Using New Regional Climate Model Simulations to Quantify Changes in Flooding in King County Rivers

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Water and Land Resources Division

King County

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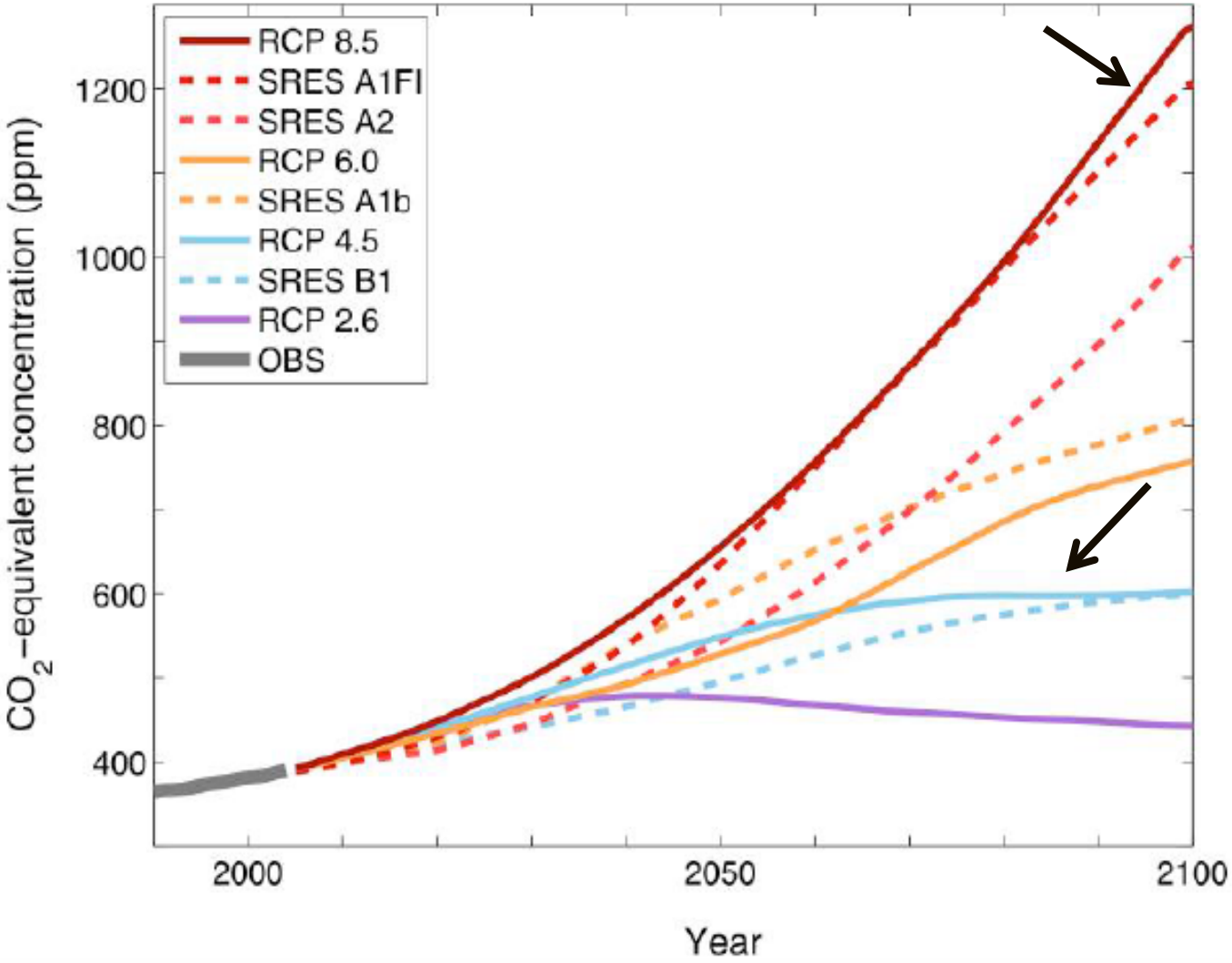
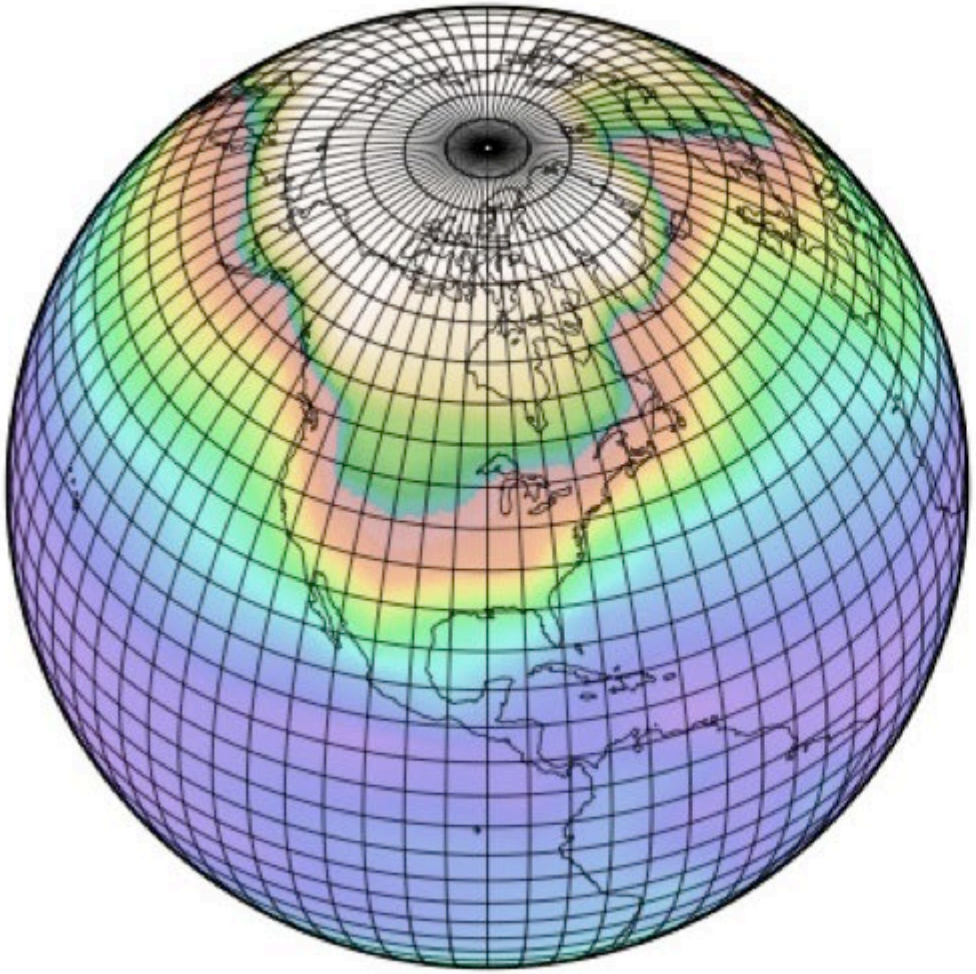
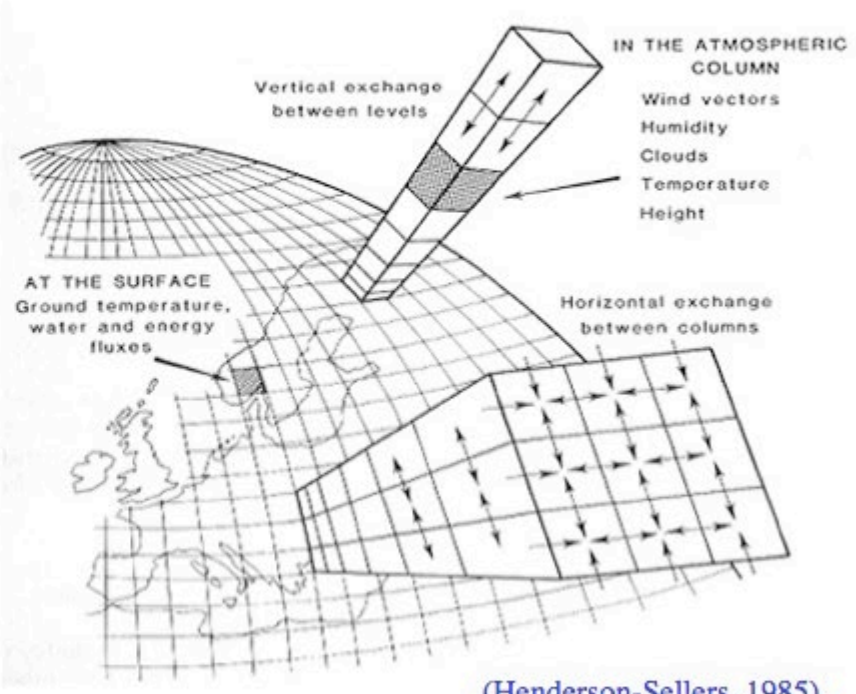
Atmospheric greenhouse gas levels are projected to continued rising this century



Global climate models are used to estimate response to greenhouse gas concentrations

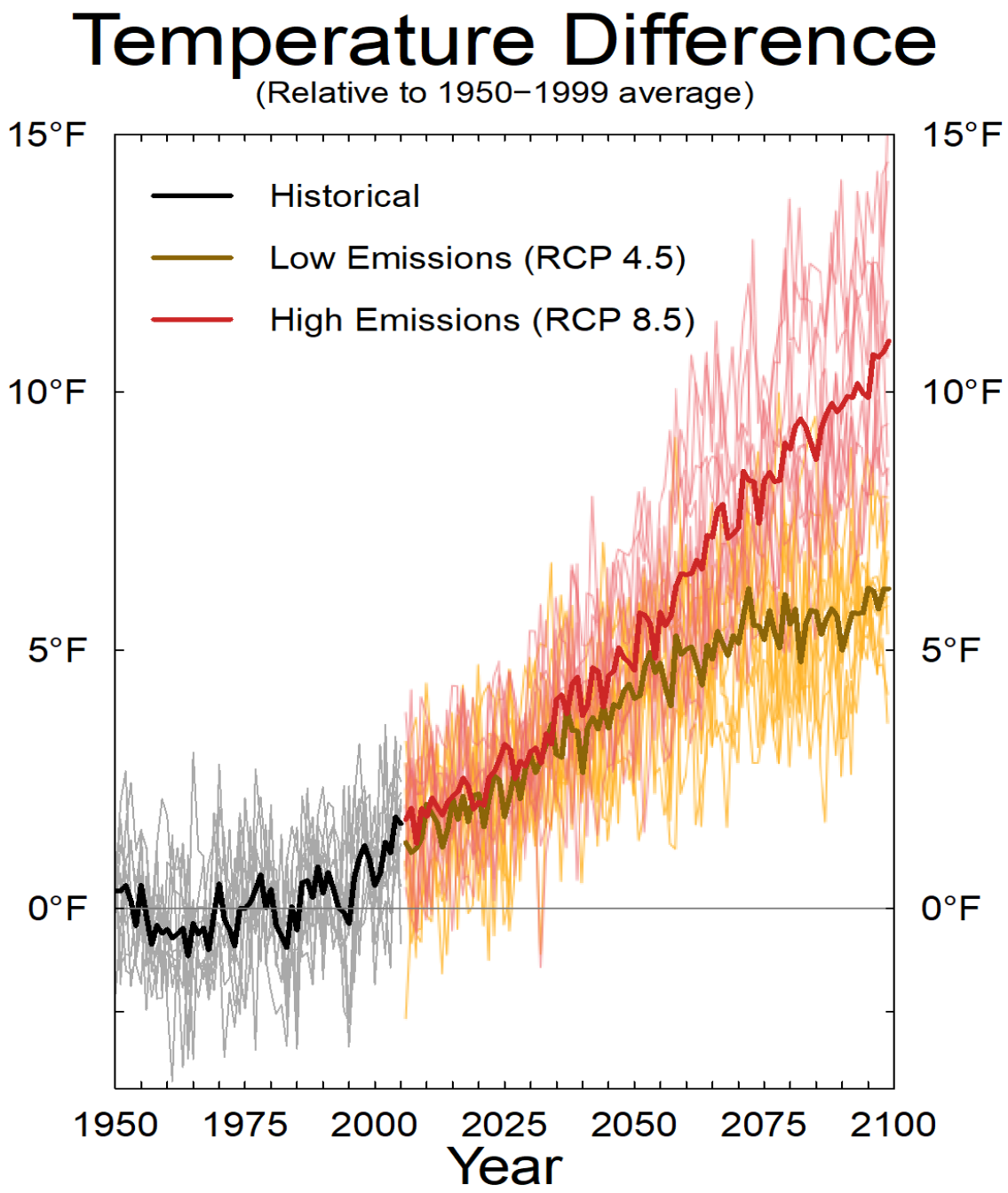




(Henderson-Sellers, 1985)

https://serc.carleton.edu/eet/index.html

Substantial warming is projected



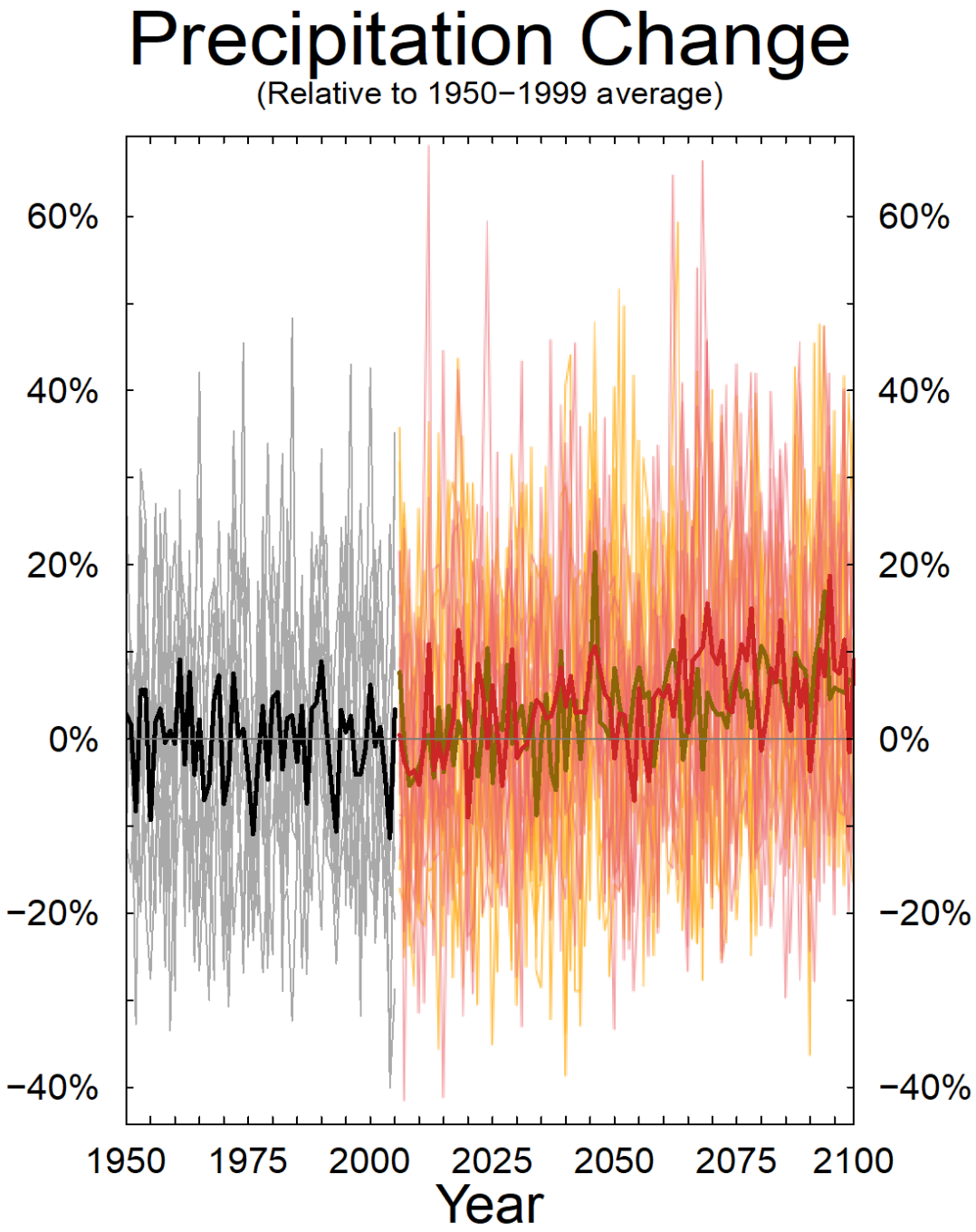
In Western Washington

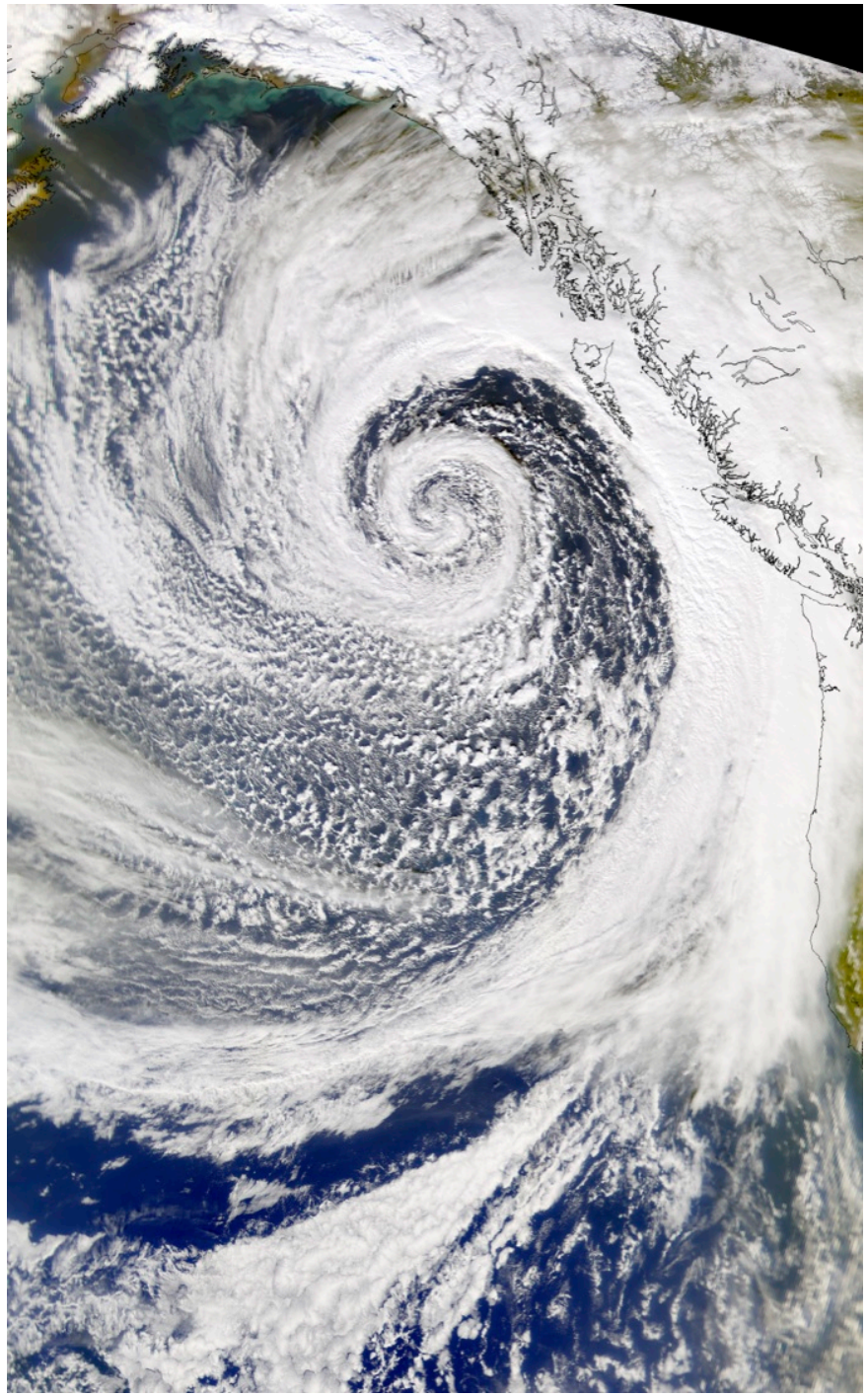
Warmer air will result in a higher snow-line

Causing a shift to rain from snow in low and mid-elevations of Cascade Mountains

Causing larger winter river flows

No clear trend in total rainfall – lots of variability





Global models project an increase in heavy rains

Heaviest rain events are projected to become **+22% more intense*** (*range:* +5 to +34%) by the 2080s.

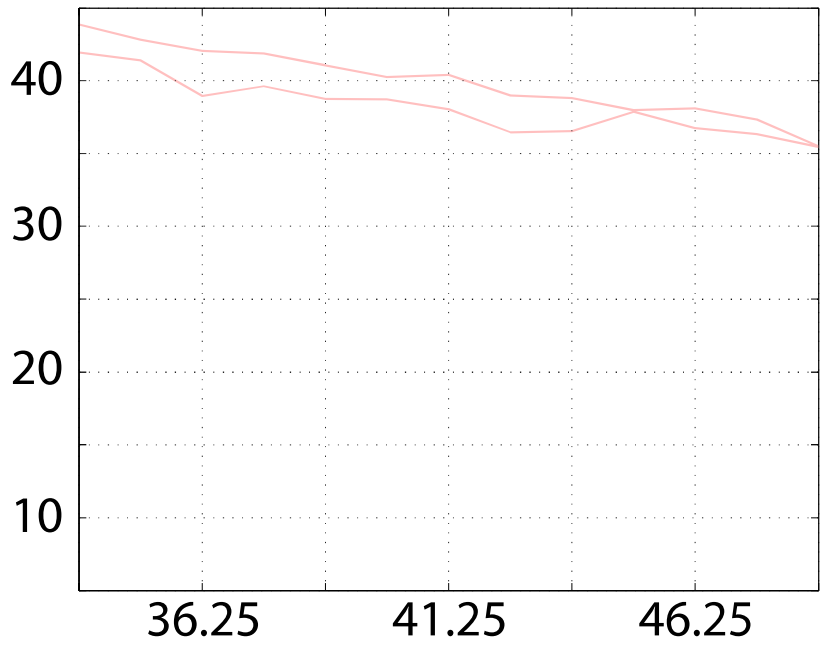
** Top 1% of **daily** rainfall totals in western WA & OR*

Warner, Mass, Salathé, J Hydromet, 2014

CLIMATE IMPACTS GROUP

Atmospheric rivers are projected to have more rain but similar winds

More Water Vapor



2080s

1980s

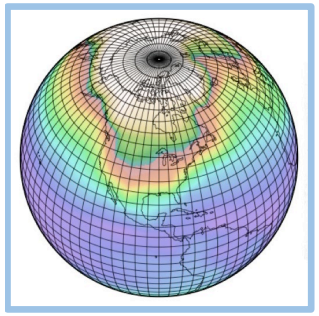
No Change in Winds

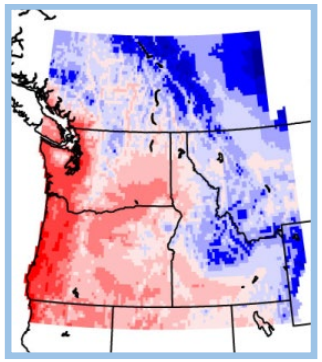
An increase in large rain events could increase river flooding

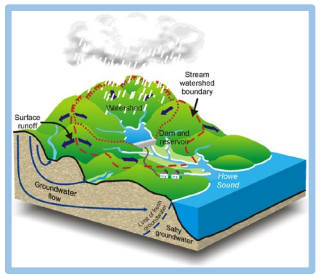
Local scale predictions needed for local decision making

Snoqualmie Valley looking North over the 124th St bridge November 2009

Quantifying climate impacts at the local scale



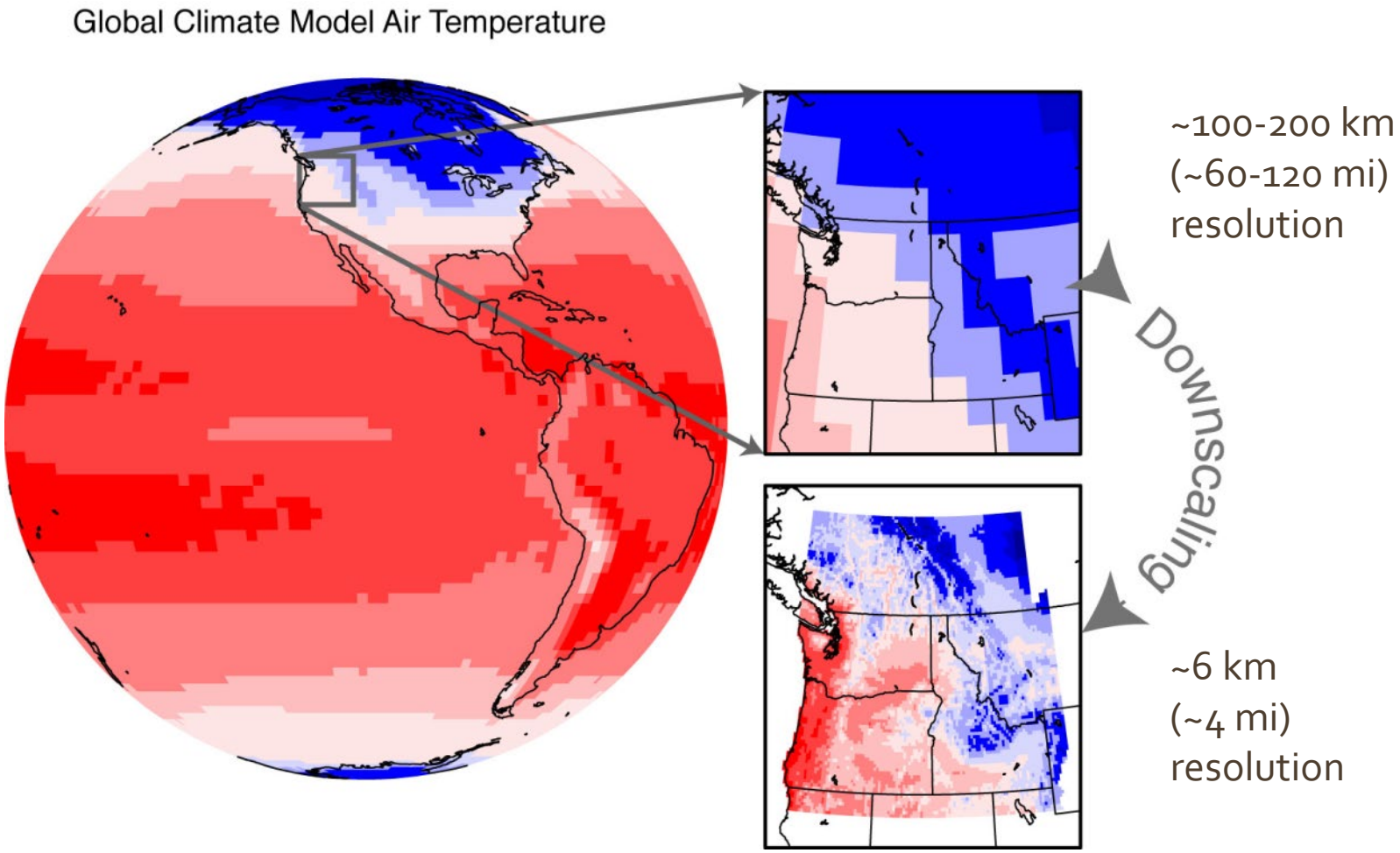




Global Climate Scenarios → Regional Climate Scenarios → Impacts Modeling → Monitoring, Assessment, Planning

(i.e.: "downscaling")

“Downscaling” relates the large to the small



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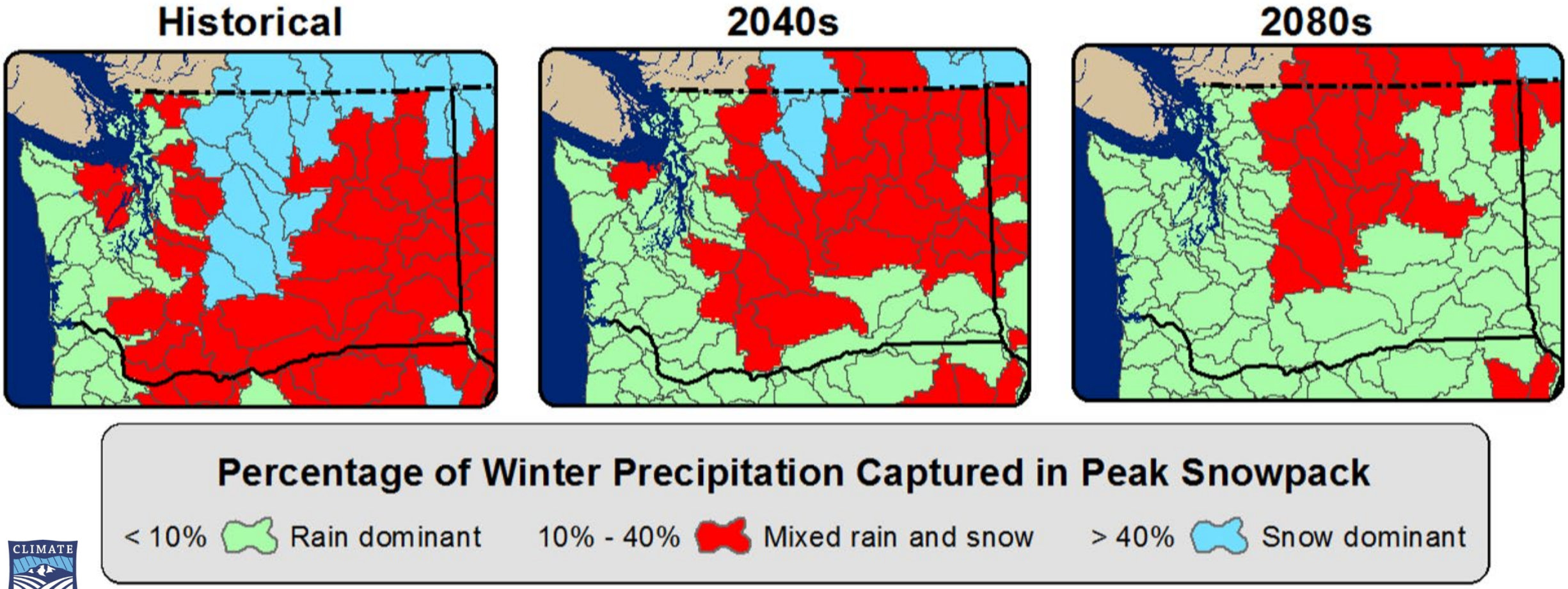
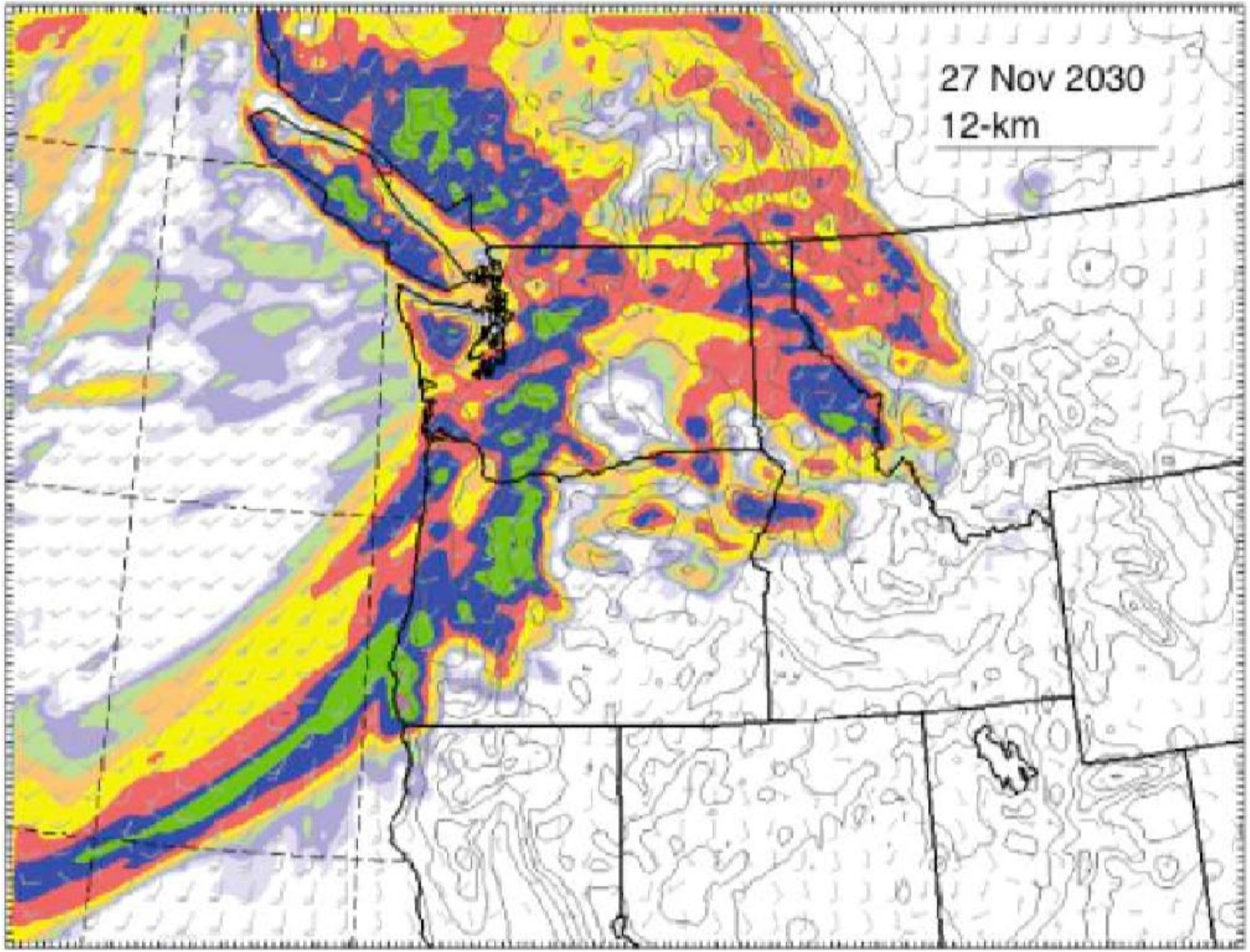
Statistical downscaling captures seasonal affects like shifting snowpack

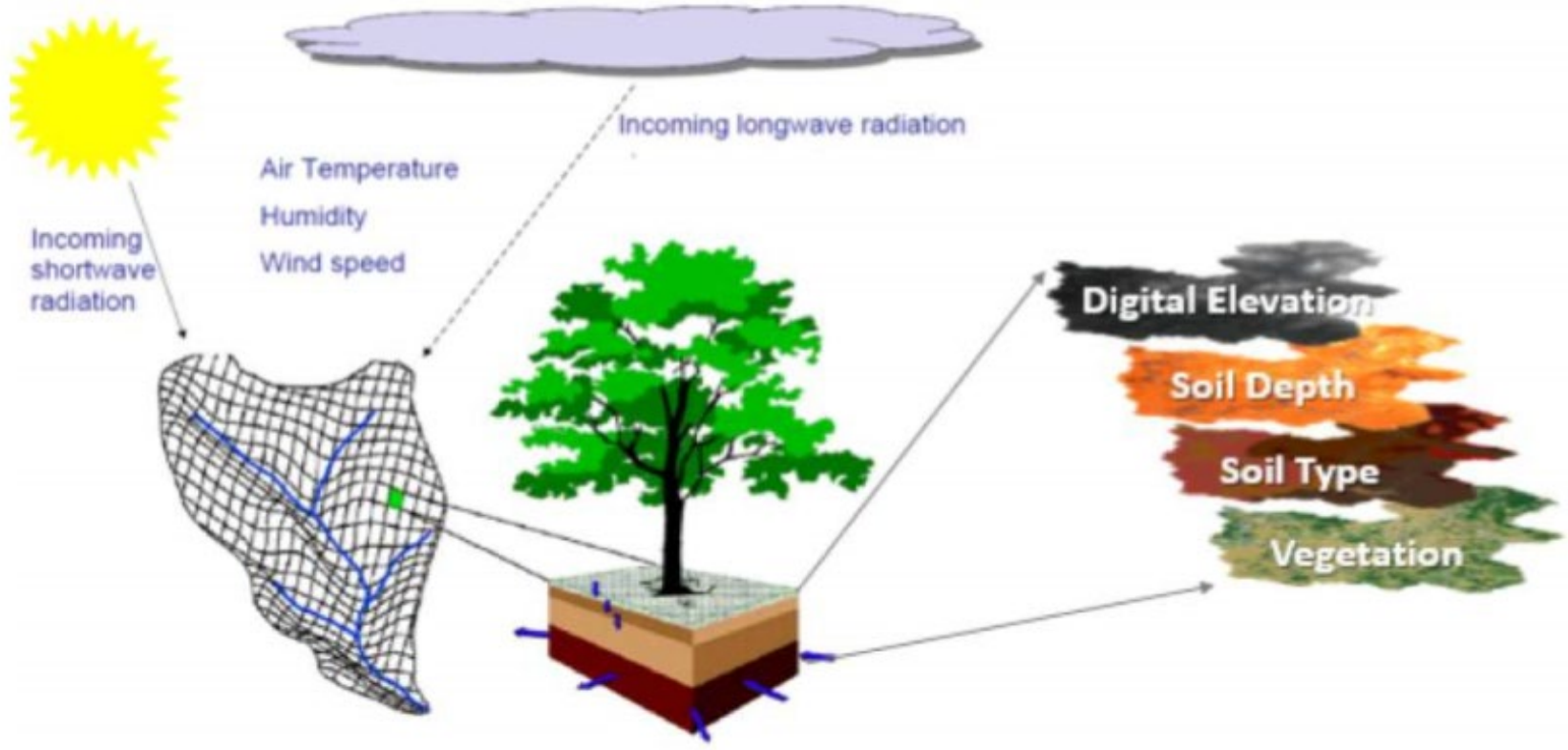


Snover et al. 2013

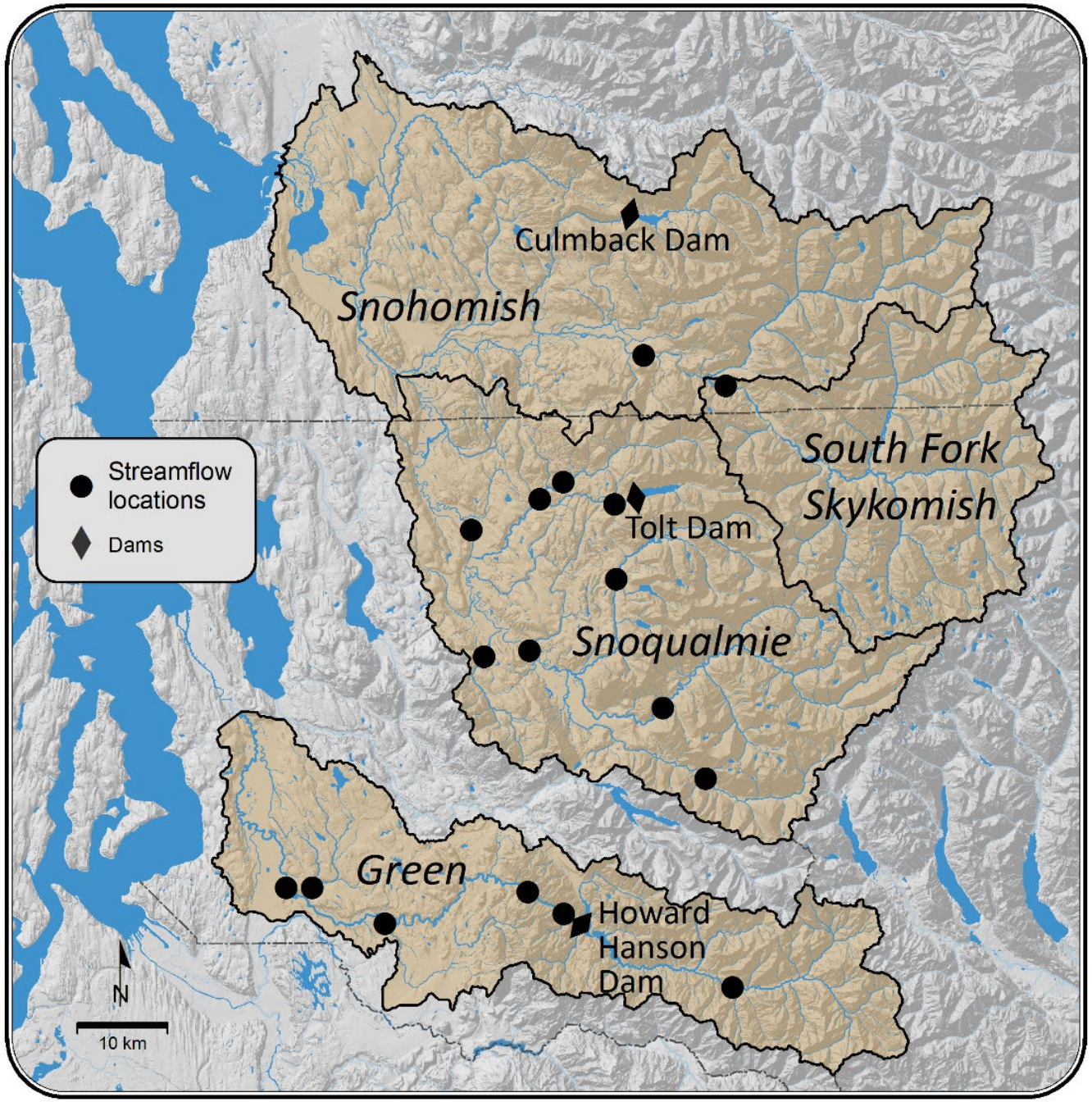
Dynamical downscaling captures smaller-scale affects like changes in storm sizes



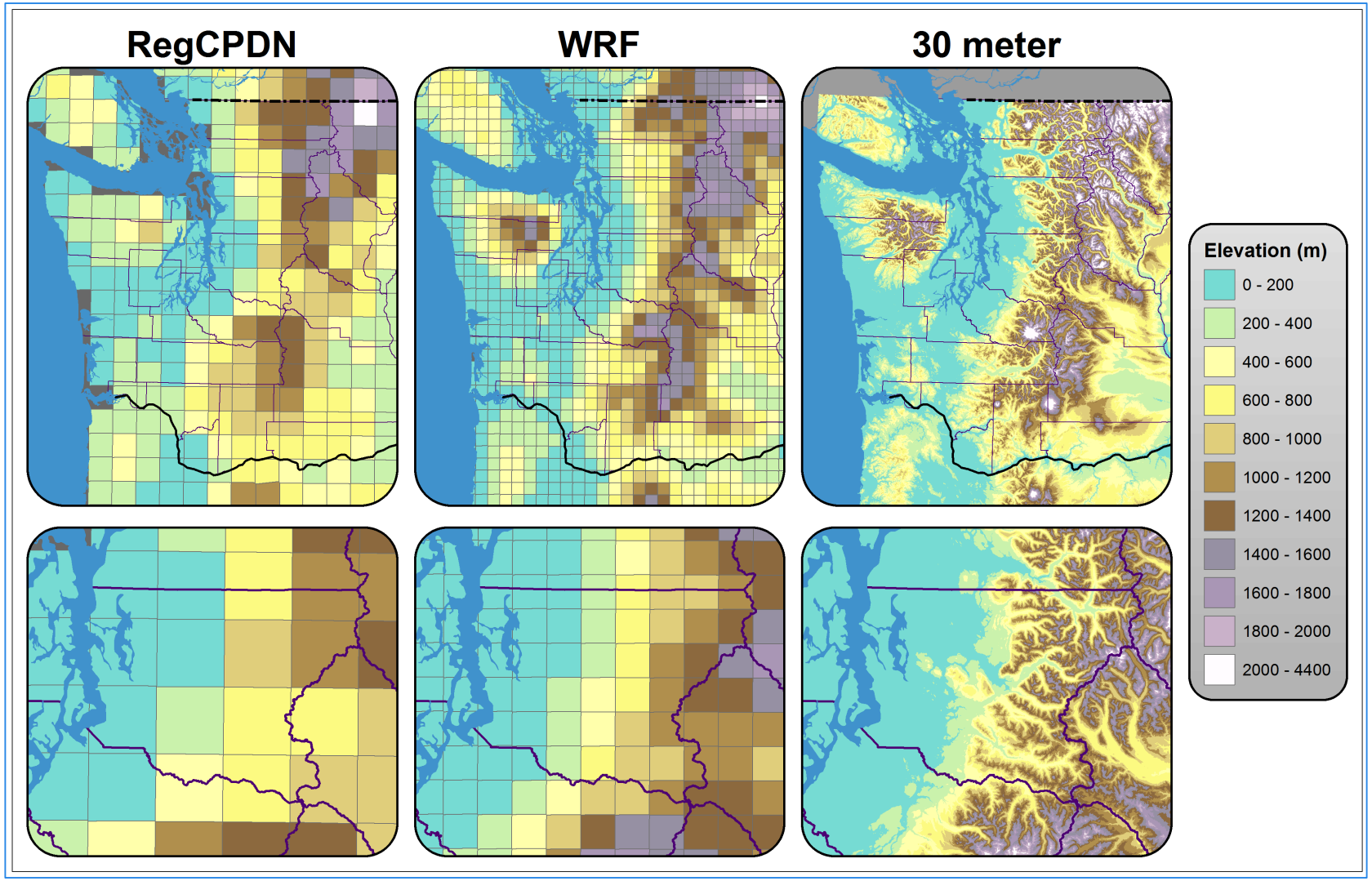
The University of Washington's Distributed Hydrologic Soil Vegetation Model was used to estimate flows in the Green, Snoqualmie, and S Fork Skykomish Rivers



Green, Snoqualmie, and South Fork Skykomish rivers

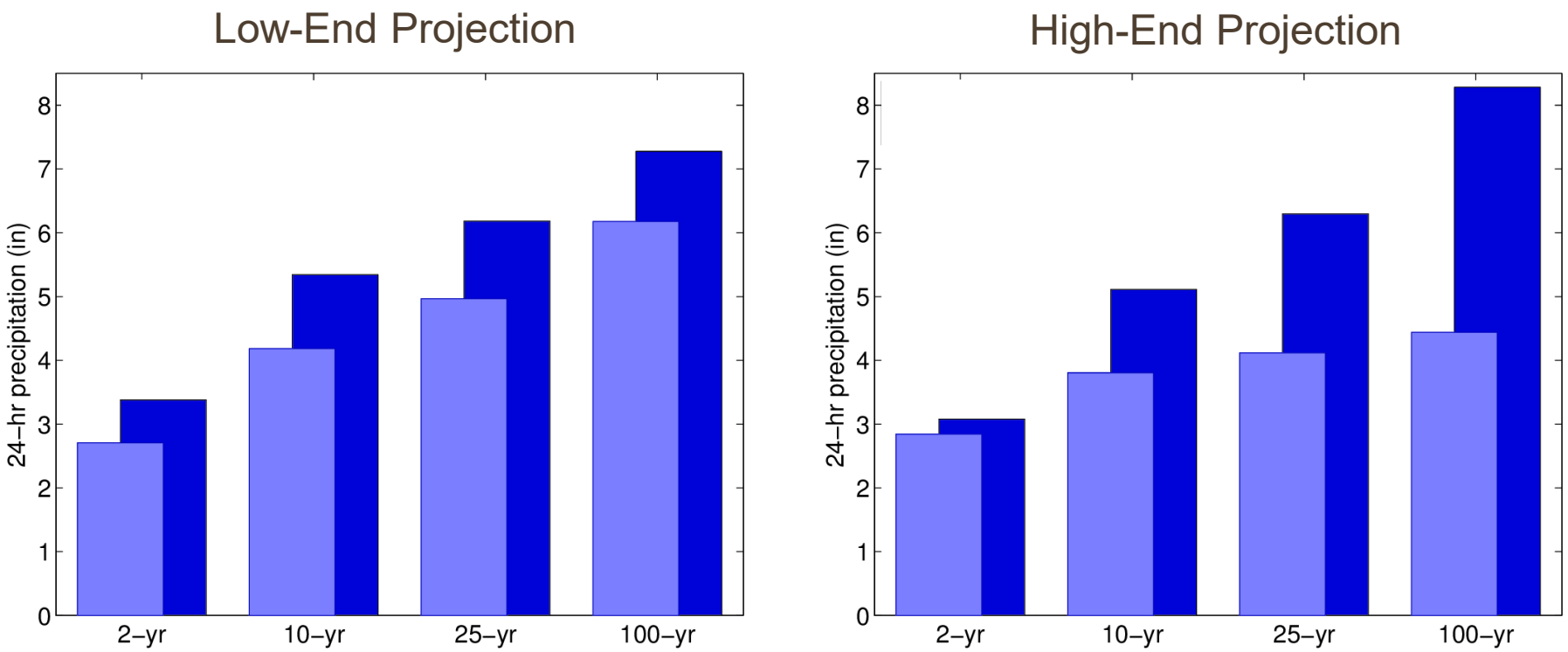


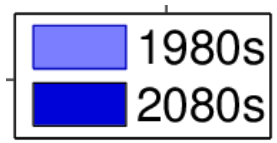
Spatial resolution



Findings: change in heavy rains

Heavy rains are projected to get heavier by the end of the century





24-hour rainfall at Sea-Tac

What does this mean for flooding in the Green and Snoqualmie/Skykomish Rivers?

Report: Effect of Climate Change on Flooding in King County Rivers

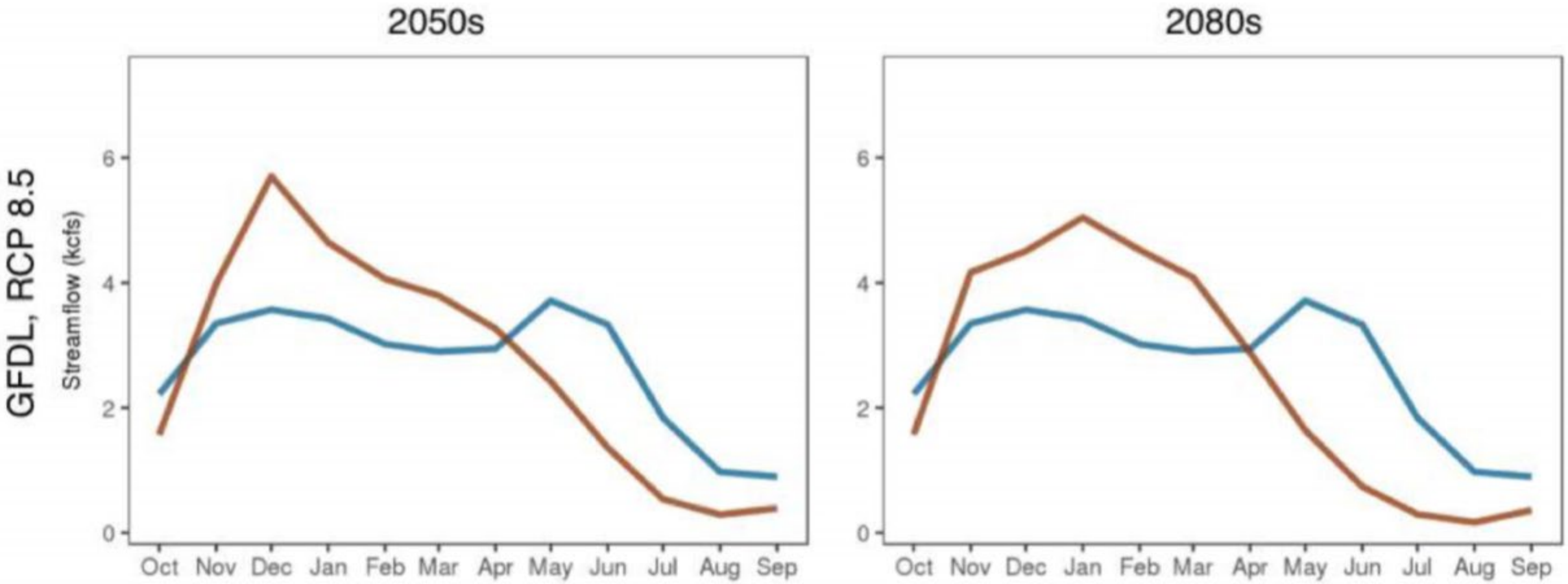
A shift from snow to rain in both watersheds causes higher winter flows and lower summer flows

Change in average streamflow for each season, 2080s relative to 1980s

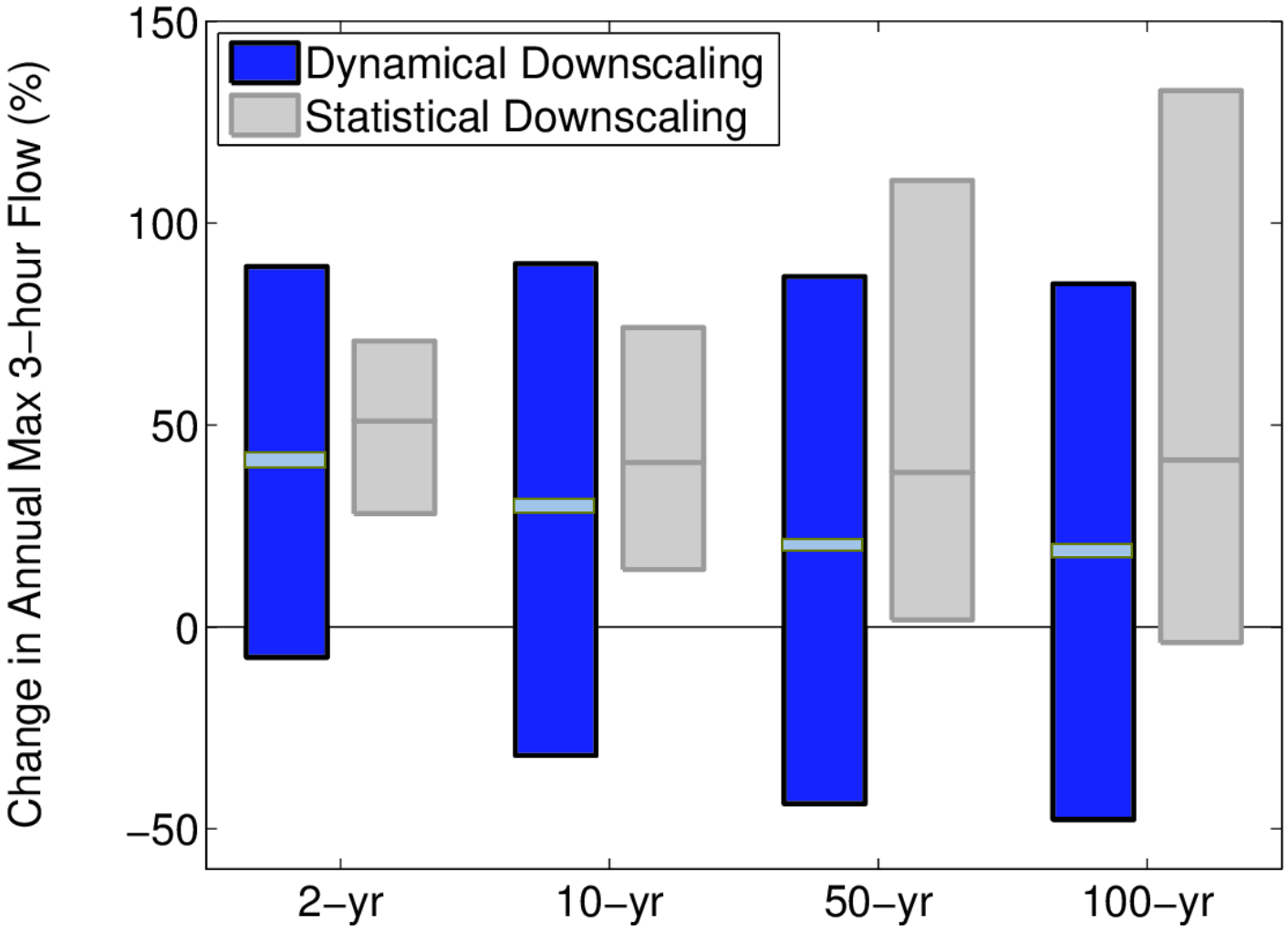
	Snoqualmie	Green
Winter *(Dec-Feb)*	+10%	+16%
Summer *(Jun-Aug)*	-70%	-60%

(table lists the minimum change among the two projections)

Average monthly Snoqualmie River flows for 2050s and 2080s compared to 1980s

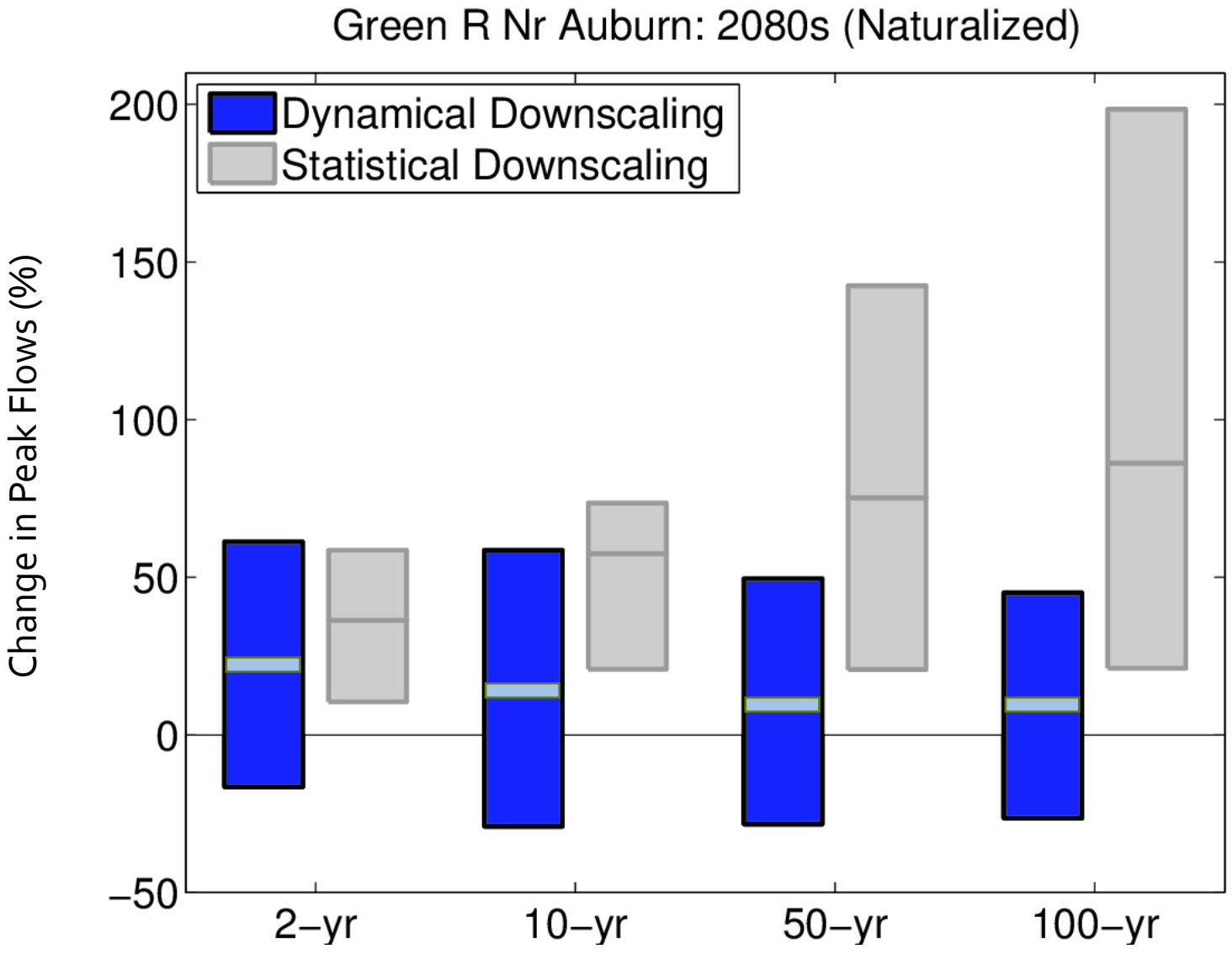


Maximum 3-hour Snoqualmie River flood flows are projected to increase by the 2080s



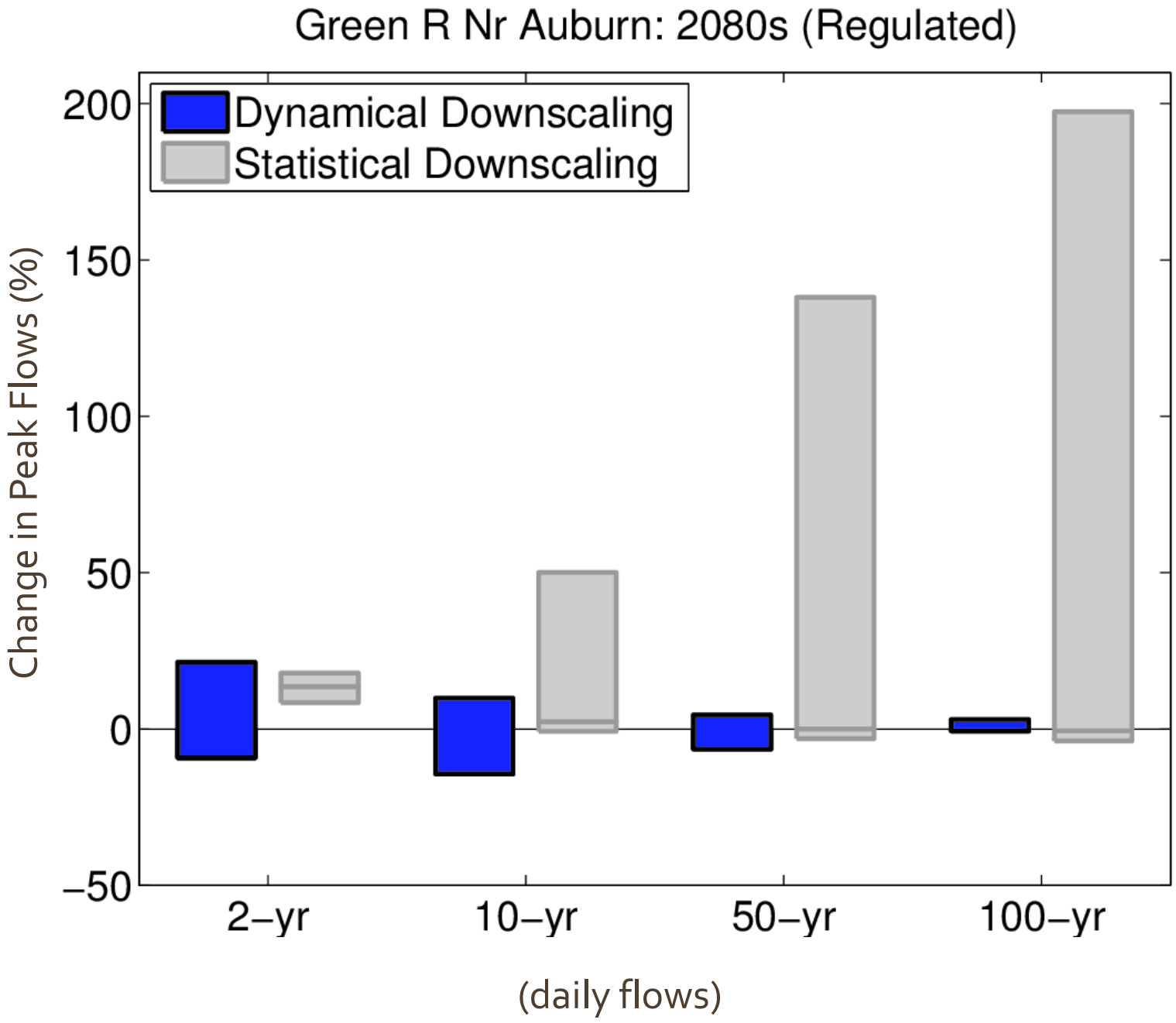
(USGS site: Snoqualmie R Near Snoqualmie)

Without the Howard Hanson Dam, Green River floods at Auburn would be projected to increase



(3-hour flows)

The Howard Hanson Dam appears to be able to mitigate projected increased flood risk



Implications for management

seattletimes.com

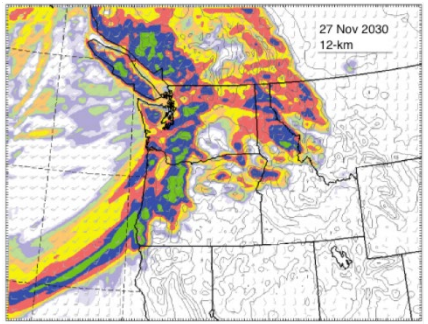
- Consider changing flow protection goals (e.g., containing 100-yr vs 500-yr flood)
- Balance between structure elevation changes and acquisitions in floodplains
- Amount of freeboard appropriate in different reaches to account for future conditions
- Consider designing projects to be retrofitted in the future to maintain a certain level of flow protection

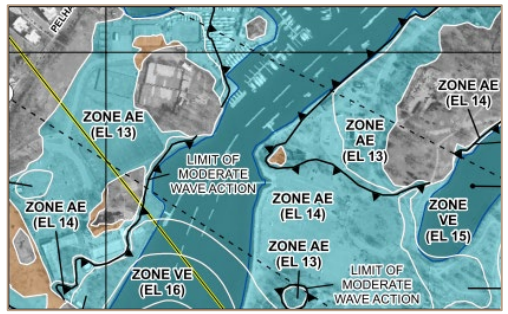
Snoqualmie River 1/5/2015

Green River 2/8/1996

Outlook: What's next?

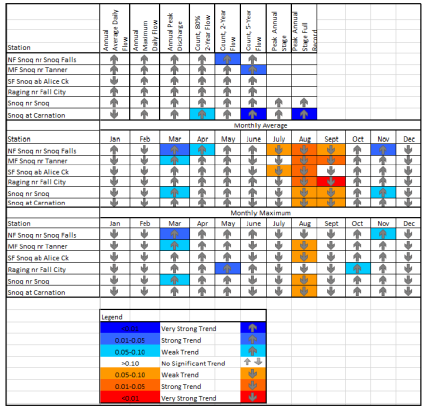
- Address climate change impacts on river flooding in the next update to the King County Flood Hazard Management Plan
- Evaluate climate change impacts on White and Cedar rivers
- Continue to track research on climate change impacts on snowpack, storm sizes, and flooding
- Continue tracking weather, river flow, floodplain, and flood impact data to understand on-the-ground conditions





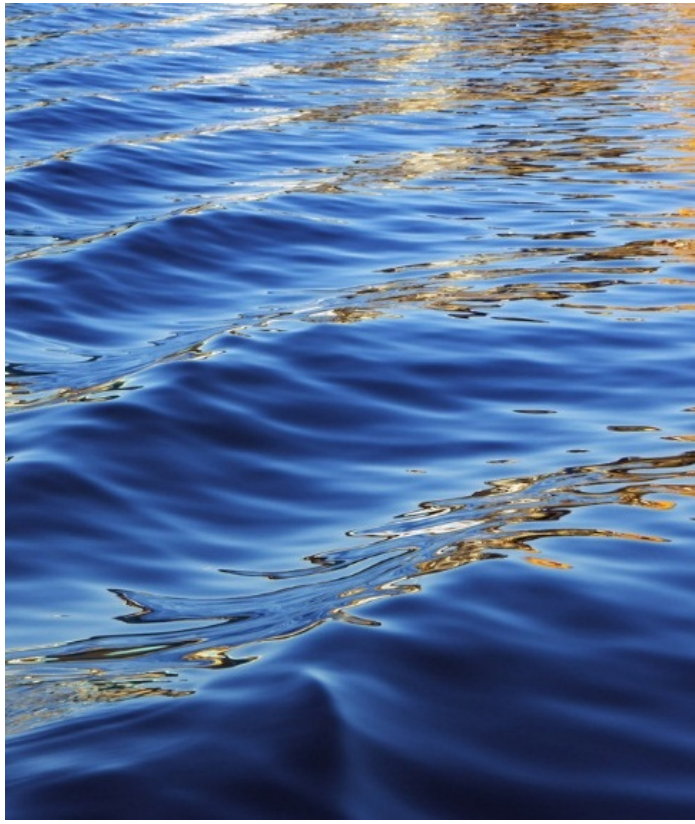
fema.gov

King County 2018



“However good our futures research may be, we shall never be able to escape from the ultimate dilemma that all of our knowledge is about the past, and all or our decisions are about the future."

(Ian Wilson, 2000, Technological Forecasting and Social Change, 65(1): 23-29)

Thank you.

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Water and Land Resources Division
King County Department of Natural Resources and Parks