Apr 5th, 1:45 PM - 2:00 PM

Space matters: incorporating mechanistically determined spatial patterns into projected impacts of climate change on stream temperature

Se-Yeun Lee
Univ. of Washington, United States, leesy@uw.edu

Aimee H. Fullerton
National Oceanic and Atmospheric Administration, United States, Aimee.Fullerton@noaa.gov

Ashley Steel
U.S.D.A. Forest Service, United States, asteel@fs.fed.us

Christian Torgersen
Univ. of Washington, United States, ctorgersen@usgs.gov

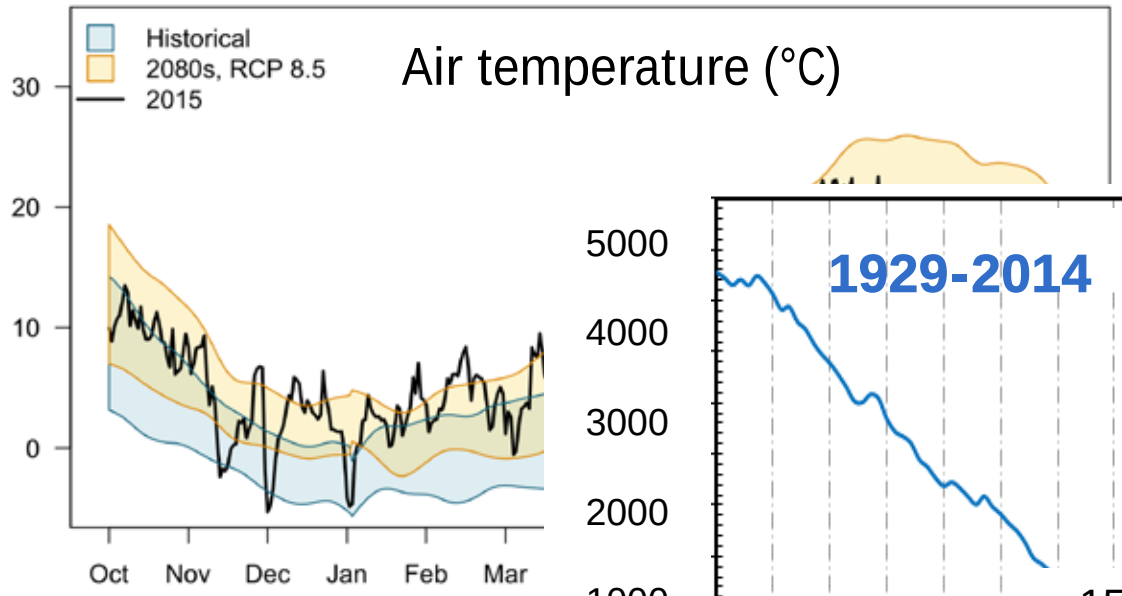
Space matters: incorporating mechanistically determined spatial patterns into projected impacts of climate change on stream temperature

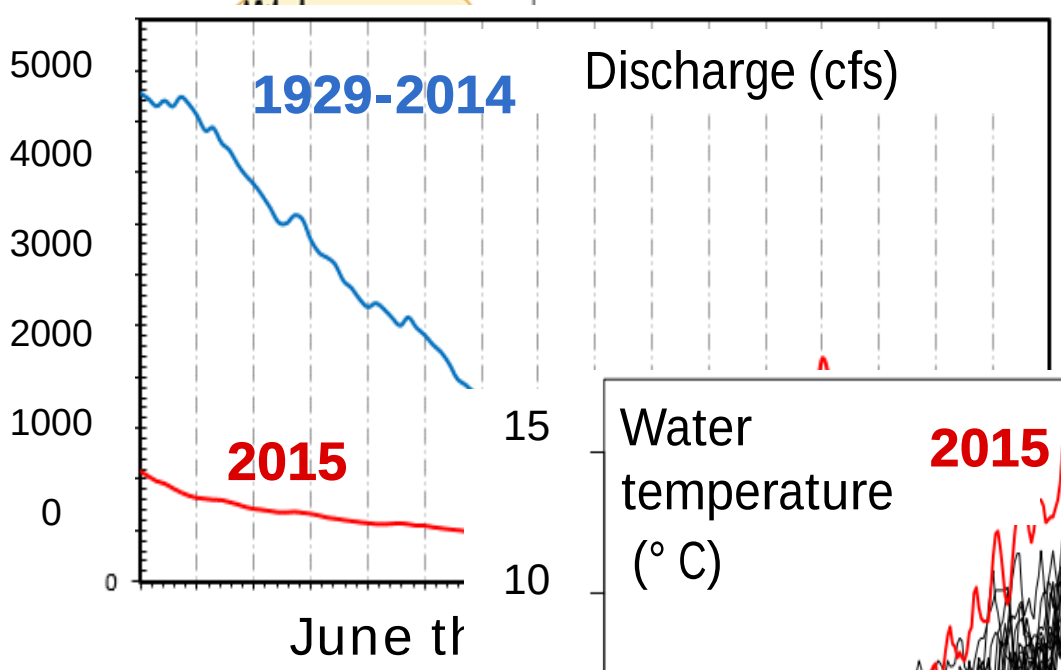
Se-Yeun Lee[1],
Aimee Fullerton[2], Ashley Steel[3], Christian Torgersen[4]

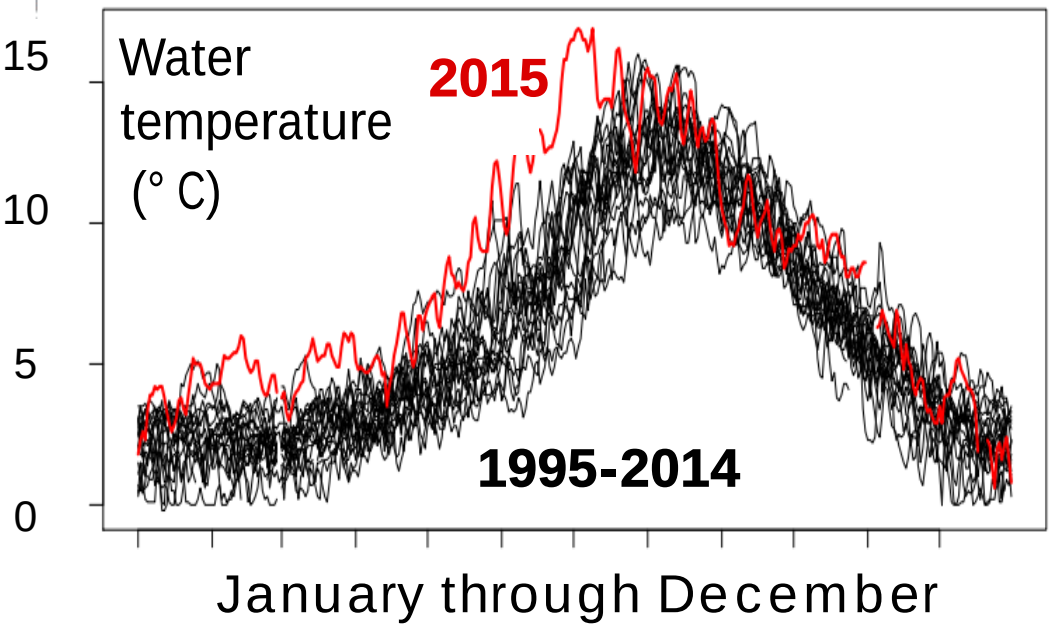
1. Climate Impacts Group, UW
2. Northwest Fisheries Science Center
3. USDA Forest Service
4. USGS Forest and Rangeland Ecosystem Science Center

Salish Sea Ecosystem Conference 04/05/2018

2015 Was a Hot, Dry Year in the Snoqualmie





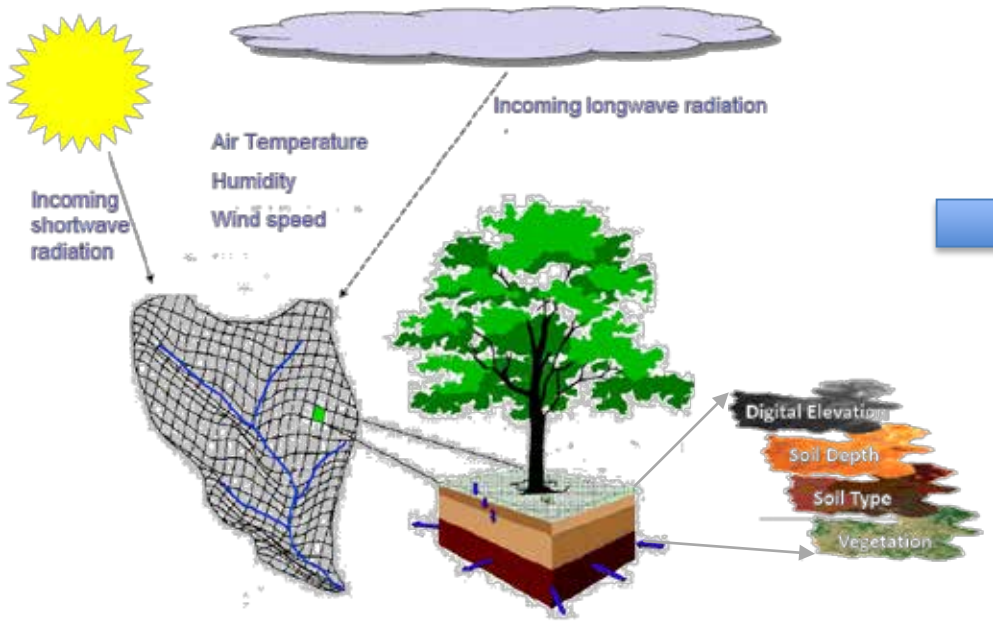


Objectives

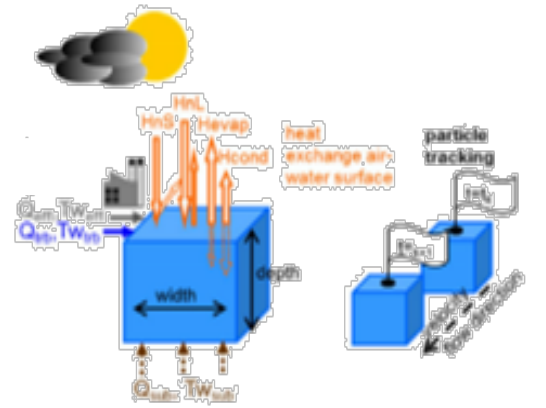
1. Predict change in location of cold-water habitats using a process-based model.
2. Compare predictions from the process-based model to predictions from other statistical model.

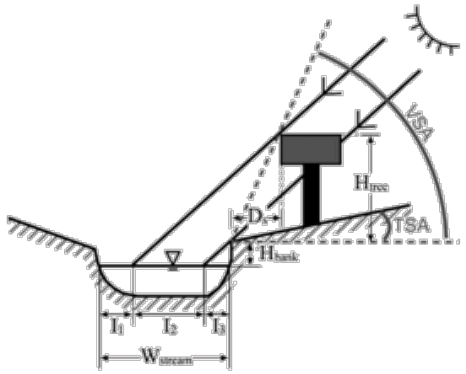
Distributed Hydrology Soil Vegetation Model- River Basin Model (**DHSVM-RBM**)

Hydrology Model (DHSVM)



Water Temperature Model (RBM)

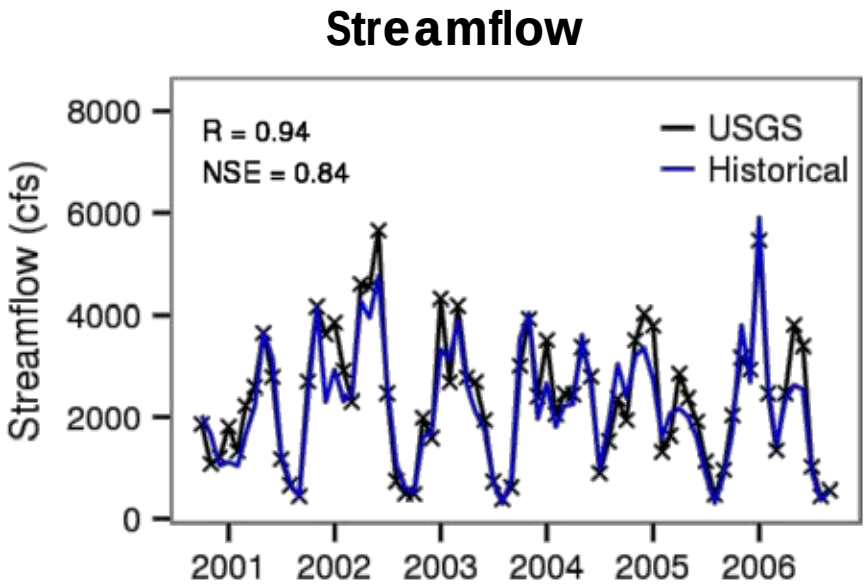




- Explicit representation of topography & vegetation
- Physically consistent picture of flow & temperature
- Resolution: 150 m and 3 hr time step

(Source: Sun et al. 2015)

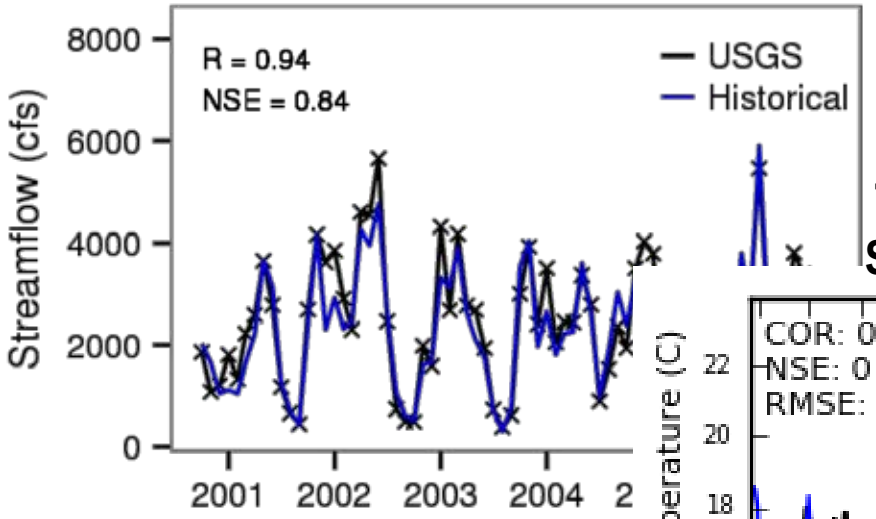
Calibration Results



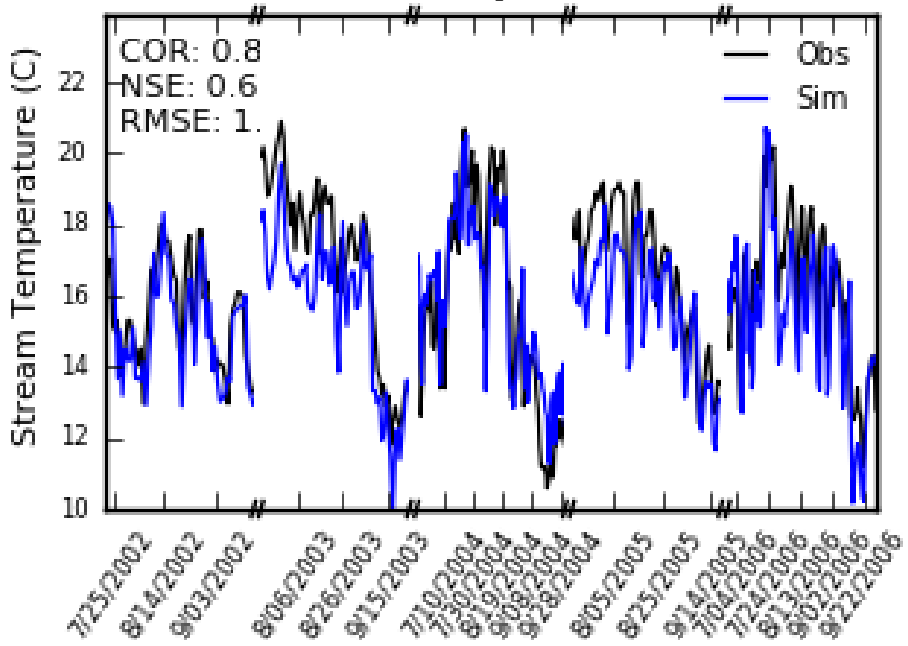
USGS Streamflow (ID 12144500)

Calibration Results

Streamflow



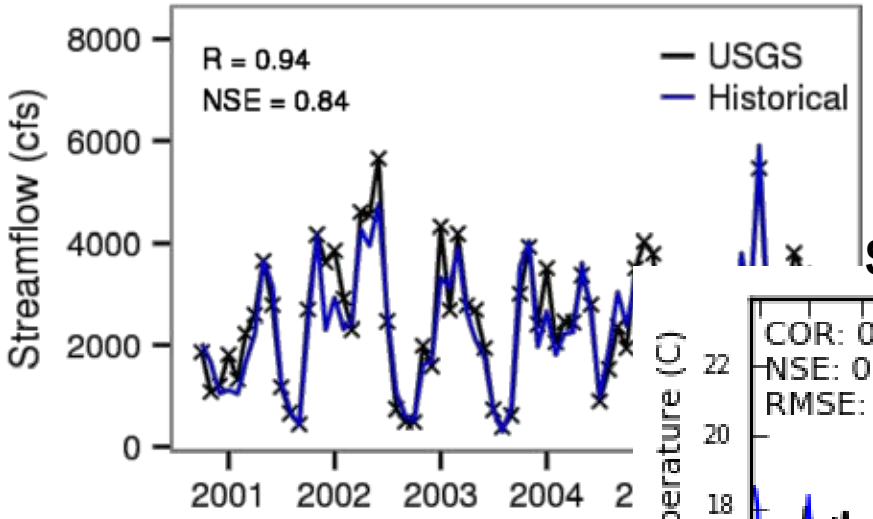
Temporal Pattern of Stream Temperature



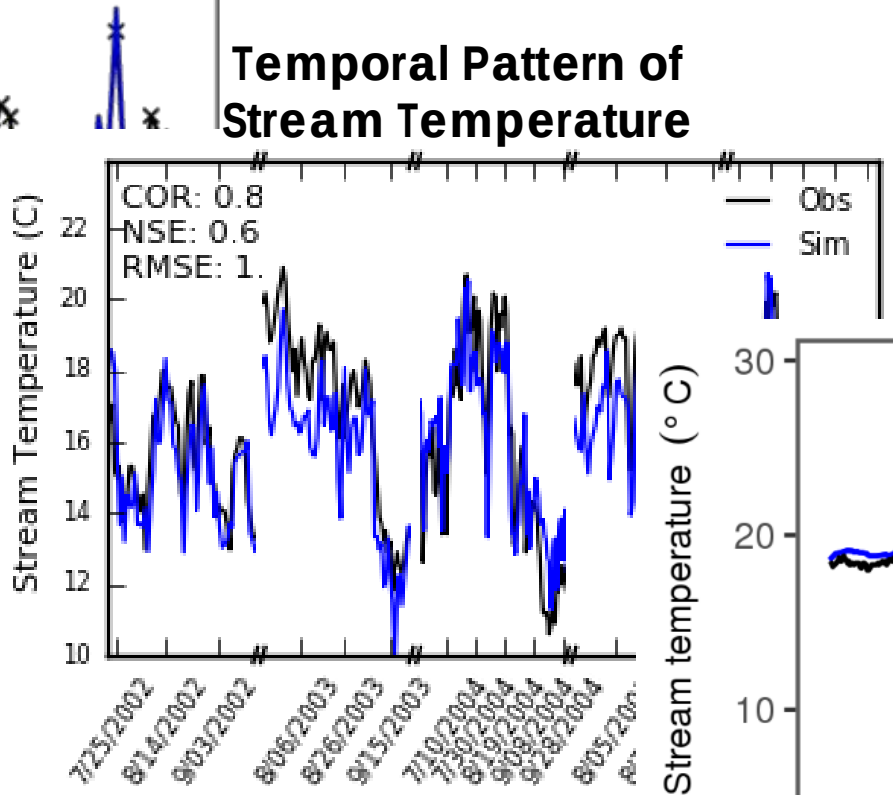
WA Dept. of Ecology (ID 07D130)

Calibration Results

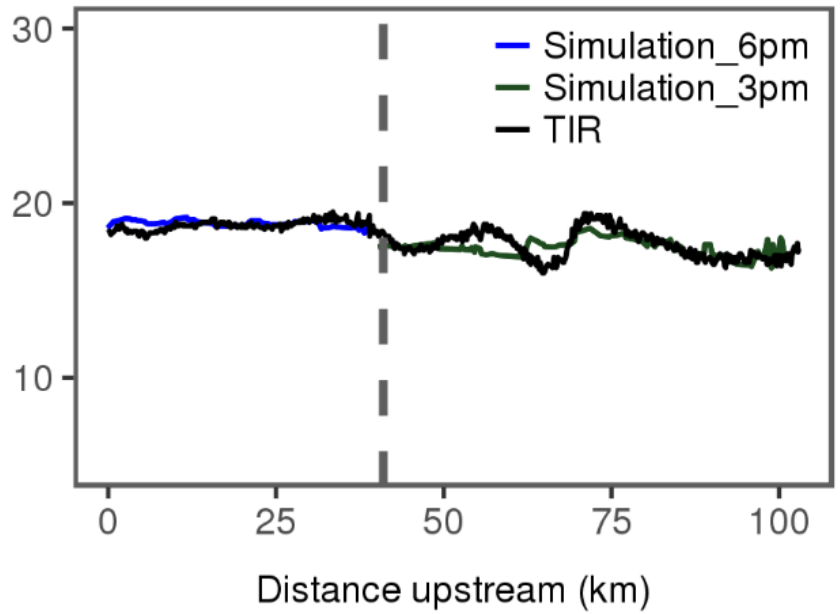
Streamflow



Temporal Pattern of Stream Temperature

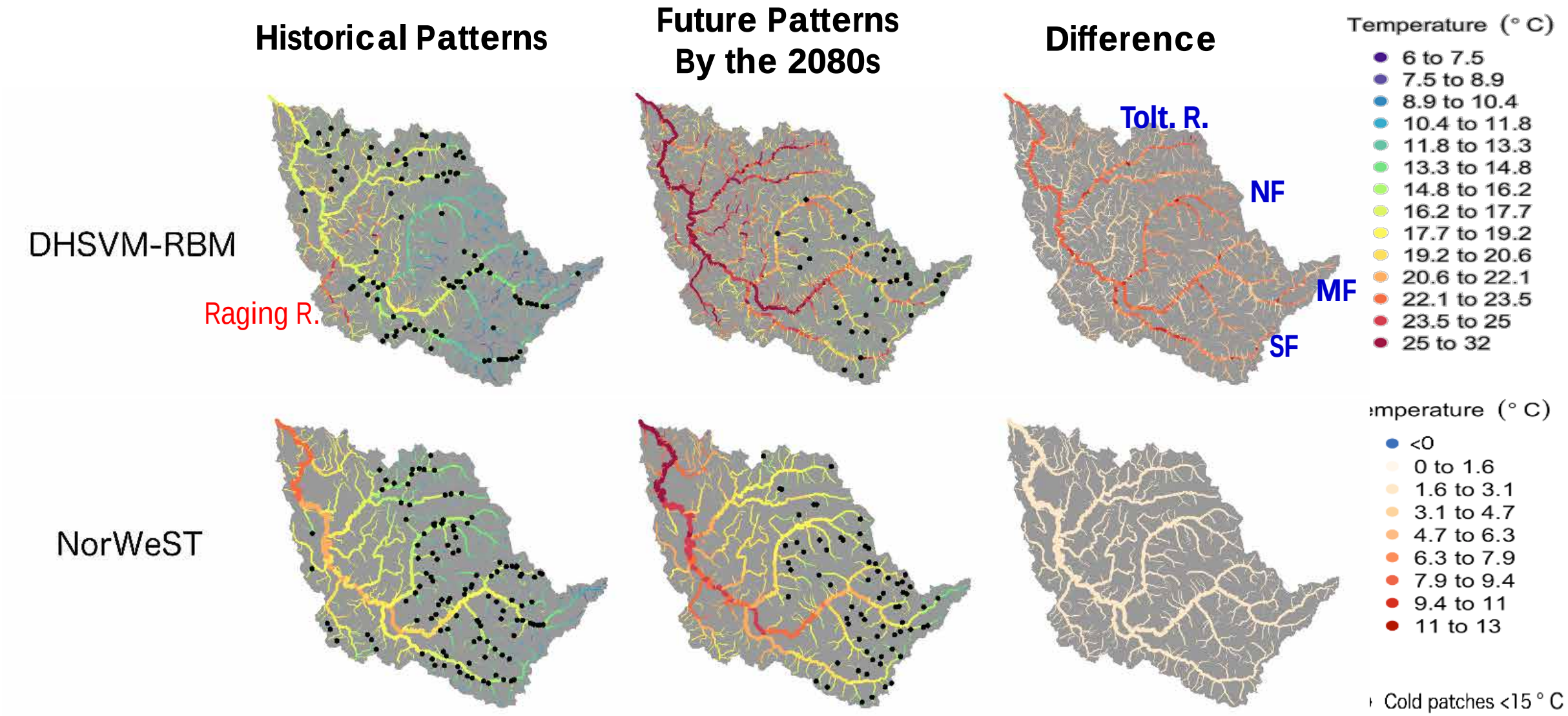


Spatial Pattern of Stream Temperature



Thermal Infrared (TIR) Surveys

Spatial Water Temp Pattern



Conclusion

1. DSHVM-RBM reproduced historical observations well except some places.
2. Declines in snowpack and summer streamflow are expected to raise water temperatures.
3. Cool patches are projected to be fewer and located farther upstream.
4. DHSVM-RBM was better than other model in predicting spatial variability in water temperature.

Future Work

- Use DHSVM-RBM to explore management scenarios including changes in riparian trees and land use that mitigate the negative impacts of climate change on thermal habitats for stream fishes.
- Explicitly simulate groundwater and snowmelt impacts on water temperature.

UW Climate Impacts Group

cig.uw.edu

leesy@uw.edu

(206) 543-6720

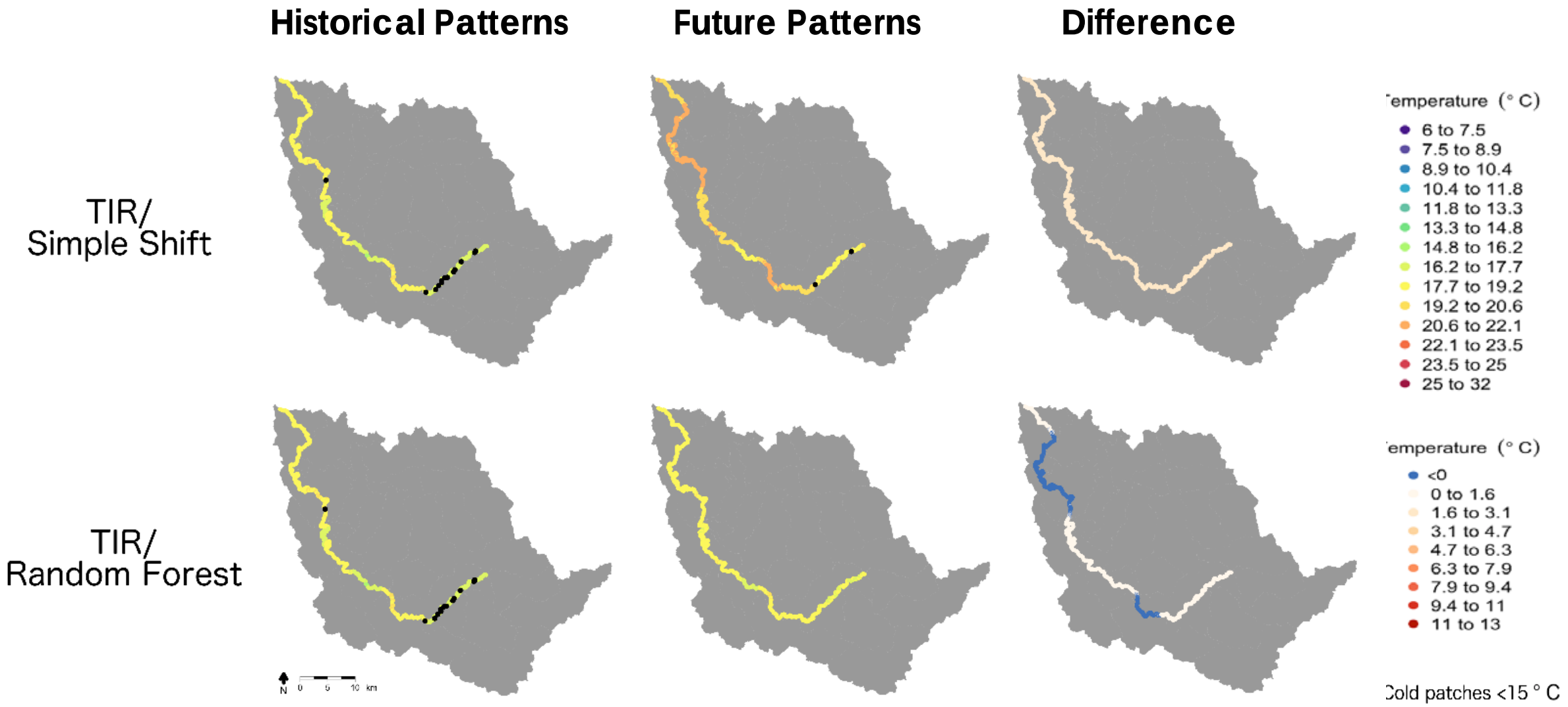
Climate Science in the Public Interest

COLLEGE OF THE ENVIRONMENT
UNIVERSITY of WASHINGTON

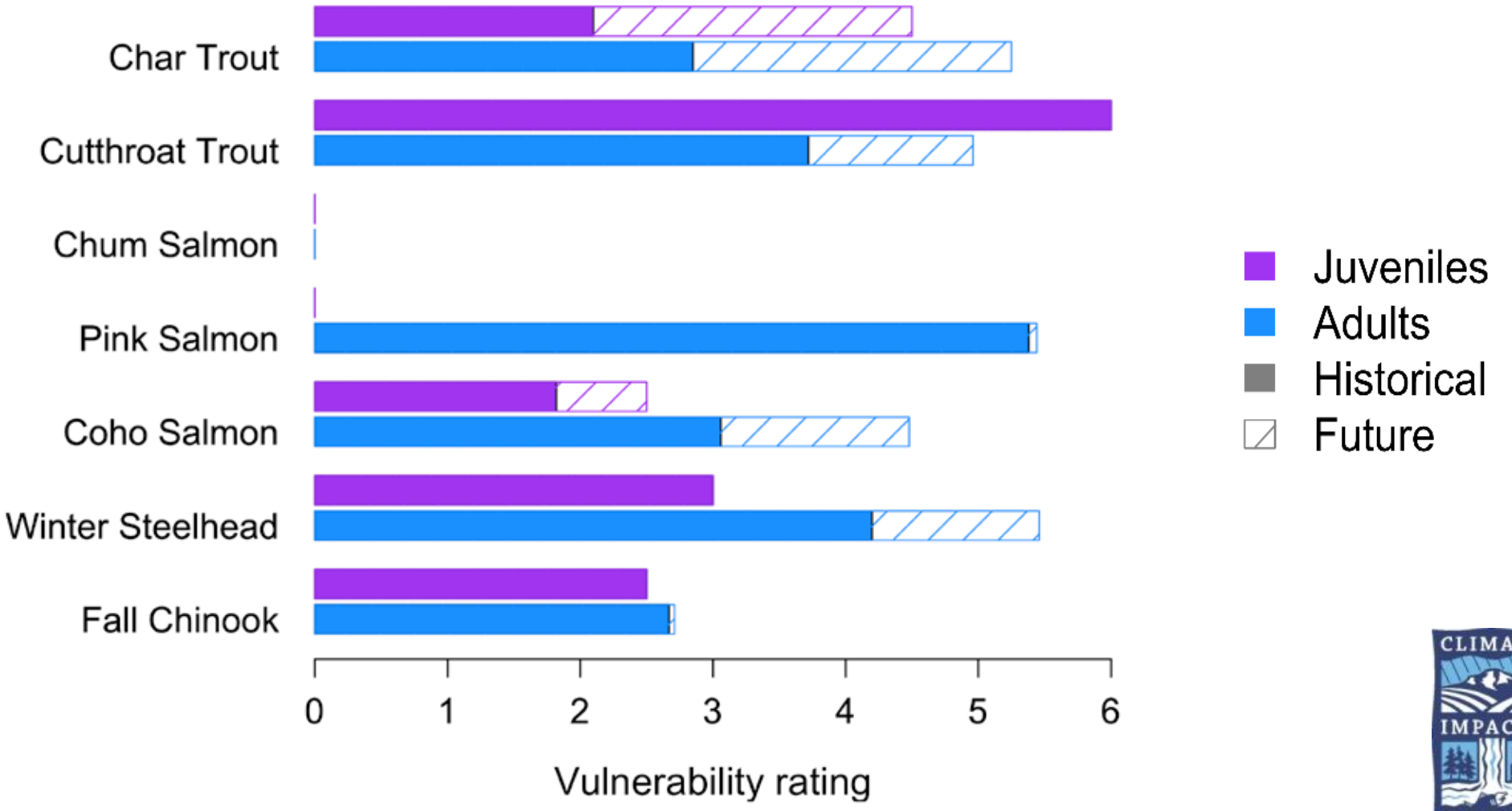
Thanks to:

NORTH PACIFIC LANDSCAPE CONSERVATION COOPERATIVE

Changes in Spatial Water Temp Pattern for the Snoqualmie River

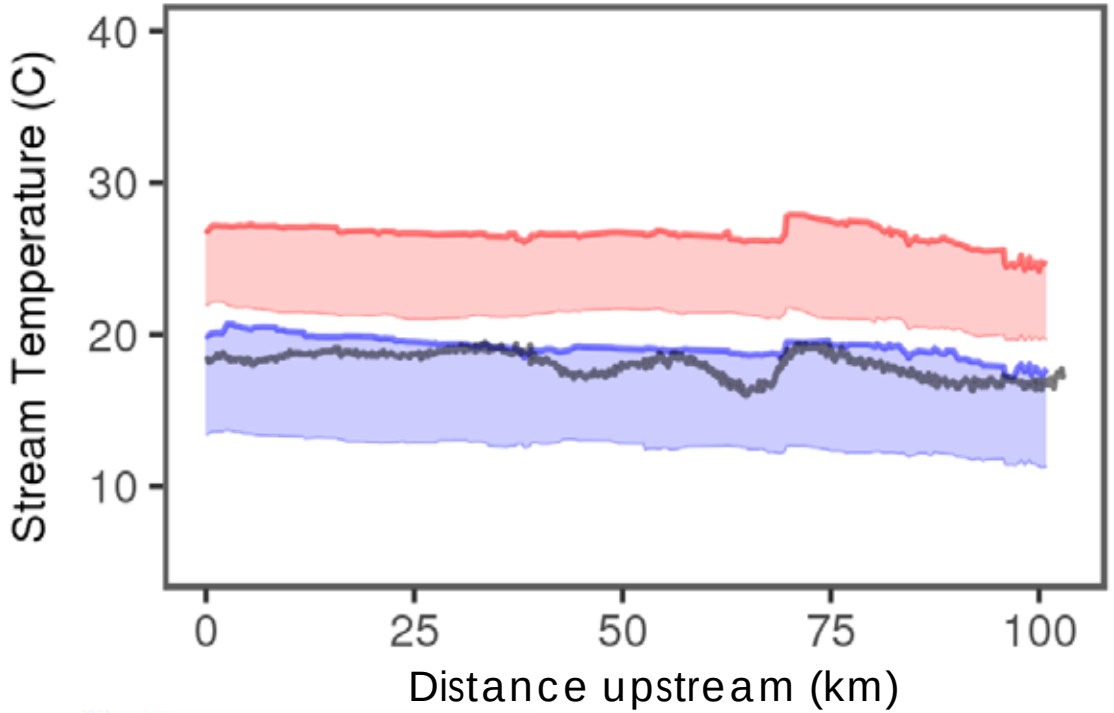


Projected Changes in Fish Vulnerability Using DHSVM-RBM by the 2080s

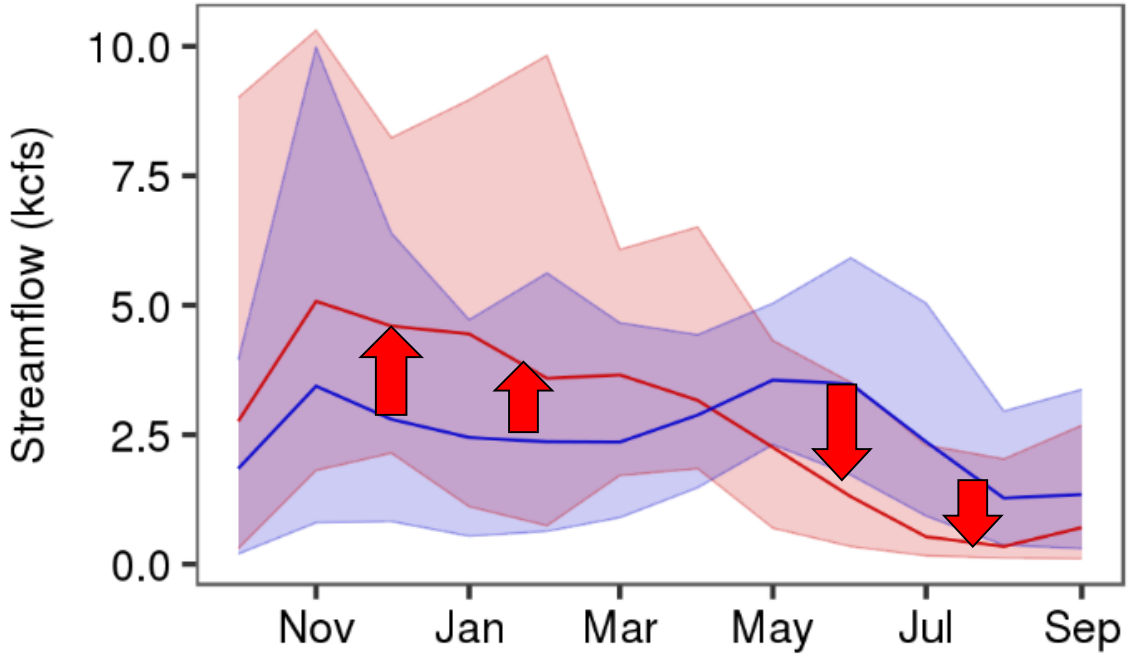


Projected Changes by the 2080s

Water Temperature



Streamflow

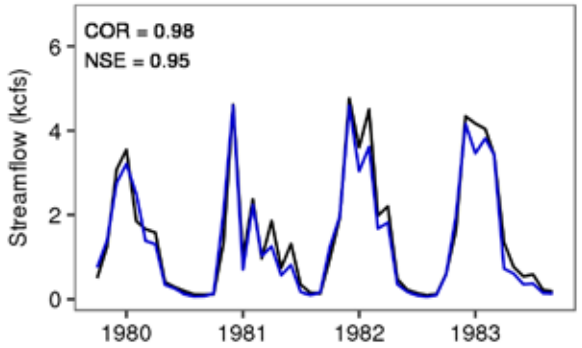


Historical Simulation
2080s for RCP 8.5
TIR

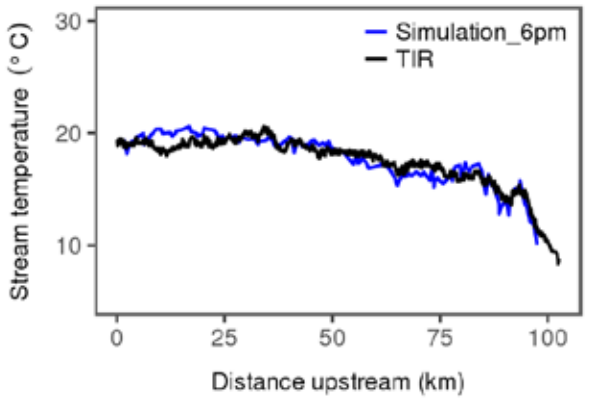
CLIMATE IMPACTS GROUP

Calibration for the Siletz

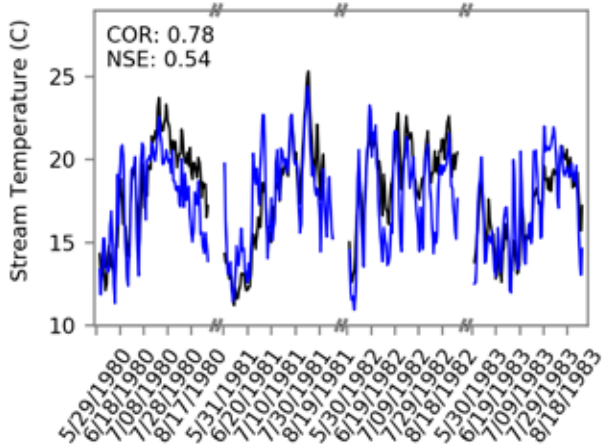
Streamflow



Stream Temperature



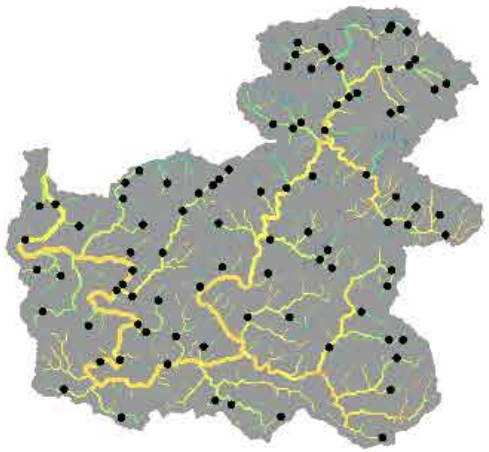
Stream Temperature

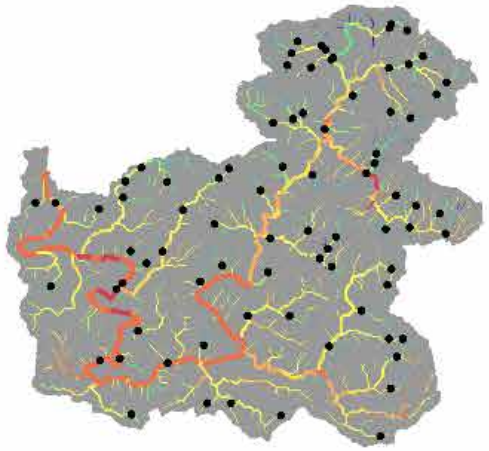


Changes in Spatial Water Temp Pattern for the Siletz River

Historical Patterns **Future Patterns** **Difference**

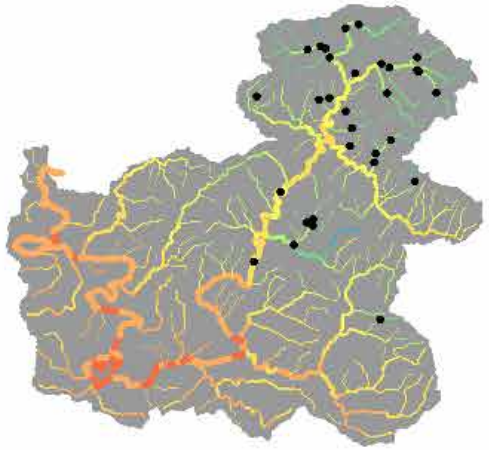
DHSVM-RBM





Temperature (° C)
- 6 to 7.5
- 7.5 to 8.9
- 8.9 to 10.4
- 10.4 to 11.8
- 11.8 to 13.3
- 13.3 to 14.8
- 14.8 to 16.2
- 16.2 to 17.7
- 17.7 to 19.2
- 19.2 to 20.6
- 20.6 to 22.1
- 22.1 to 23.5
- 23.5 to 25
- 25 to 32

NorWeST



Temperature (° C)
- <0
- 0 to 1.6
- 1.6 to 3.1
- 3.1 to 4.7
- 4.7 to 6.3
- 6.3 to 7.9
- 7.9 to 9.4
- 9.4 to 11
- 11 to 13

● Cold patches <15 ° C

CLIMATE IMPACTS GROUP