Downscaled Microclimates

John Dingman
USGS – Sacramento, CA
jdingman@usgs.gov

Talk Outline

- Overview of the GCMs
- Processing Steps
  - Progress
- Look at completed datasets

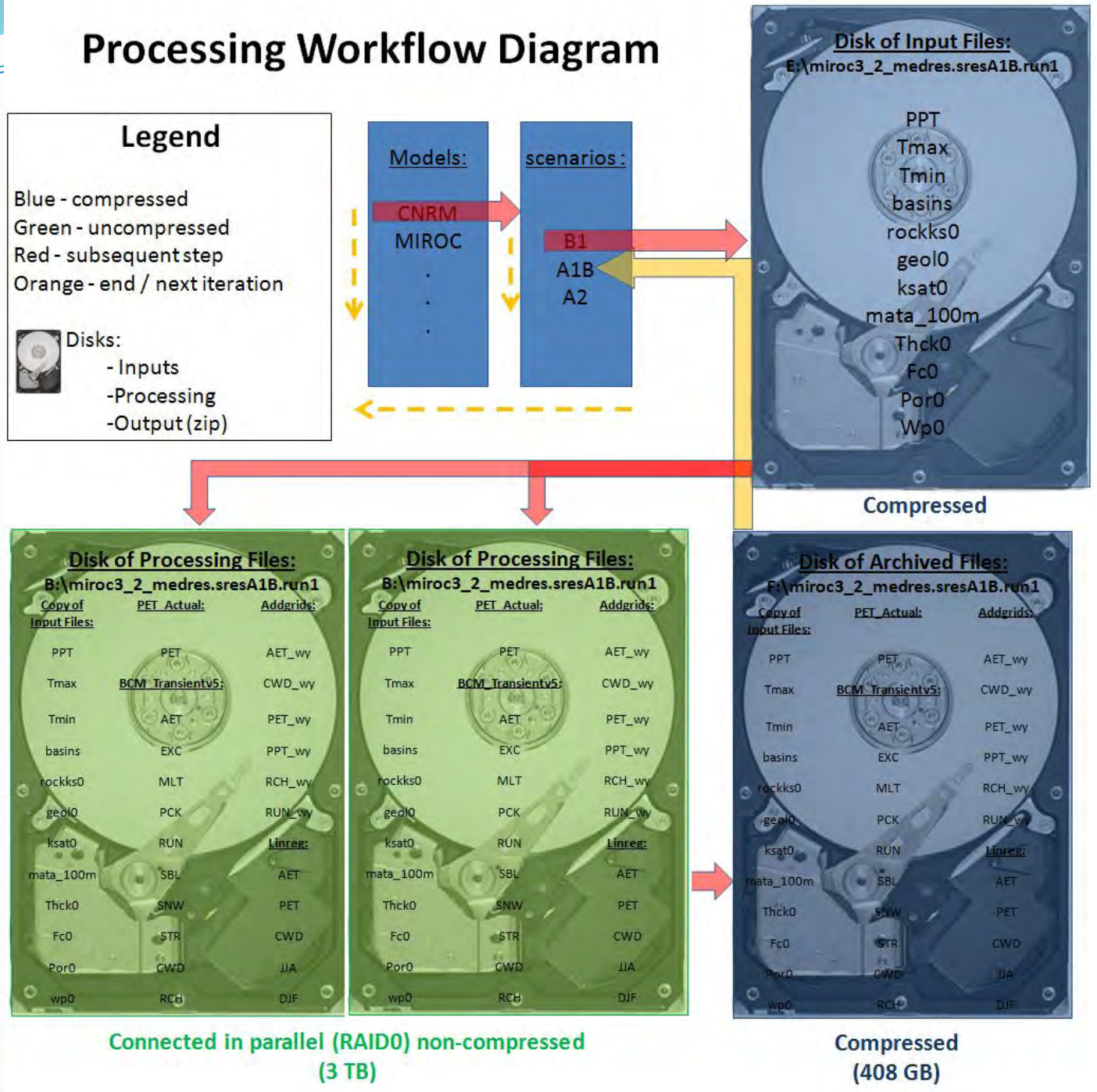
Global Climate Models (GCMs)

- CMIP 3:
  - 23 Models
  - Scenarios:
    - B1
    - A1B
    - A2
- CMIP 5:
  - 20 Models
  - Scenarios:
    - RCPs (2.6, 4.5, 6.0, 8.5)
- Variables
  - ppt, tmn, tmx, (tas)

Processing Steps

- Reproject:
  - WGS84 -> CA Teale Albers NAD83
  - Bilinear image resampling
- Regrid:
  - 800m -> 270m
- PET:
- BCM (monthly):
  - AET, EXC, MLT, PCK, SBL, SNW, STR, CWD, RCH, RUN
- Addgrids (WY, Oct. 1- Sept. 30):
  - AET, CWD, PET, PPT, RCH, RUN
- Linreg (10 water years):
  - AET, PET, PPT, CWD, DJF, JJA
    - AVE, COV, INT, RSQ, SLP, STD, VAR

Processing Workflow Diagram



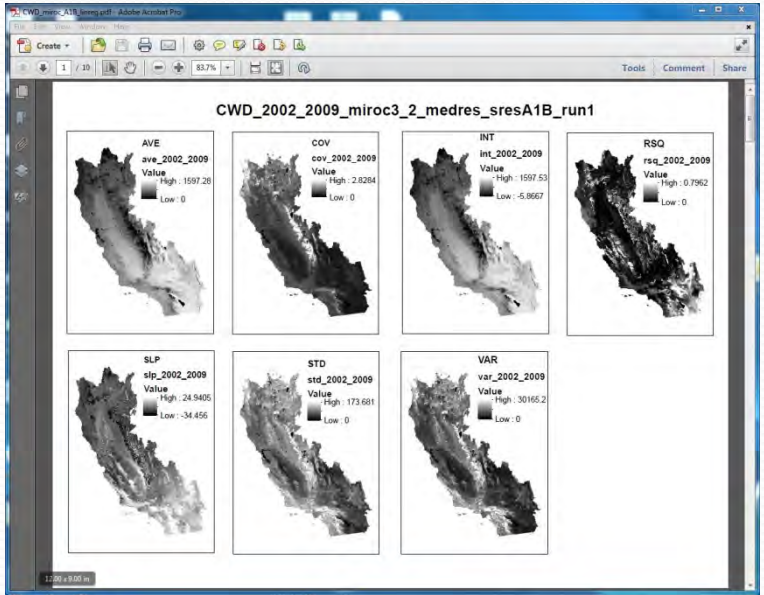
Linreg Proofs

- Variables:
  - AET, PET, PPT, CWD, DJF, JJA
- Using python arc.mapping – proofs
  - Allows for automated map creation and away to check the datasets

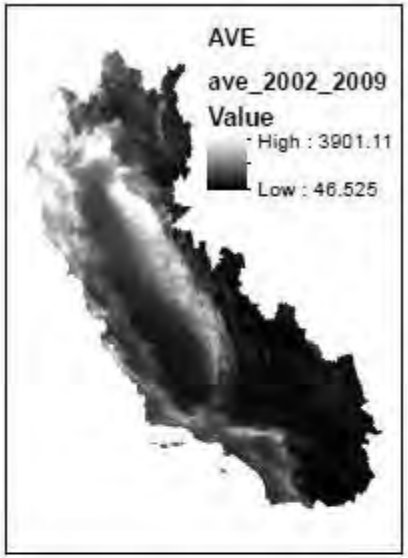
Proof_linreg_pet_2010_2019.py - C:\Proof_linreg_pet_2010_2019.py

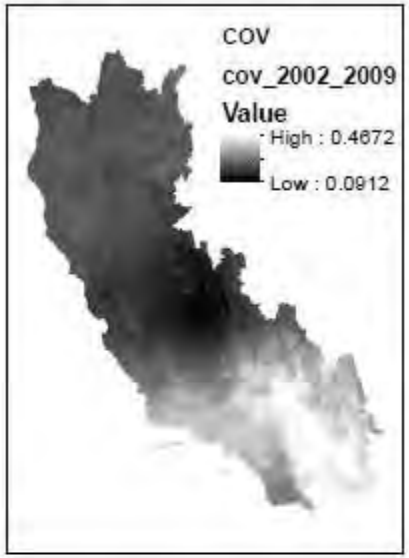
File Edit Format Run Options Windows Help

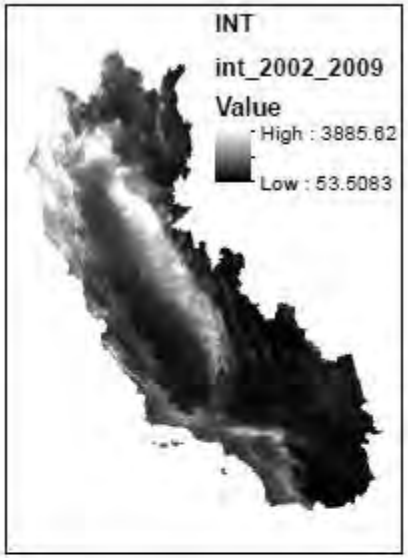
```
# Addgrids_proof
# Created on: 2012-09-01
# Created by: John Dingman (jdingman@usgs.gov)
# Description: Creates proofs of 6 output variables from addgrids.exe (AET, CWD,
# ---------------------------------------------------------------------------

# Import arcpy module
import arcpy
arcpy.env.overwriteOutput = True

### AVE
# Local variables:
ave_2010_2019_asc = "E:\\miroc3_2_medres.sresA1B.run1\\pet2010_2019_ave_miroc3_2
ave_2010_2019 = "E:\\miroc3_2_medres.sresA1B.run1\\ave_2010_2019"
ave_2010_2019_asc2 = "E:\\miroc3_2_medres.sresA1B.run1\\ave_2010_2019"
Output_raster_layer_ave = "ave_2010_2019"
ave_2010_2019_lyr = "E:\\miroc3_2_medres.sresA1B.run1\\ave_2010_2019.lyr"

# Process: ASCII to Raster
arcpy.ASCIIToRaster_conversion(ave_2010_2019_asc, ave_2010_2019, "FLOAT")

# Process: Build Pyramids And Statistics
arcpy.BuildPyramidsandStatistics_management(ave_2010_2019_asc2, "INCLUDE_SUBDIRE

# Process: Make Raster Layer
arcpy.MakeRasterLayer_management(ave_2010_2019_asc2, Output_raster_layer_ave, ""

# Process: Save To Layer File
arcpy.SaveToLayerFile_management(Output_raster_layer_ave, ave_2010_2019_lyr, "")
```

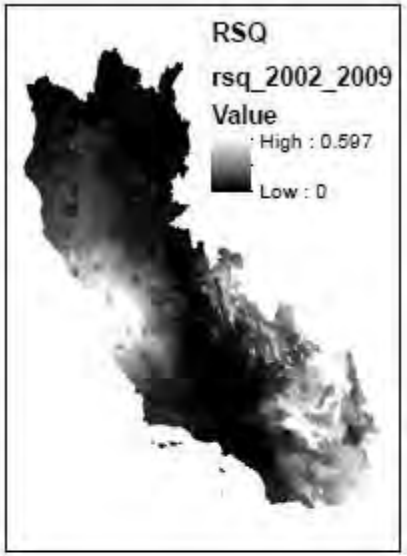


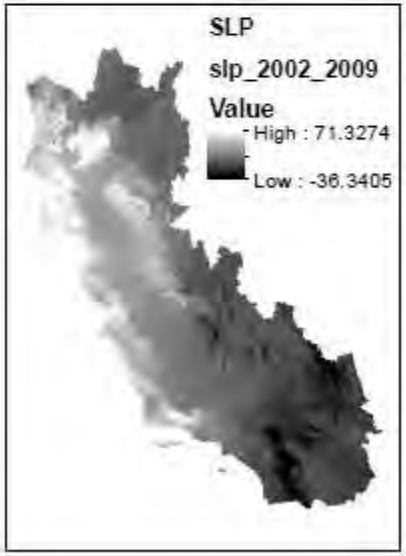
PPT_2002_2009_miroc3_2_medres_sresA1B_run1

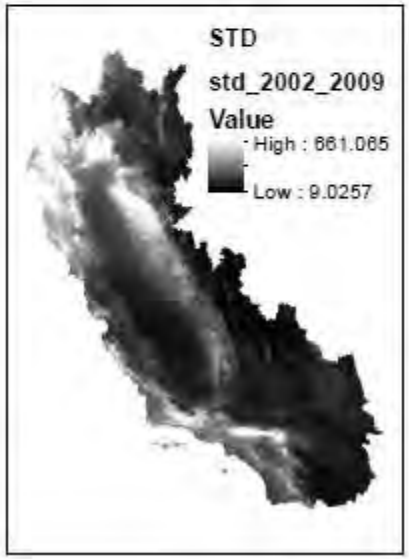


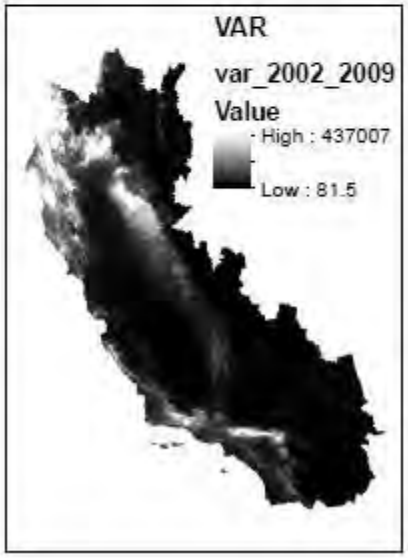












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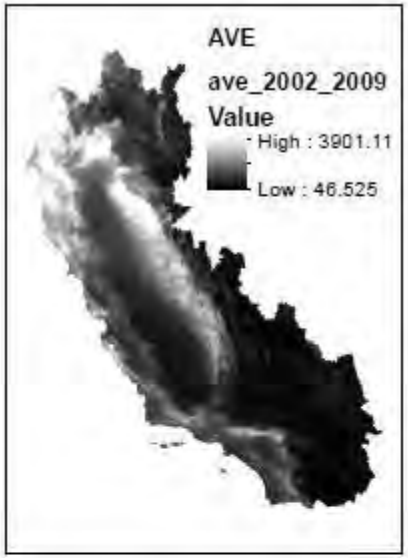
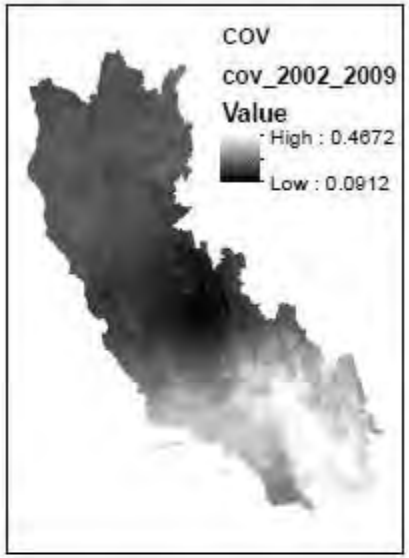
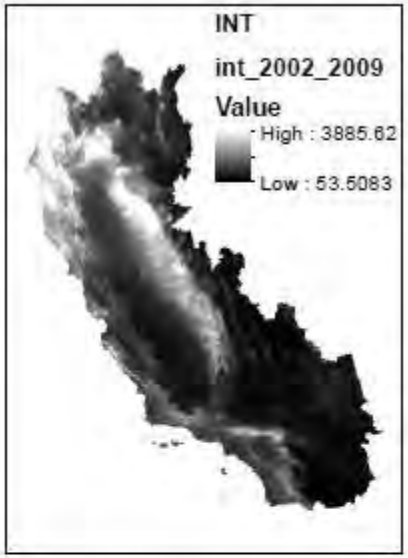
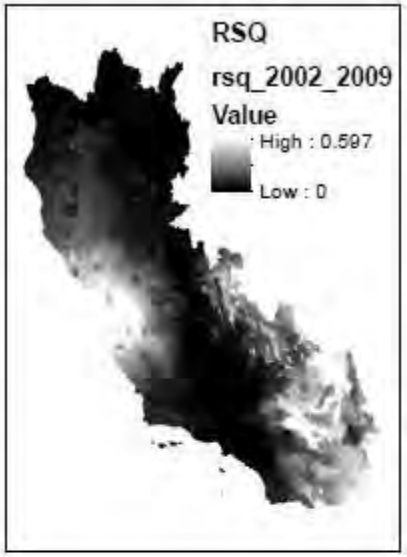
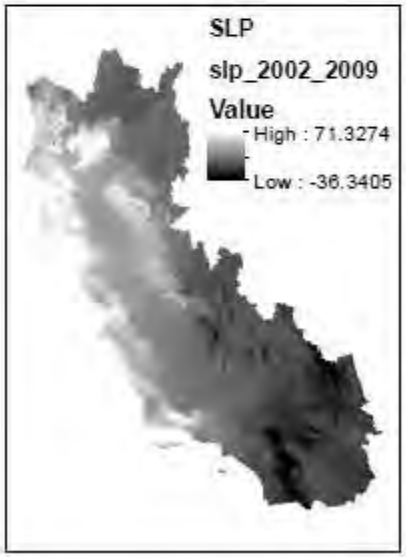
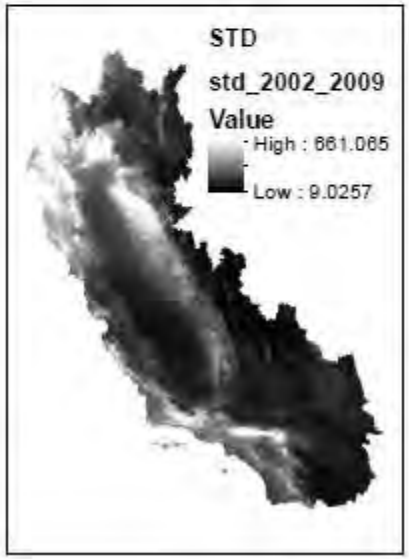


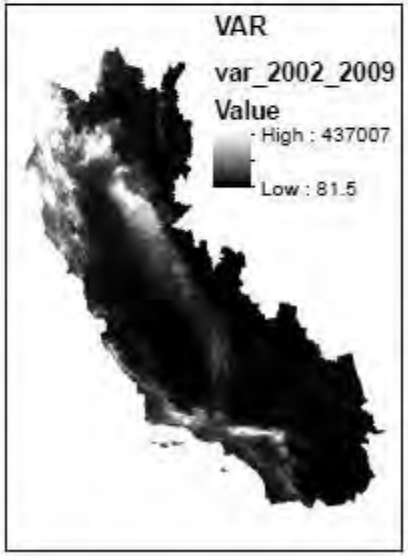








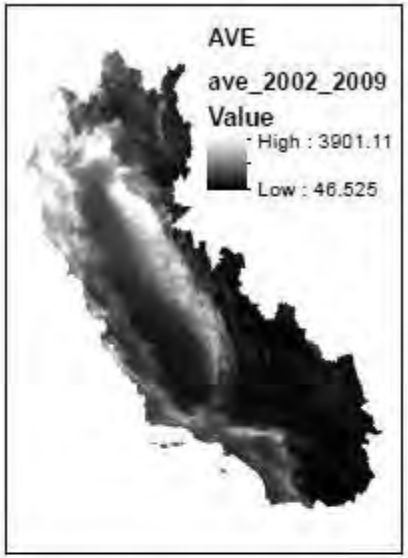


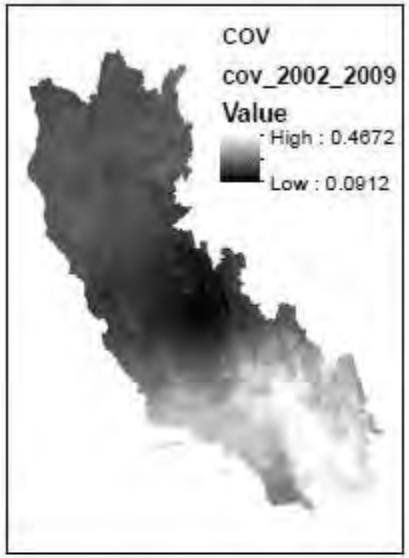


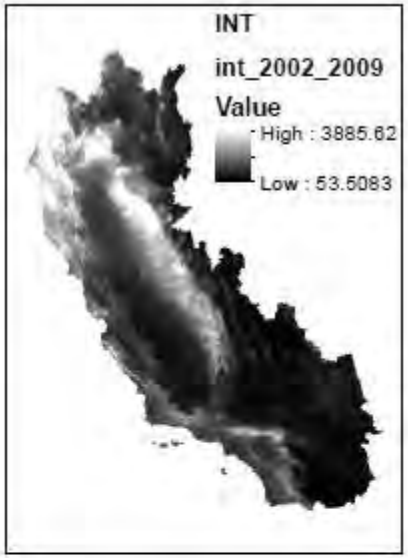
What are we looking at?

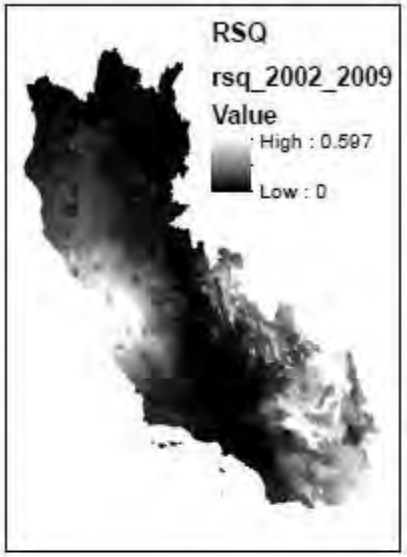
Precipitation

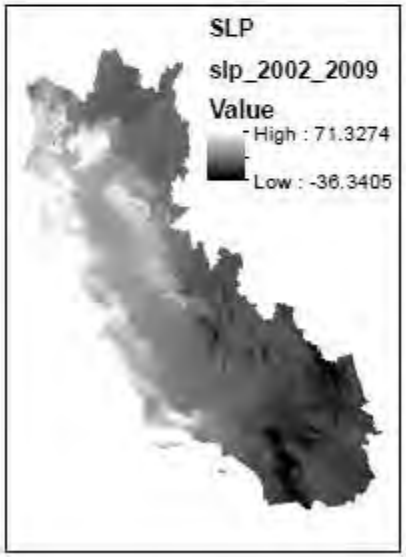
PPT_2002_2009_miroc3_2_medres_sresA1B_run1

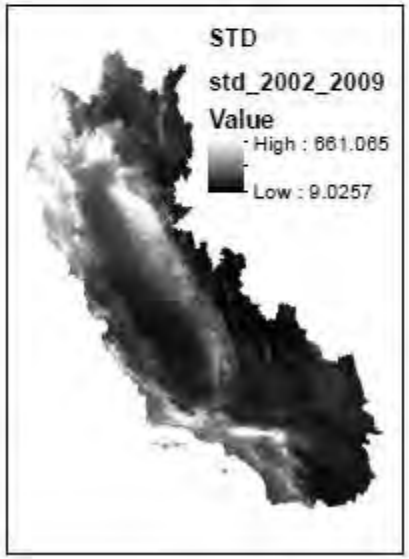


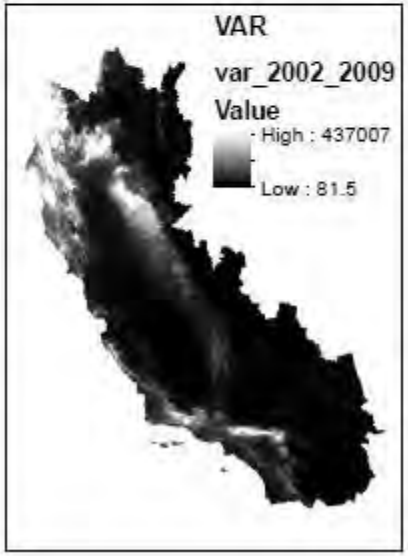








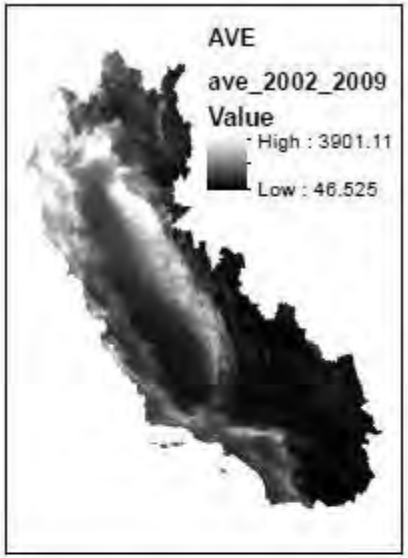


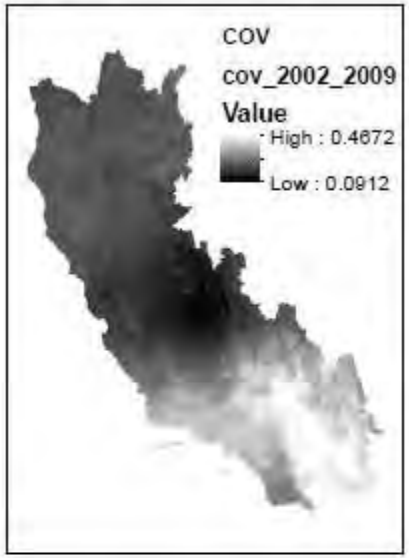


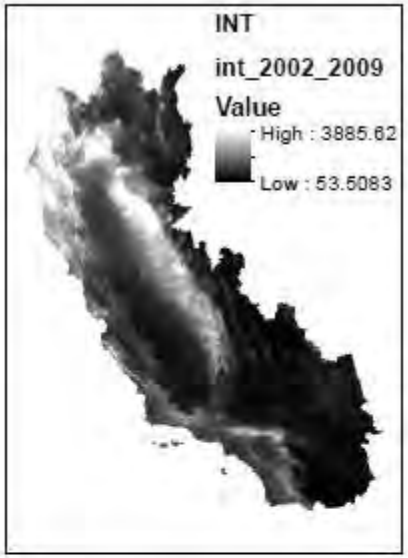
What are we looking at?

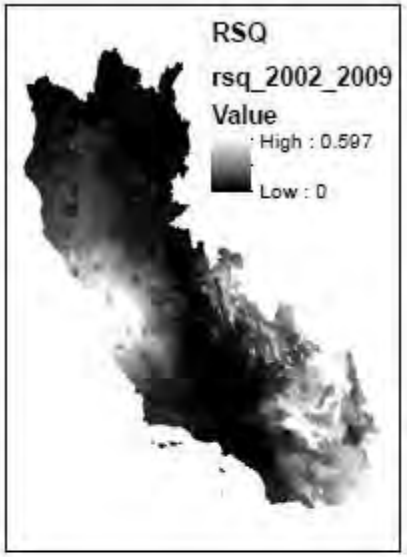
Water year range

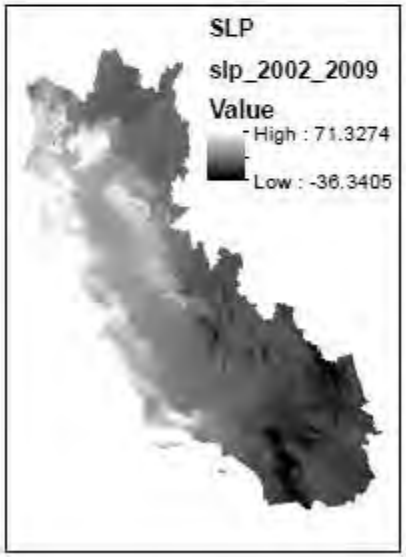
PPT_2002_2009_miroc3_2_medres_sresA1B_run1

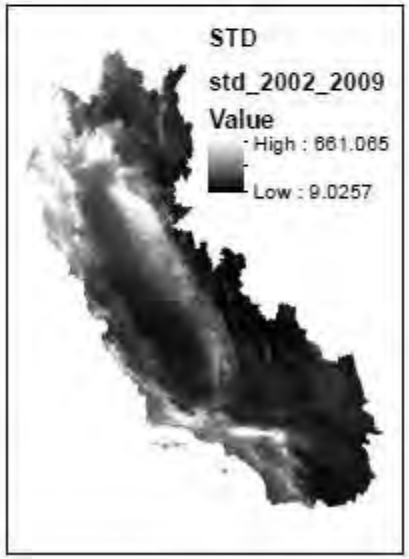


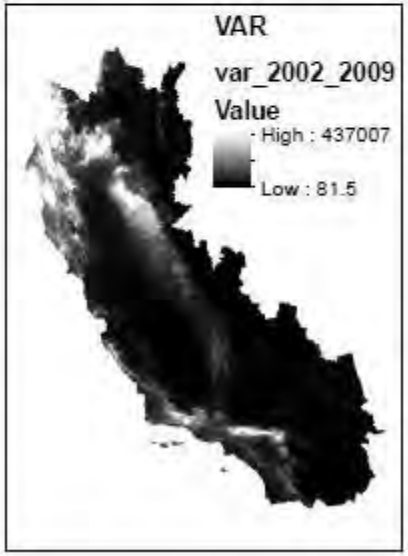








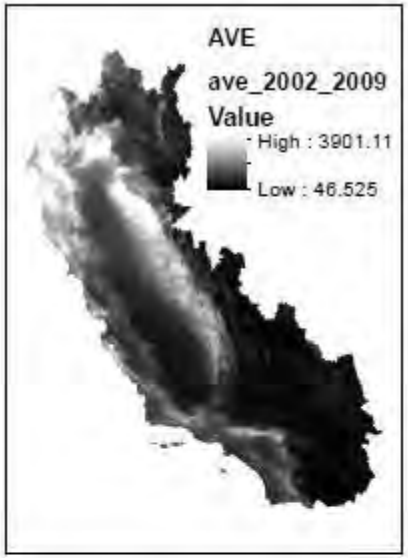


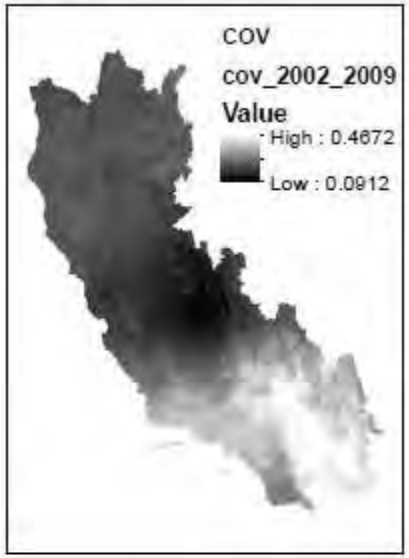


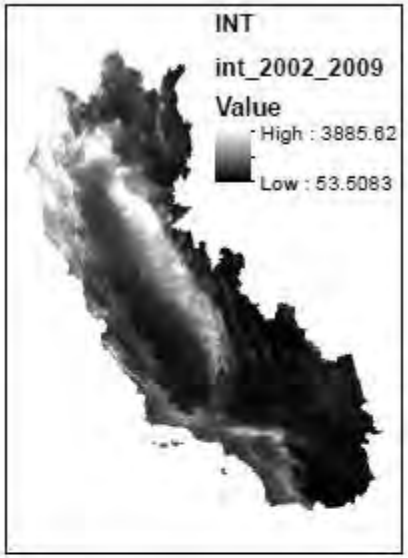
What are we looking at?

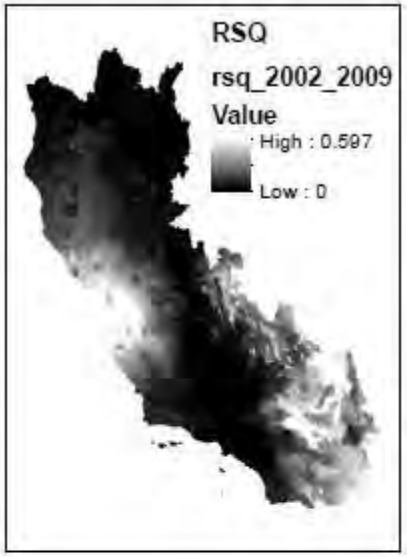
Model name

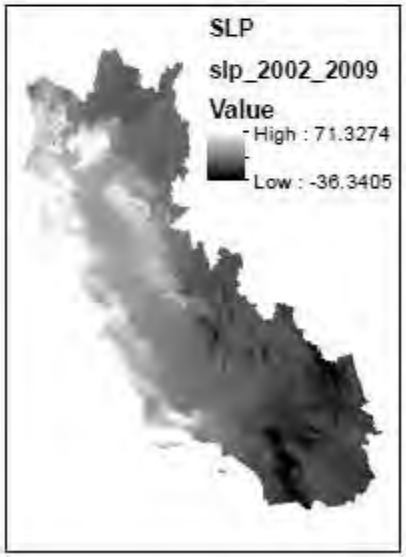
PPT_2002_2009_miroc3_2_medres_sresA1B_run1

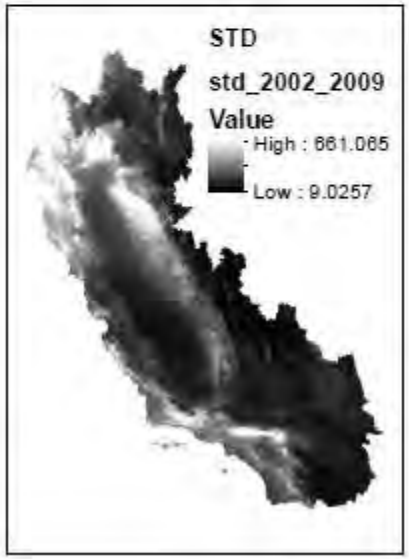


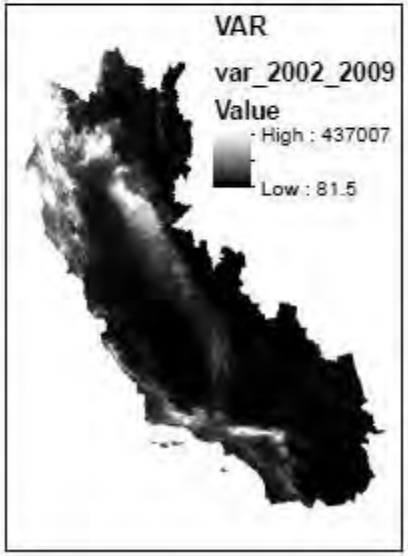








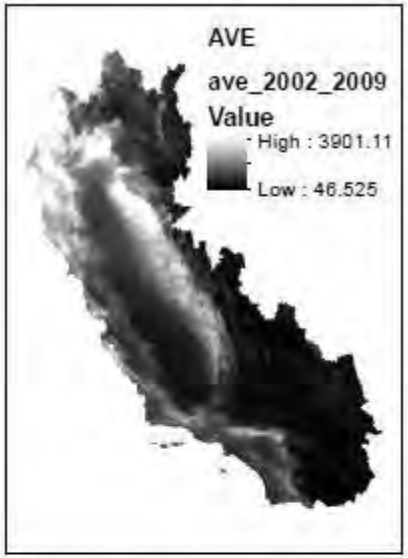


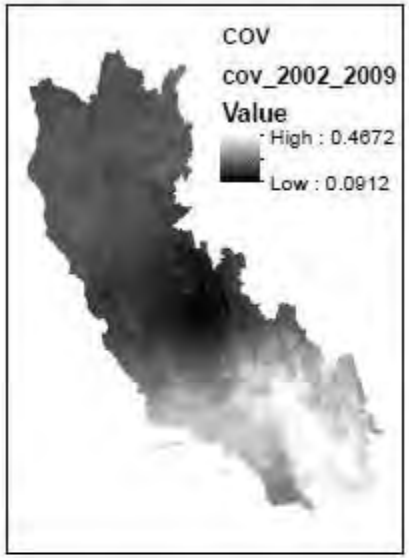


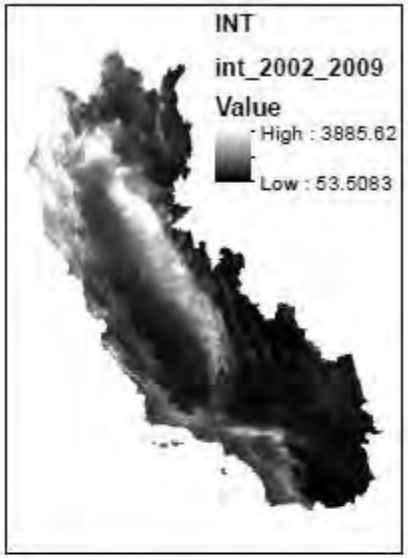
What are we looking at?

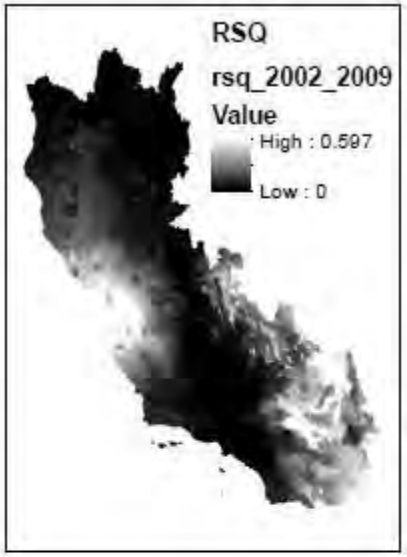
Model scenario

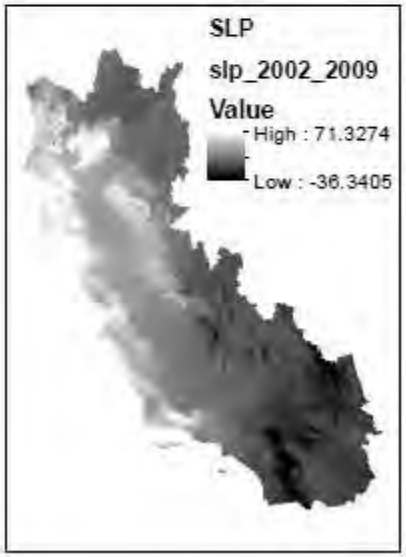
PPT_2002_2009_miroc3_2_medres_sresA1B_run1

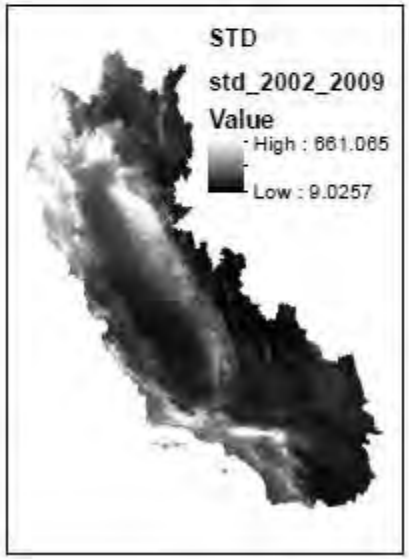


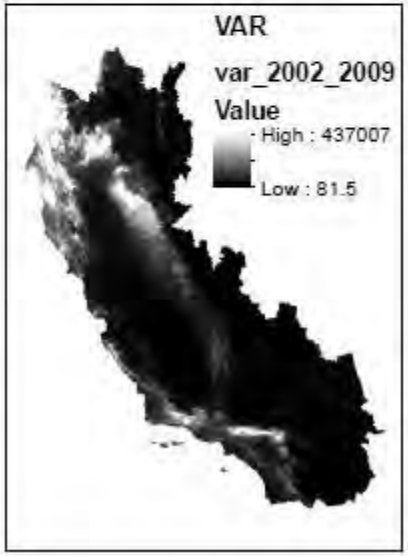








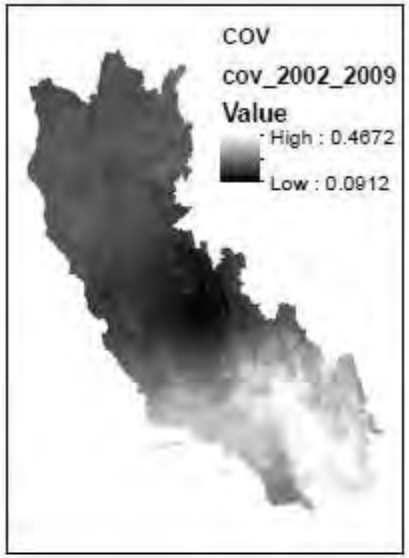


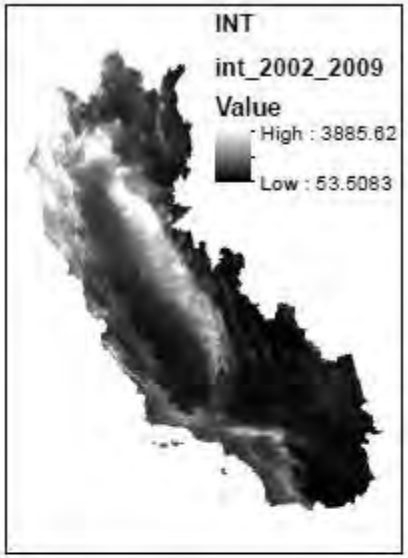


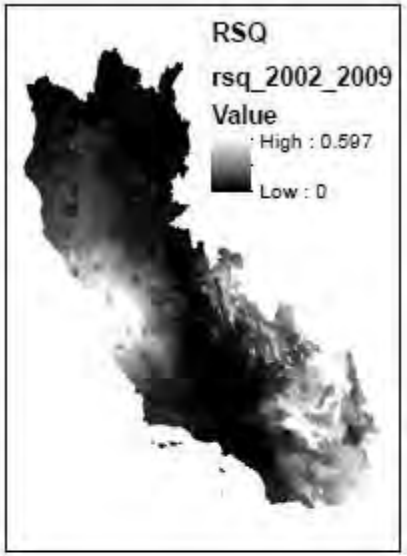
What are we looking at?

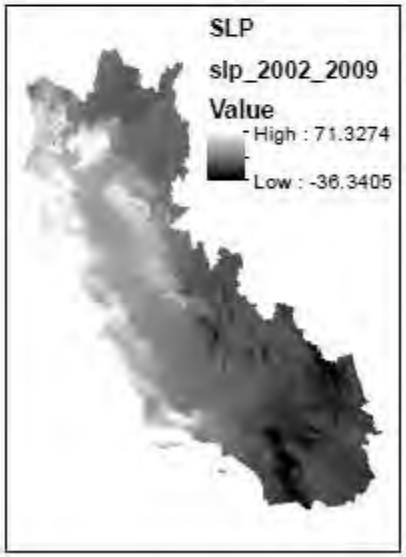
Run number

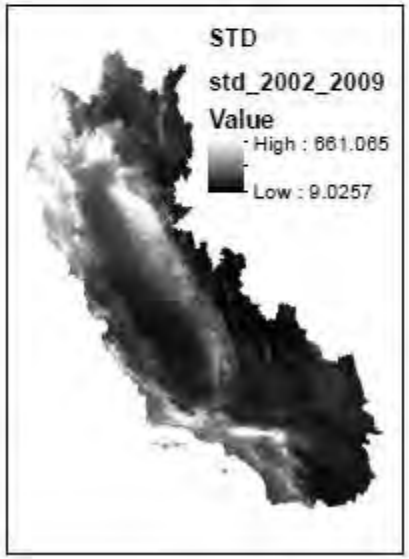
PPT_2002_2009_miroc3_2_medres_sresA1B_run1

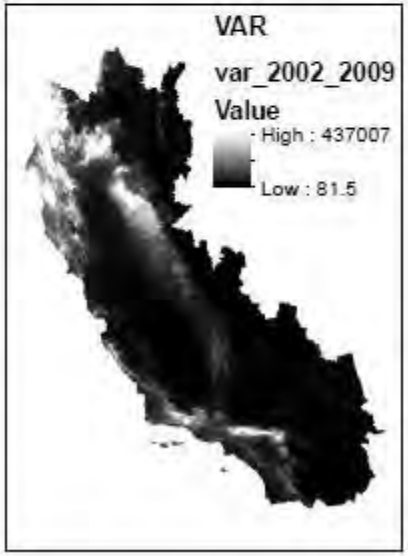










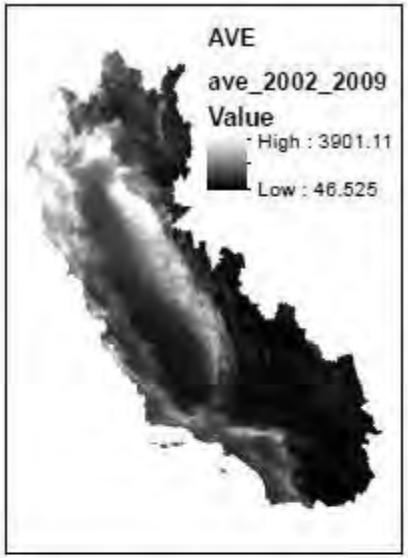


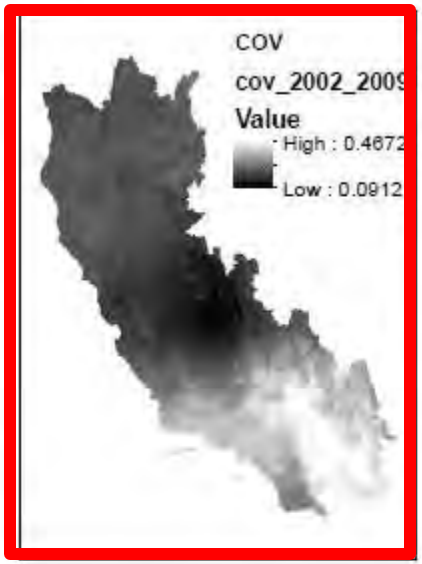
What are we looking at?

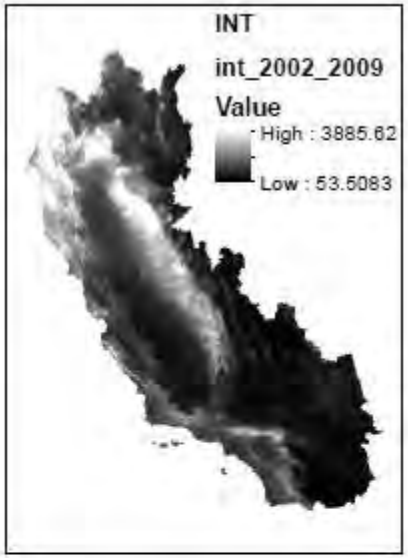
Variables:

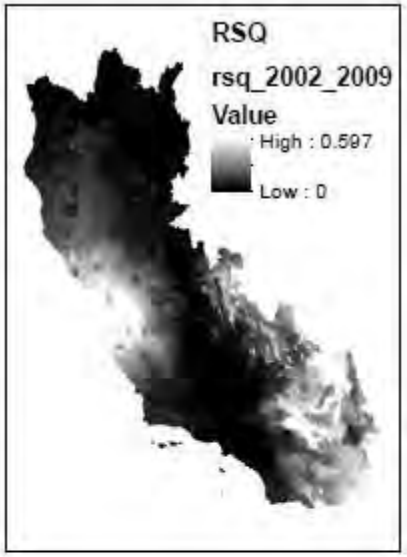
Average

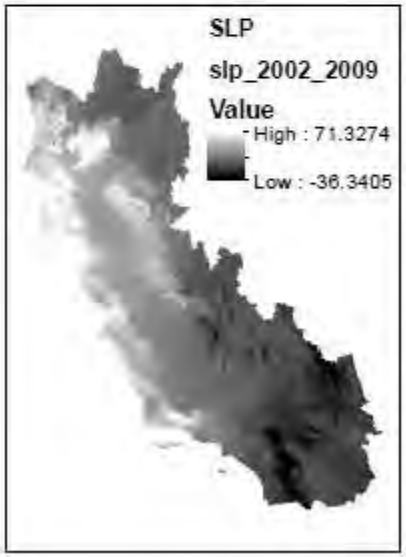
PPT_2002_2009_miroc3_2_medres_sresA1B_run1

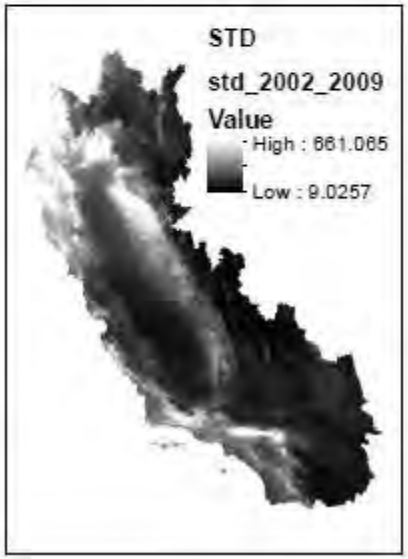


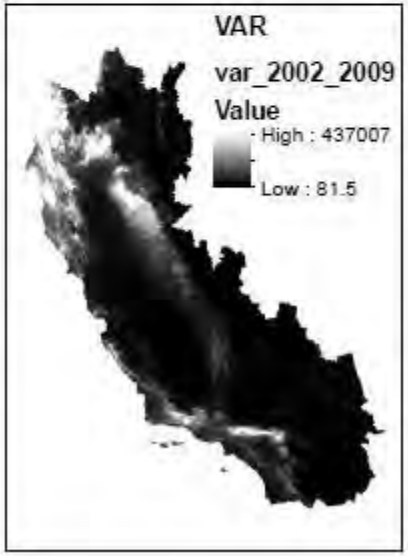










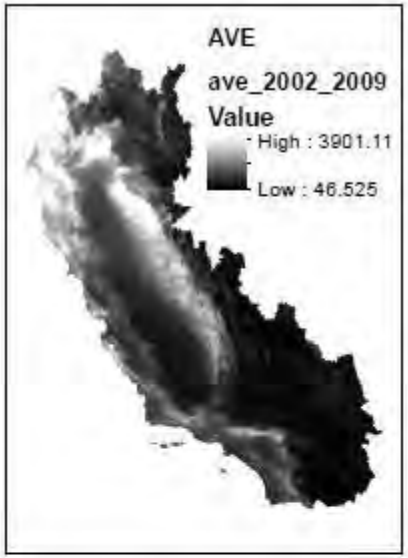


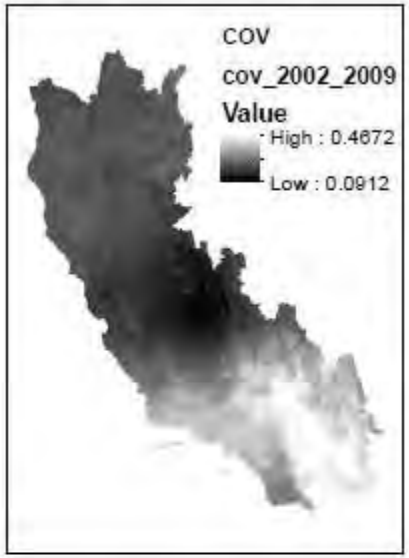
What are we looking at?

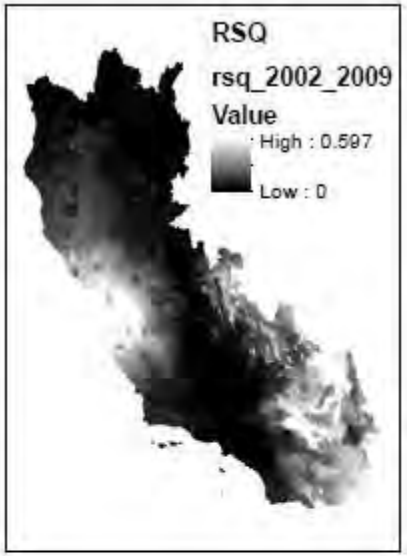
Variables:

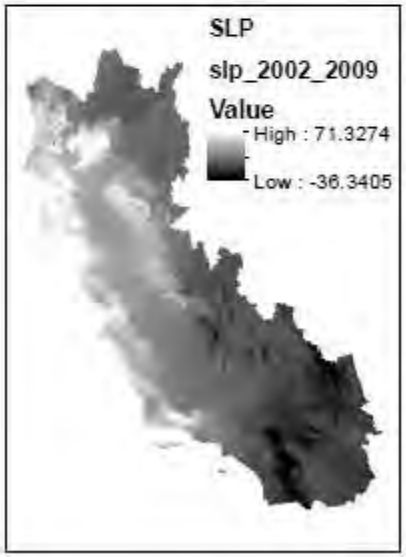
Coefficient of Variation

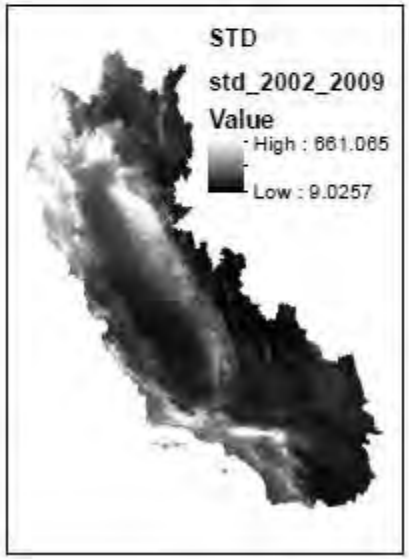
PPT_2002_2009_miroc3_2_medres_sresA1B_run1

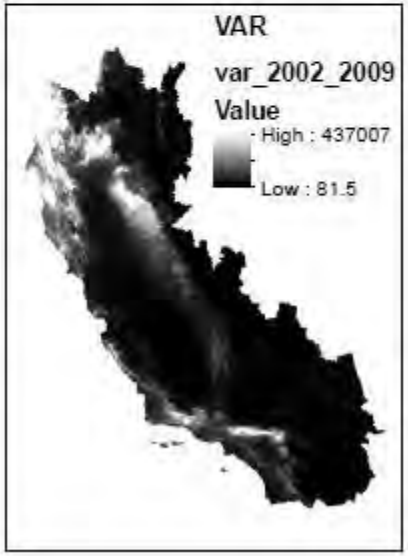










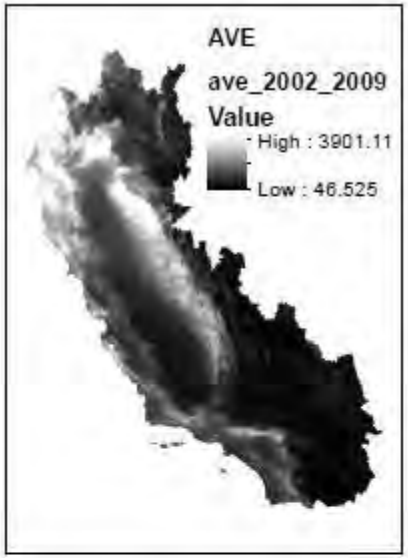


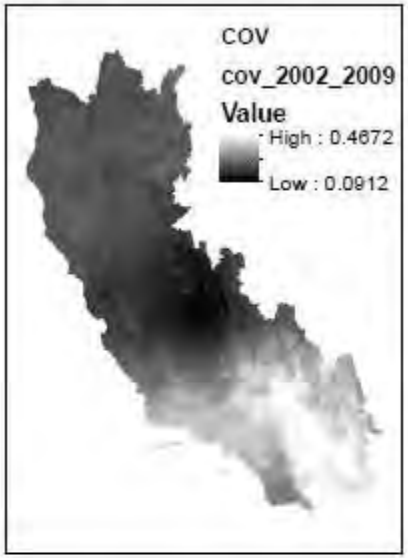
What are we looking at?

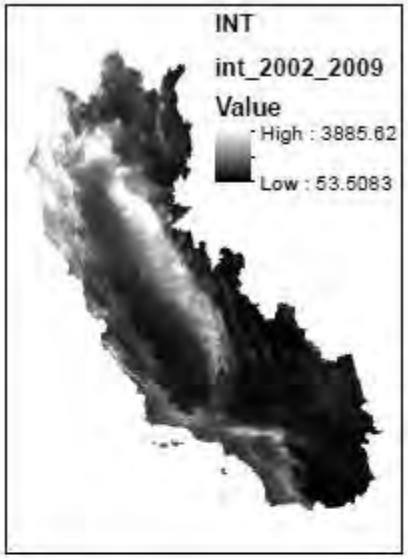
Variables:

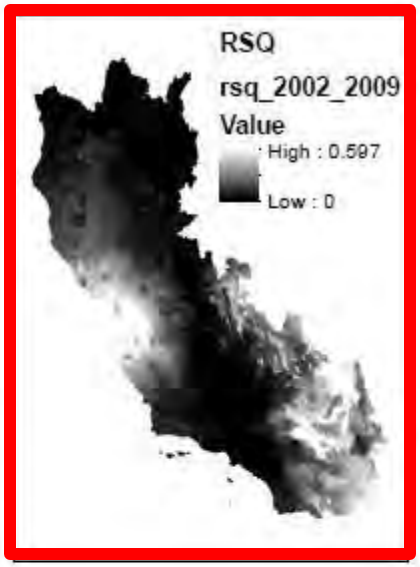
Intercept

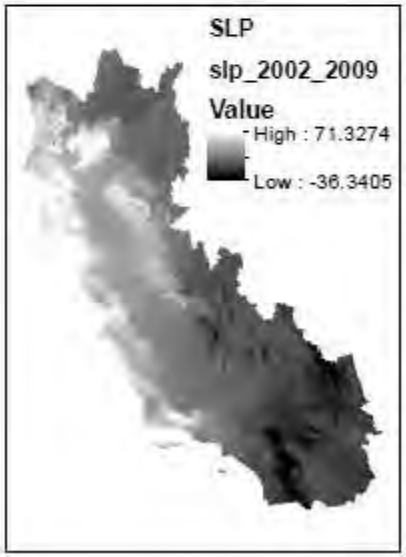
PPT_2002_2009_miroc3_2_medres_sresA1B_run1

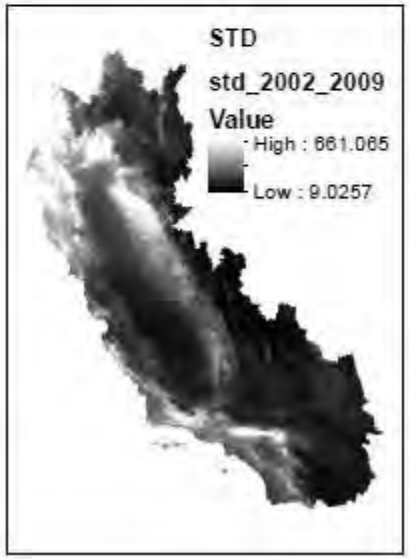


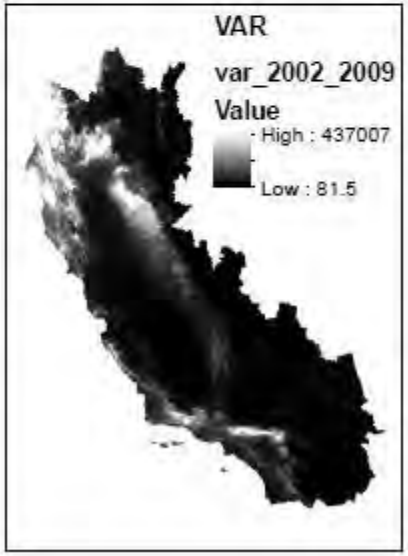










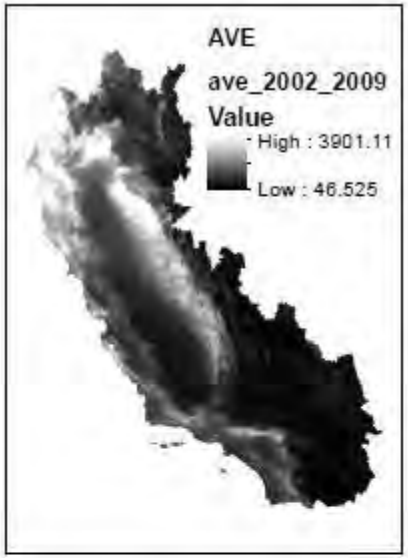


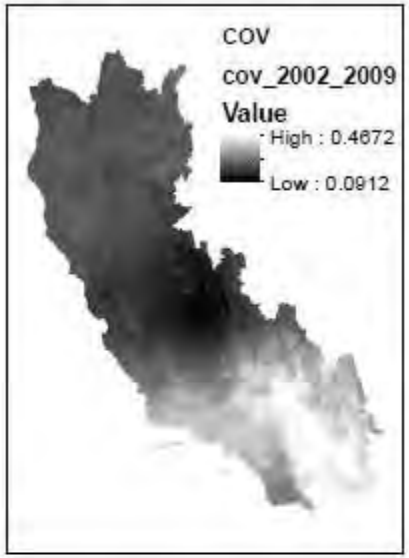
What are we looking at?

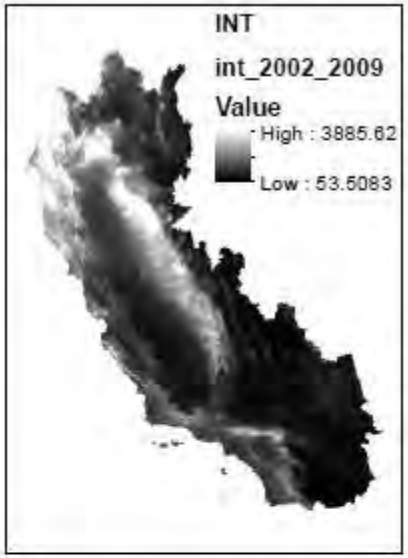
Variables:

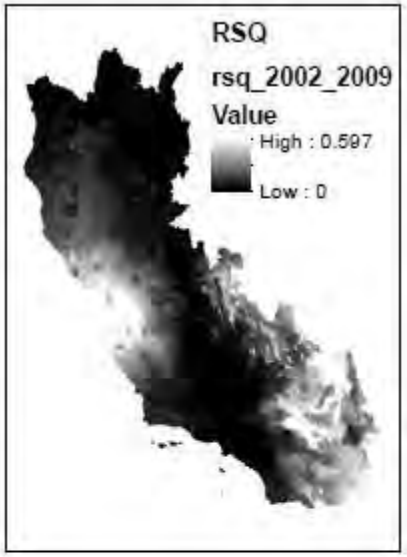
R^2

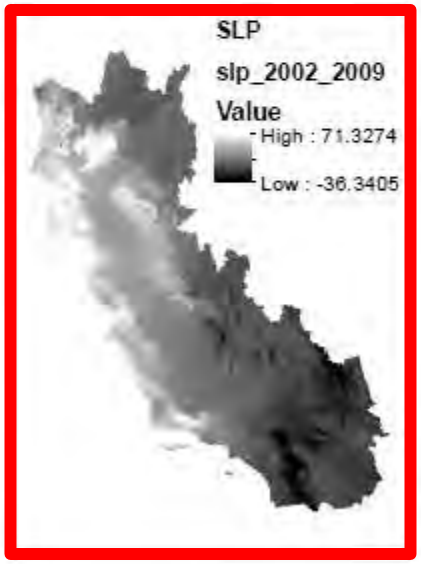
PPT_2002_2009_miroc3_2_medres_sresA1B_run1

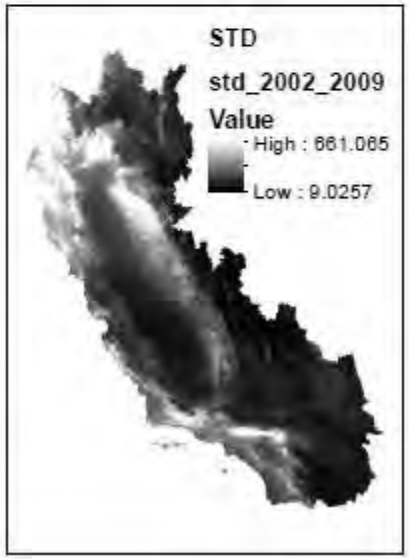


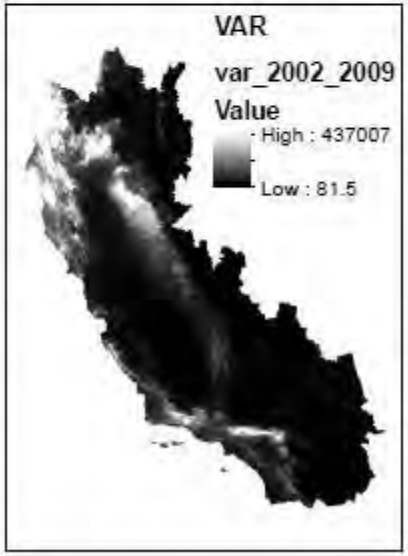










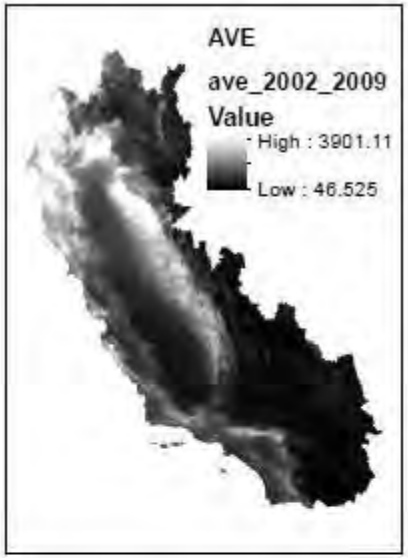


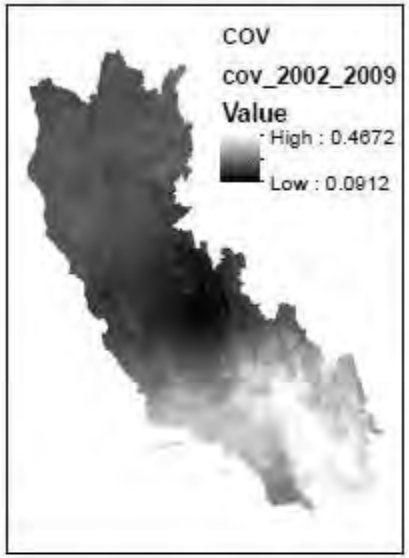
What are we looking at?

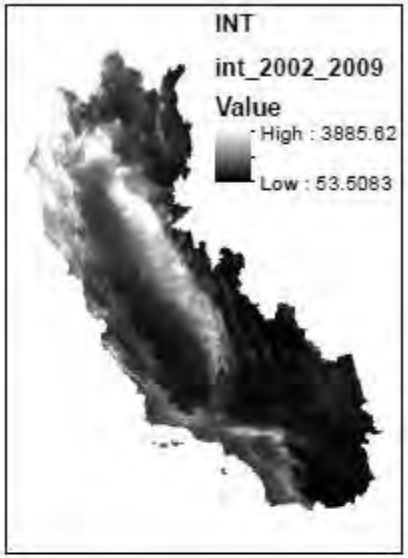
Variables:

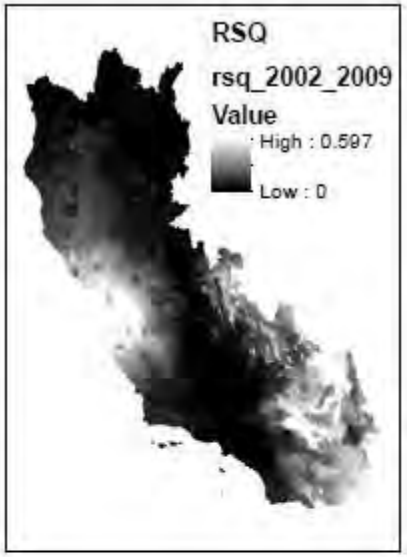
Slope

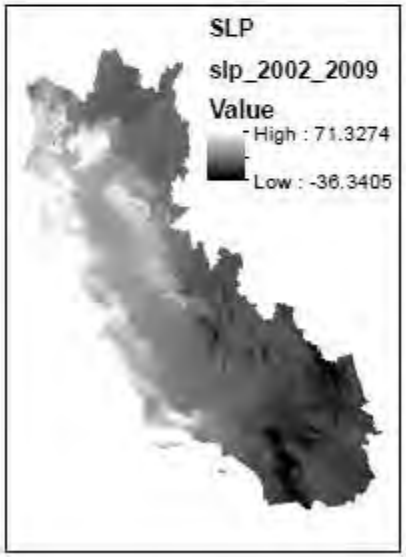
PPT_2002_2009_miroc3_2_medres_sresA1B_run1

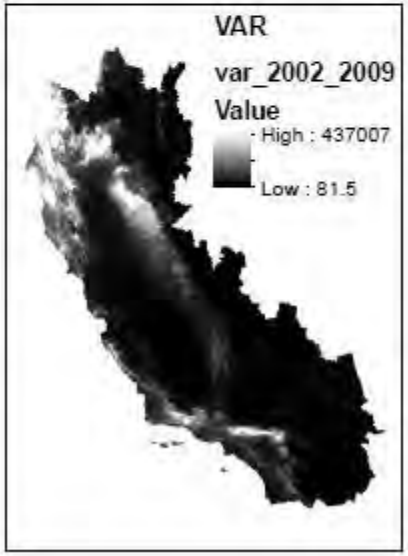










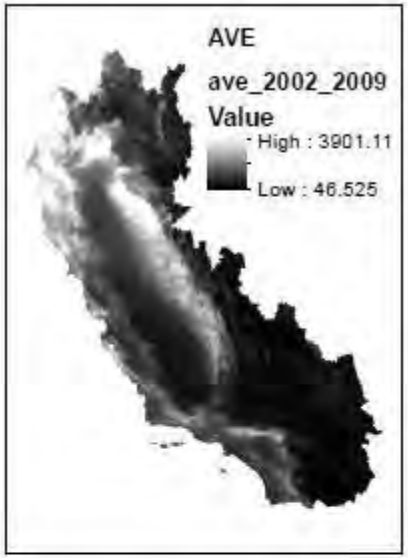


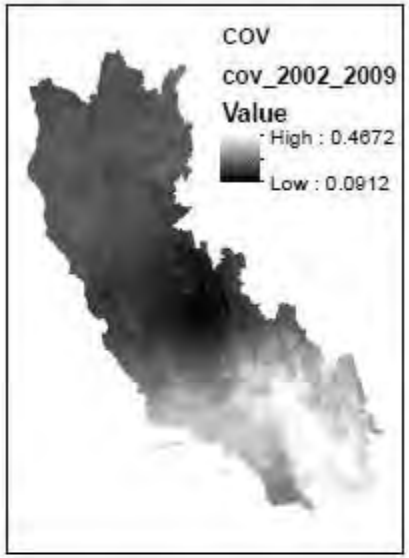
What are we looking at?

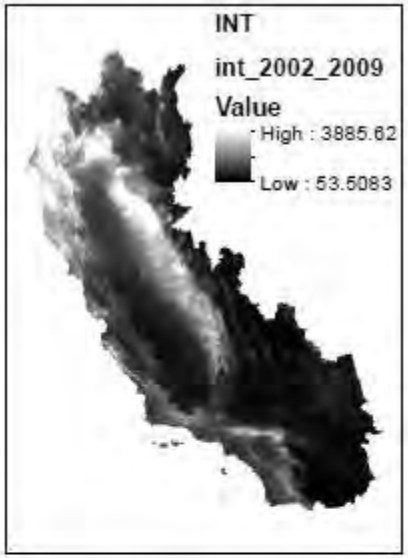
Variables:

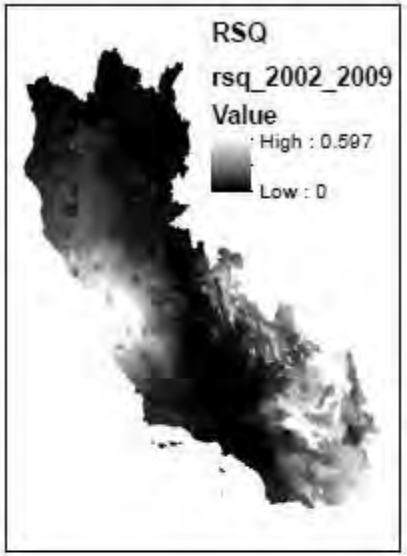
Standard deviation

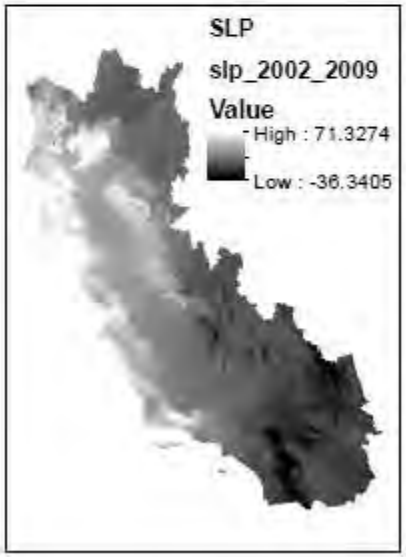
PPT_2002_2009_miroc3_2_medres_sresA1B_run1

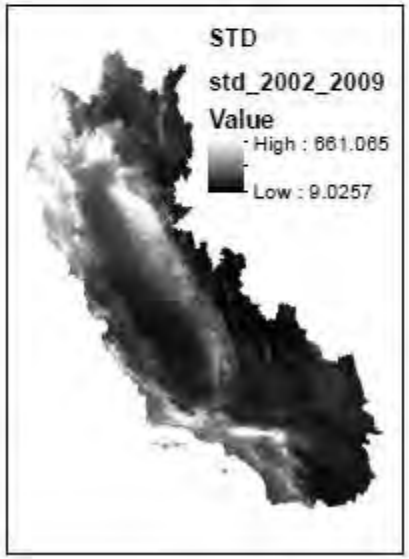










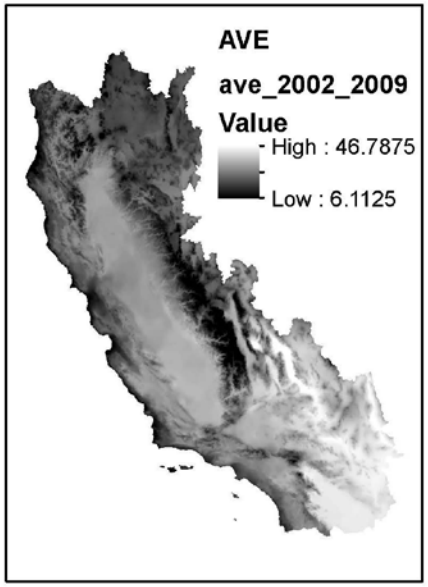


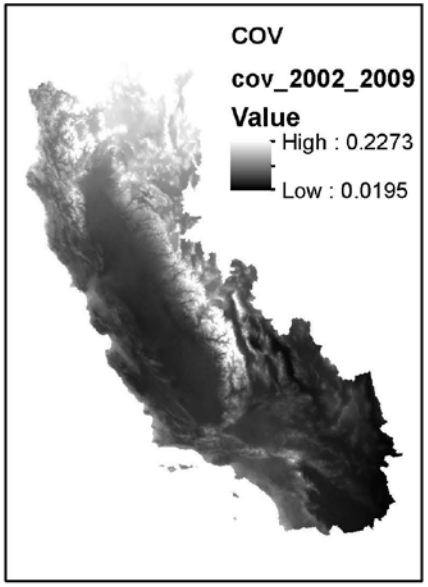
What are we looking at?

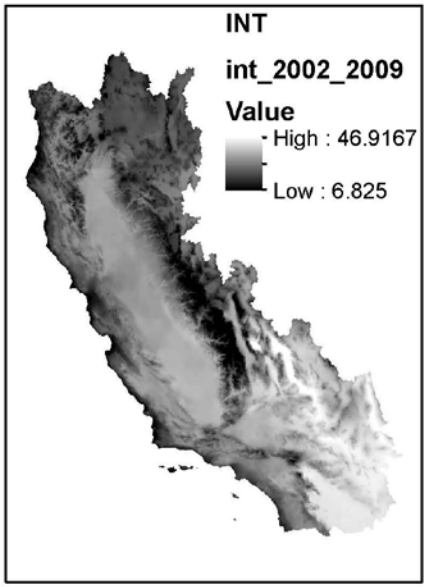
Variables:

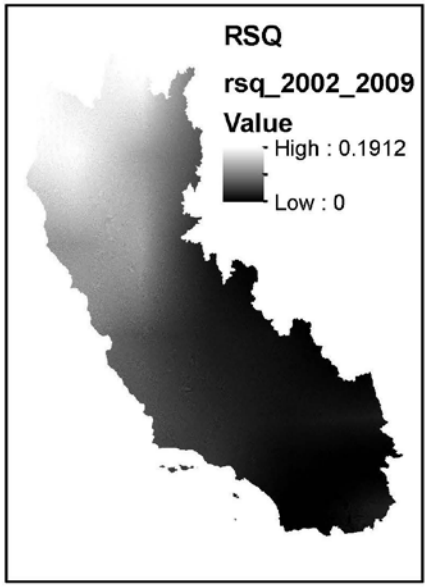
Variance

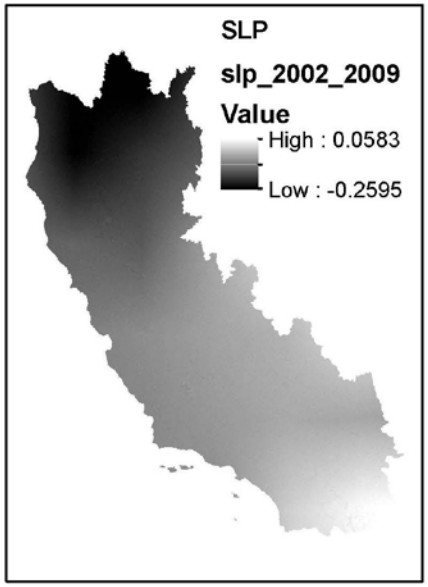
JJA_2002_2009_miroc3_2_medres_sresA1B_run1

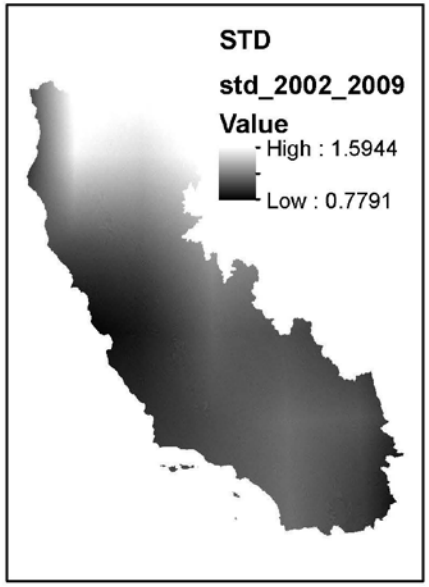


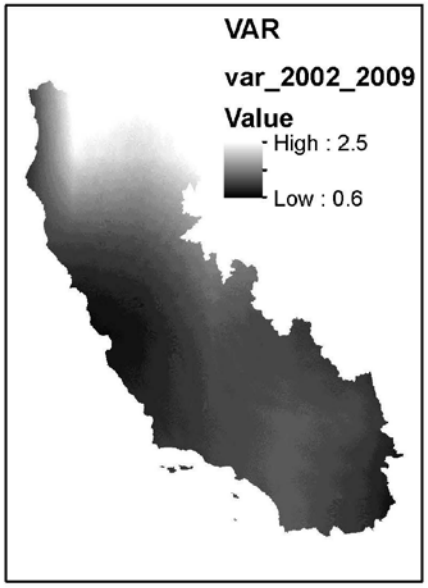




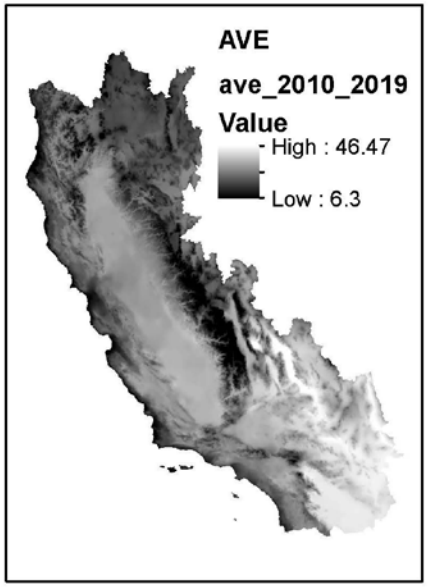


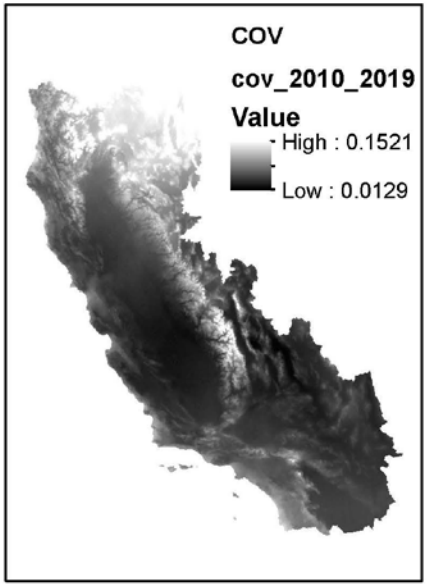


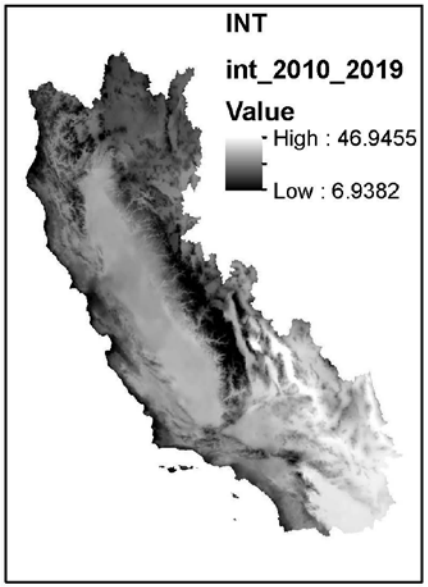


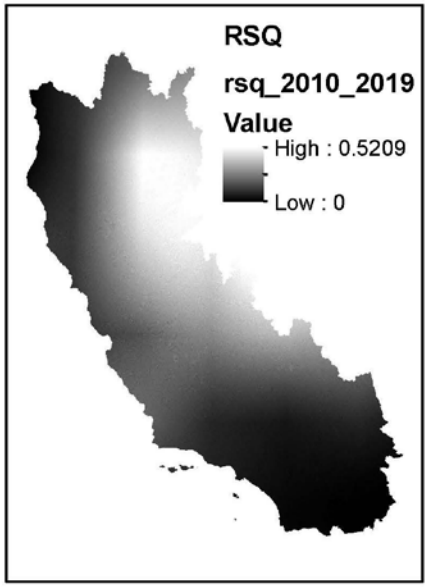


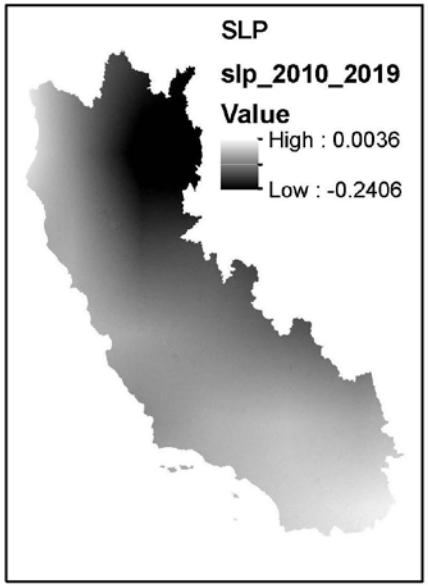
JJA_2010_2019_miroc3_2_medres_sresA1B_run1

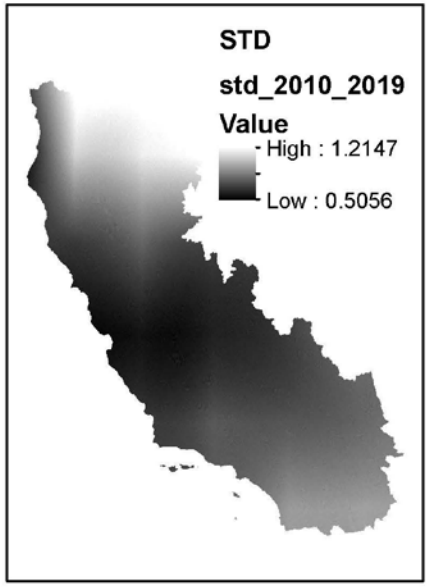


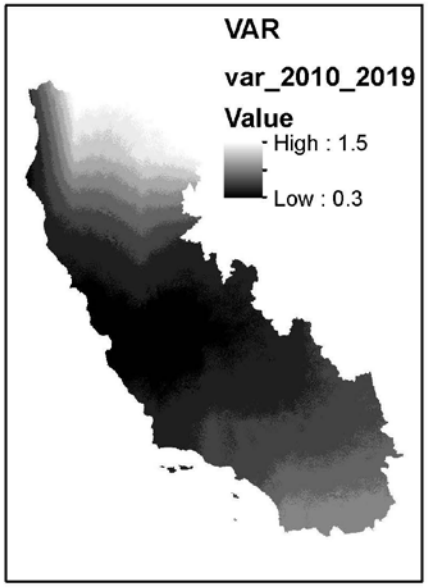




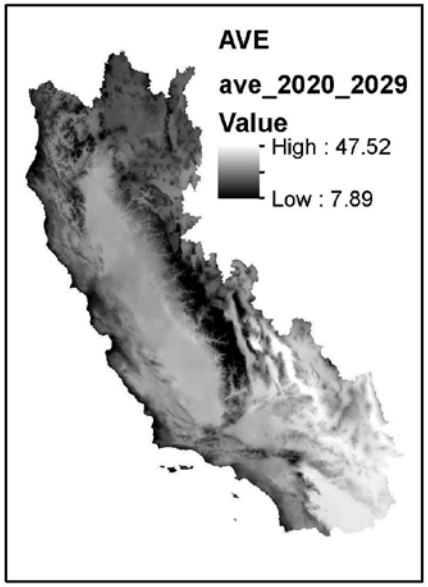


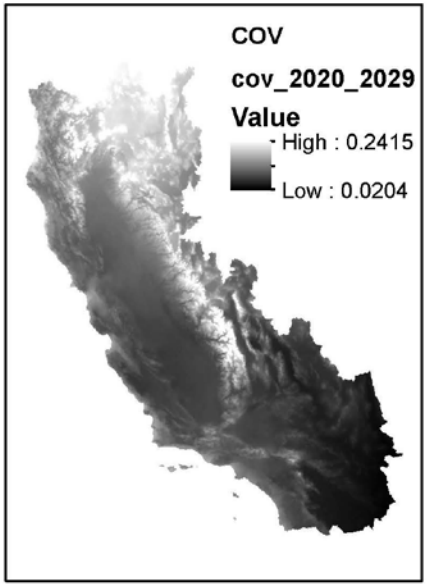


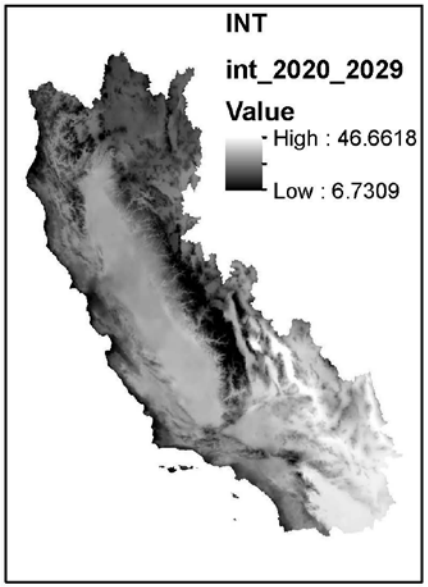


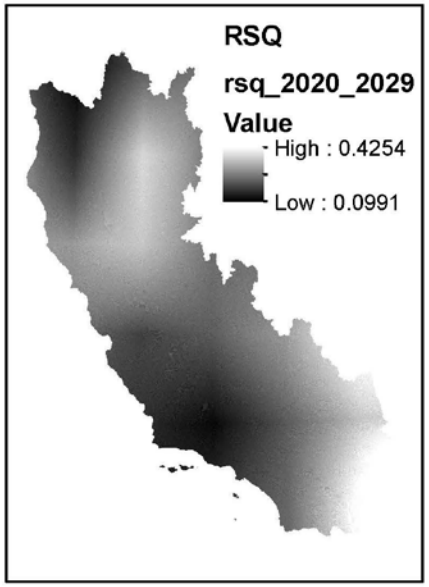


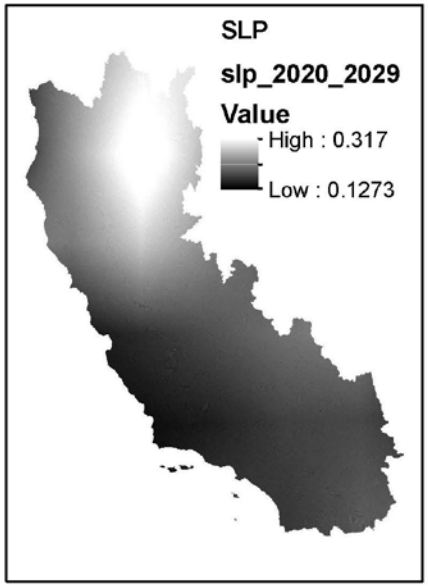
JJA_2020_2029_miroc3_2_medres_sresA1B_run1

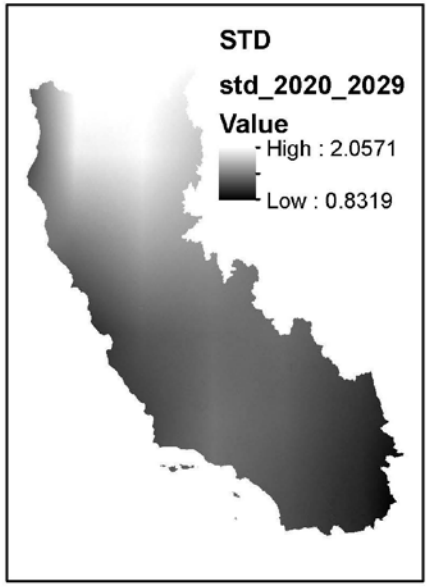


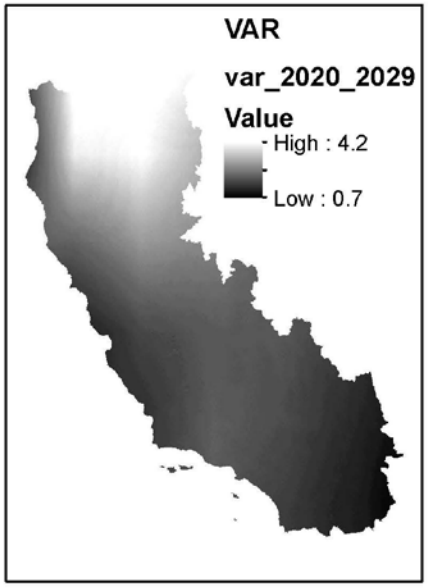




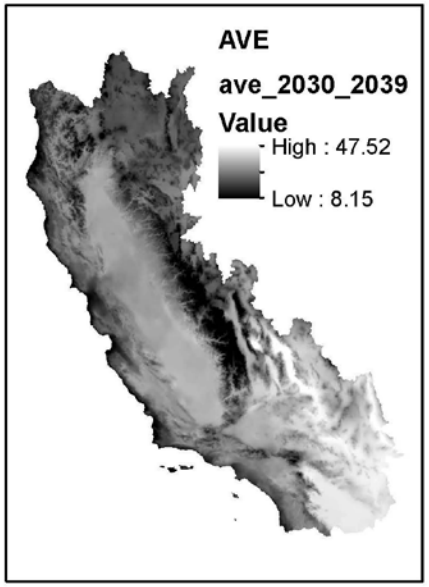


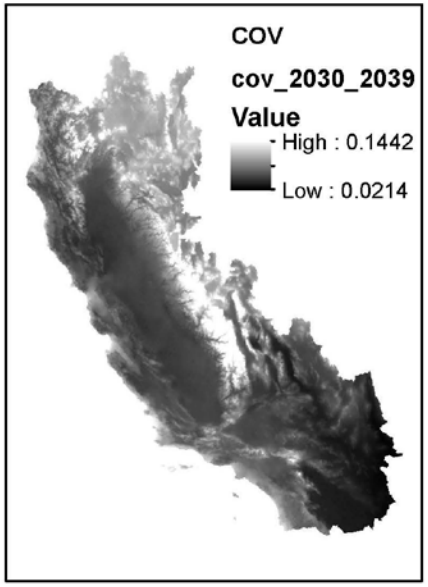


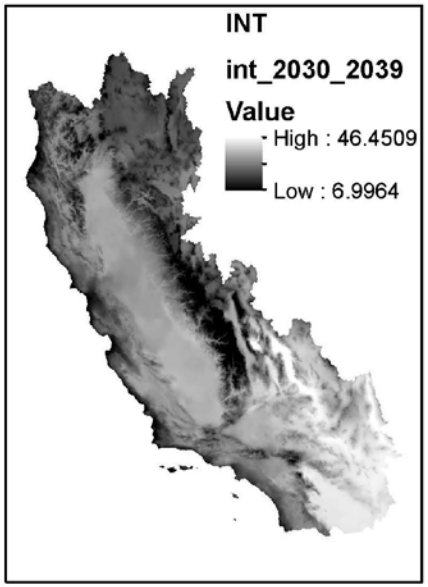


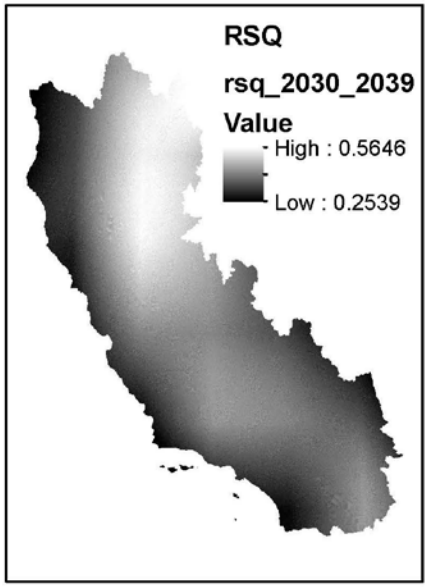


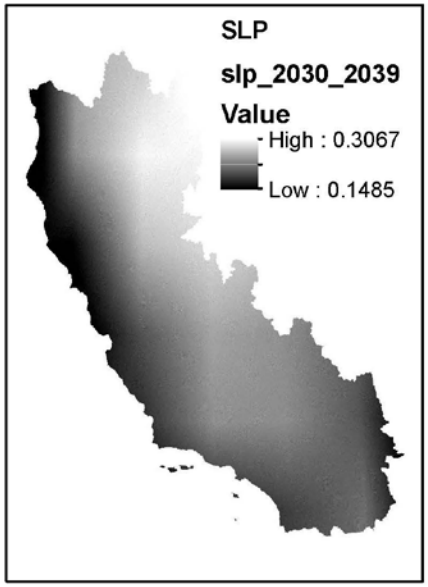
JJA_2030_2039_miroc3_2_medres_sresA1B_run1

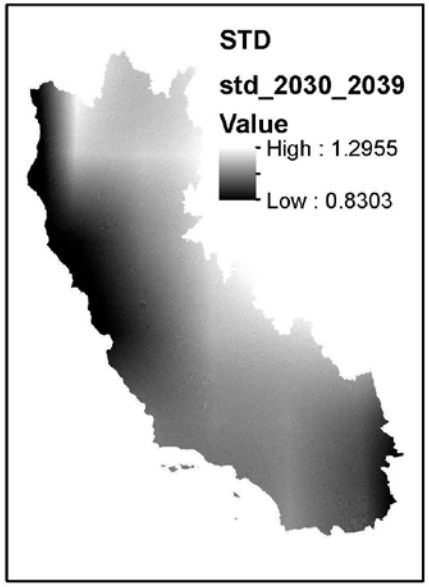


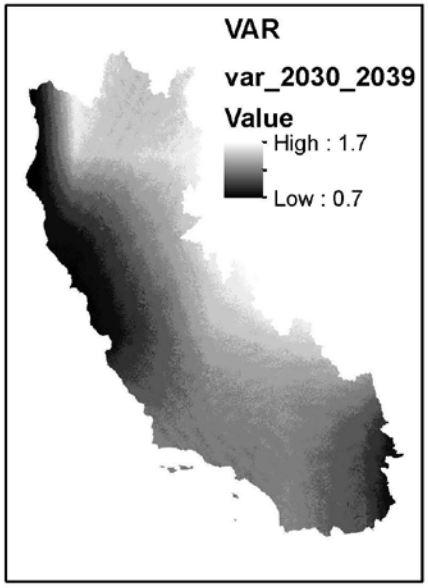




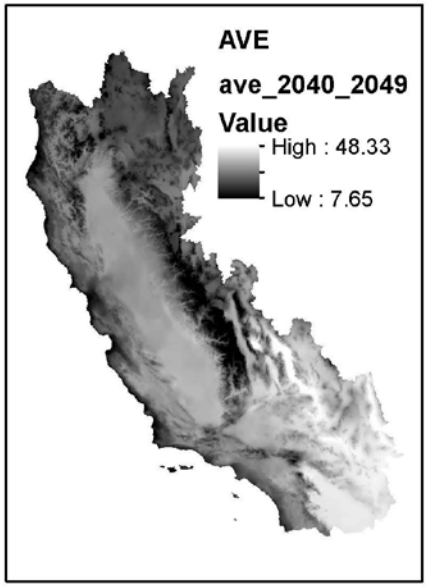


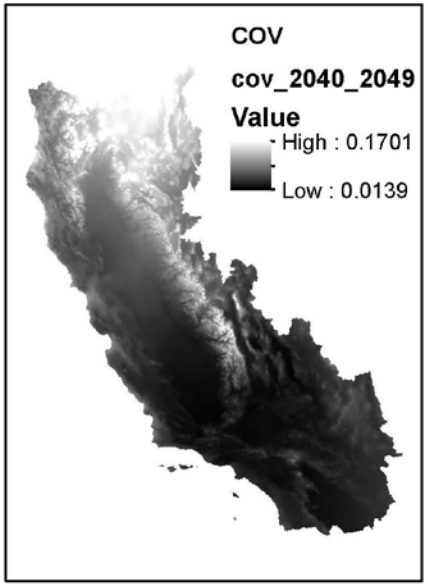


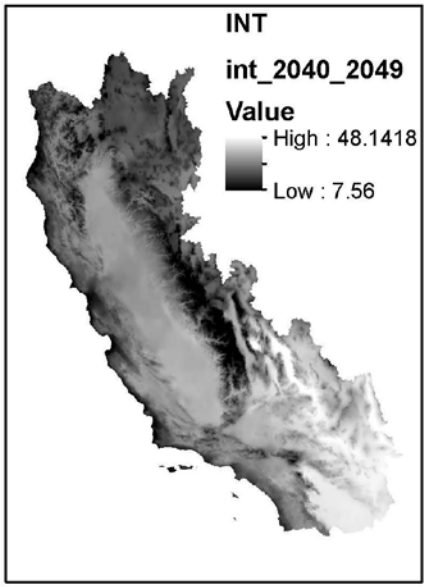


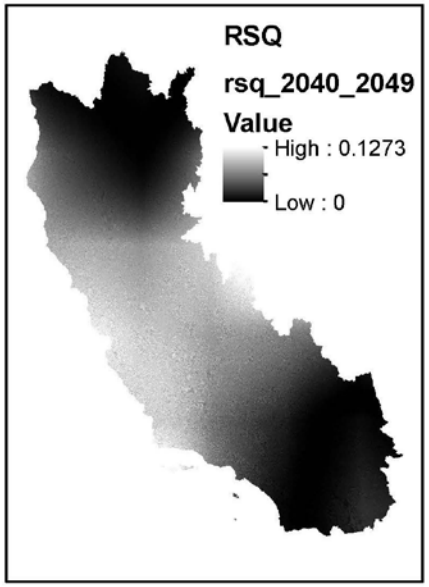


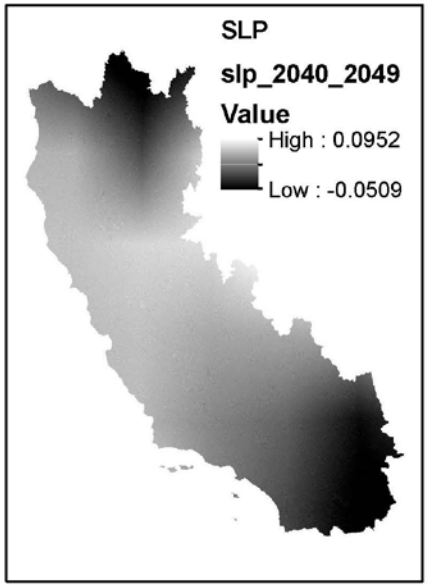
JJA_2040_2049_miroc3_2_medres_sresA1B_run1

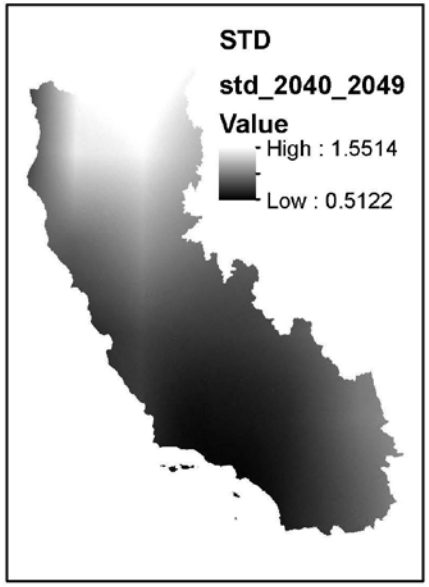


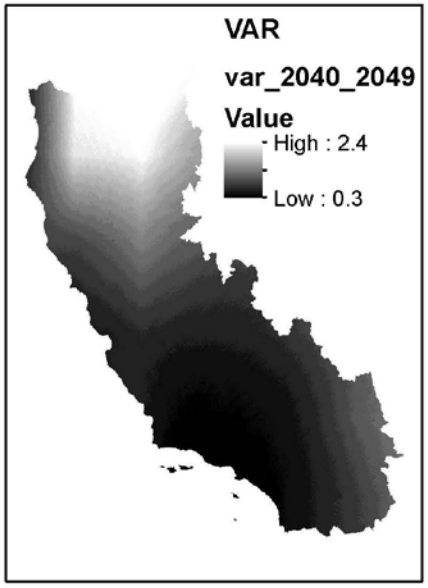




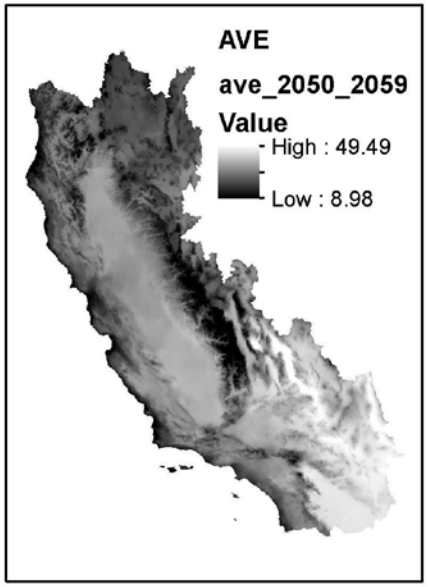


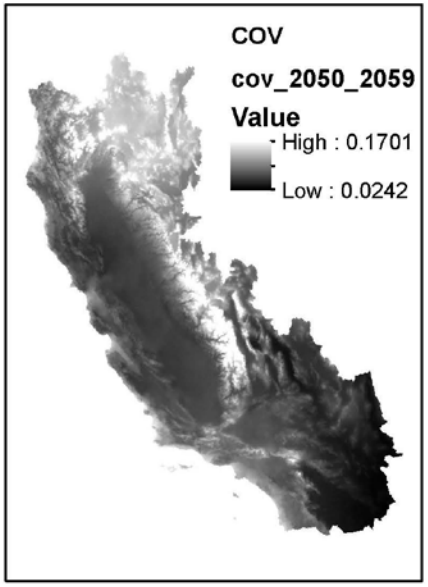


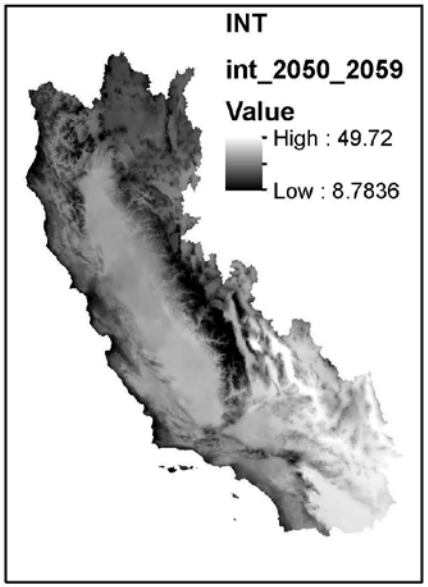


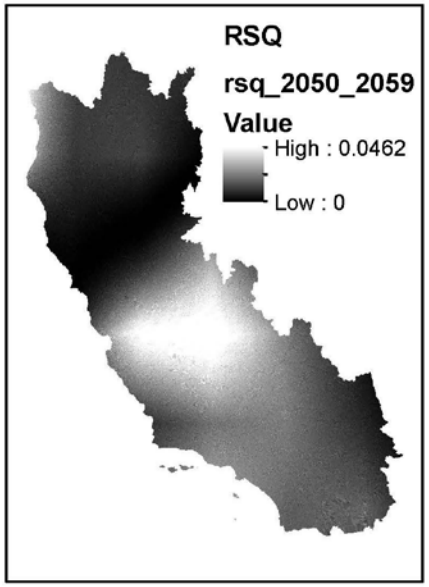


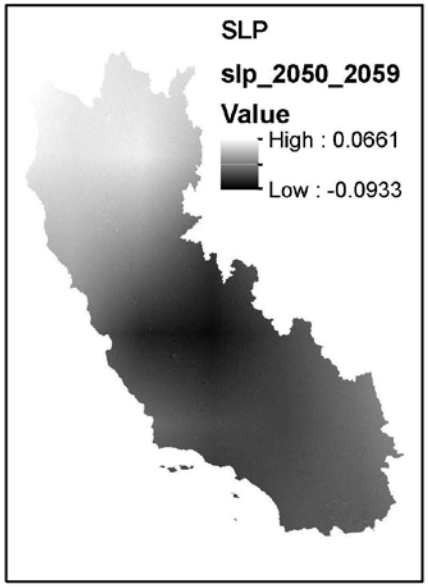
JJA_2050_2059_miroc3_2_medres_sresA1B_run1

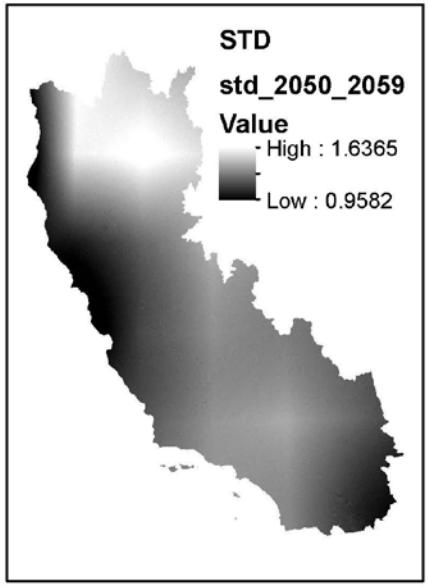


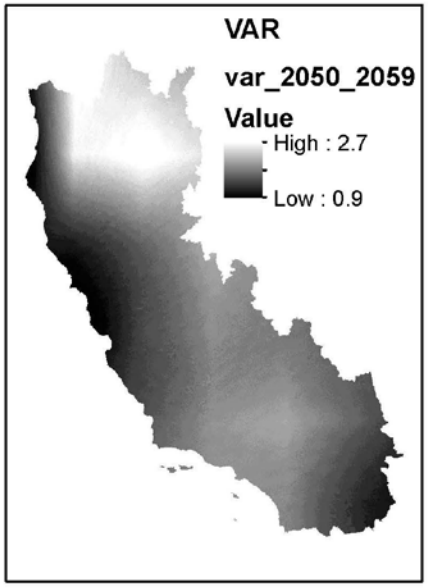




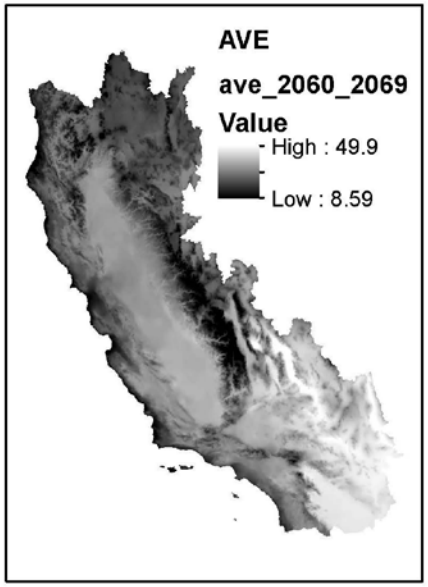


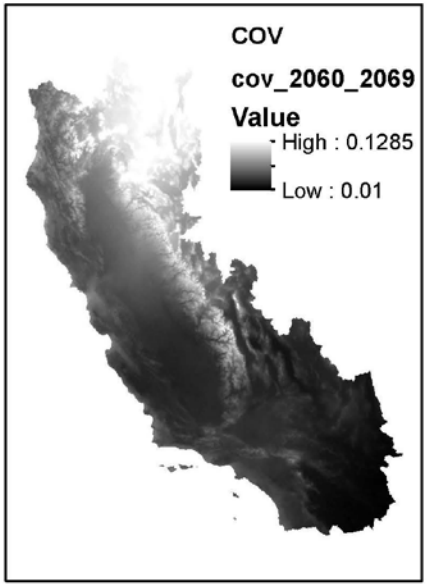


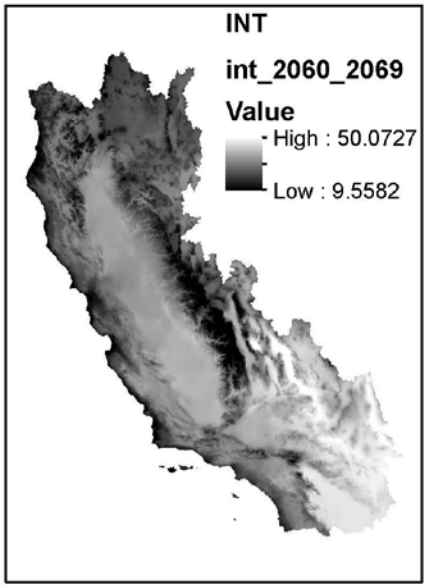


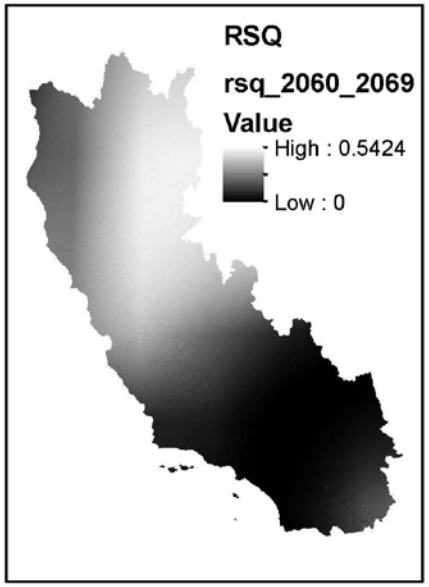


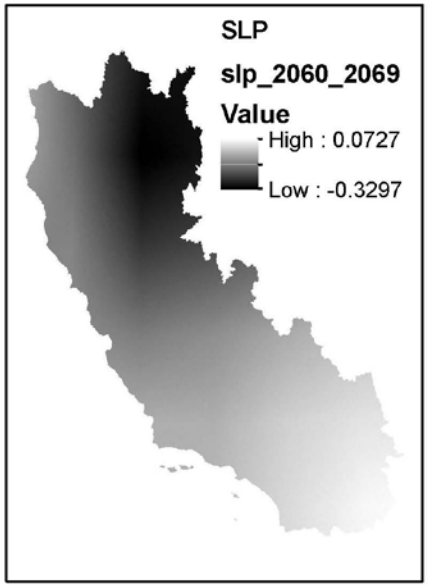
JJA_2060_2069_miroc3_2_medres_sresA1B_run1

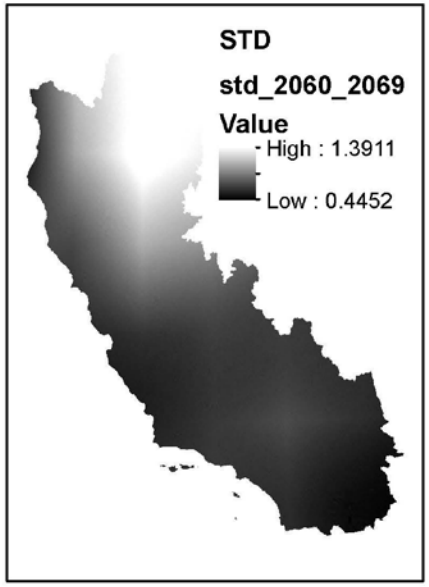


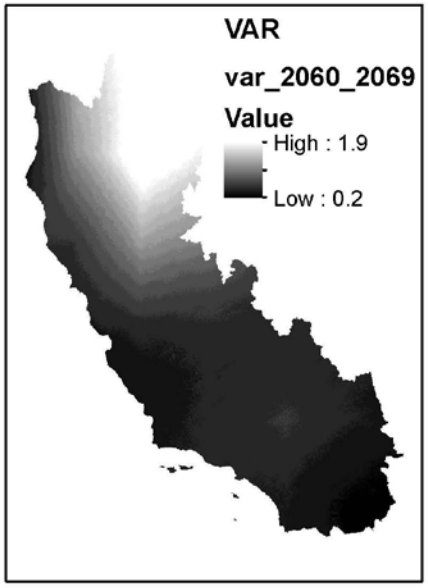




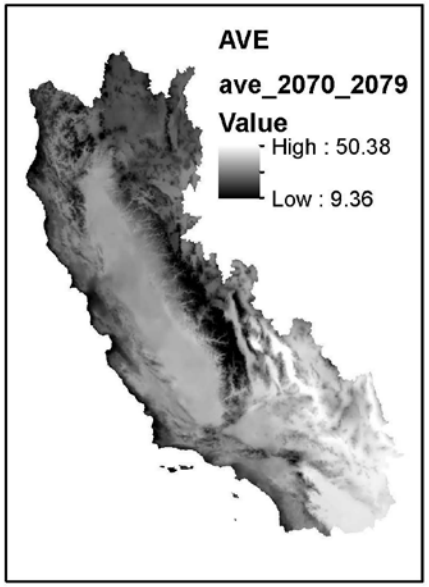


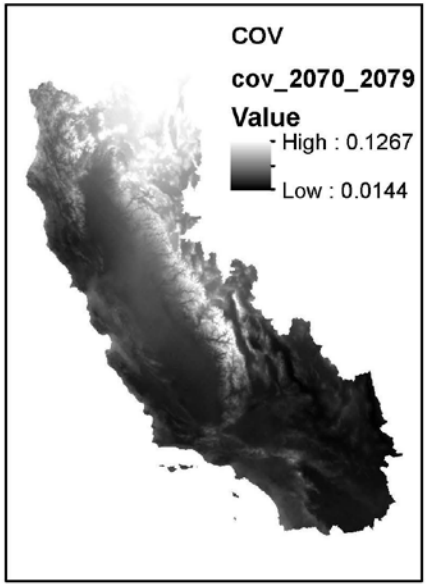


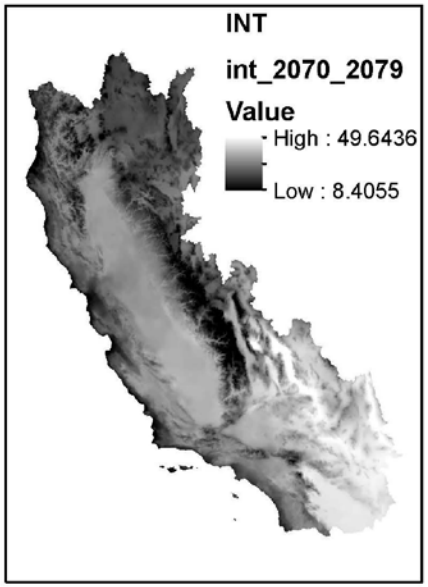


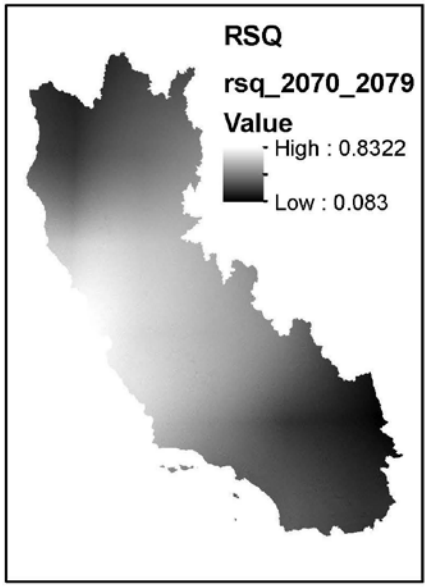


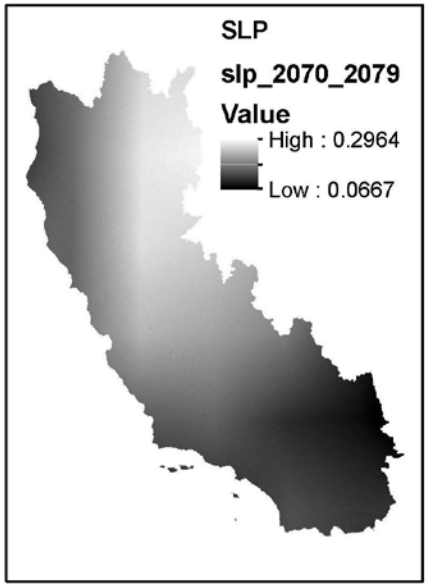
JJA_2070_2079_miroc3_2_medres_sresA1B_run1

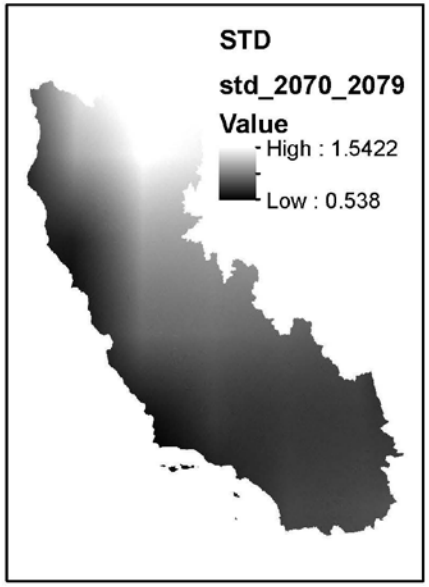


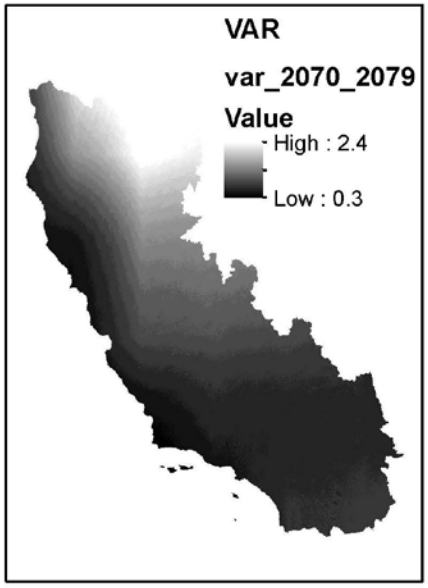




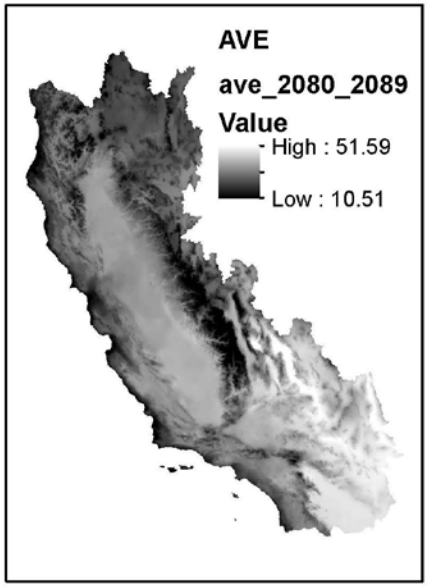


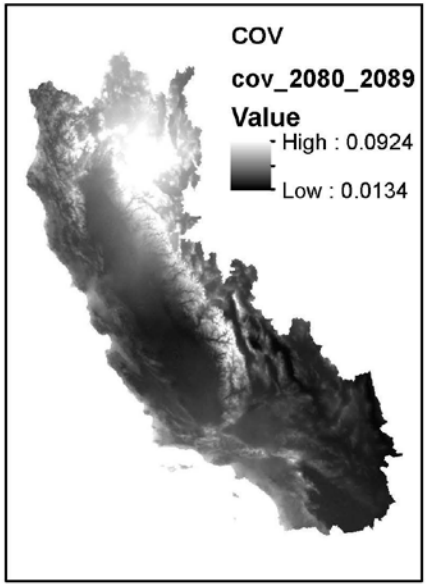


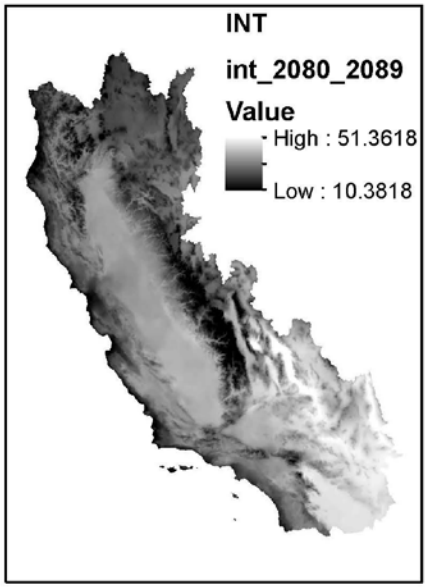


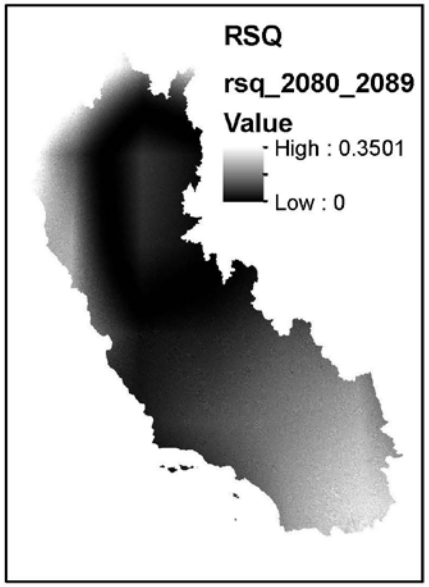


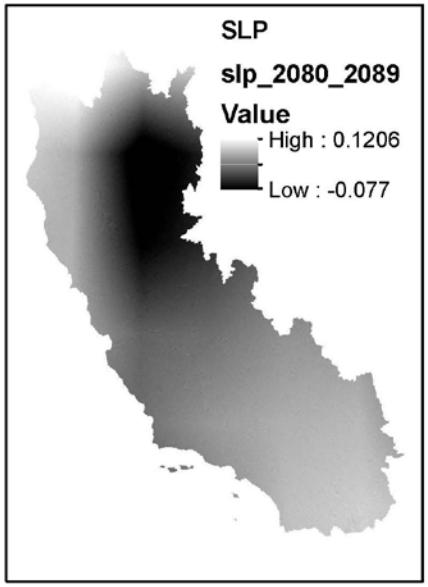
JJA_2080_2089_miroc3_2_medres_sresA1B_run1

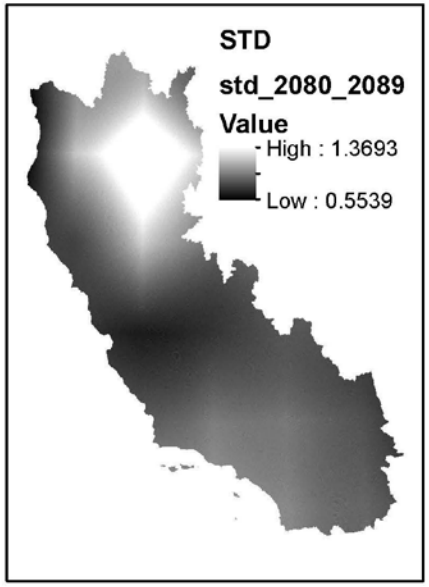


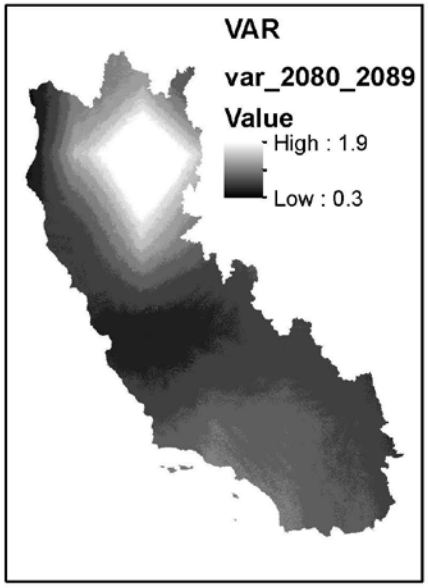




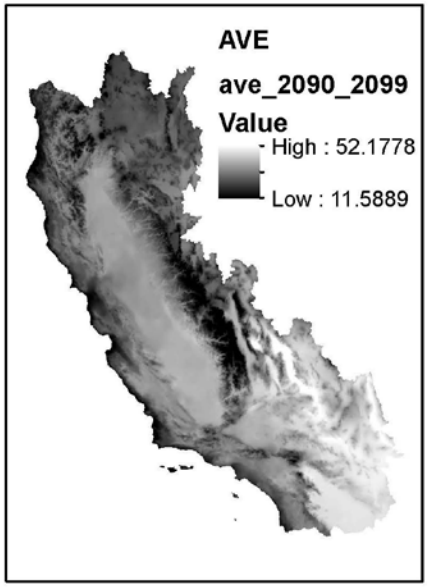


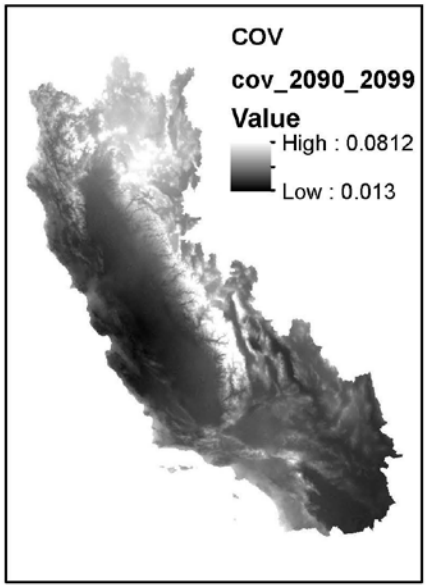


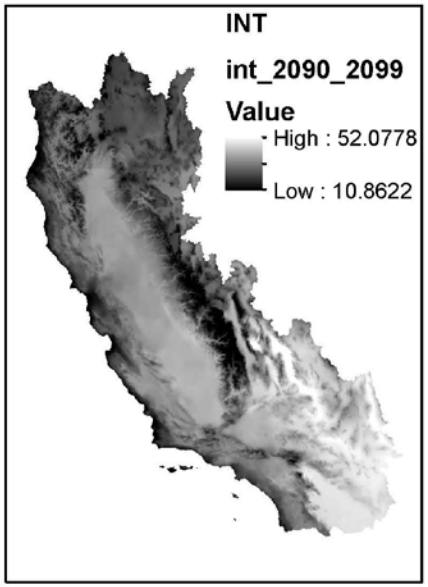


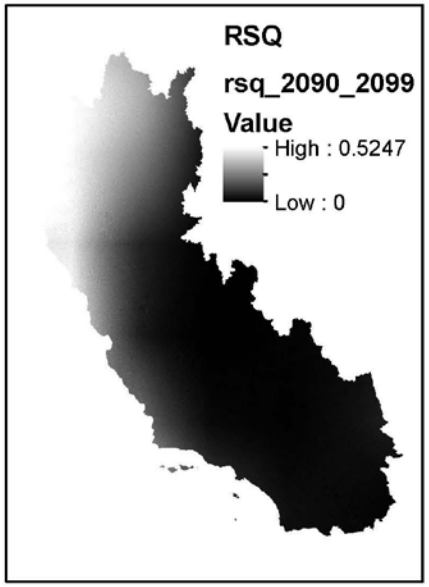


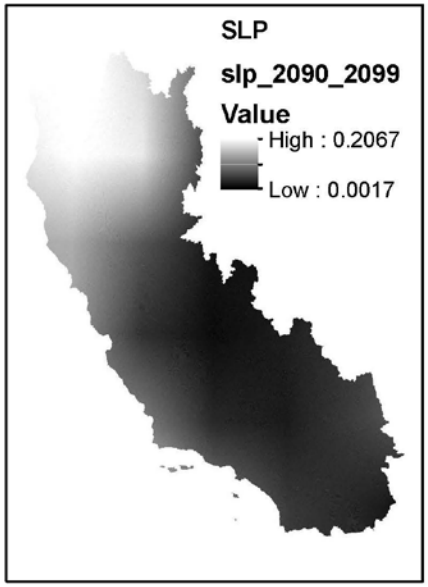
JJA_2090_2099_miroc3_2_medres_sresA1B_run1

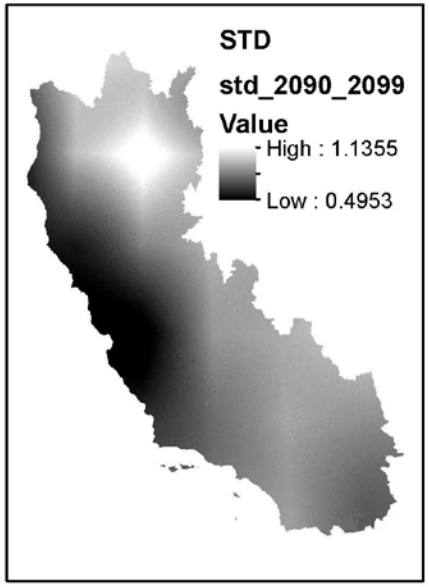


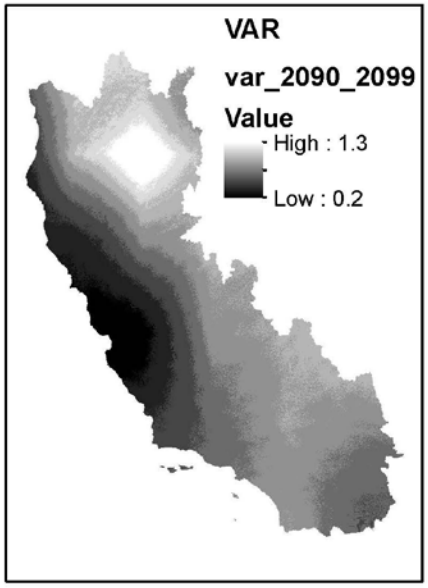




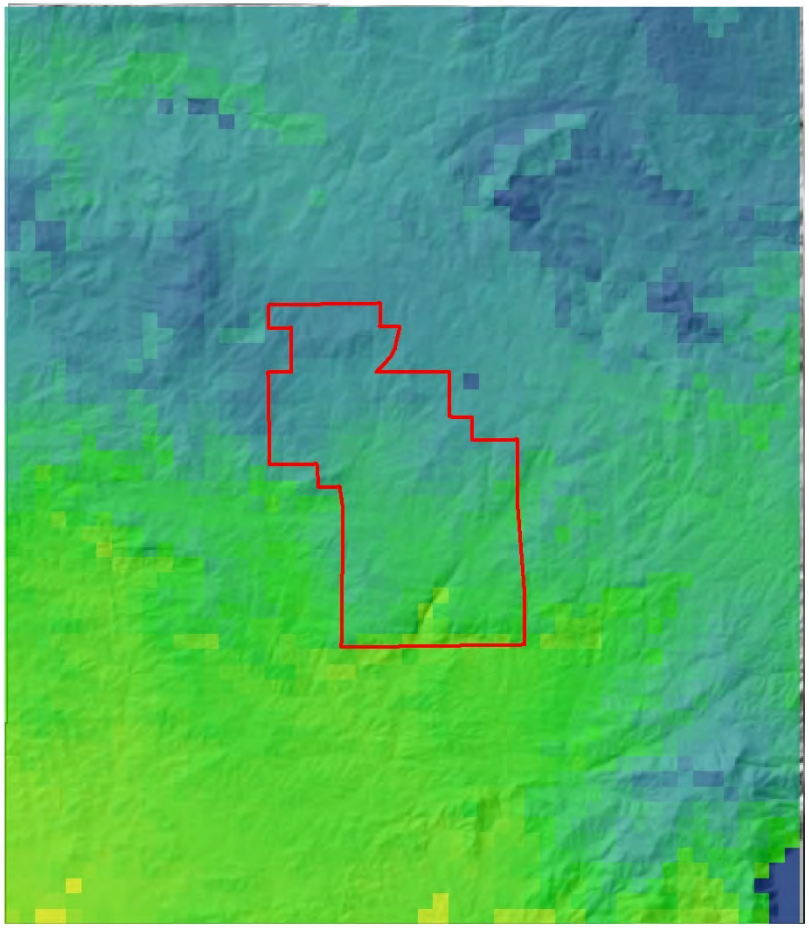




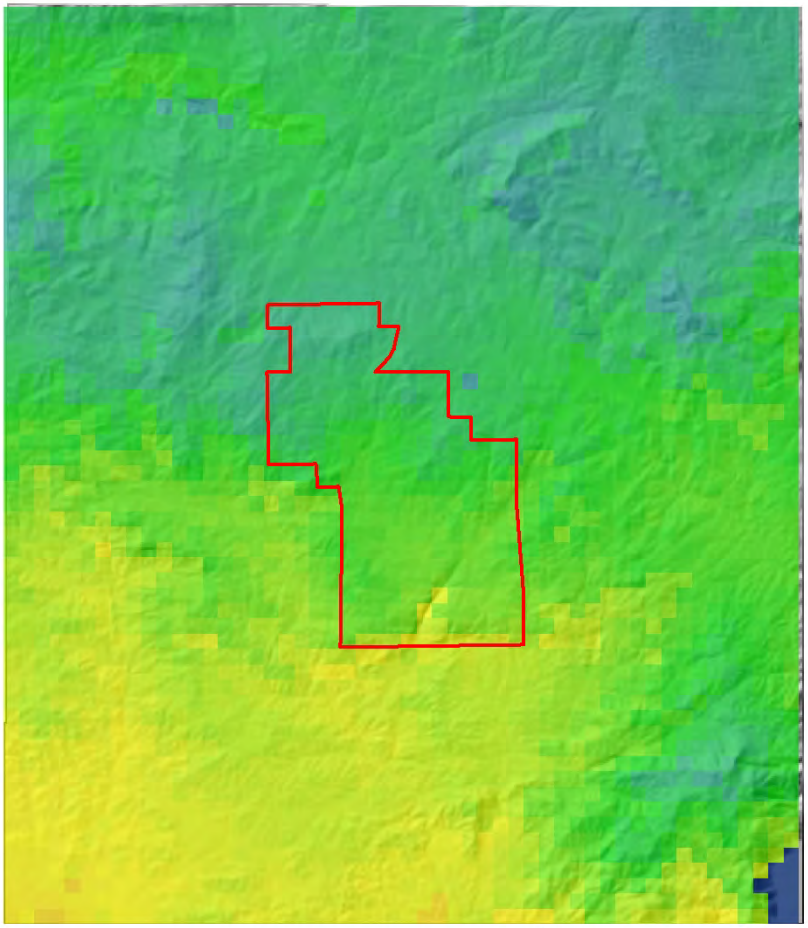




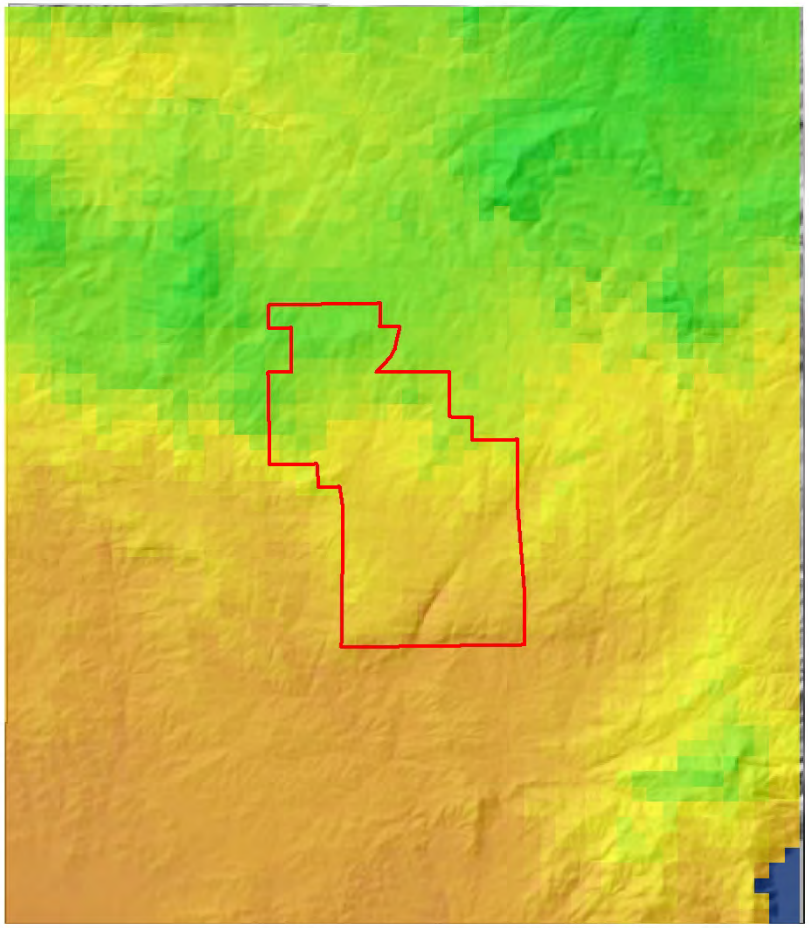
Miroc_medres_A1B_2002_2009



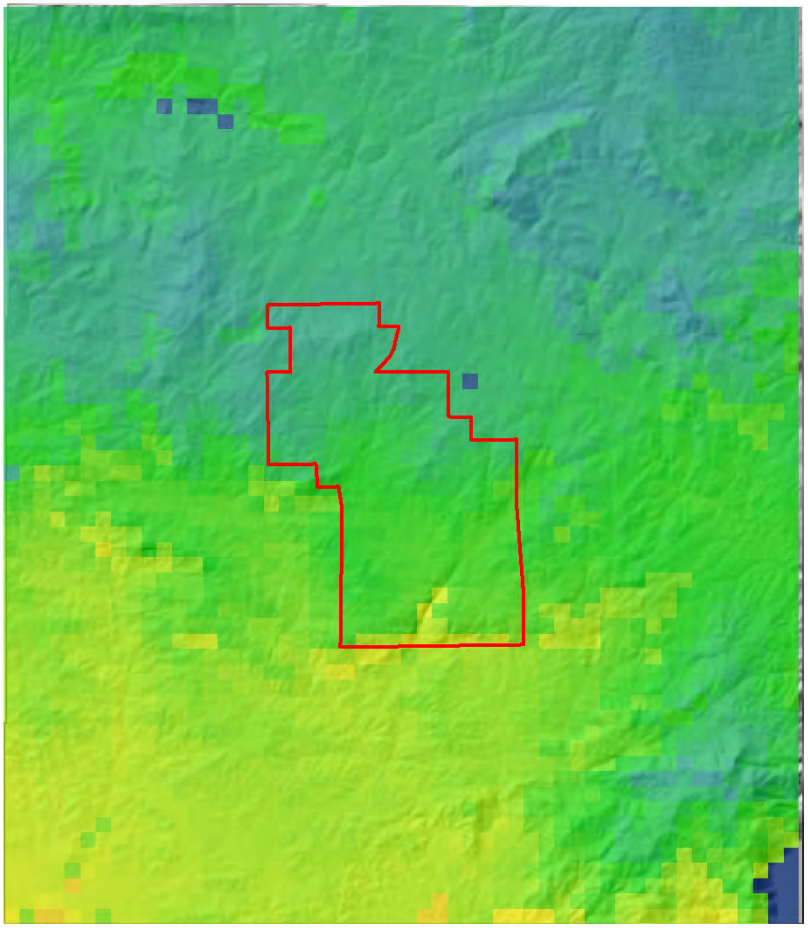
Miroc_medres_A1B_2010_2019



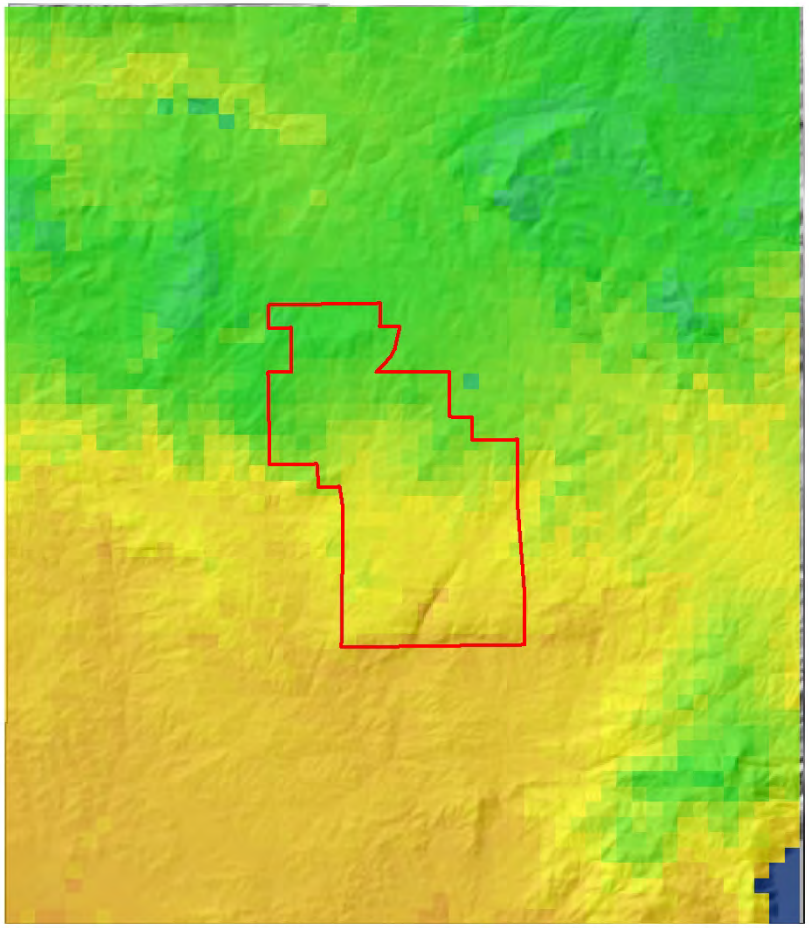
Miroc_medres_A1B_2020_2029



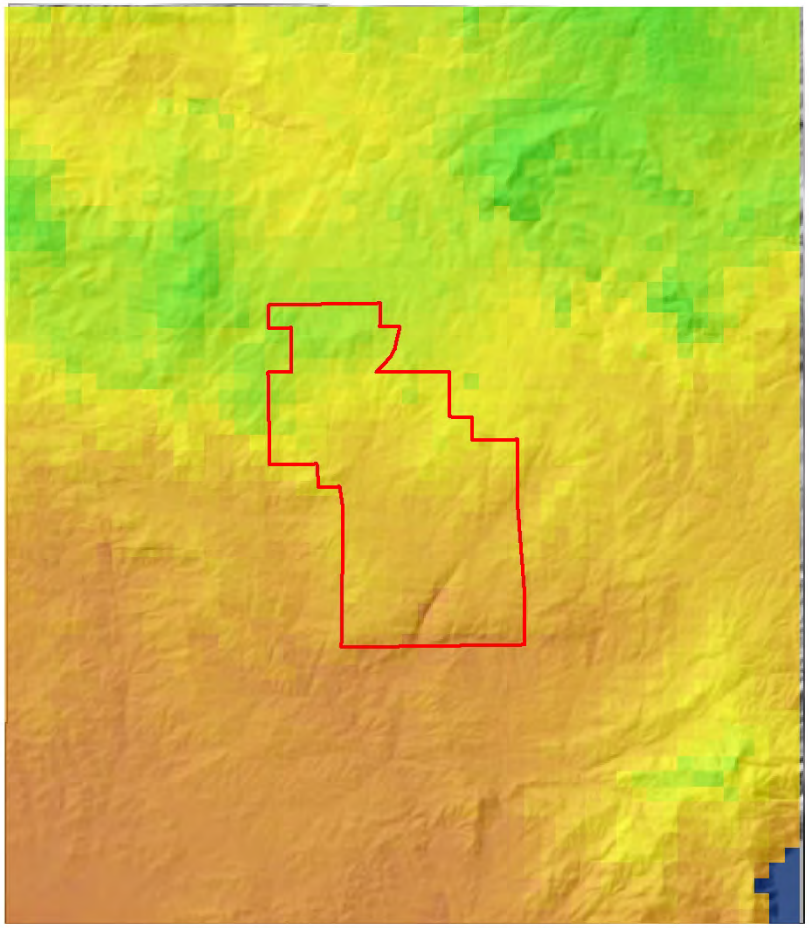
Miroc_medres_A1B_2030_2039



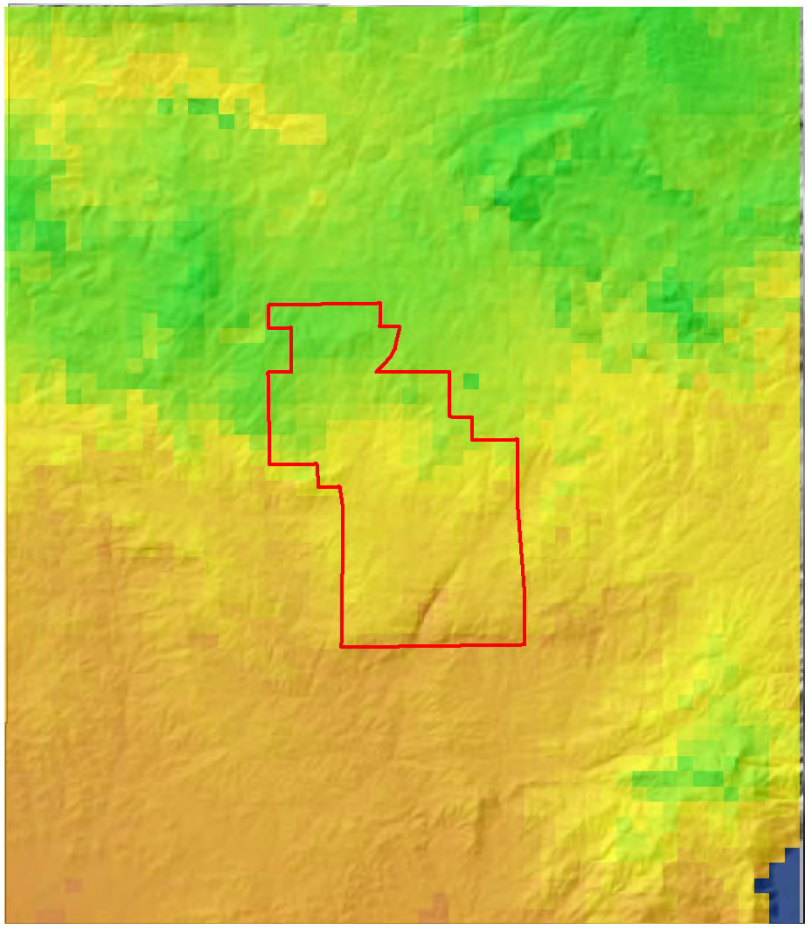
Miroc_medres_A1B_2040_2049



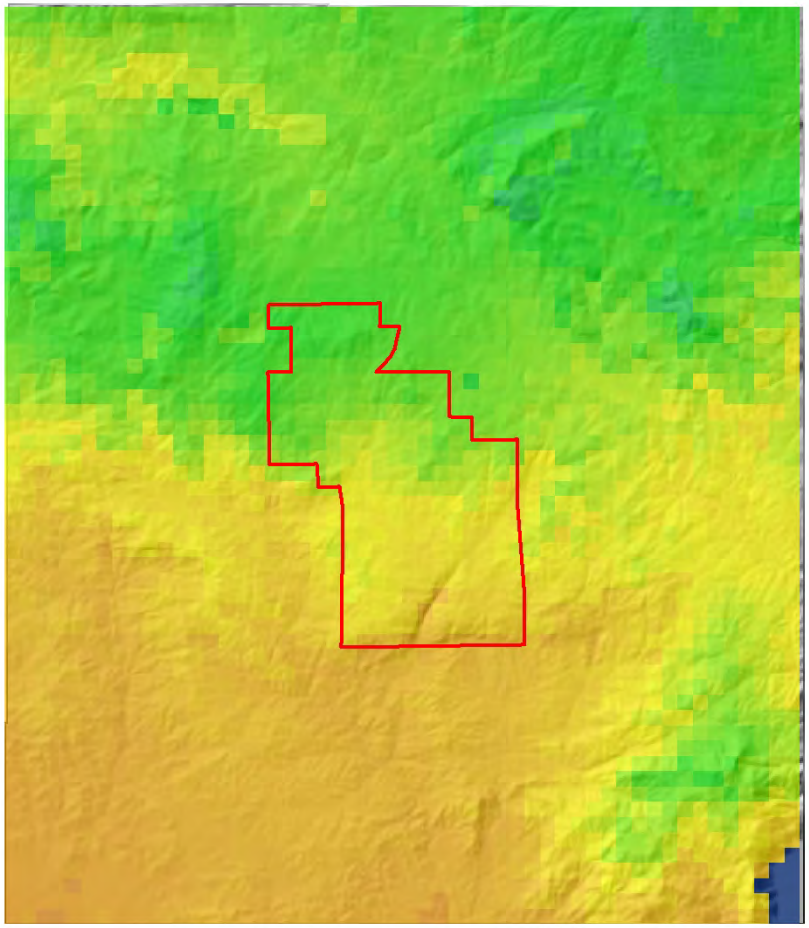
Miroc_medres_A1B_2050_2059



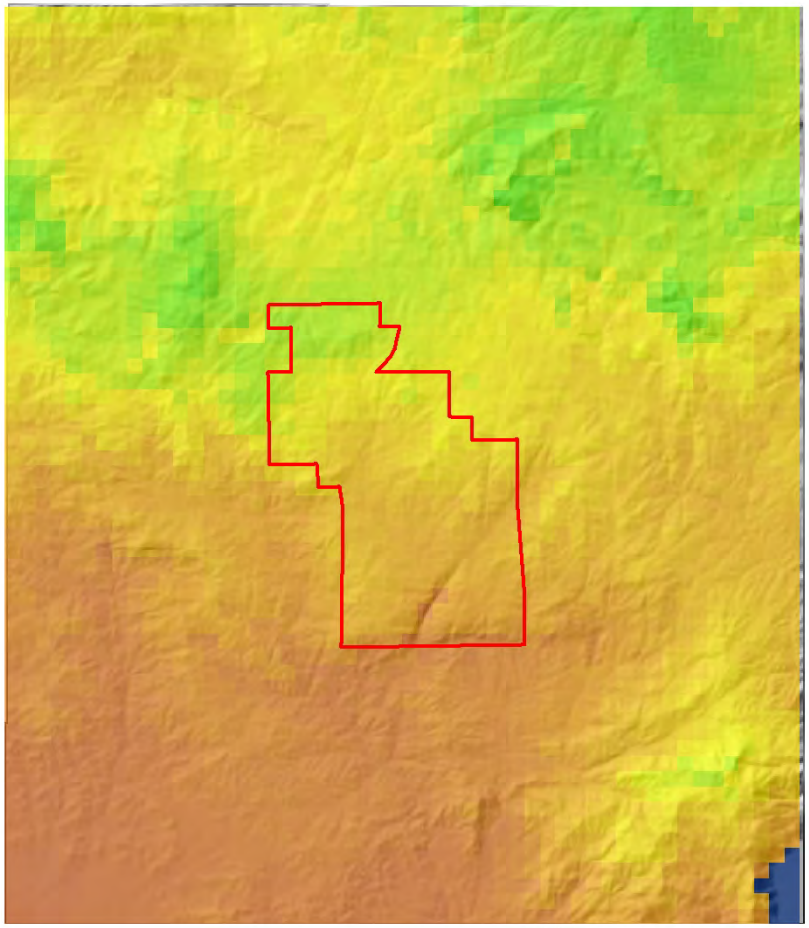
Miroc_medres_A1B_2060_2069



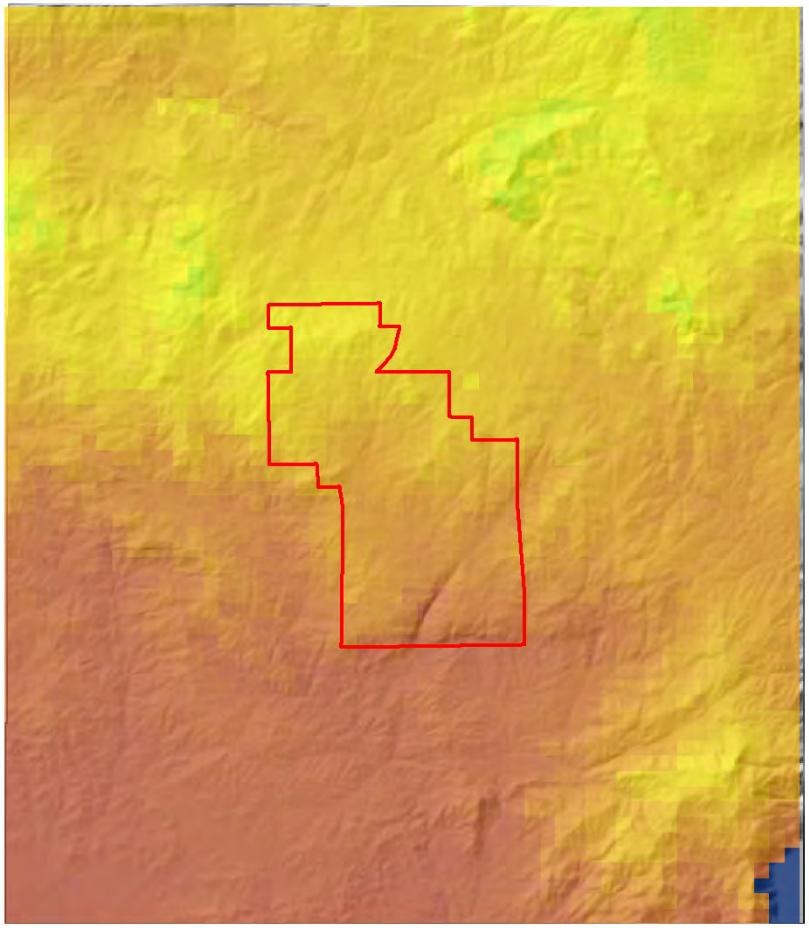
Miroc_medres_A1B_2070_2079



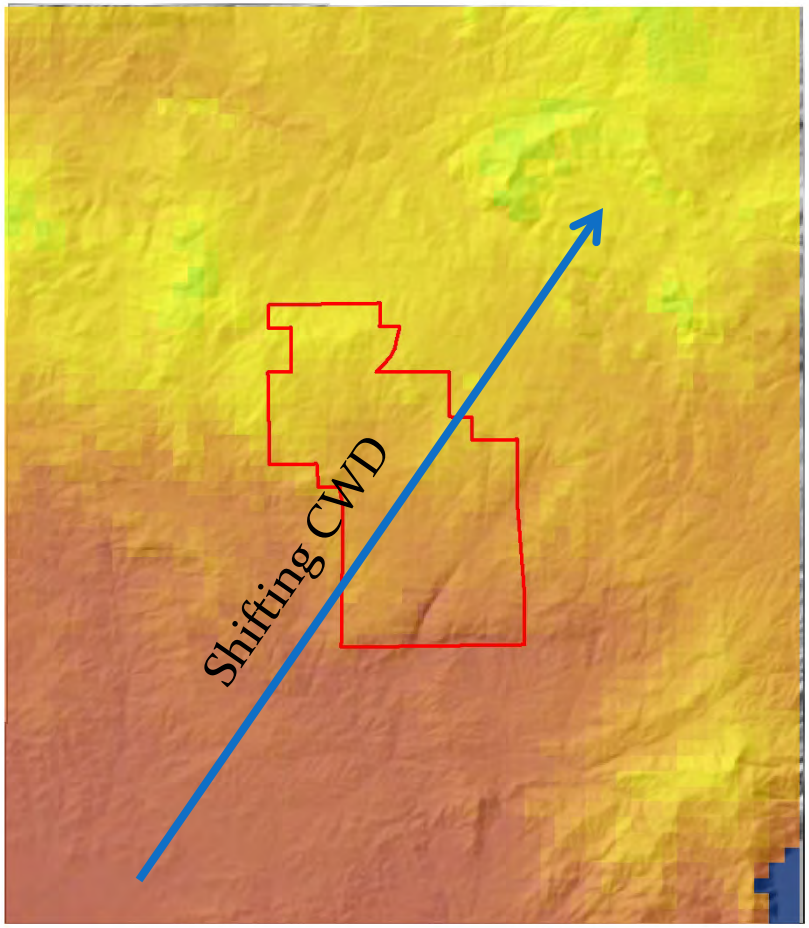
Miroc_medres_A1B_2080_2089



Miroc_medres_A1B_2090_2099



Miroc_medres_A1B_2090_2099



Suggestions

- Temporal Smoothing:

$$A_y = \frac{x_{y-2} + x_{y-1} + x_y + x_{y+1} + x_{y+2}}{5}$$

More noise

$$A_y = \frac{x_{y-5} + x_{y-4} + x_{y-3} + x_{y-2} + x_{y-1} + x_y + x_{y+1} + x_{y+2} + x_{y+3} + x_{y+4} + x_{y+5}}{11}$$

Less noise

Where,

A_y = Averaged variable for a given year (CWD, PPT, TMN, TMX, etc.).
x = Value
y = Year (2005, 2006, 2007 and ...)

Suggestions

- Principle Component Analysis (PCA):
  - How different are CWD, PPT, Tmin, Tmax, PET, AET from each other (correlates vs. providing new info)?
    - Space
    - Time
  - Distills information:
    - Much of the variability (information) can be captured in the first few components.
    - Where do these variables work at predicting species presence and where do they not?