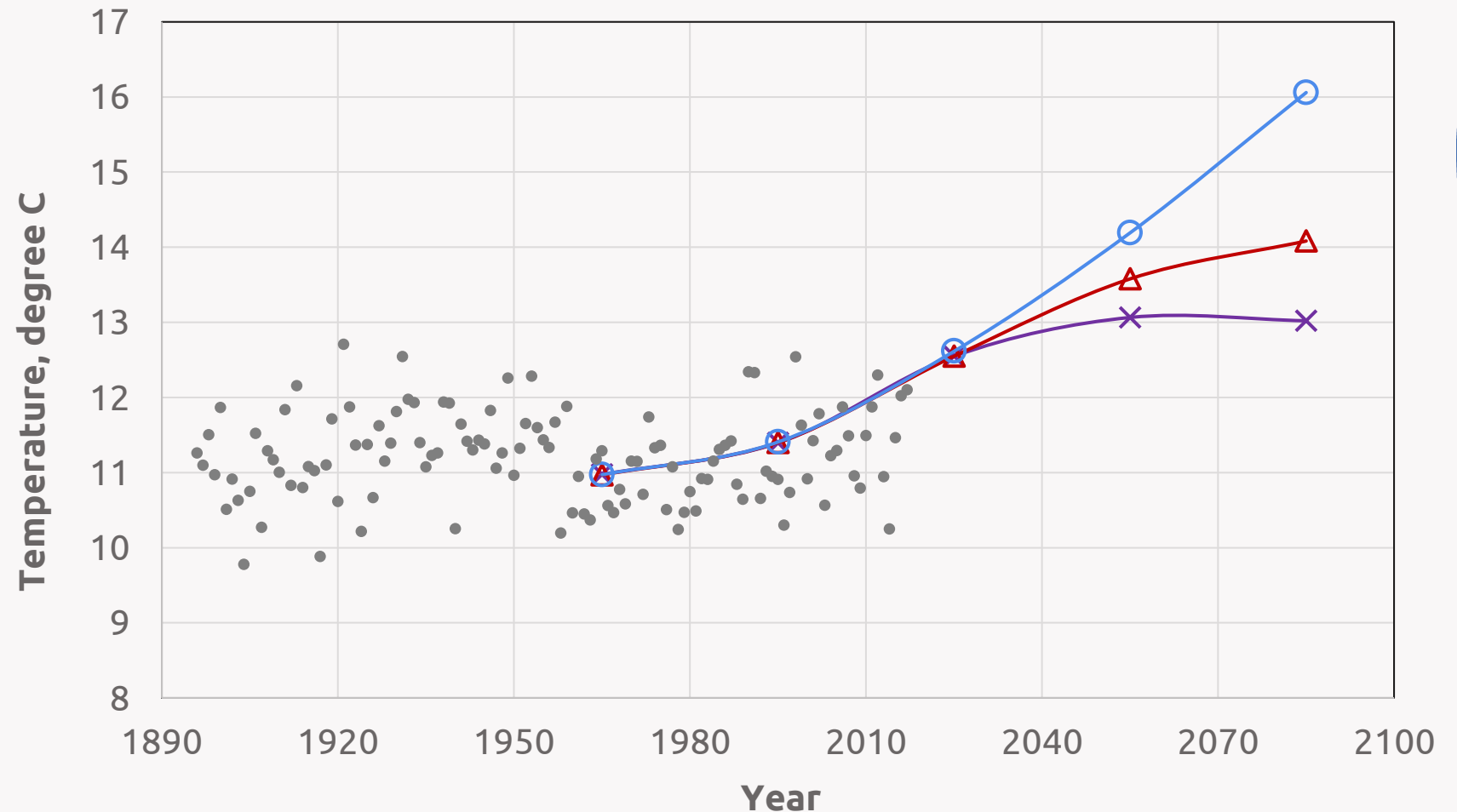
¹Parameter-elevation Regressions on Independent Slopes Model

²Coupled Model Intercomparison Project Phase 5



Potomac basin annual temperature

- Historical
 - High in 1930's
 - Slight upward trend
- 2085 projected increases* (°C)
 - RCP 2.6: +2.0
 - RCP 4.5: +3.1
 - RCP 8.5: +5.1



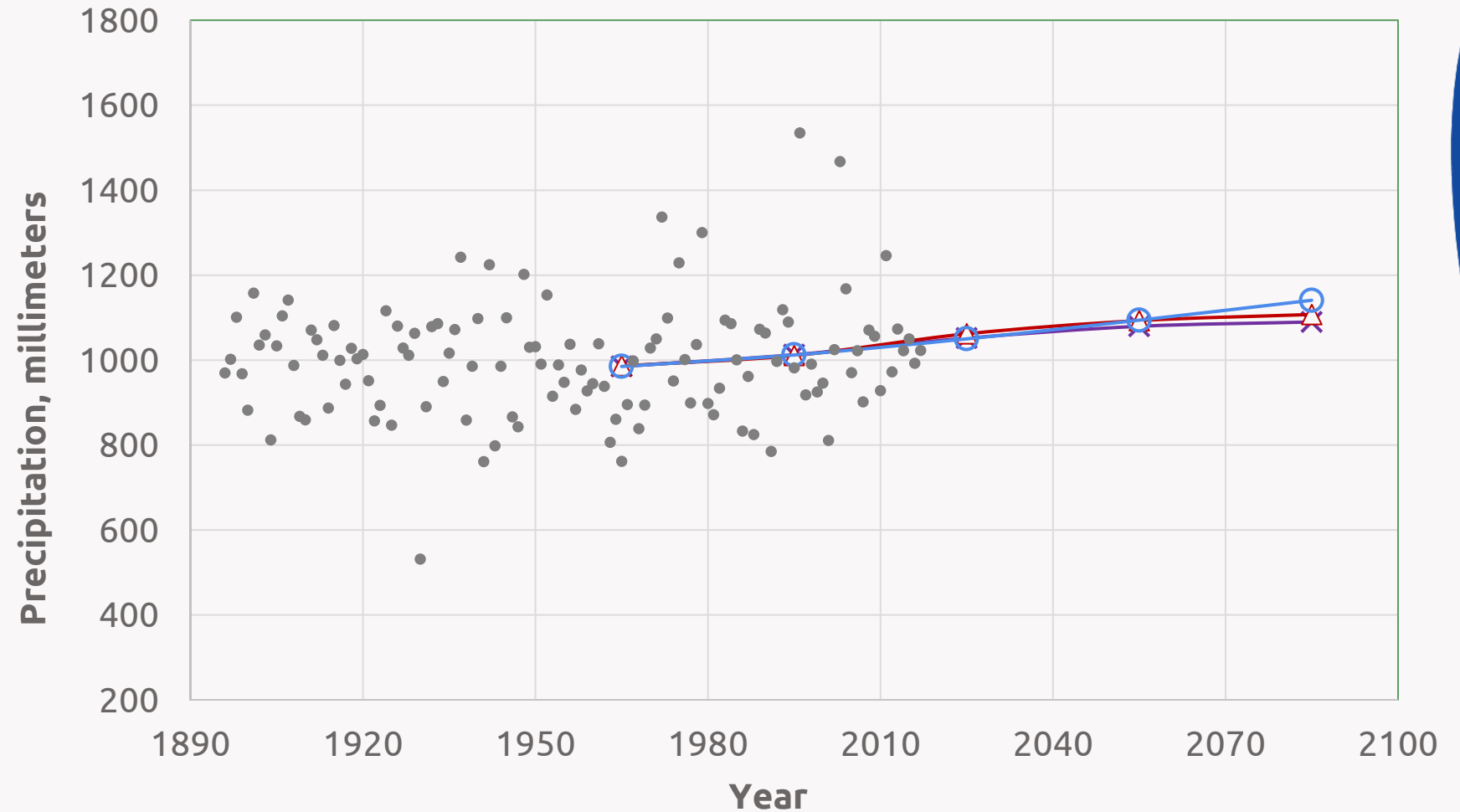
• PRISM historical × RCP 2.6 ▲ RCP 4.5 ○ RCP 8.5

*Ensemble 30-year mean projected increases for 2070-2099 over baseline period of 1897-1980



Potomac basin annual precipitation

- Historical
 - Highly variable
 - Slight upward trend
- 2085 projected increases*
 - RCP 2.6: +10%
 - RCP 4.5: +12%
 - RCP 8.5: +15%



• PRISM historical × RCP 2.6 △ RCP 4.5 ○ RCP 8.5

*Ensemble 30-year mean projected increases
for 2070-2099 over baseline period of 1897-
1980



Potomac River annual flow

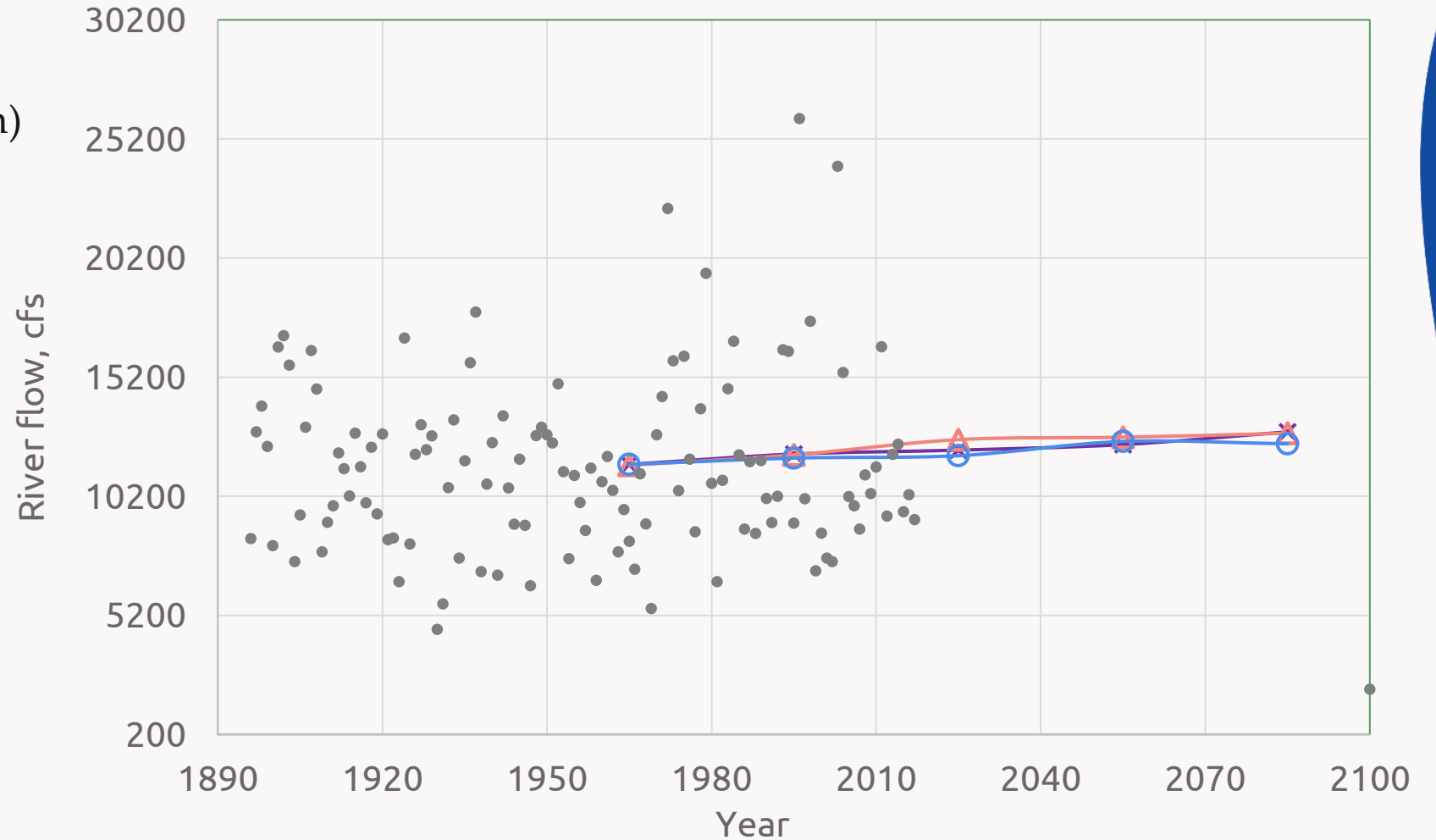
(natural, above Little Falls dam)

- **Historical**

- Highly variable
- No discernable trend

- **2085 projected increases***

- RCP 2.6: +12%
- RCP 4.5: +12%
- RCP 8.5: +8%



• Flow historical * RCP 2.6 ▲ RCP 4.5 ○ RCP 8.5

*Ensemble 30-year mean projected increases
for 2070-2099 over baseline period of 1897-
1980

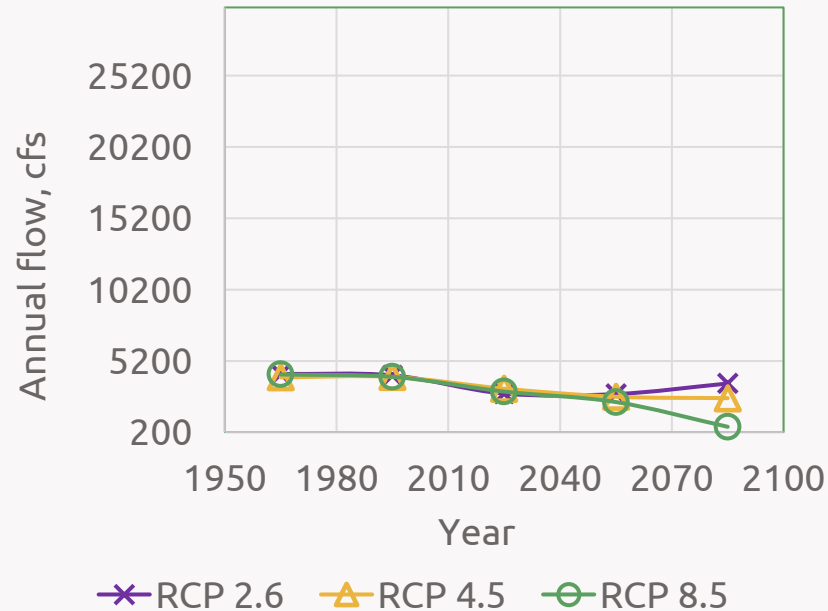


Potomac River annual flow – extreme drought

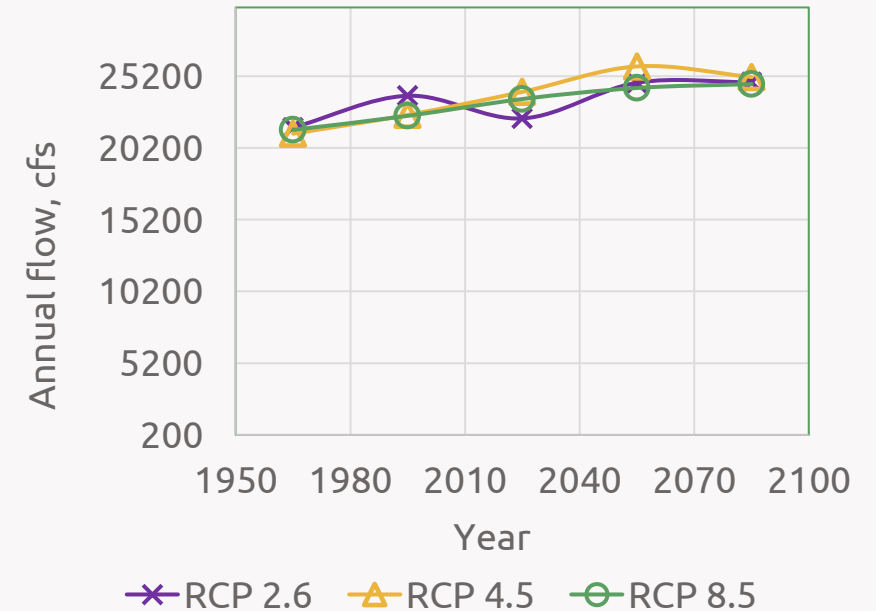
2085 projected changes in
1st and 99th percentiles

- High temperature sensitivity scenario
 - RCP 2.6: -16% and +15%
 - RCP 4.5: -36% and +19%
 - RCP 8.5: -87% and +15%
- Medium temperature sensitivity scenario
 - RCP 2.6: +1% and +18%
 - RCP 4.5: -11% and +24%
 - RCP 8.5: -46% and +22%
- Low temperature sensitivity scenario
 - RCP 2.6: +16% and +21%
 - RCP 4.5: +12% and +29%
 - RCP 8.5: -7% and +30%

Extreme dry years:
1st percentile values
- high temperature sensitivity



Extreme wet years:
99th percentile values
- high temperature sensitivity



Conclusion

- Results

- Competing effects of rising precipitation and rising temperature evident
- Most scenarios indicate that extreme drought in the Potomac basin will be more severe than experienced in the past

- Needs

- Better estimation of temperature sensitivity of streamflows
- Curtailing of global GHG emissions crucial (avoidance of RCP8.5-like scenario)

Contact: cschultz@icprb.org

