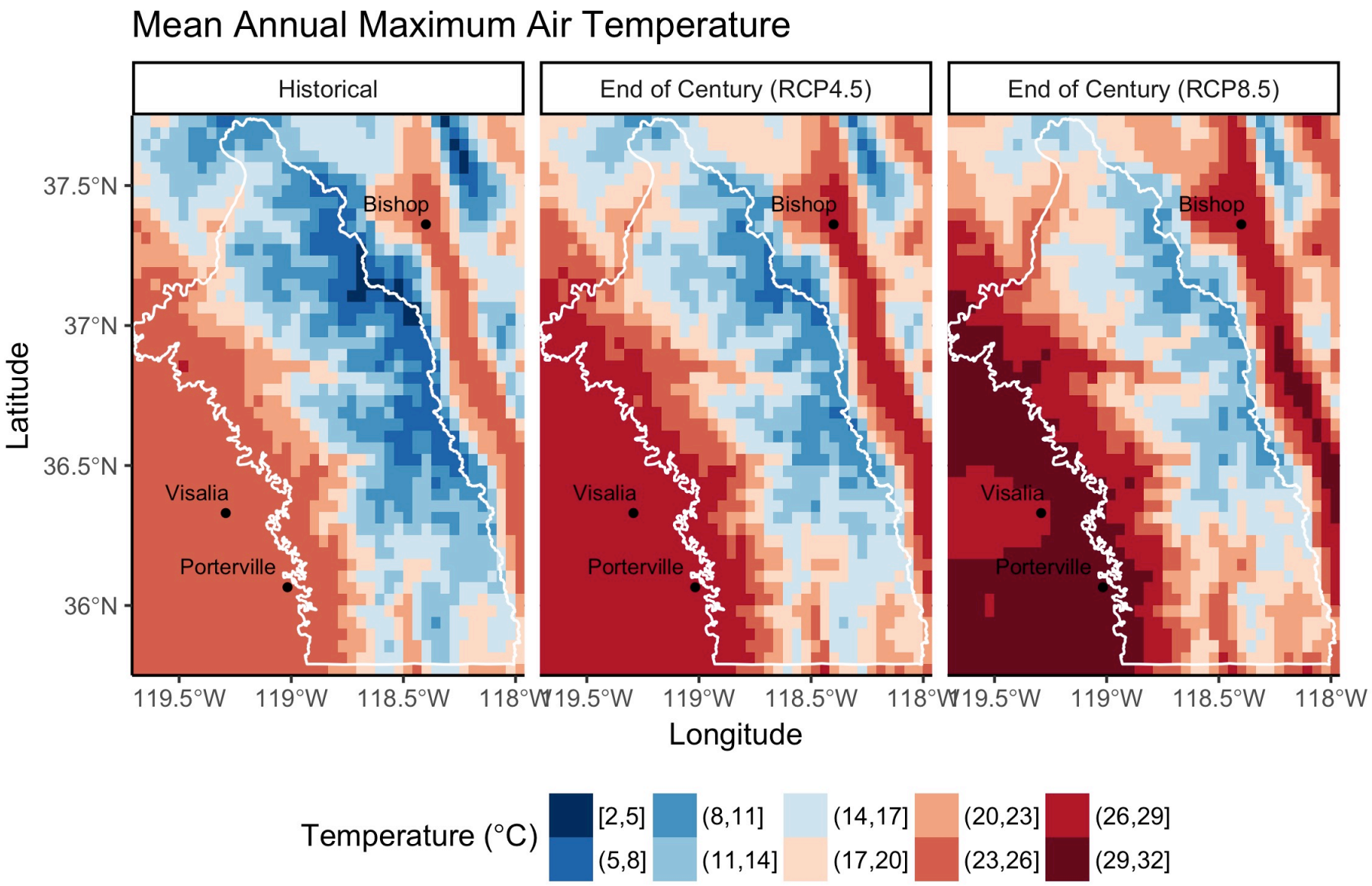
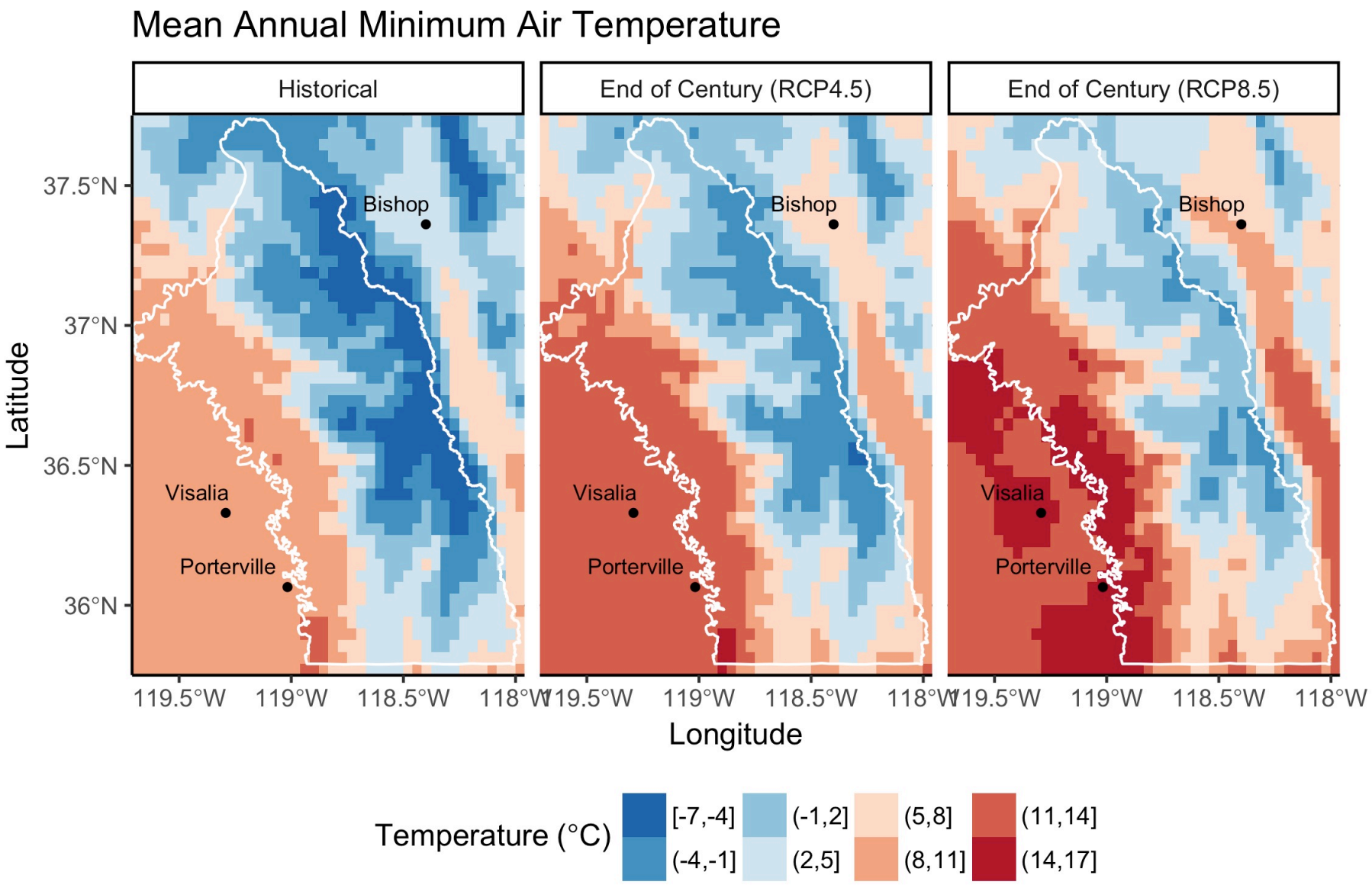
Assessment of Climate Change Effects and Impacts on the Hydrology of Southern Sierra Nevada Basins

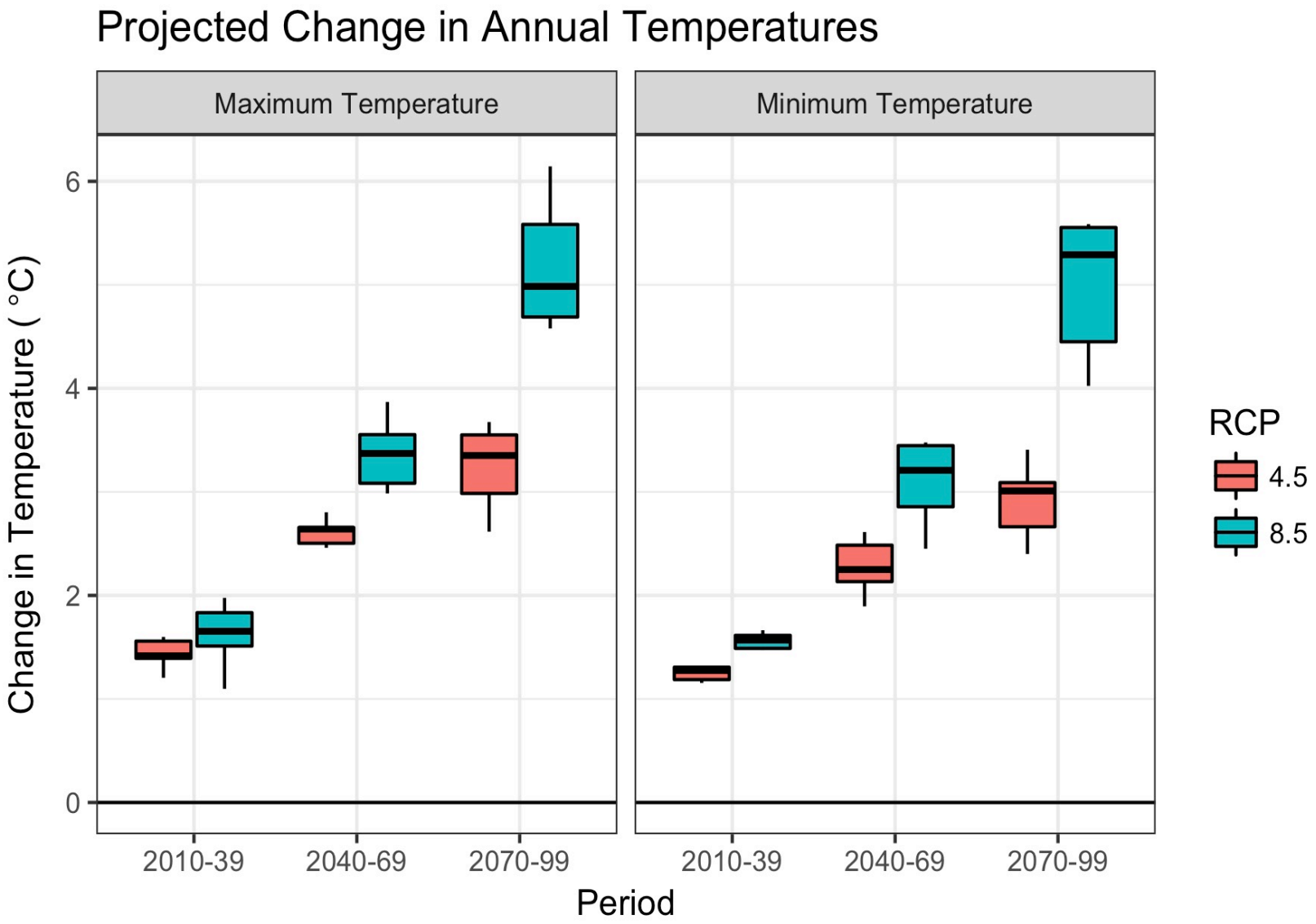
7 June 2018

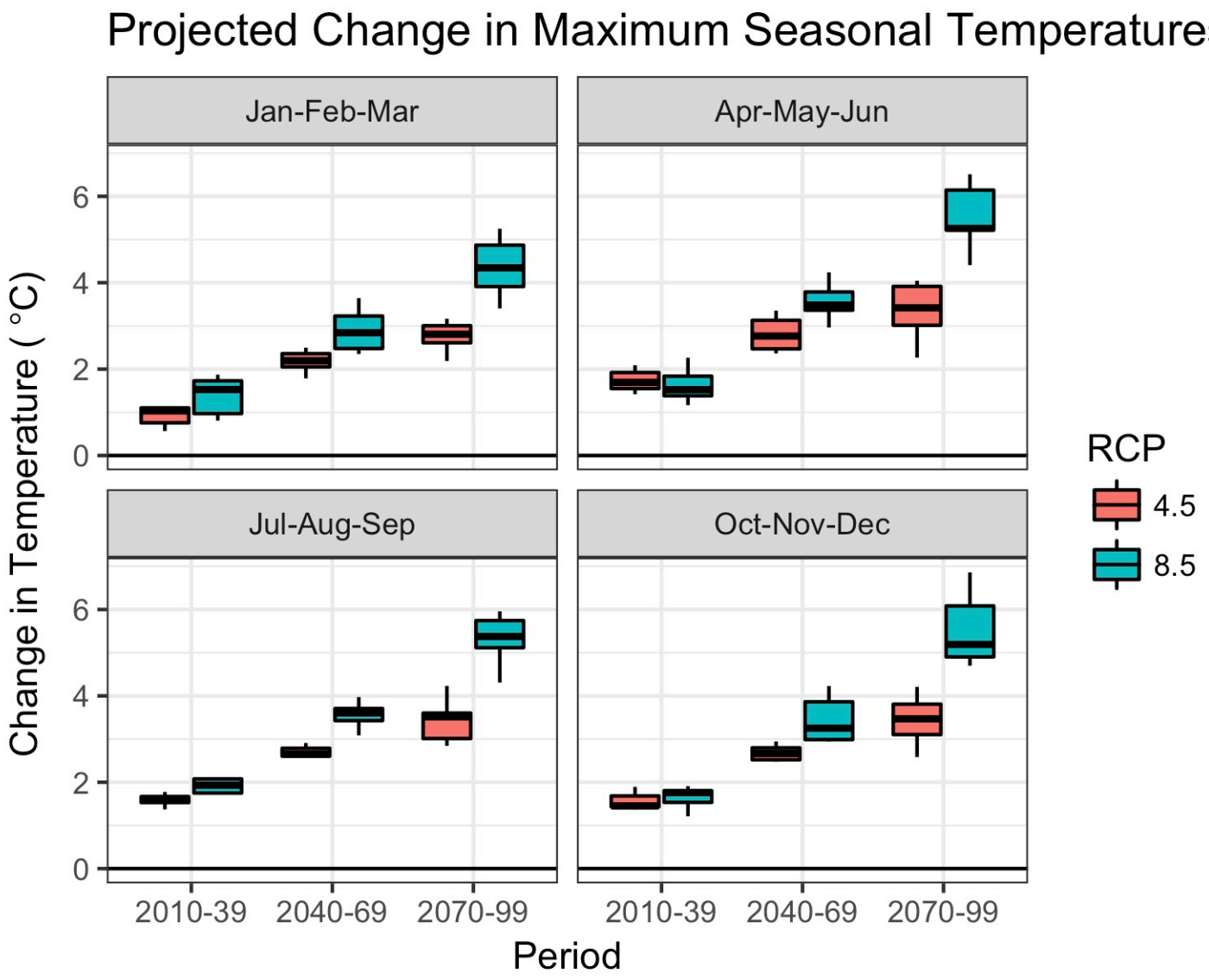
Temperature and precipitation

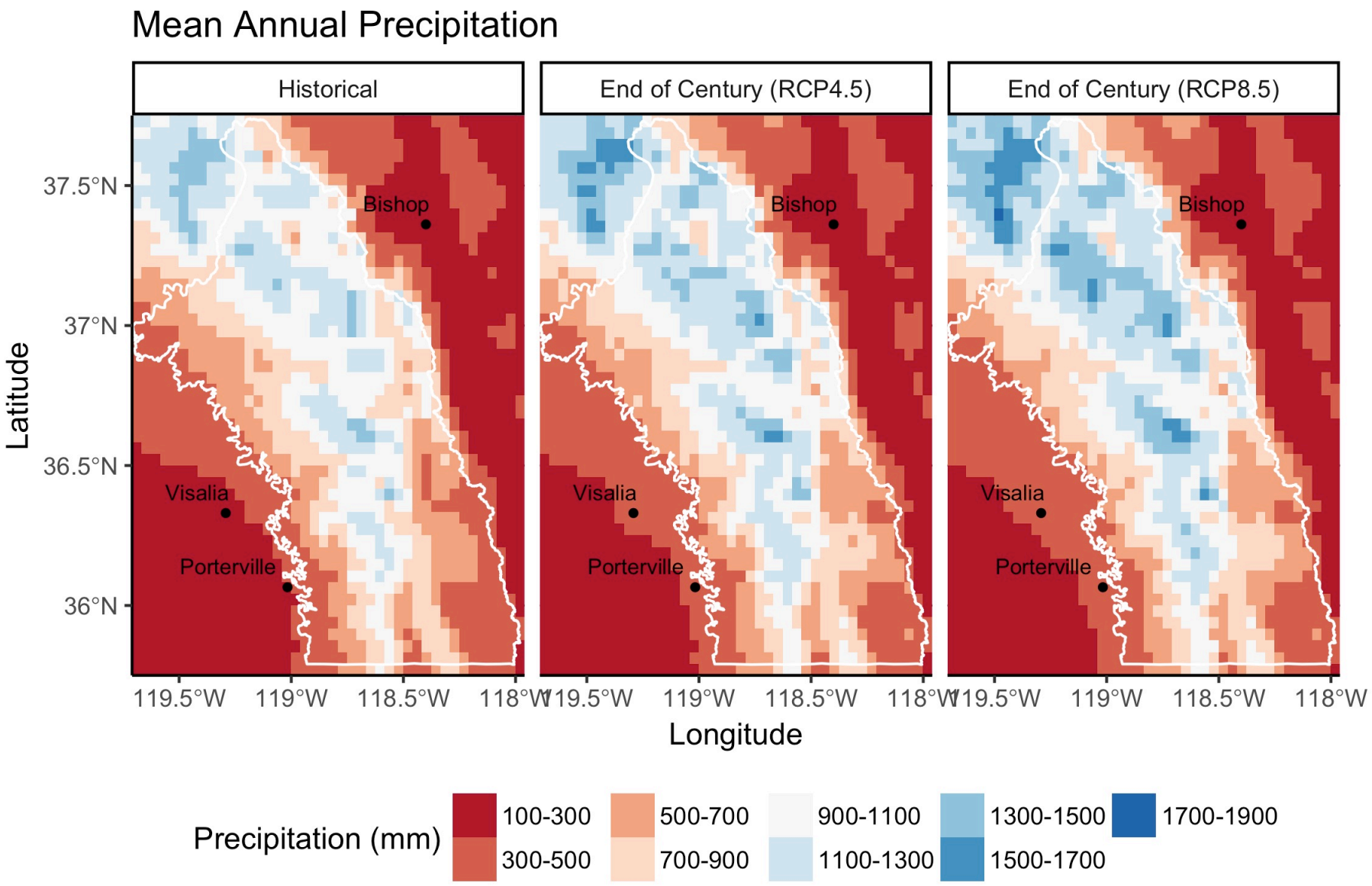
- How will temperatures and precipitation in the Southern Sierra Region be altered under climate change?
- Downscaled MACA dataset
  - Coupled Model Inter-Comparison Project Phase 5 (CMIP5)
  - Output from 6 Global Climate Models (GCMs)
  - RCP4.5 and RCP8.5 scenarios
  - 4-km resolution
- Historical period (1950-2005)
- Projection periods (2010-2039, 2040-2069, 2070-2099)

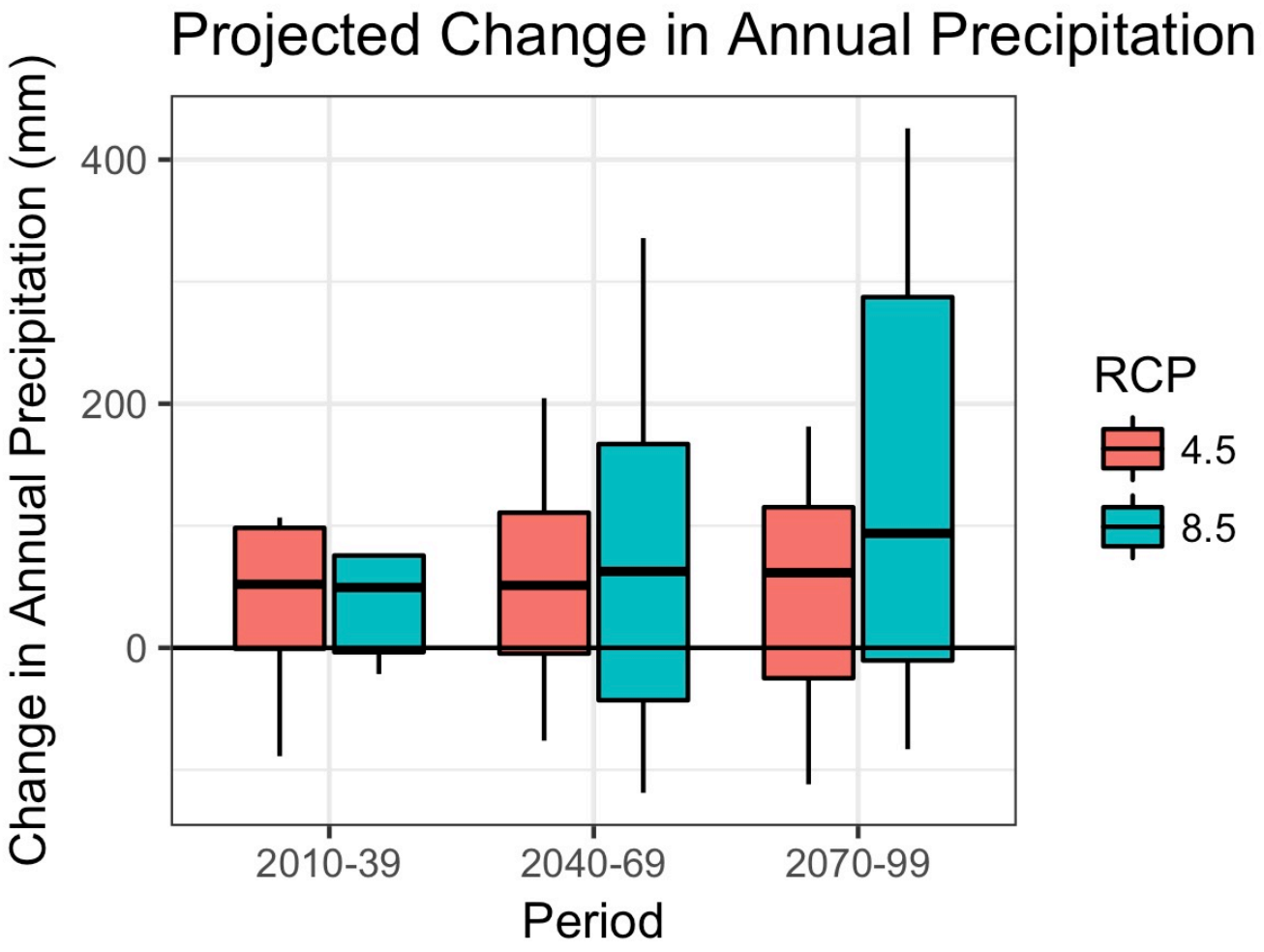

Mean Annual Maximum Air Temperature
Historical
End of Century (RCP4.5)
End of Century (RCP8.5)
Bishop
Visalia
Porterville
37.5°N
37°N
36.5°N
36°N
Latitude
119.5°W
119°W
118.5°W
118°W
Longitude
Temperature (°C)
[2,5]
(5,8]
(8,11]
(11,14]
(14,17]
(17,20]
(20,23]
(23,26]
(26,29]
(29,32]


Mean Annual Minimum Air Temperature
Historical
End of Century (RCP4.5)
End of Century (RCP8.5)
Bishop
Visalia
Porterville
37.5°N
37°N
36.5°N
36°N
Latitude
119.5°W
119°W
118.5°W
118°W
Longitude
Temperature (°C)
[-7,-4]
(-4,-1]
(-1,2]
(2,5]
(5,8]
(8,11]
(11,14]
(14,17]


Projected Change in Annual Temperatures
Maximum Temperature
Minimum Temperature
Change in Temperature (°C)
0
2
4
6
2010-39
2040-69
2070-99
Period
RCP
4.5
8.5

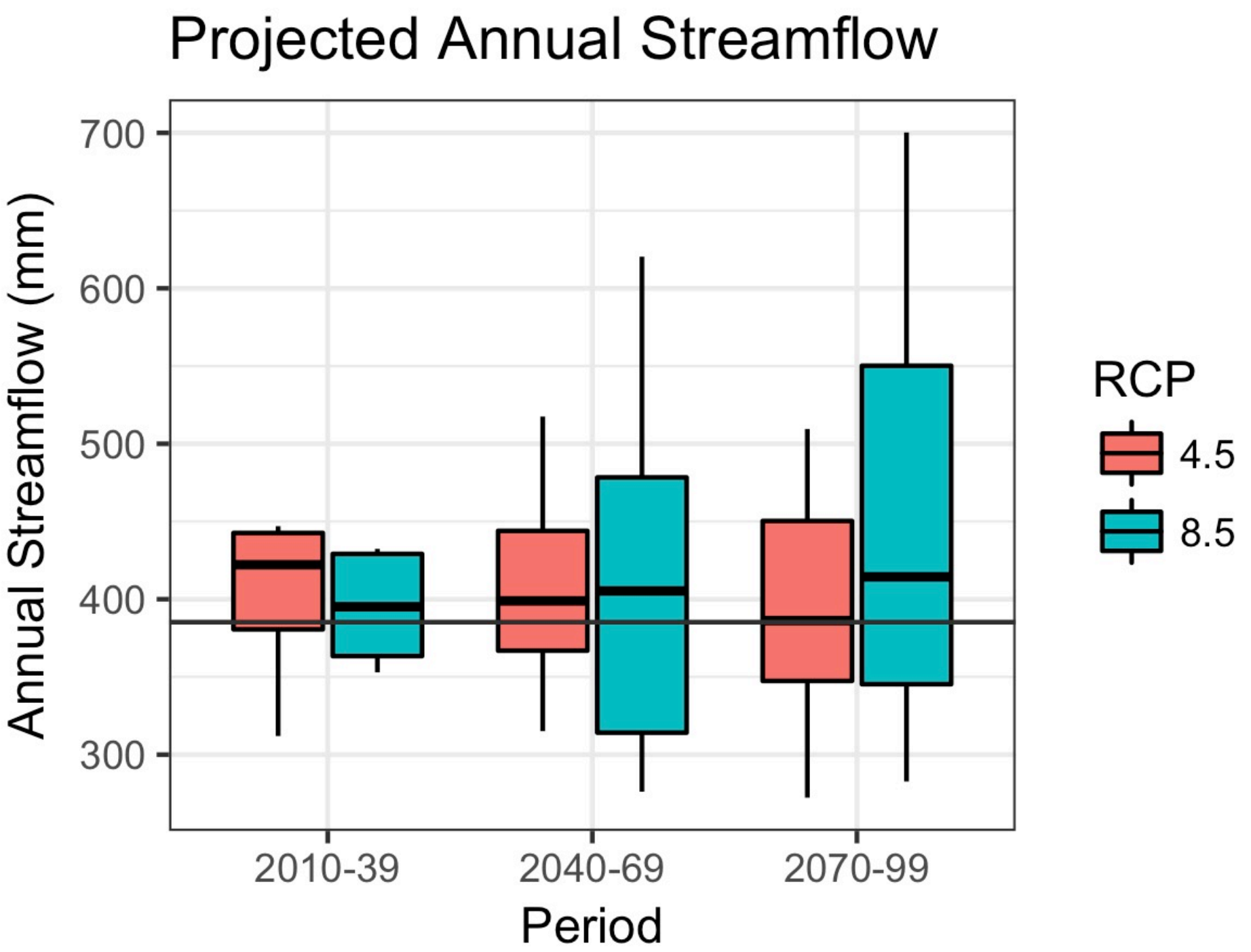

Projected Change in Maximum Seasonal Temperatures
Jan-Feb-Mar
Apr-May-Jun
Jul-Aug-Sep
Oct-Nov-Dec
Change in Temperature (°C)
0
2
4
6
2010-39
2040-69
2070-99
Period
RCP
4.5
8.5

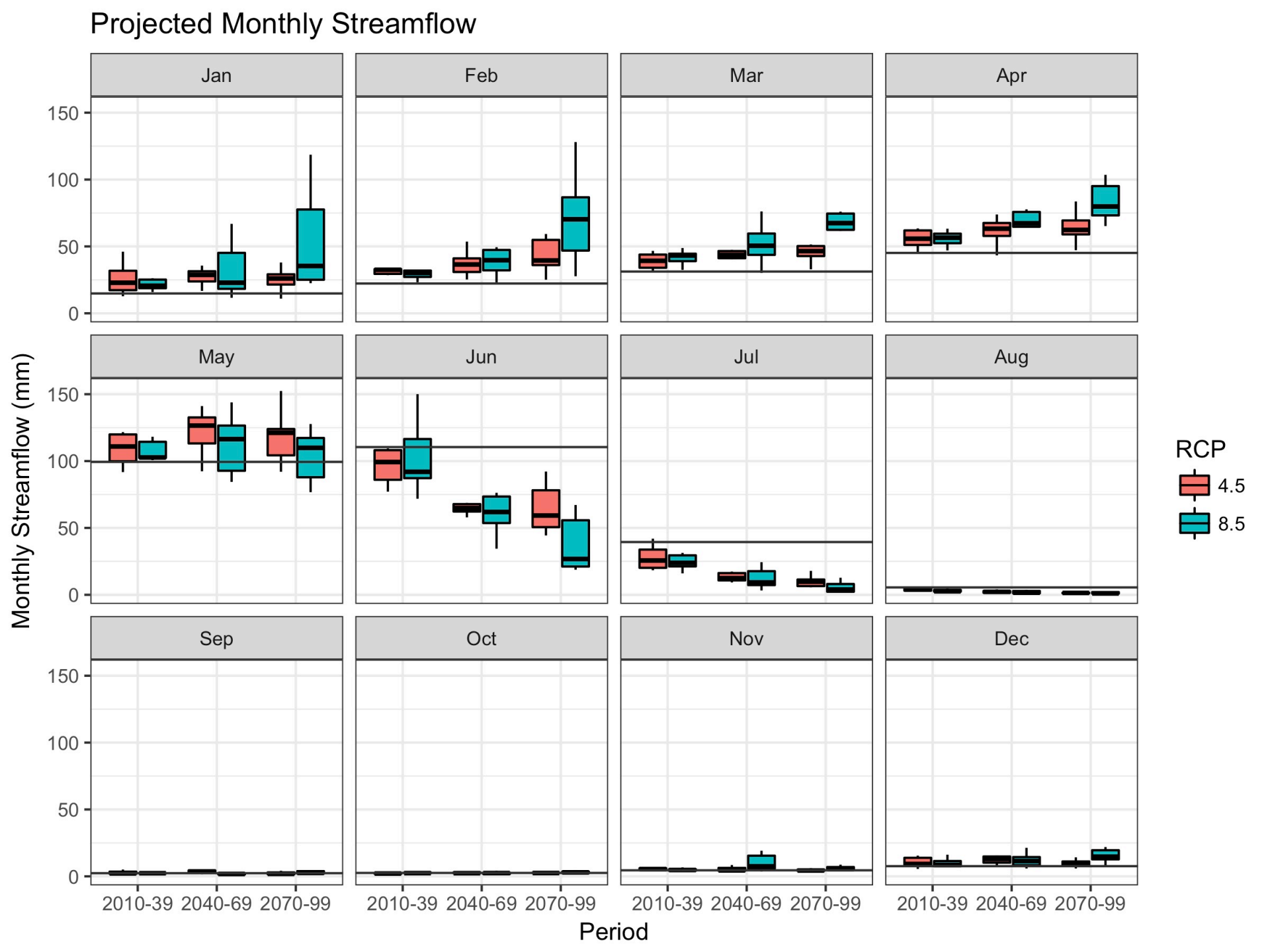

Mean Annual Precipitation
Historical
End of Century (RCP4.5)
End of Century (RCP8.5)
Bishop
Visalia
Porterville
37.5°N
37°N
36.5°N
36°N
Latitude
119.5°W
119°W
118.5°W
118°W
Longitude
Precipitation (mm)
100-300
300-500
500-700
700-900
900-1100
1100-1300
1300-1500
1500-1700
1700-1900

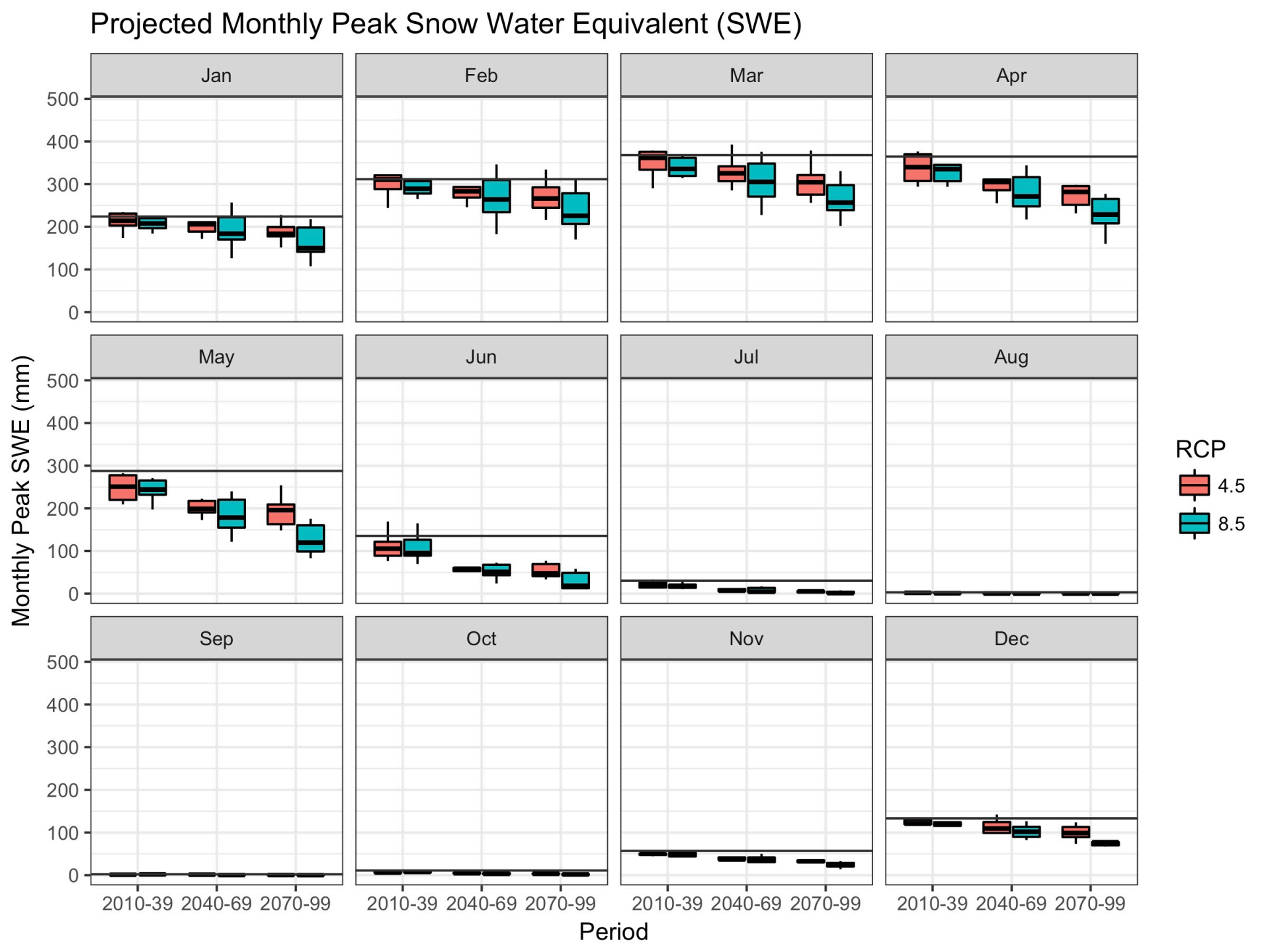

Projected Change in Annual Precipitation
Change in Annual Precipitation (mm)
400
200
0
2010-39
2040-69
2070-99
Period
RCP
4.5
8.5

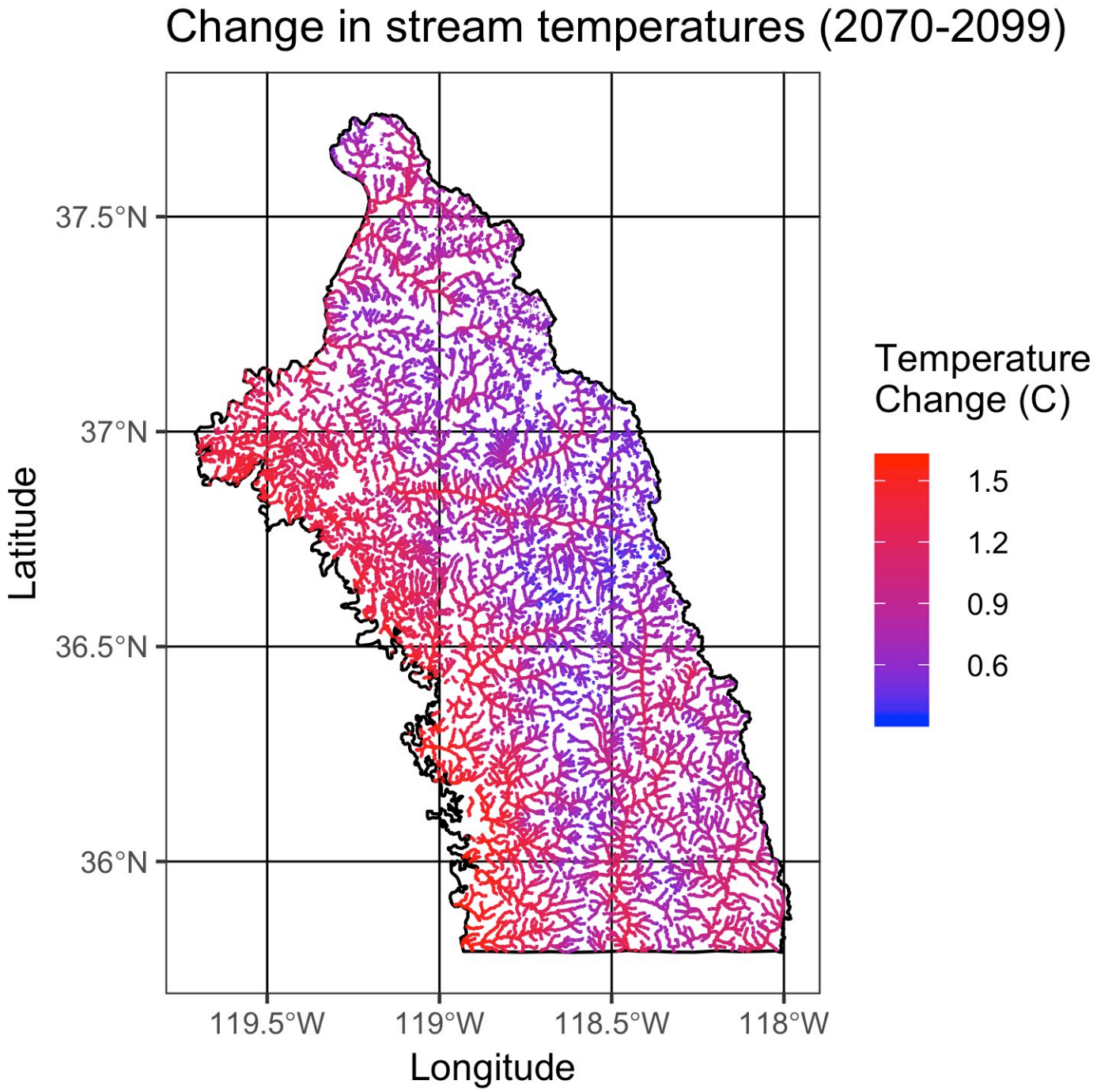
Streamflow, Snowpack and ET

- How will hydrology be altered by climate change in the Southern Sierra Region?
- Variable Infiltration Capacity (VIC) Model
  - Compatible with climate/precipitation projections


Projected Annual Streamflow
Annual Streamflow (mm)
700
600
500
400
300
2010-39
2040-69
2070-99
Period
RCP
4.5
8.5

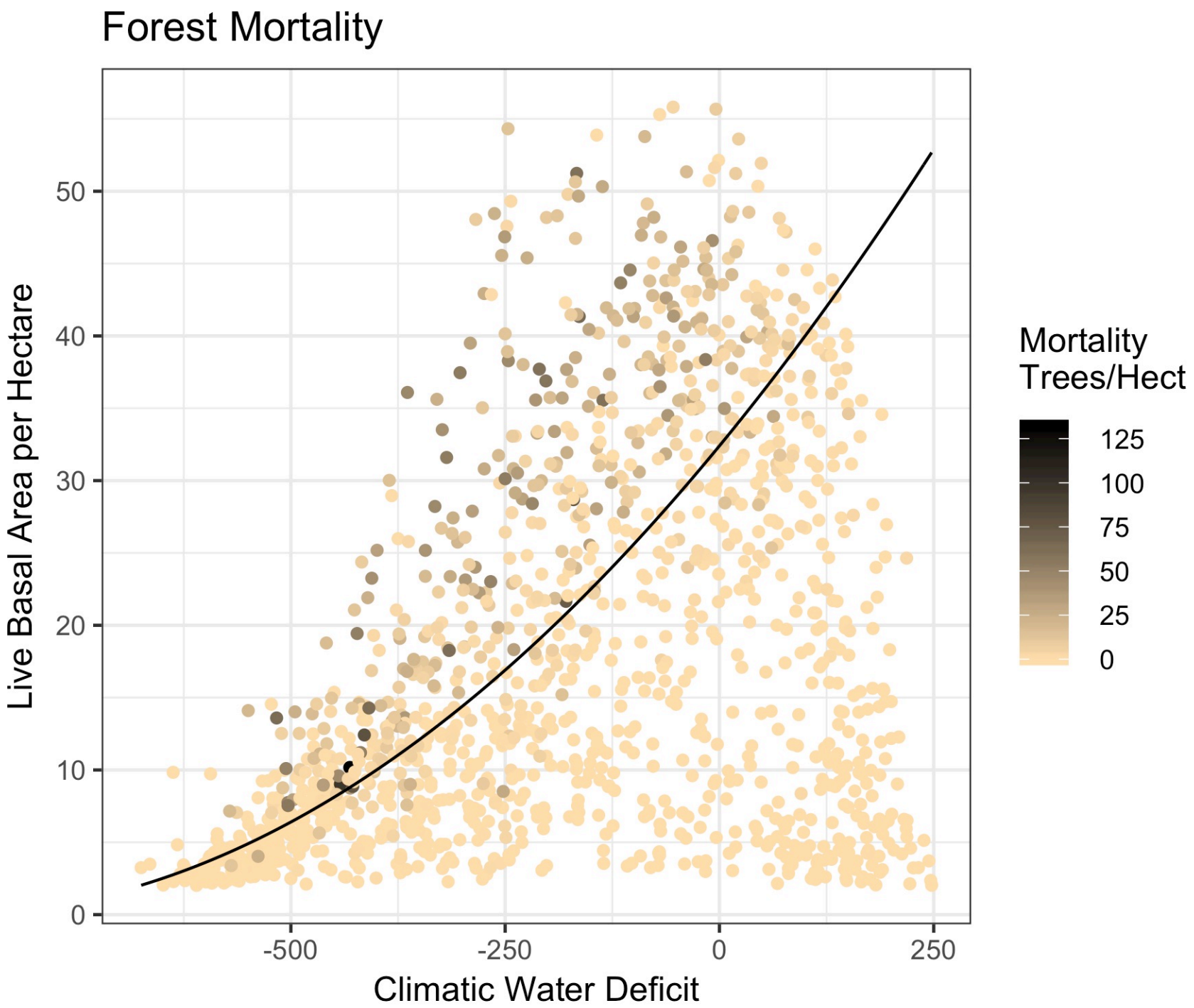

Projected Monthly Streamflow
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
150
100
50
0
Monthly Streamflow (mm)
2010-39
2040-69
2070-99
Period
RCP
4.5
8.5


Projected Monthly Peak Snow Water Equivalent (SWE)
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
0
100
200
300
400
500
Monthly Peak SWE (mm)
2010-39
2040-69
2070-99
Period
RCP
4.5
8.5


Change in stream temperatures (2070-2099)
37.5°N
37°N
36.5°N
36°N
Latitude
119.5°W
119°W
118.5°W
118°W
Longitude
Temperature Change (C)
1.5
1.2
0.9
0.6

Forest Mortality

- What is the potential effect of climate change on forest mortality in the Southern Sierra Region?
- Forest Health Protection Aerial Detection Survey database
  - GIS database of estimated forest mortality for sampled locations
- Climatic Water Deficit (annual precipitation – annual potential ET) at a location.


Forest Mortality
Live Basal Area per Hectare
0
10
20
30
40
50
-500
-250
0
250
Climatic Water Deficit
Mortality
Trees/Hect
125
100
75
50
25
0