Climate Trends in Pacific Northwest America From 1960s to Early 2000s

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Regional ClimatePrediction.Net

- Superensemble (many of thousands of simulations) regional climate modeling
- ClimatePrediction.Net organized by Oxford University
- Western United States is one of the regional areas included in the Regional ClimatePrediction.Net project

BOINC

- Berkeley Open Infrastructure for Network Computing
- Many Thousands of Volunteers
- Master Data Base at Oregon State University
- One Week to Run a One Year Simulation

Challenges to Modeling

- Understand and represent all the relevant processes
- Balance the high spatial resolution and the computational requirements
- Account for uncertainties accurately

The Model

- Western United States
- Resolution of 1.25°x 1.875°
- Pacific Ocean and inland waters
- Mountain ranges and Valleys

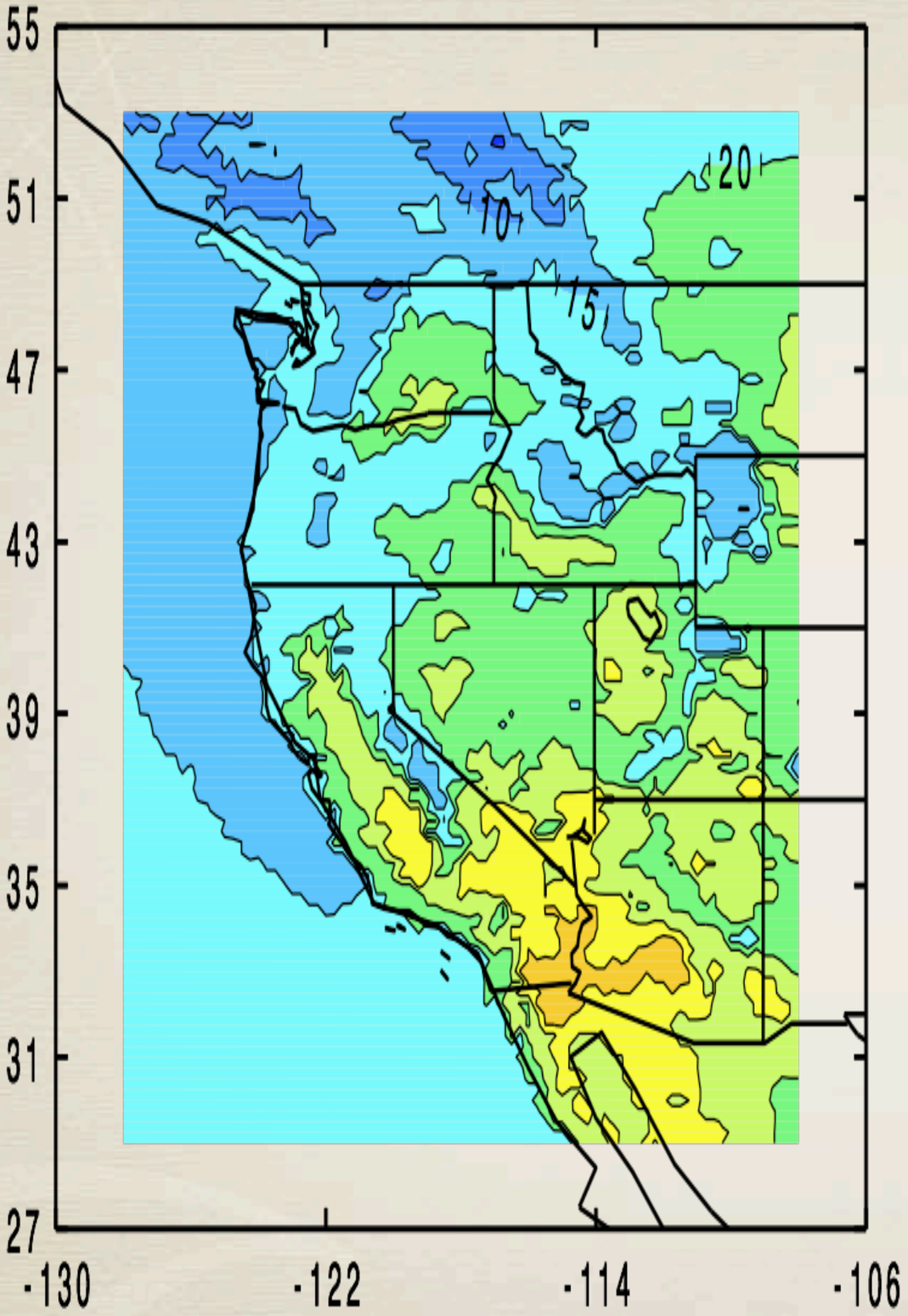
The Model (cont.)

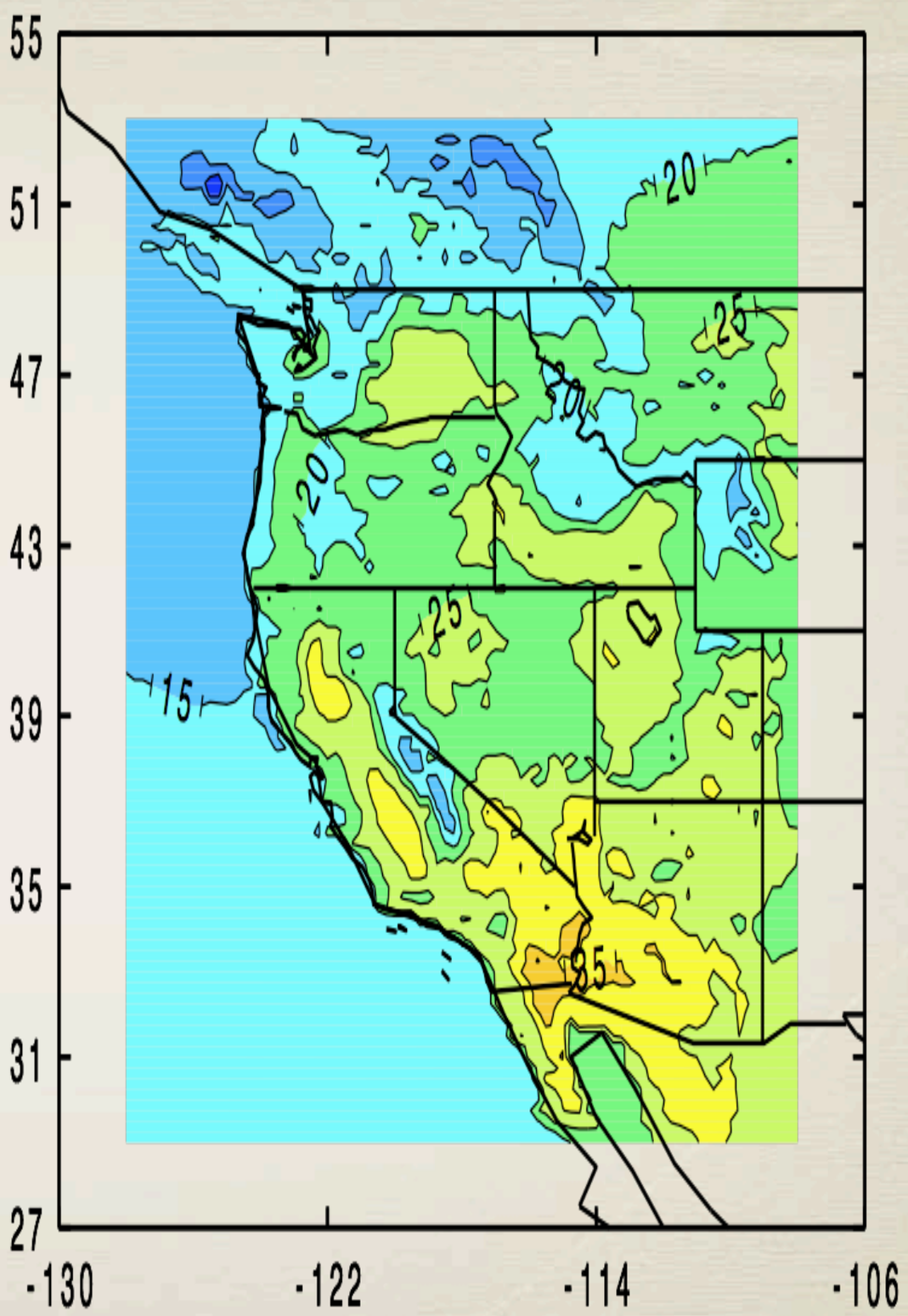
- Slight perturbations in the initial conditions and ocean boundaries
- Slight changes according to the year for a better ‘reality’
- Changes in Greenhouse gases and sea surface temperatures

Advantages to RegCPDN

- Fine spatial resolution (25km while most are 50km)
- Superensemble for statistical analysis
- Lots of output variables
- Close values to observational models including the North American Regional Reanalysis data (NARR)

NARR July 1980 regCPDN





Are there any seasonal trends from the Regional ClimatePrediction.Net Models between the 1960s and early 2000s in the following output variables:

- Frost
- Snow Mass
- Maximum Temperature (Tmin)
- Minimum Temperature (Tmin)
- Max Wind Speed
- Number of Wet Days (Wet_days)
- Amount of Precipitation on the Wettest Day (Pmax_1)

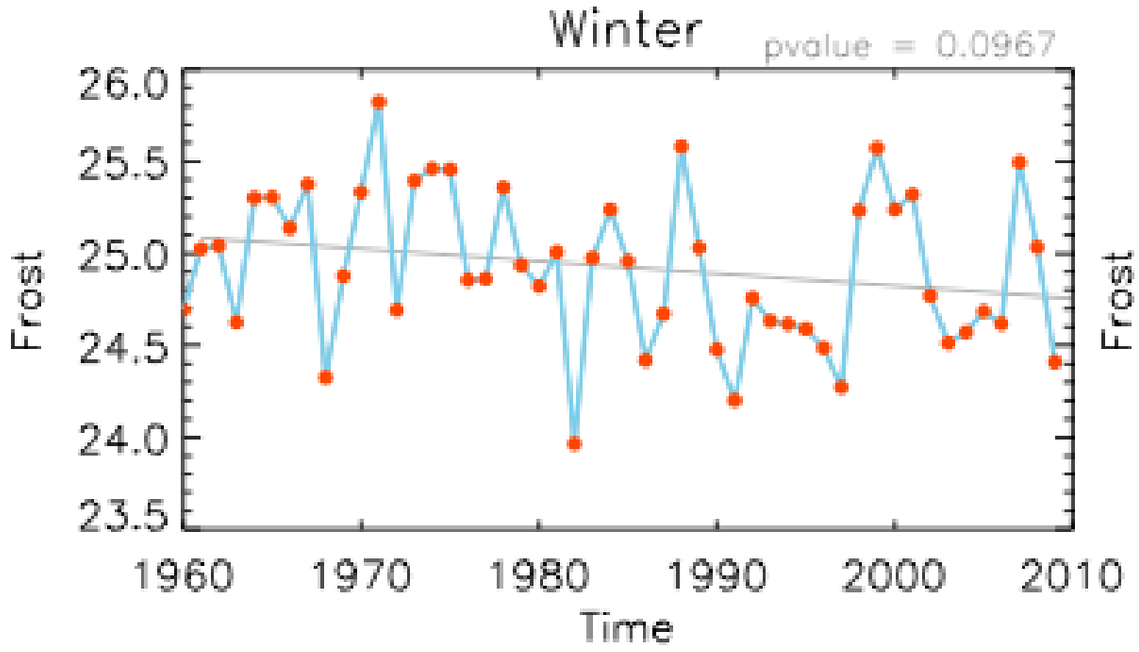
Methodology

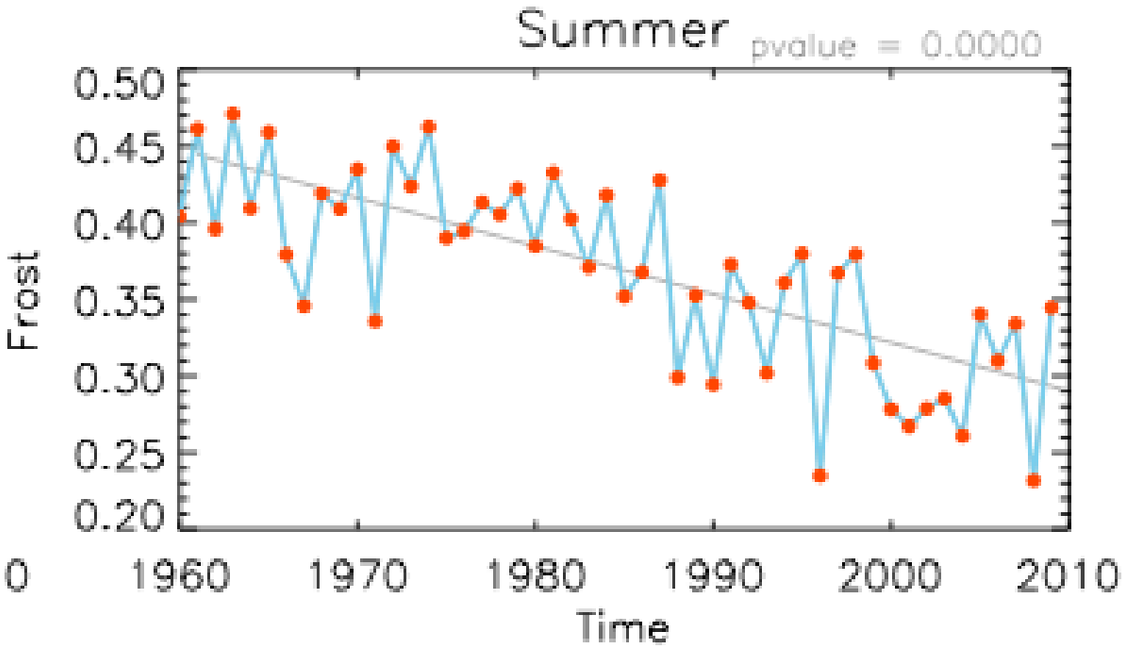
- Regional ClimatePrediction.Net (RegCPDN) outputs
- IDL (Interactive Data Language)
- Average over each season
  - Winter DJF
  - Spring MAM
  - Summer JJA
  - Fall SON

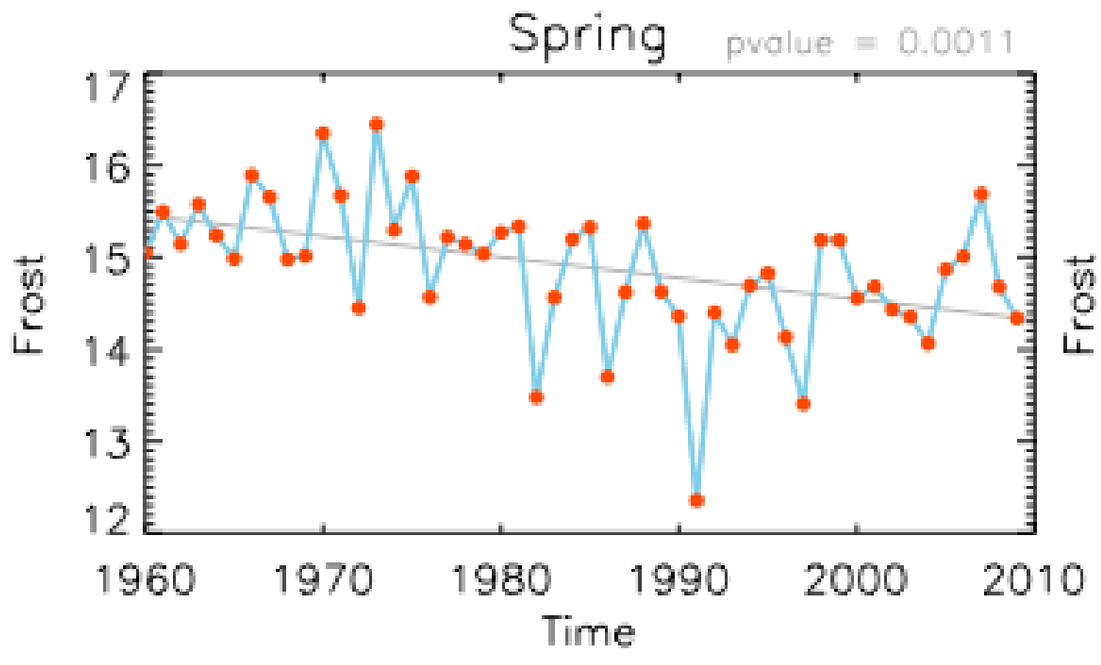
Frost

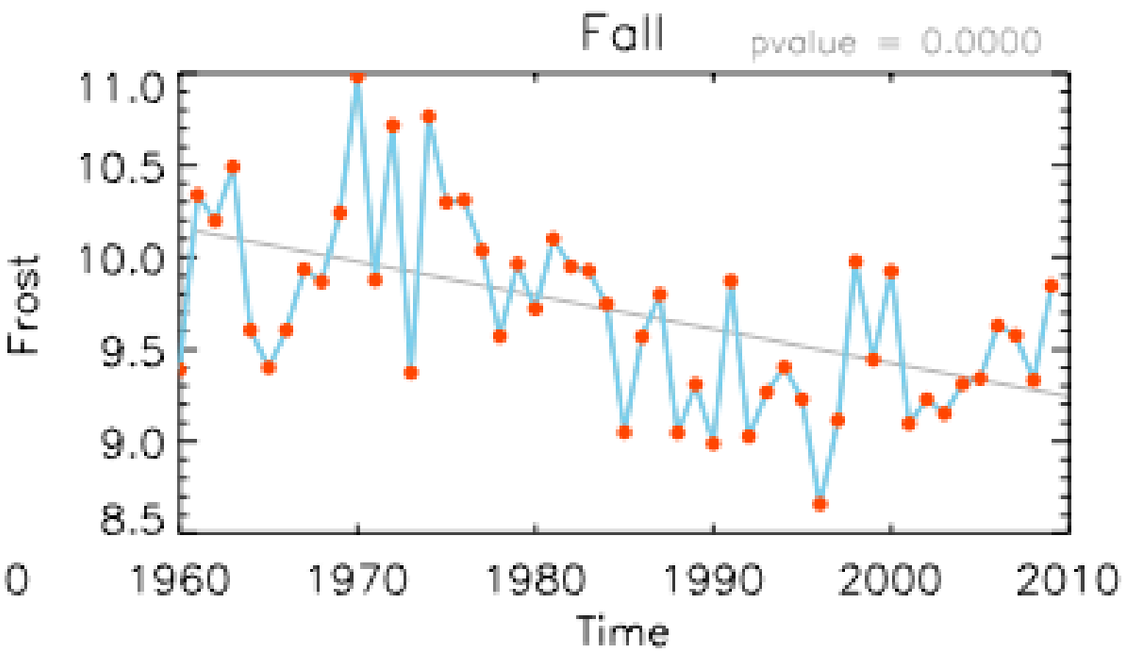
Number of Frost Days

Seasonal Average Frost over Pacific Northwest America versus Time

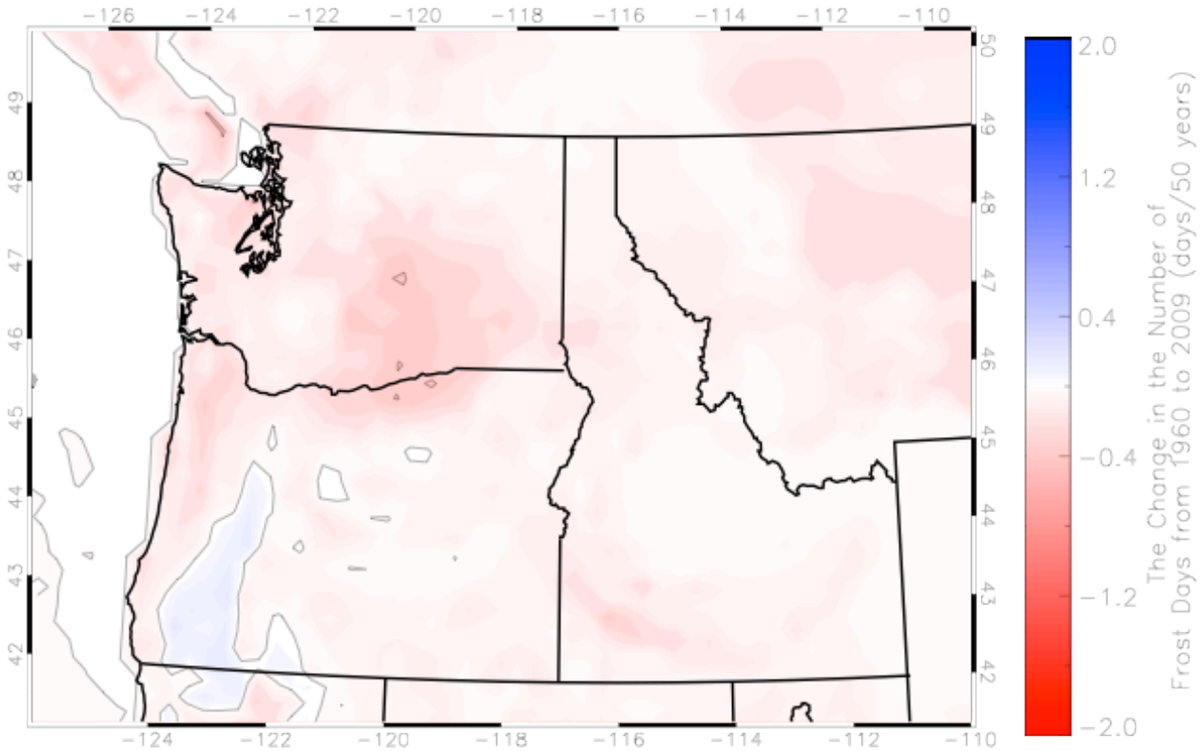




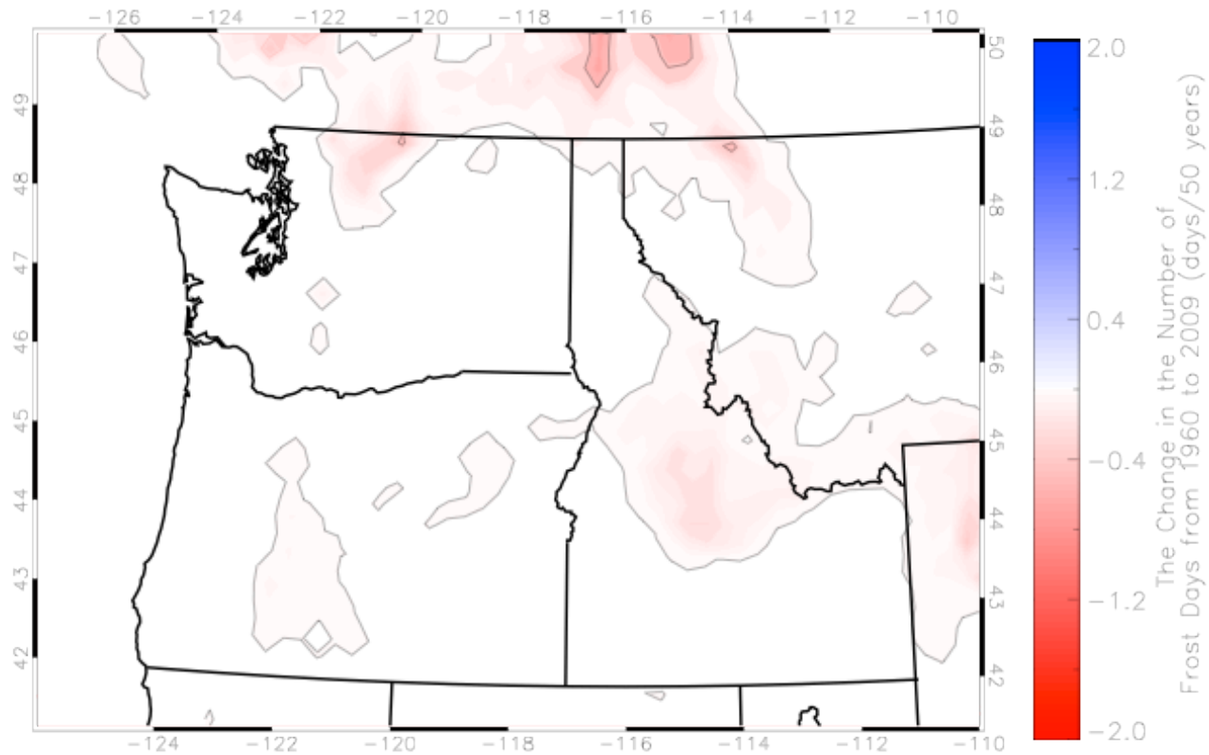




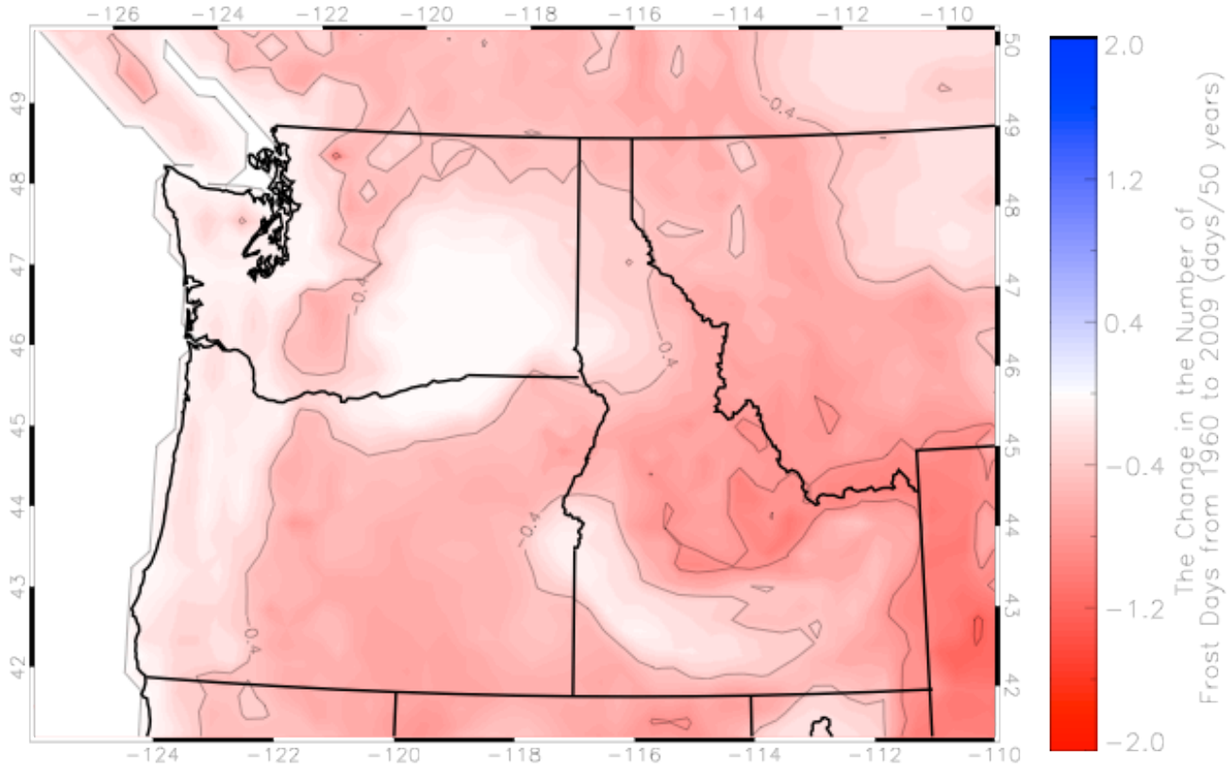
Winter Frost



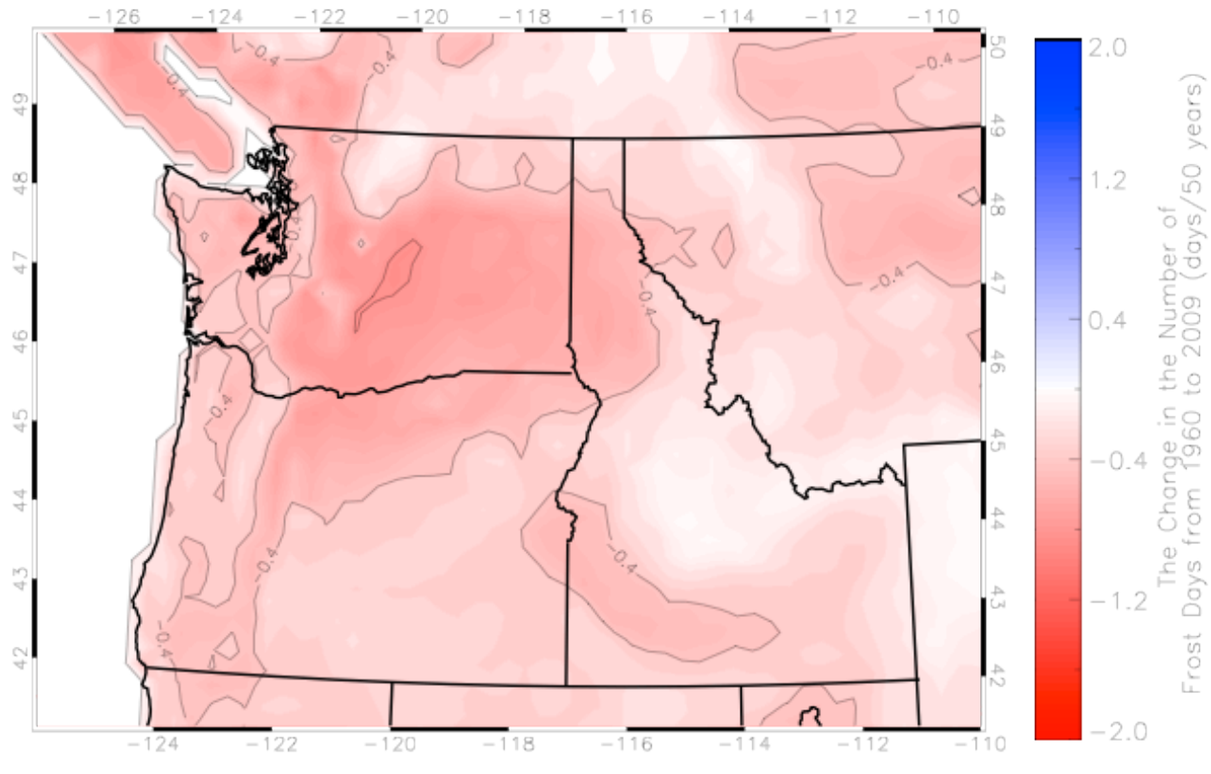
Summer Frost



Spring Frost



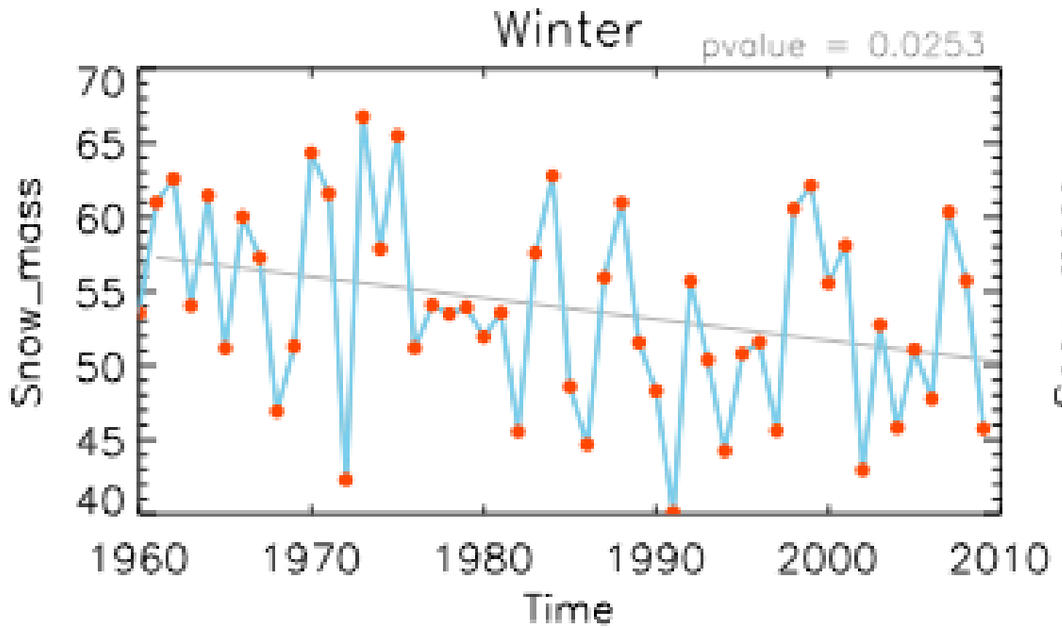
Fall Frost

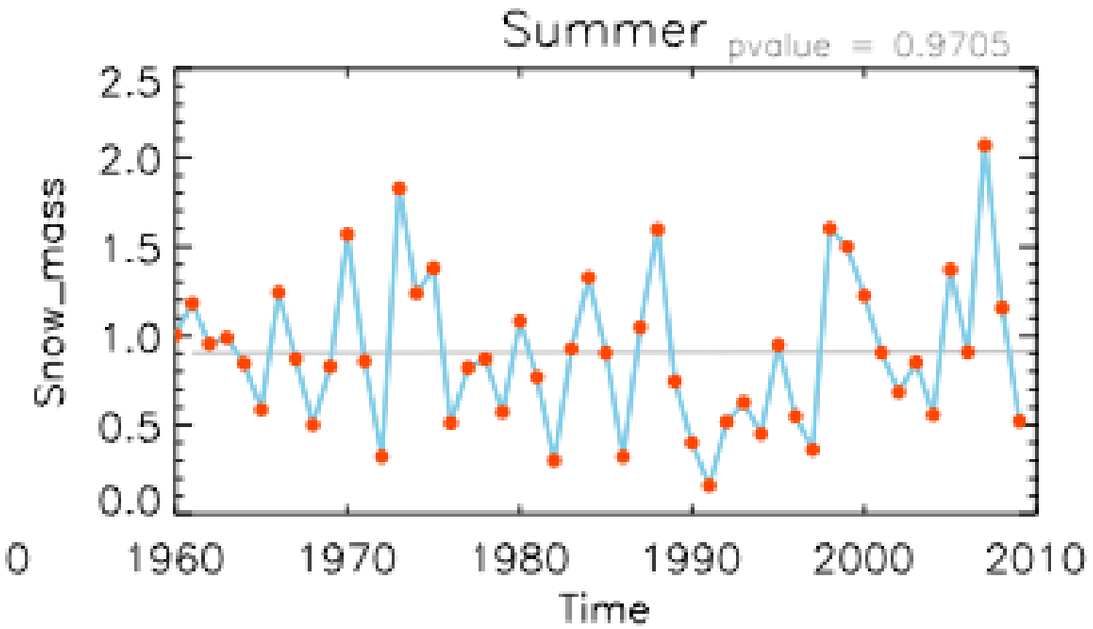


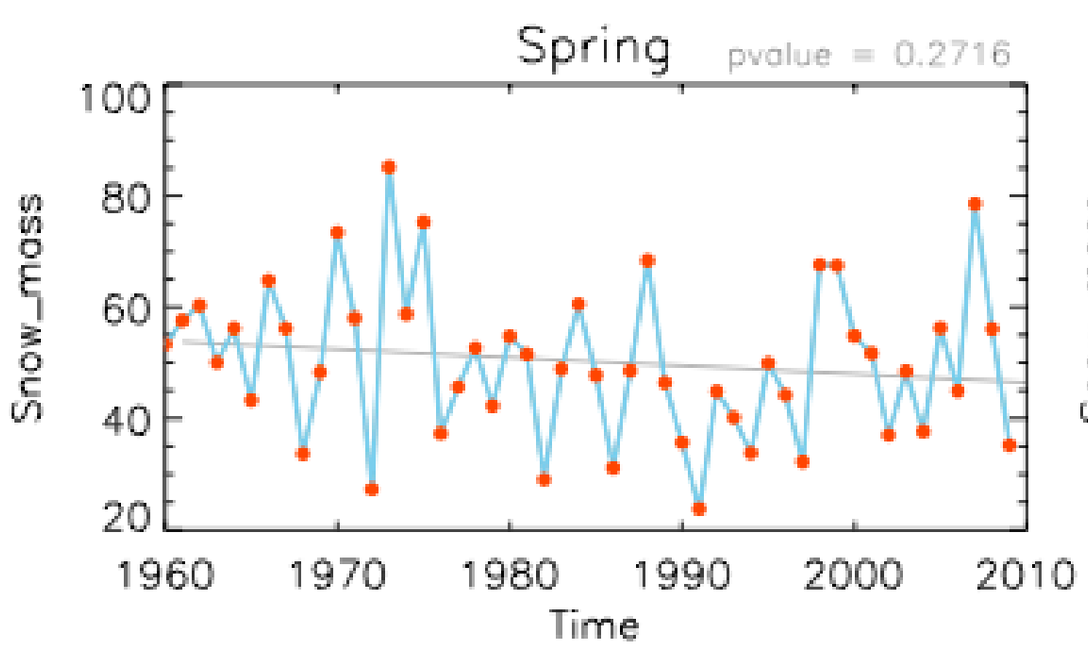
Snow Mass

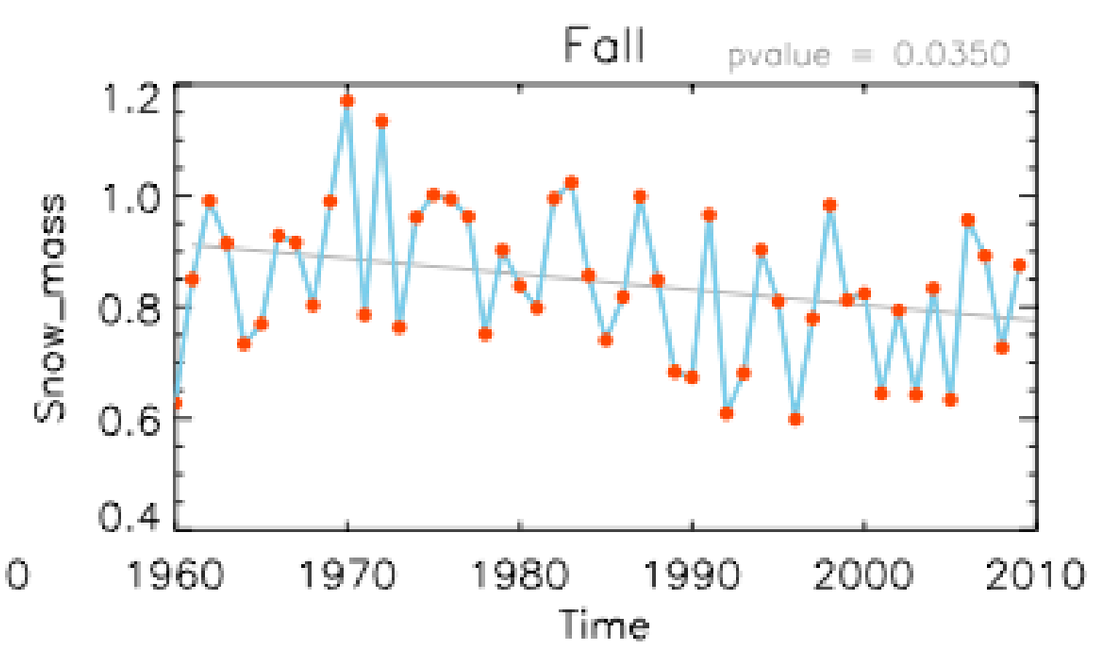
The Amount of Snow

Seasonal Average Snow Mass in Pacific Northwest America versus Time

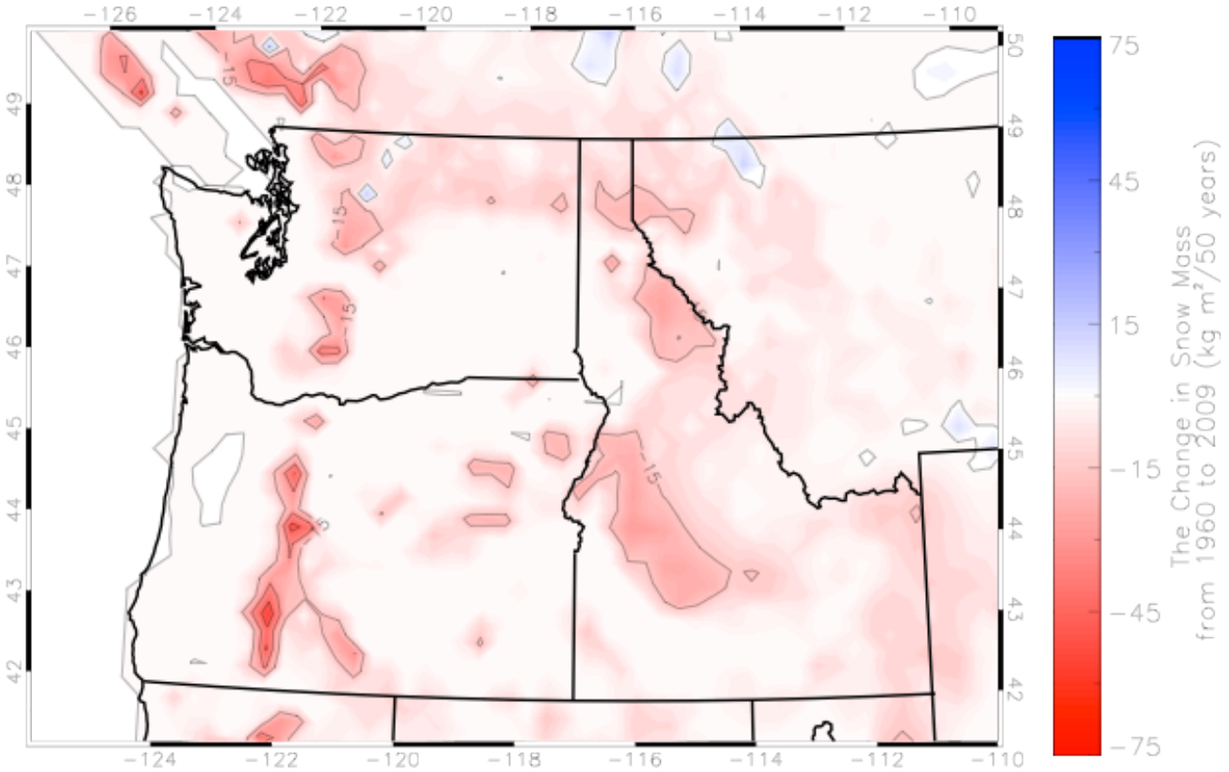




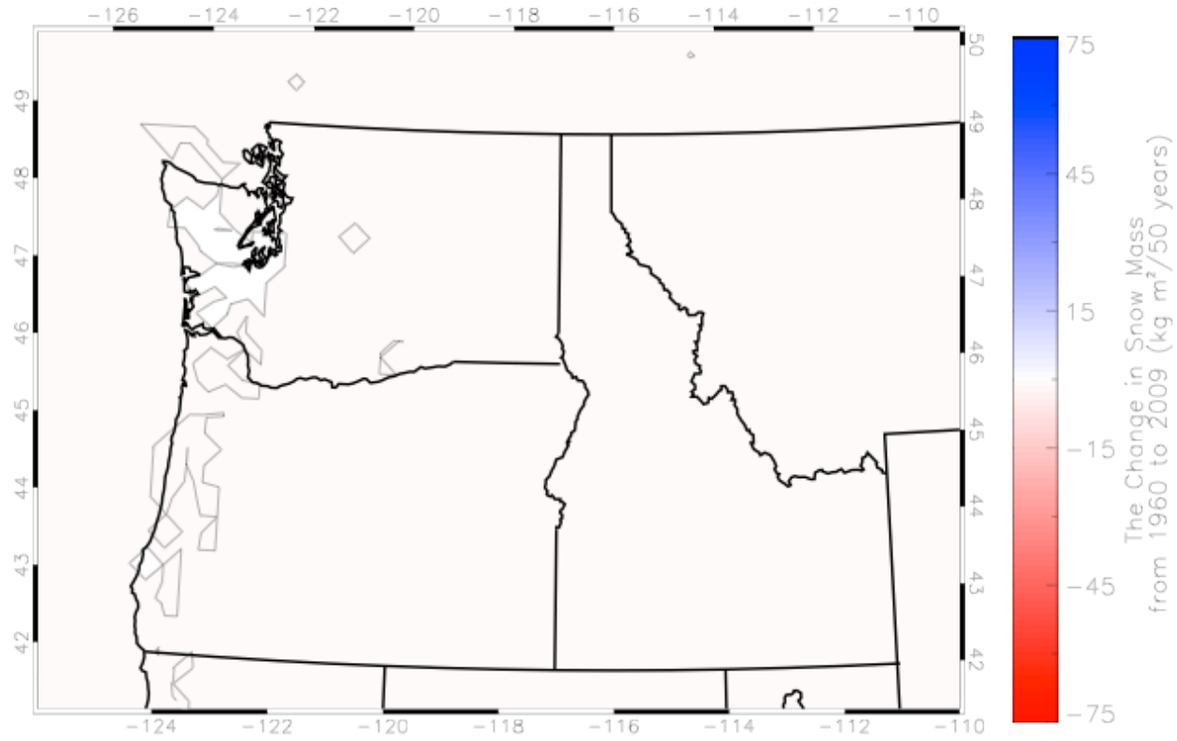




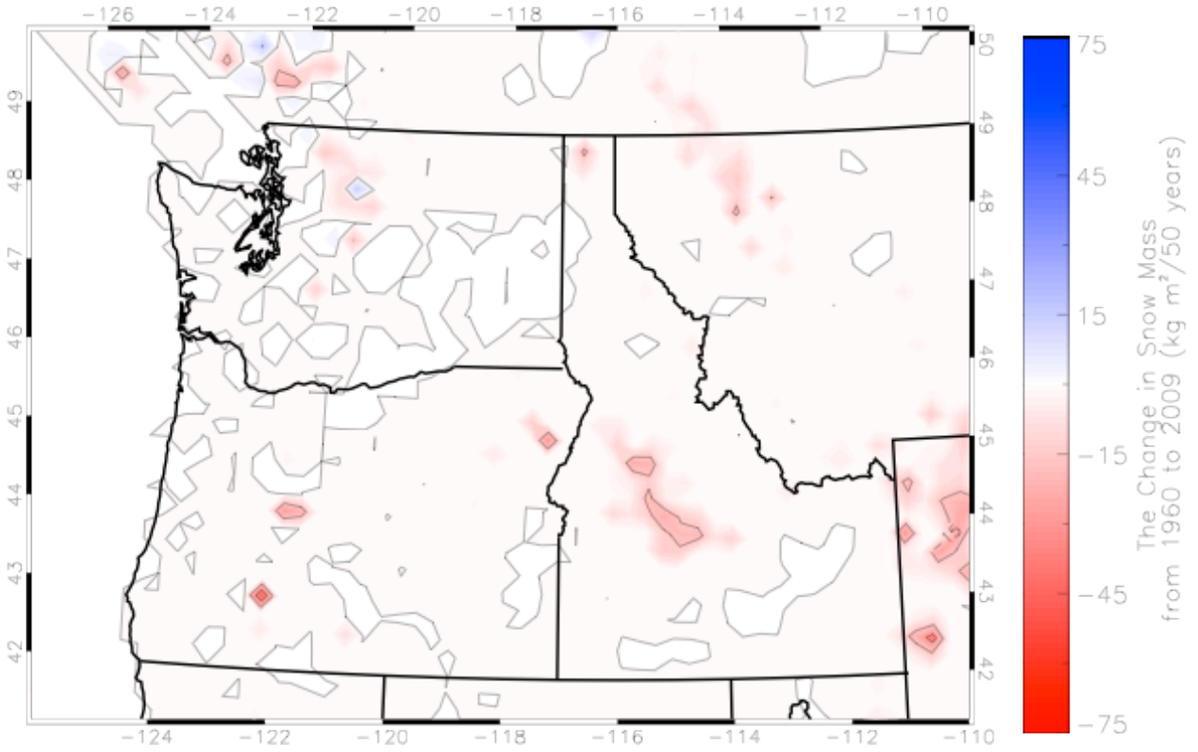
Winter Snow Mass



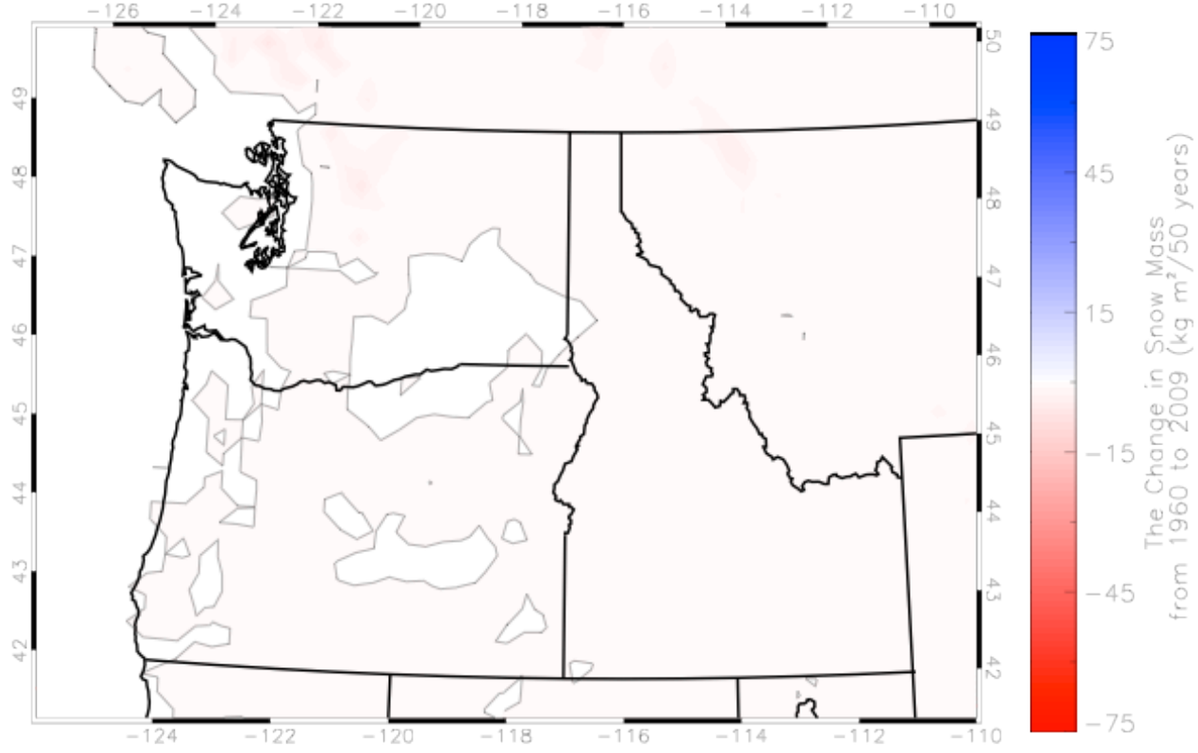
Summer Snow Mass



Spring Snow Mass



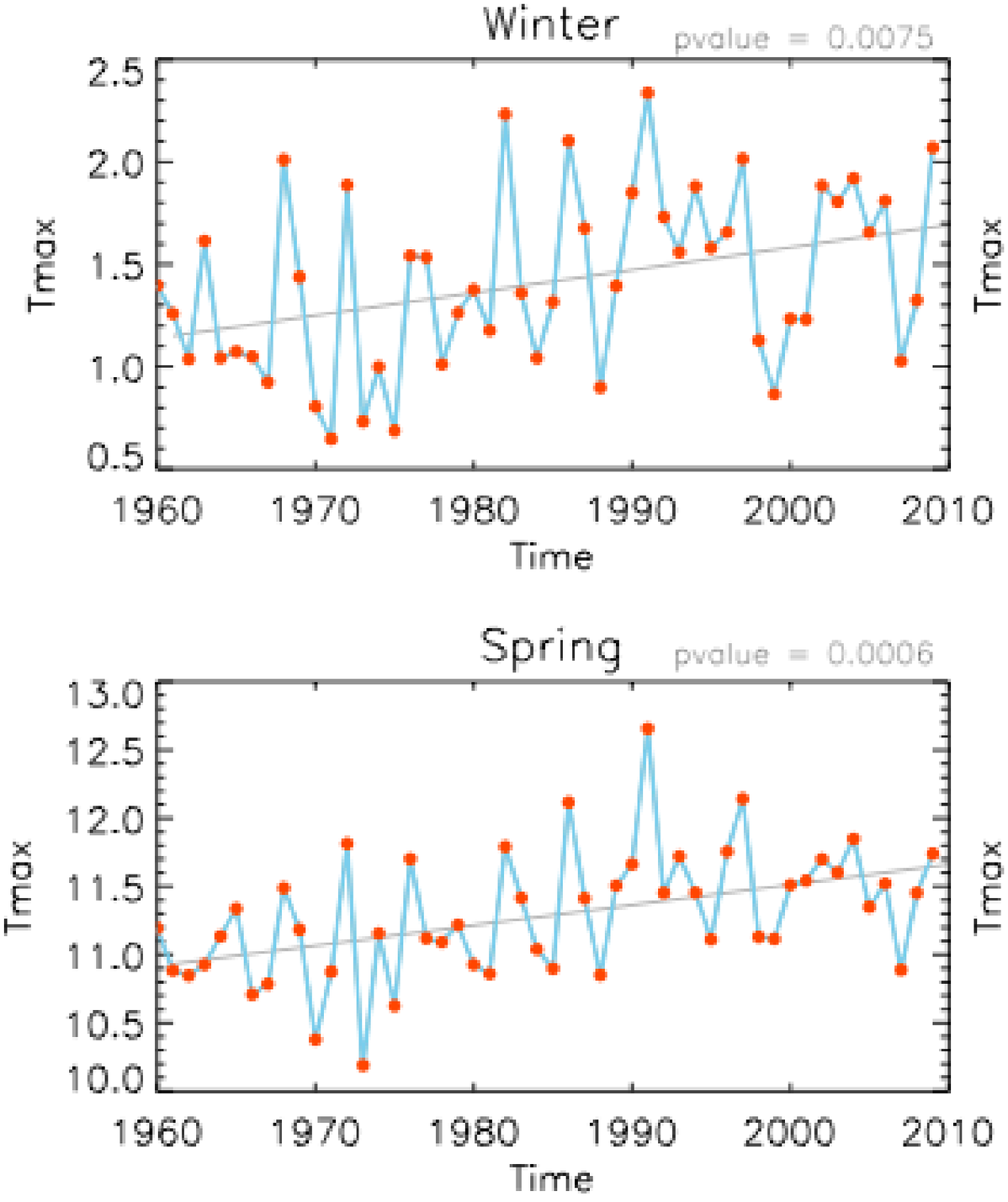
Fall Snow Mass

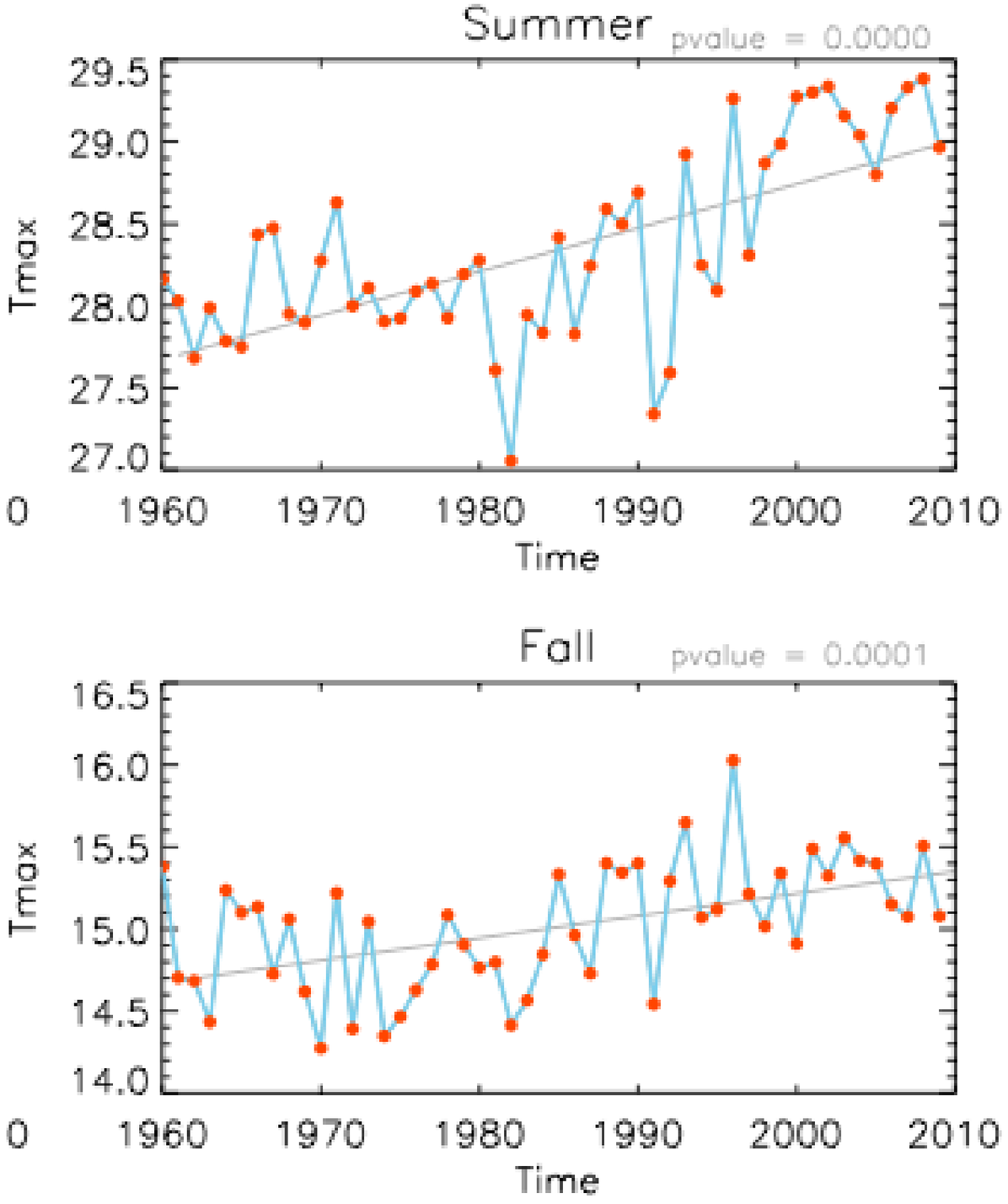


Max Temperature

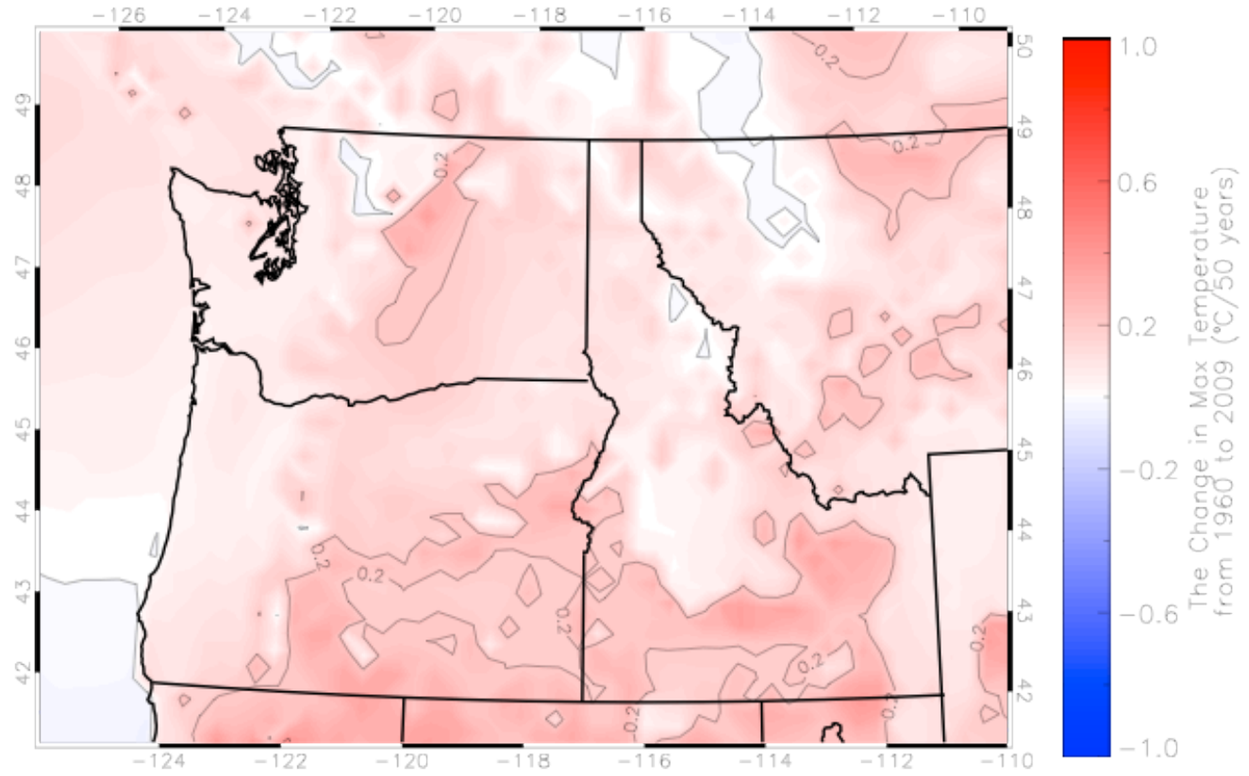
Average Maximum Temperature

Seasonal Average Tmax in Pacific Northwest America versus Time

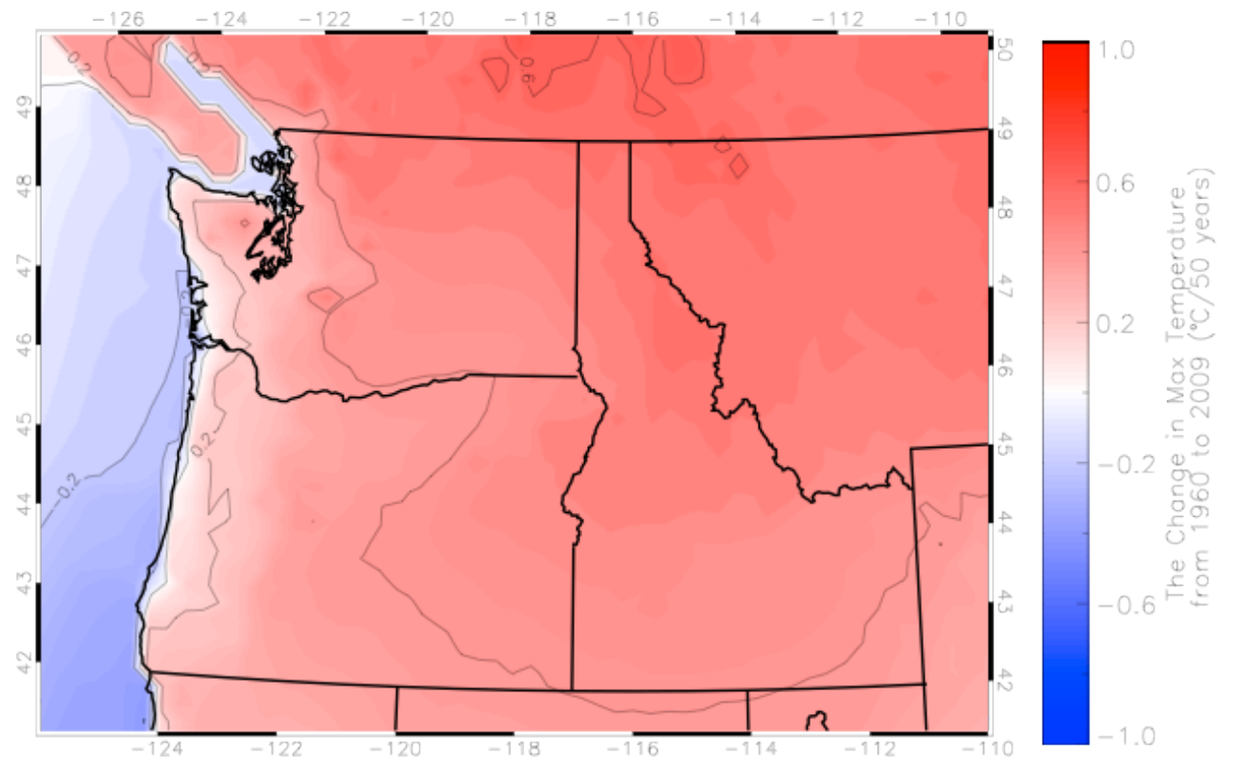




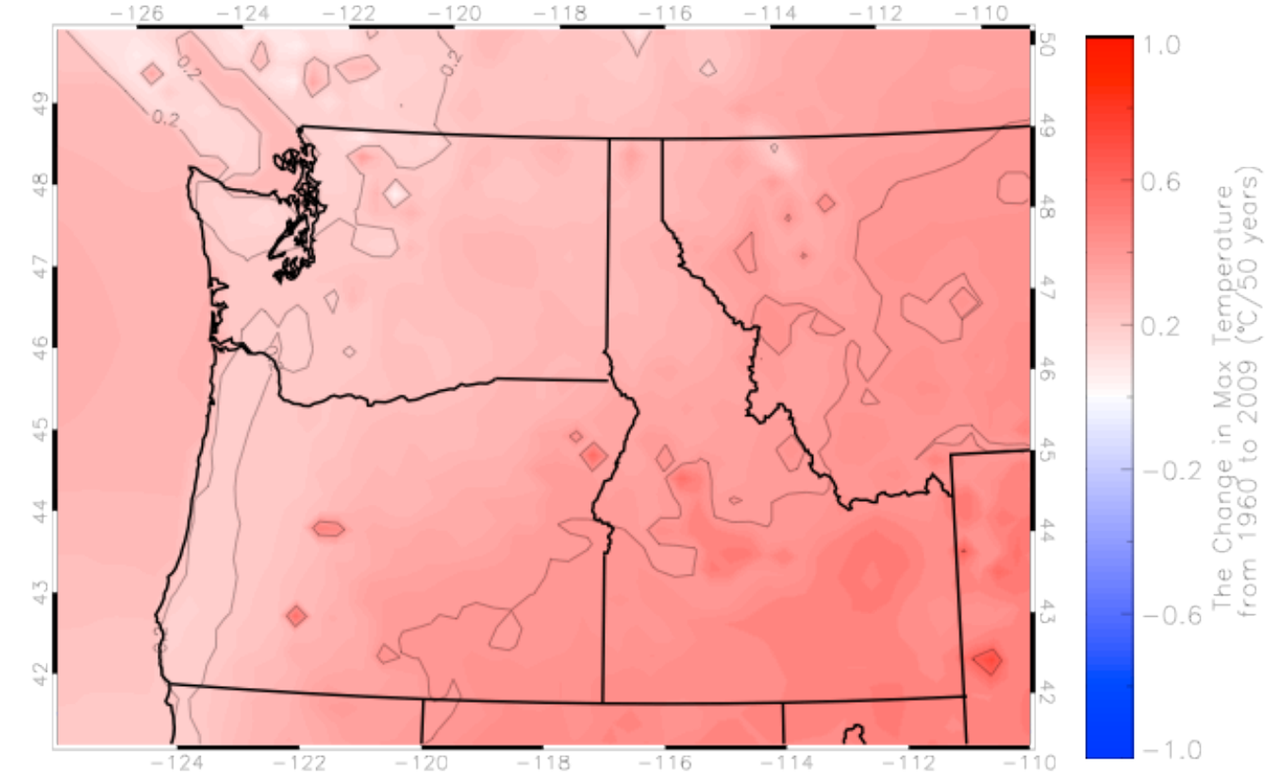
Winter Max Temperature



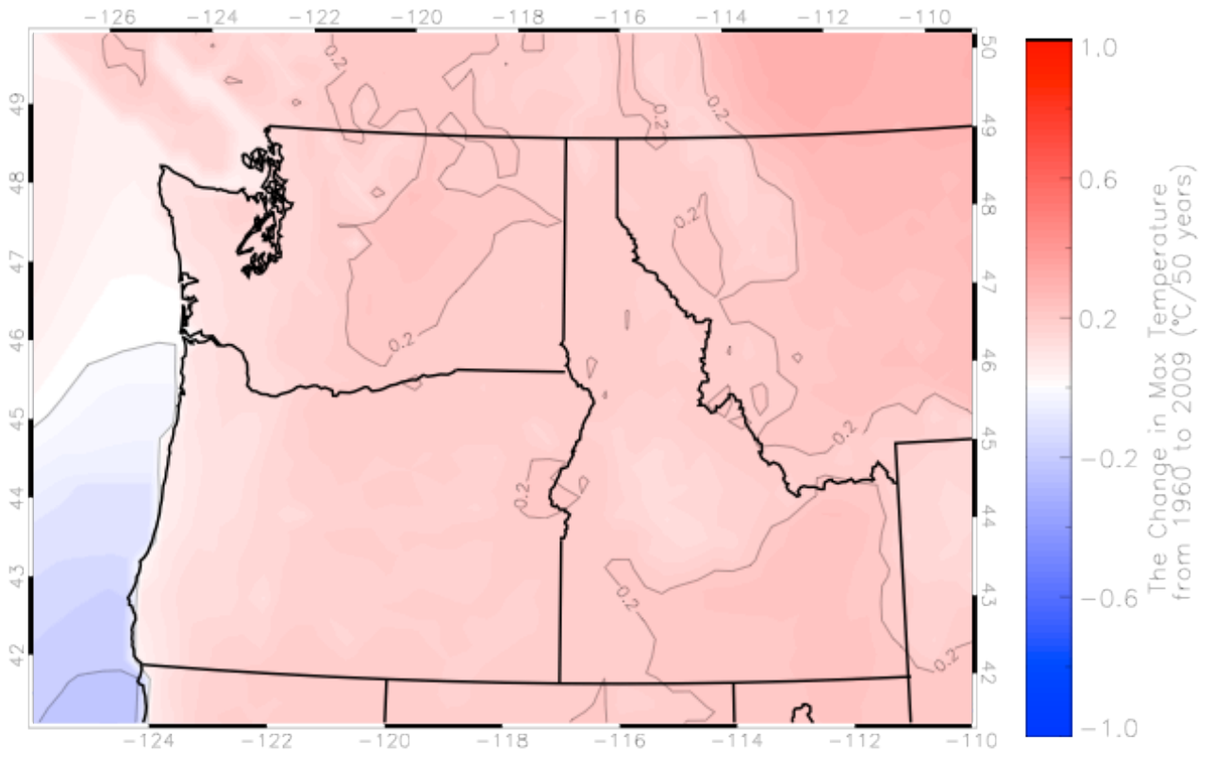
Summer Max Temperature



Spring Max Temperature



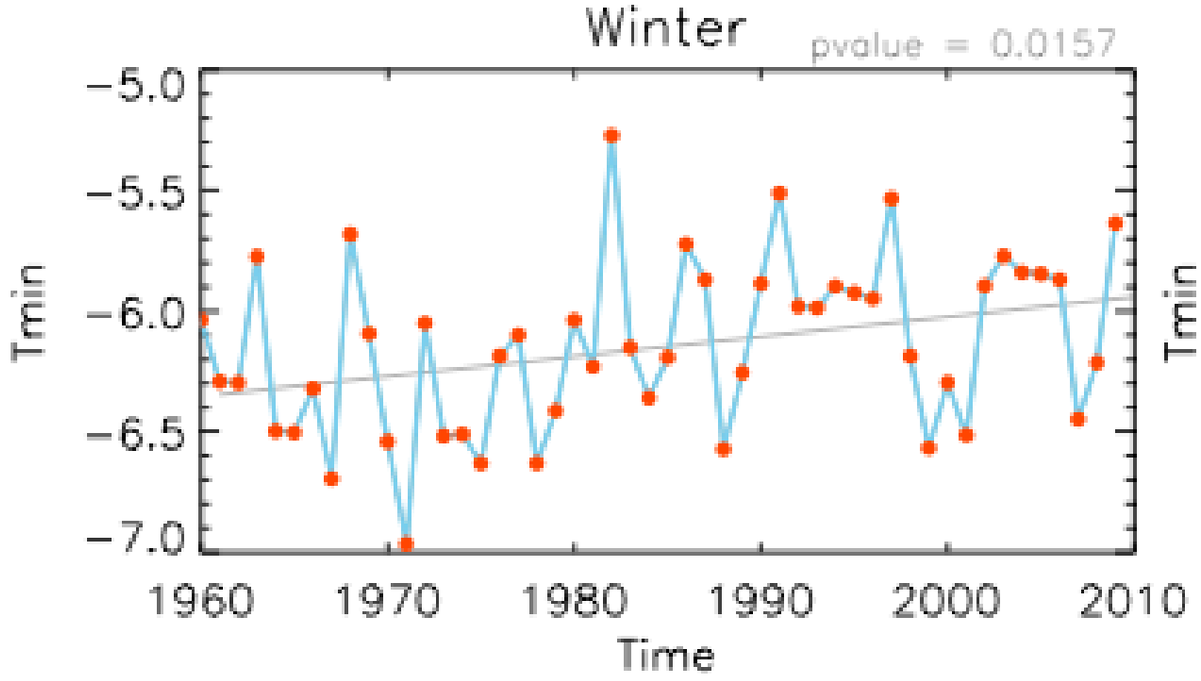
Fall Max Temperature

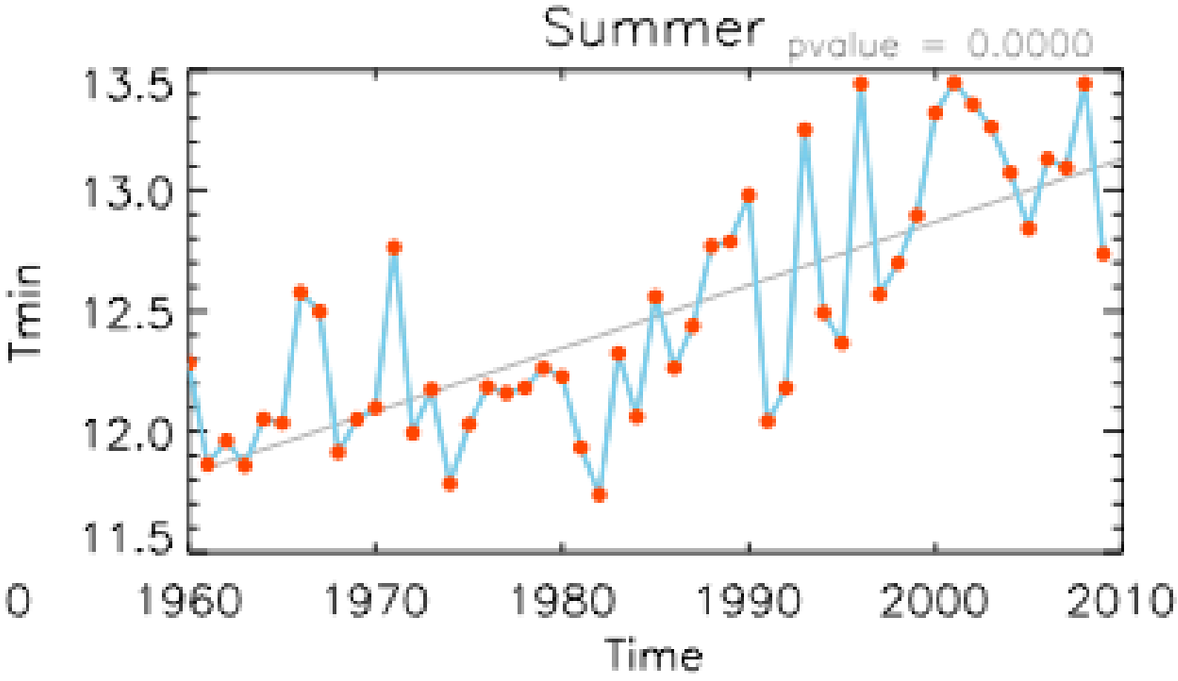


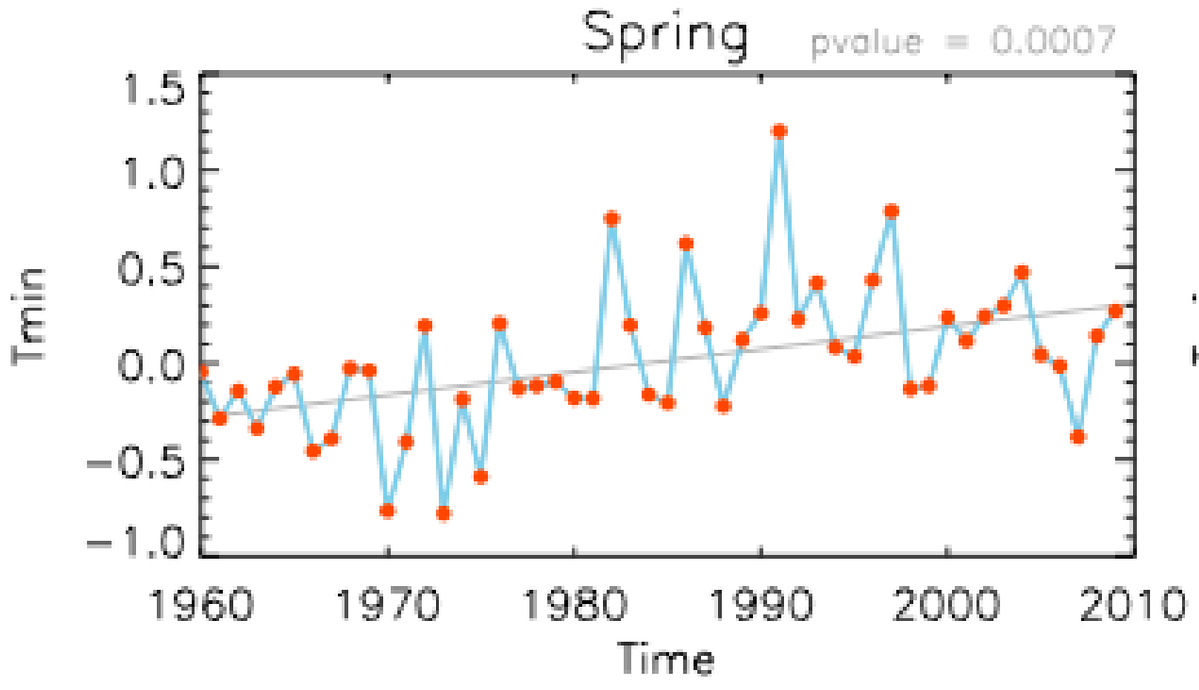
Min Temperature

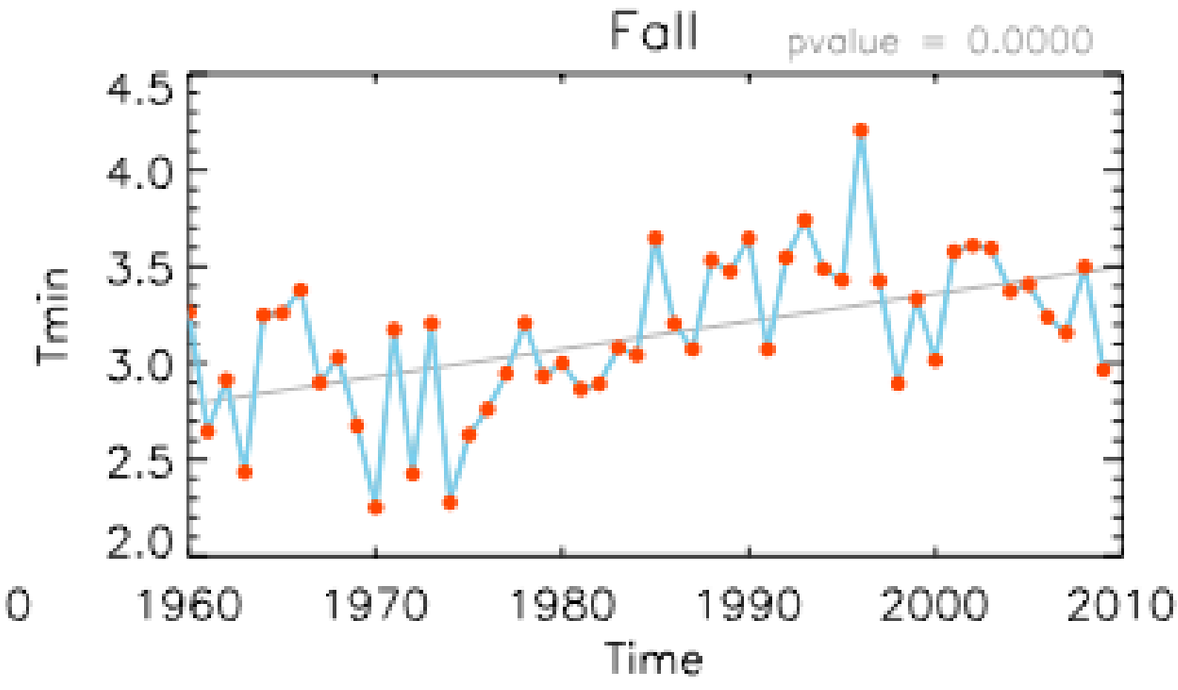
Average Minimum Temperature

Seasonal Average Tmin in Pacific Northwest America versus Time

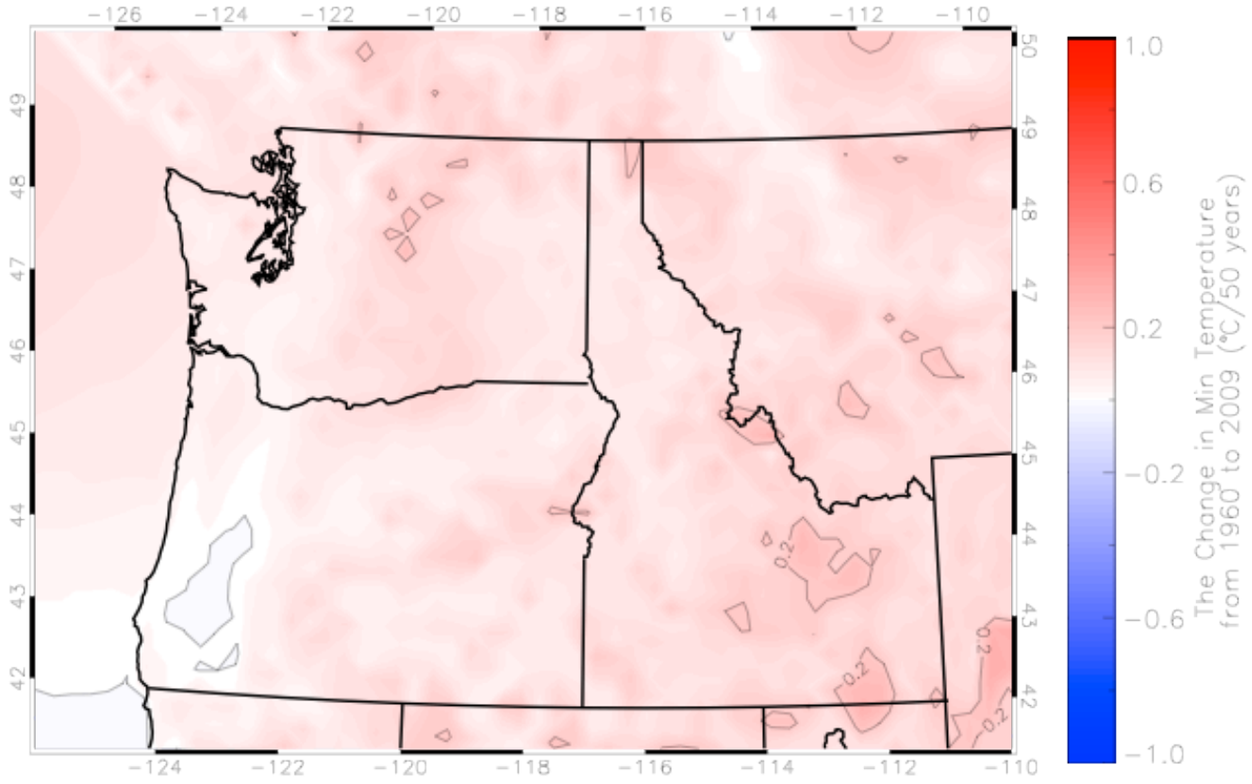




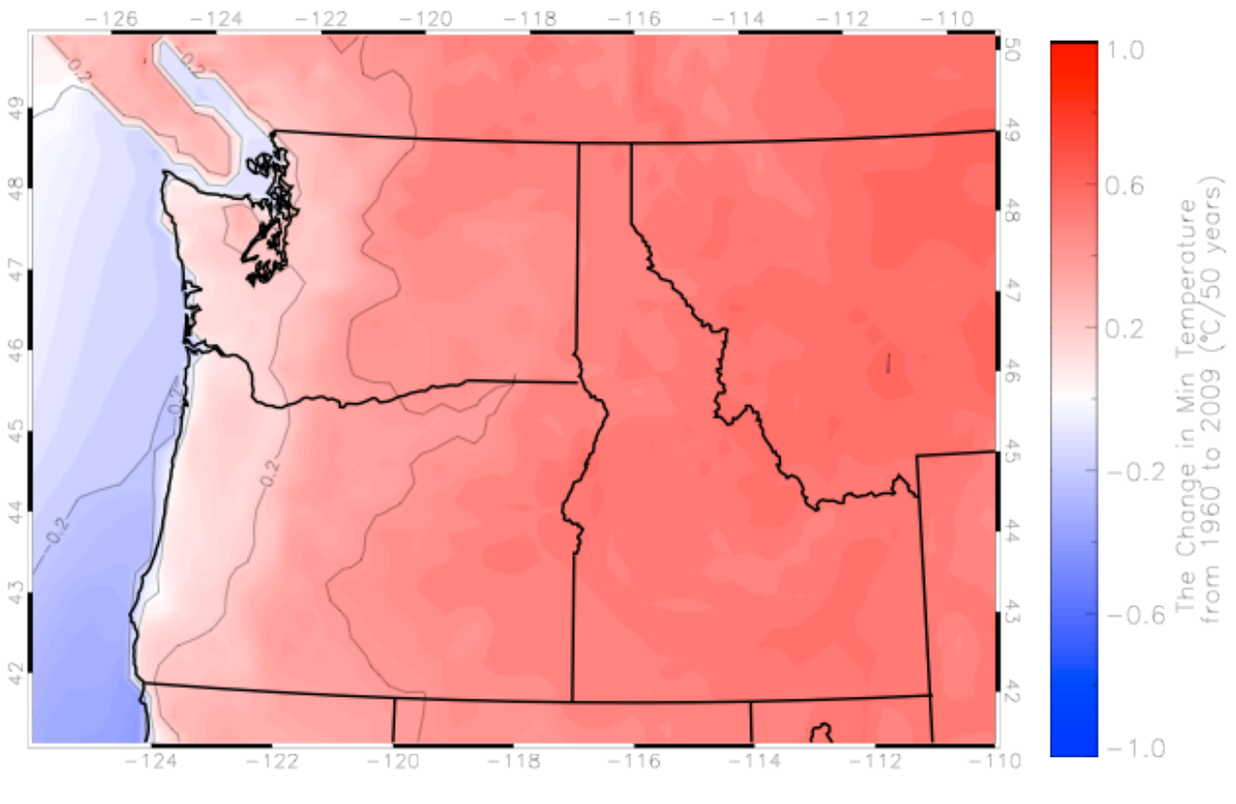




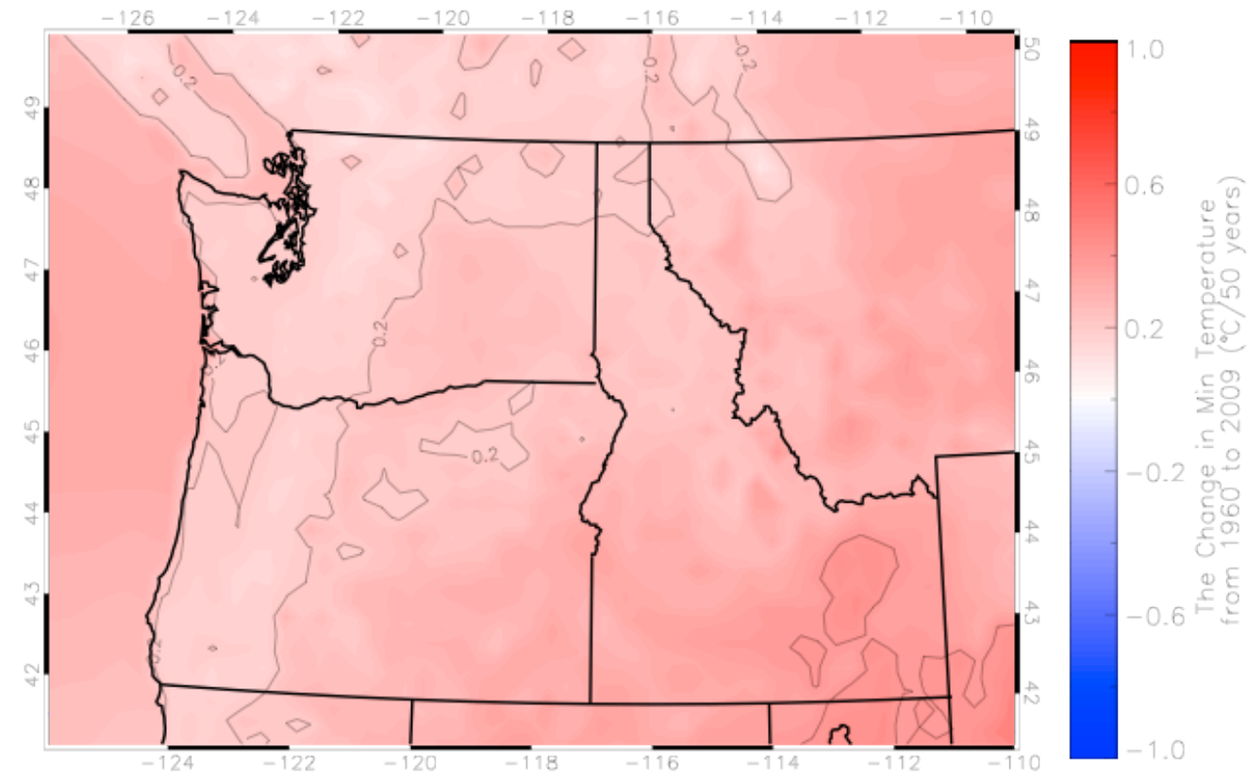
Winter Min Temperature



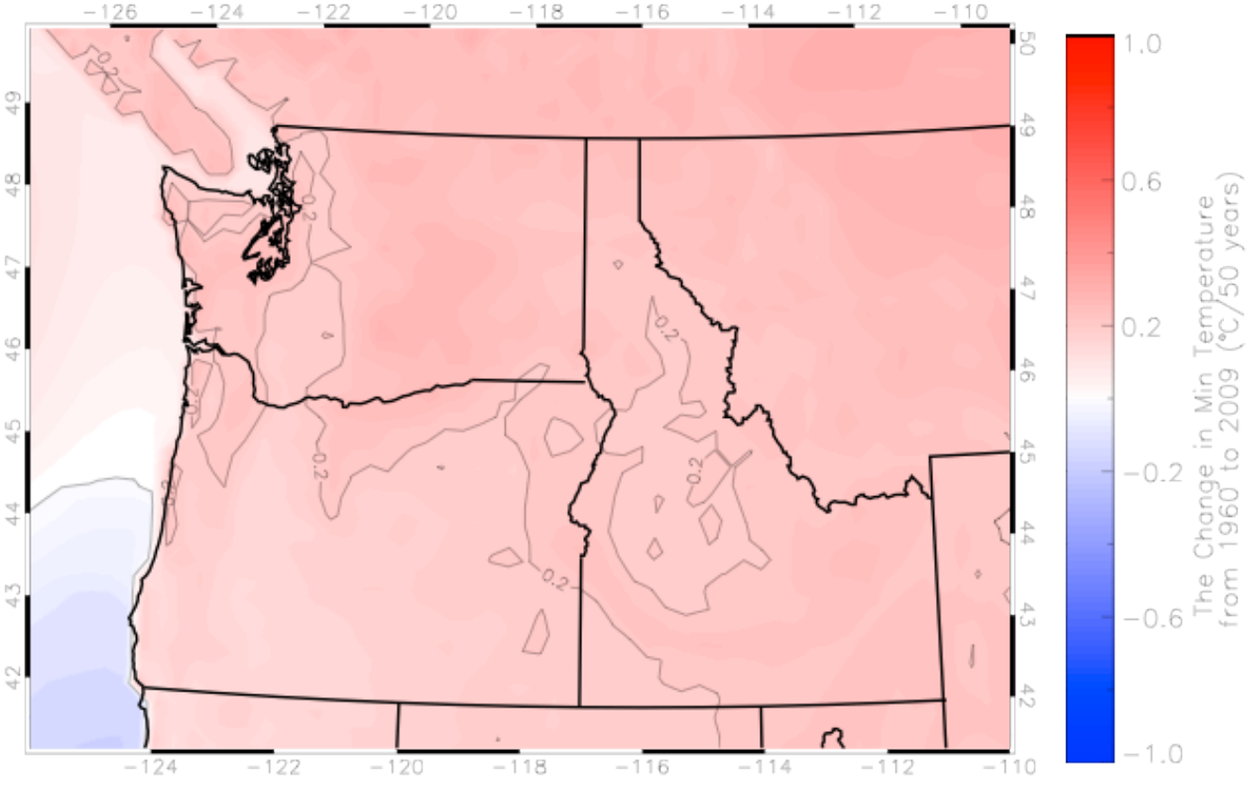
Summer Min Temperature



Spring Min Temperature



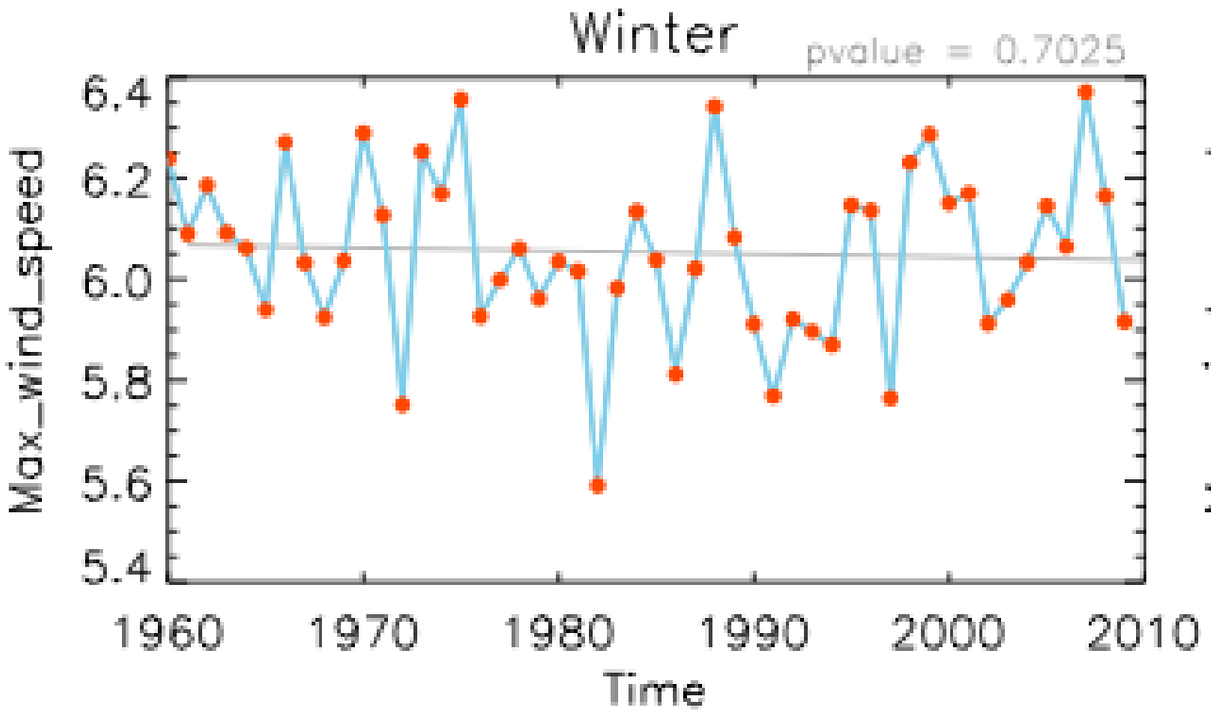
Fall Min Temperature

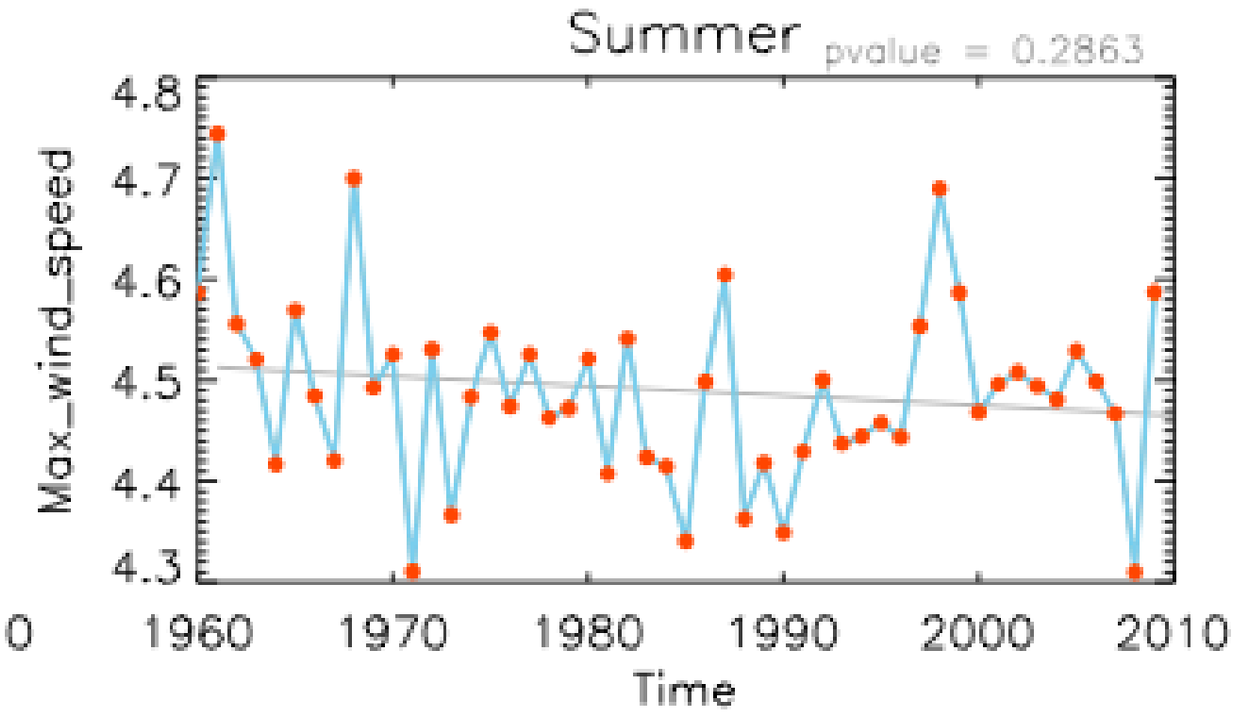


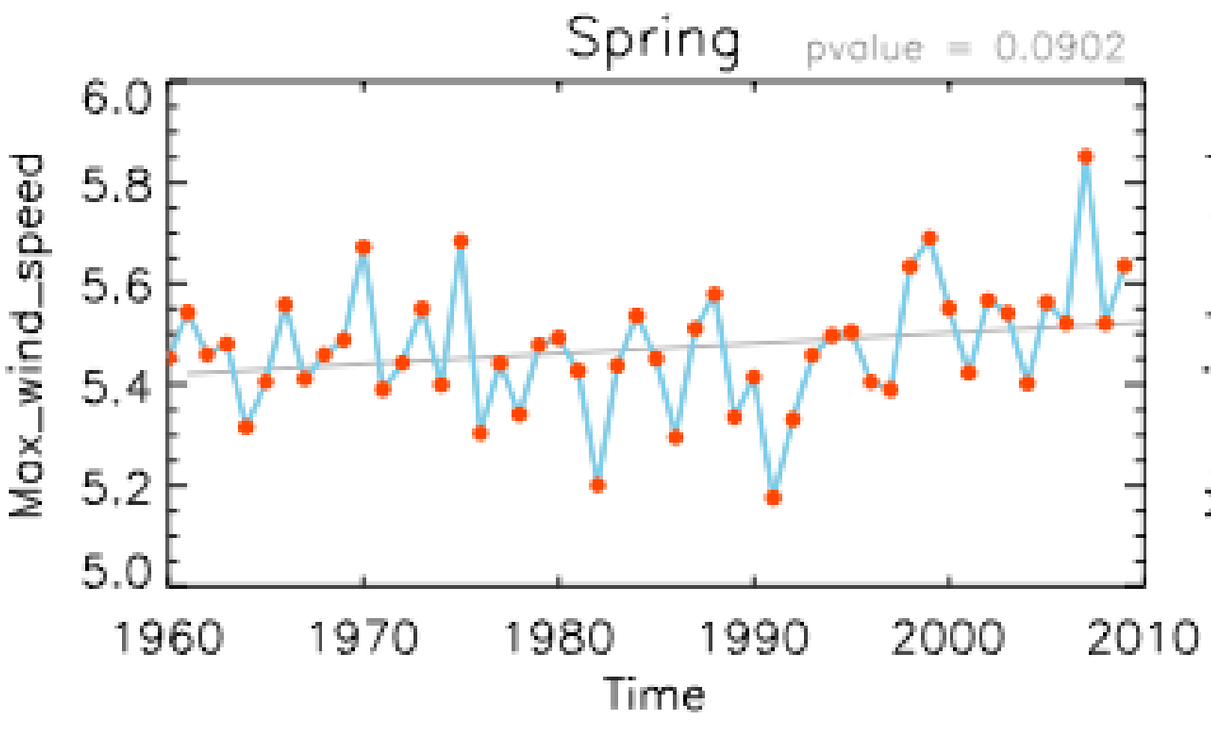
Max Wind Speed

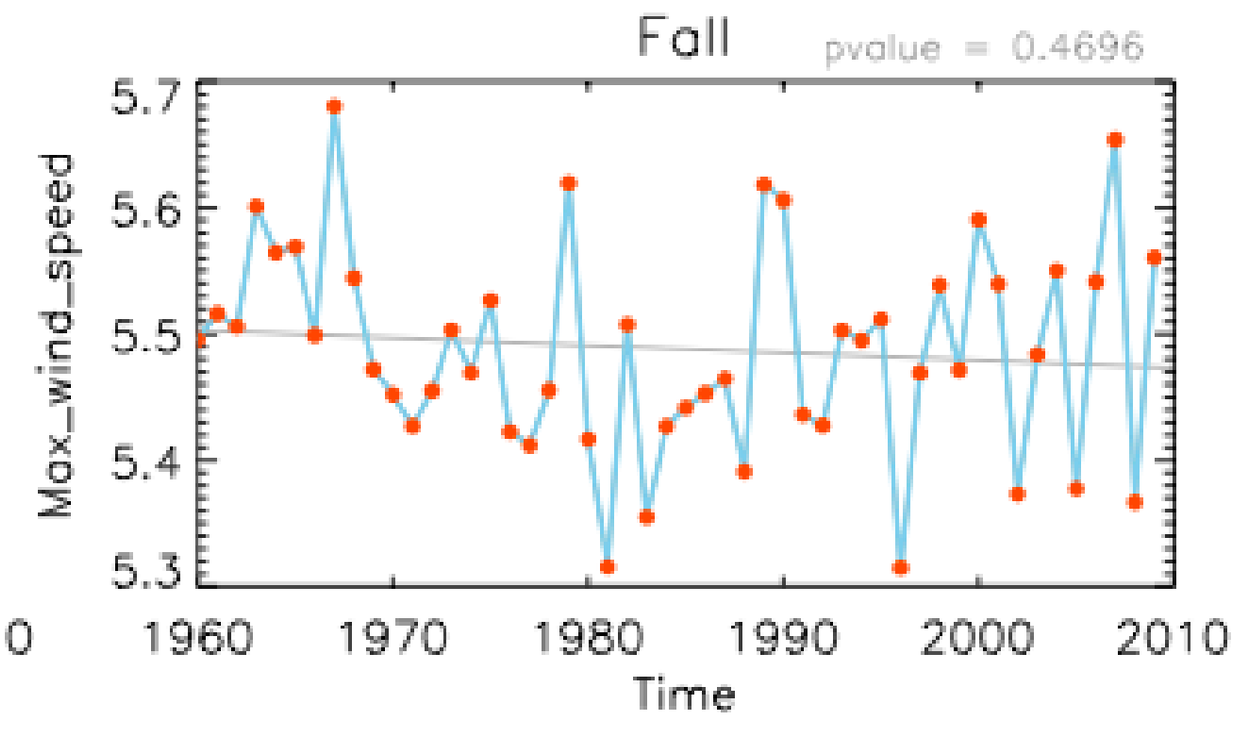
The Maximum Wind Speed

Seasonal Average Max Wind Speed in Pacific Northwest America versus Time

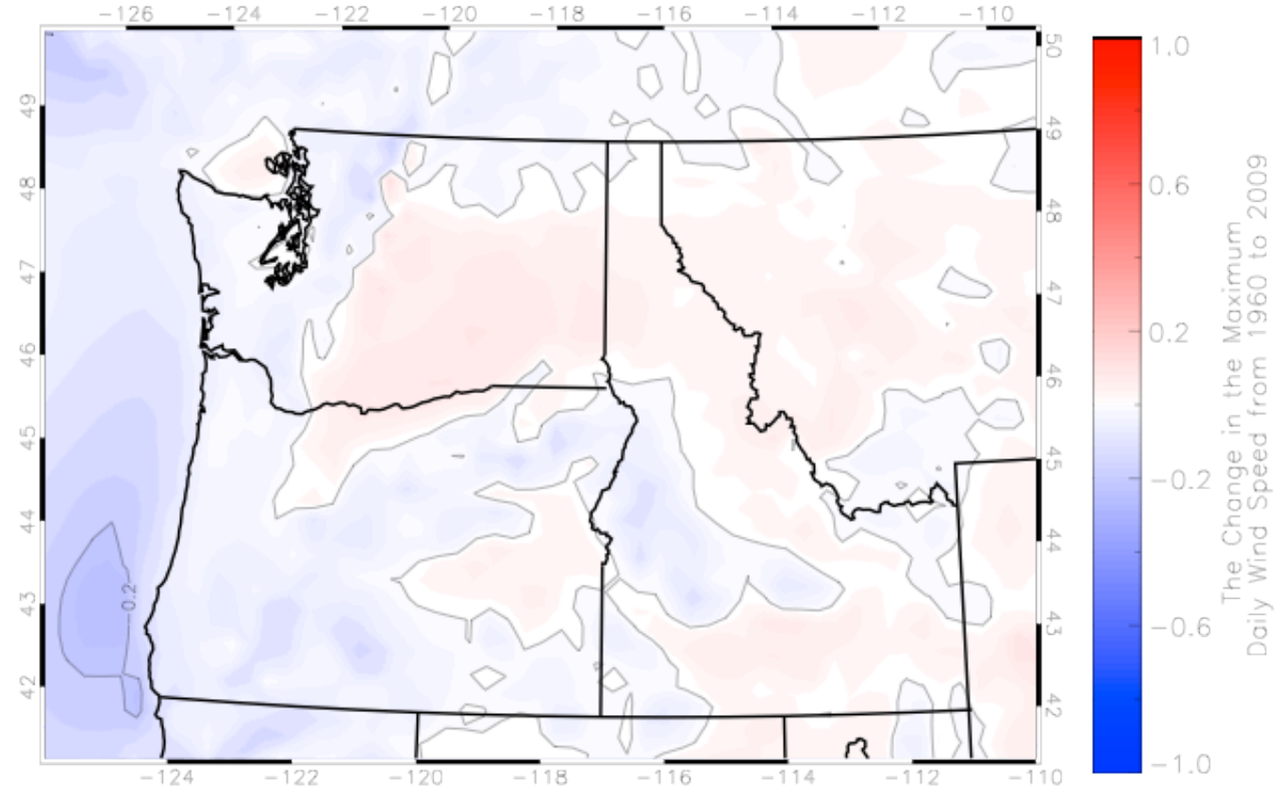




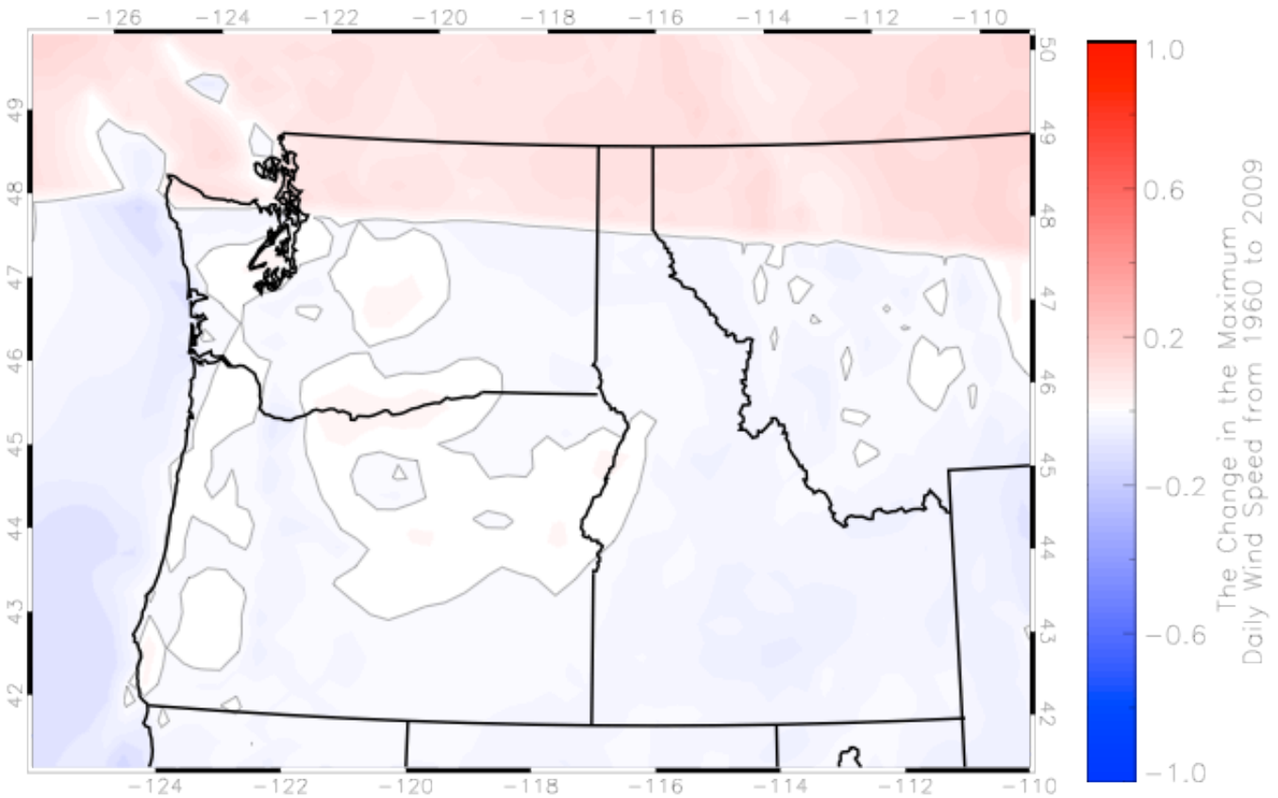




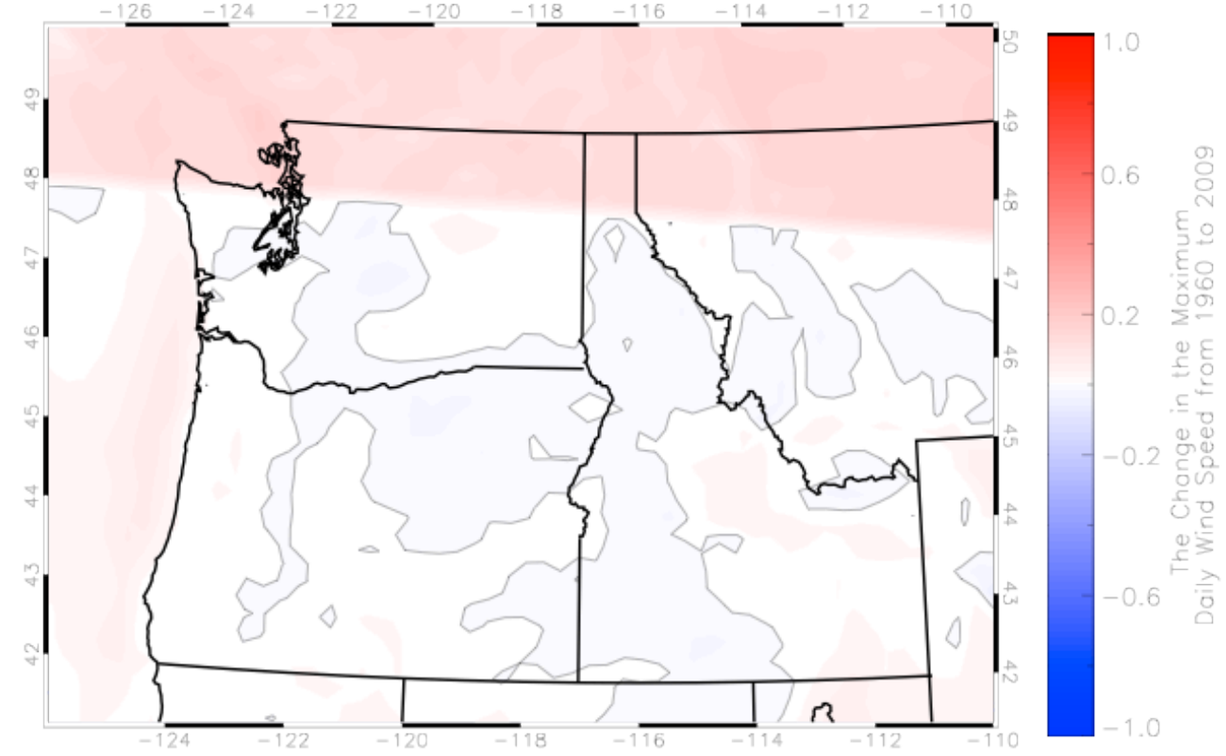
Winter Max Wind Speed



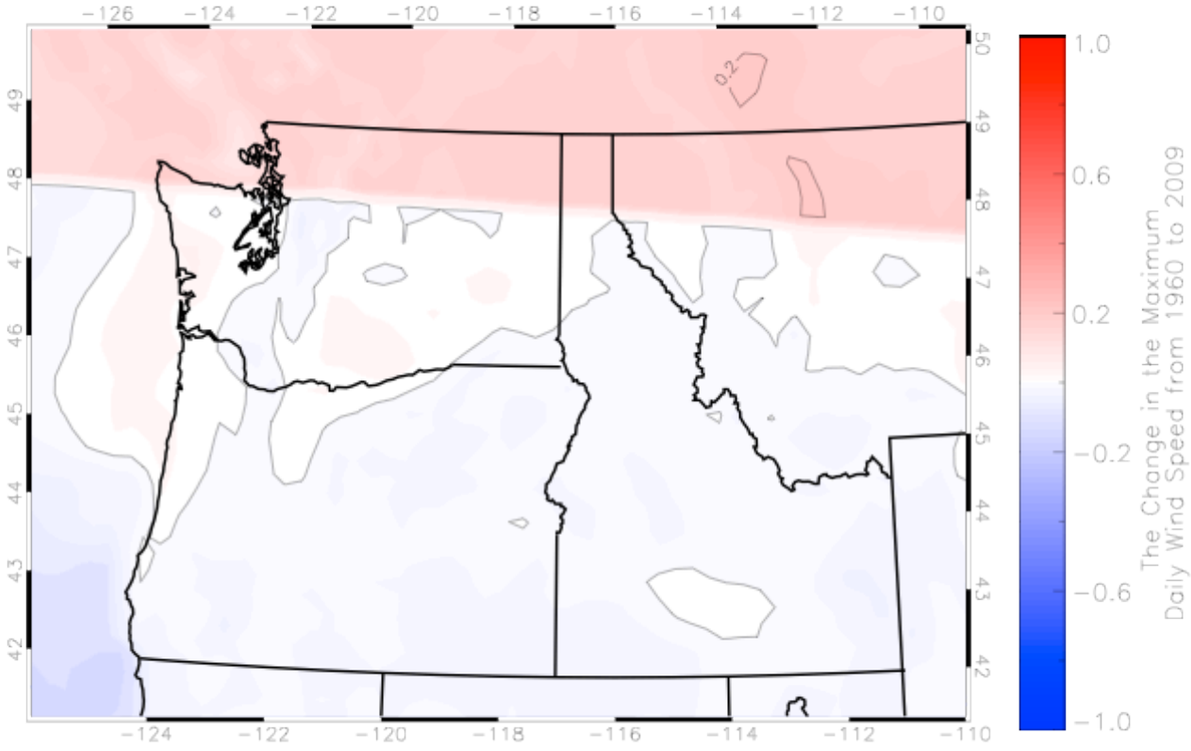
Summer Max Wind Speed



Spring Max Wind Speed



Fall Max Wind Speed

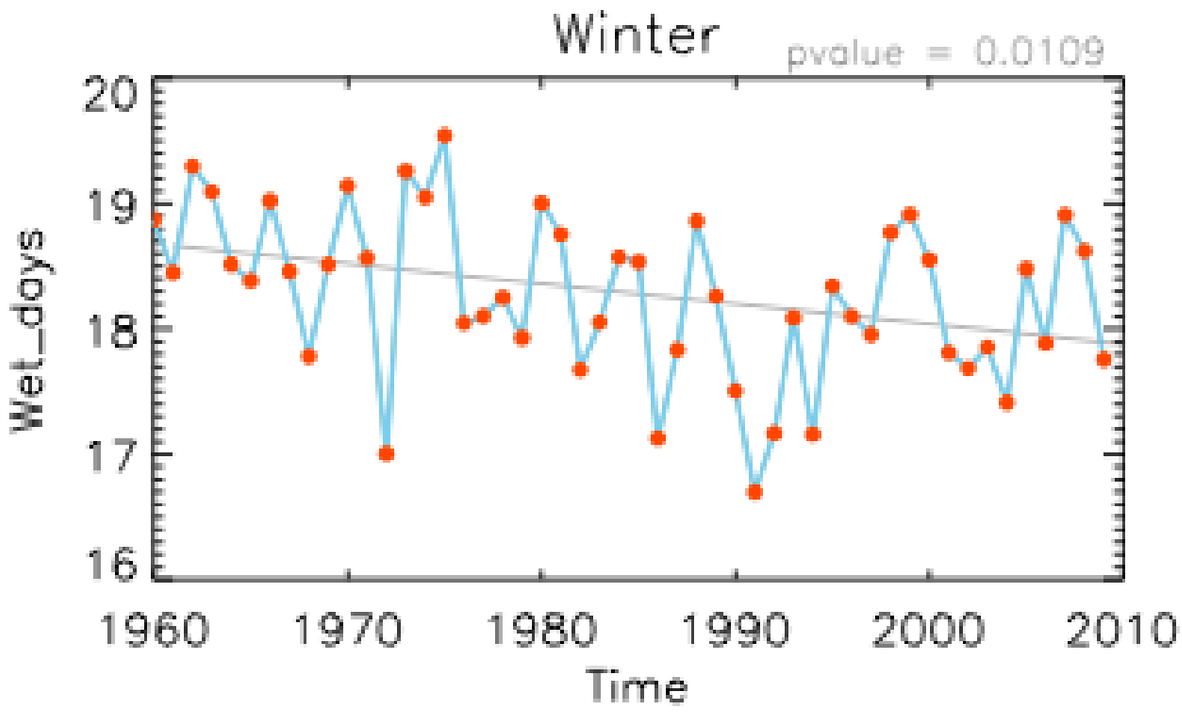


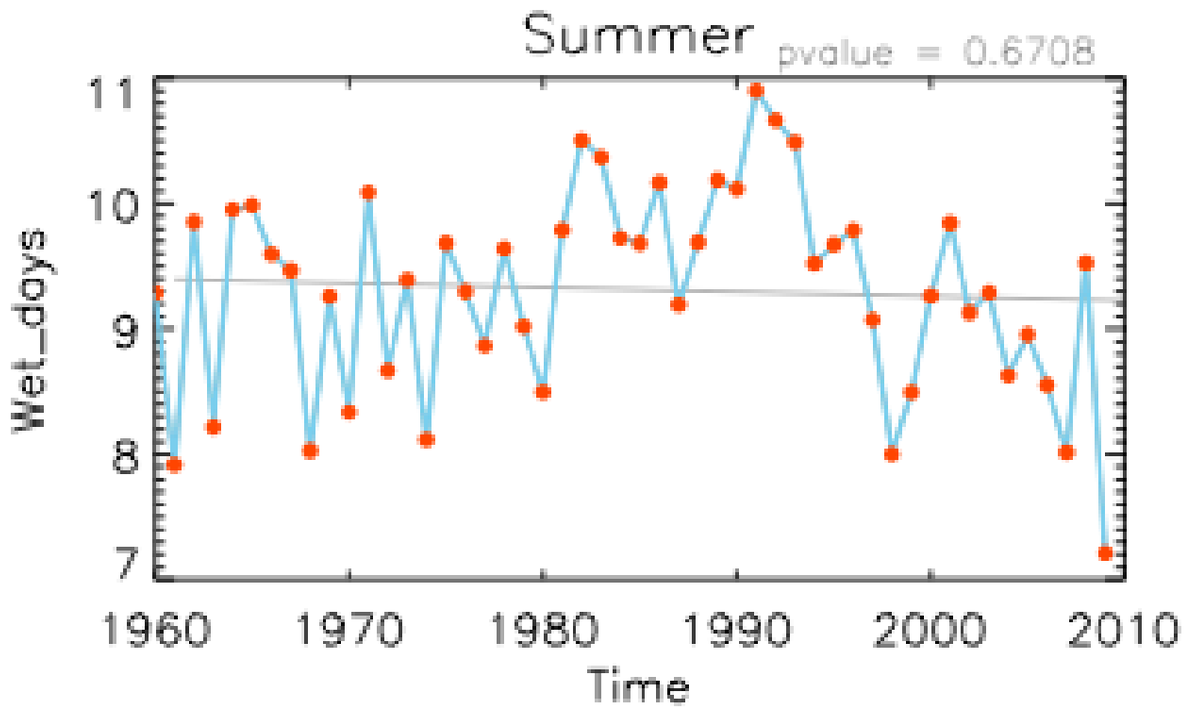
Number of Wet Days

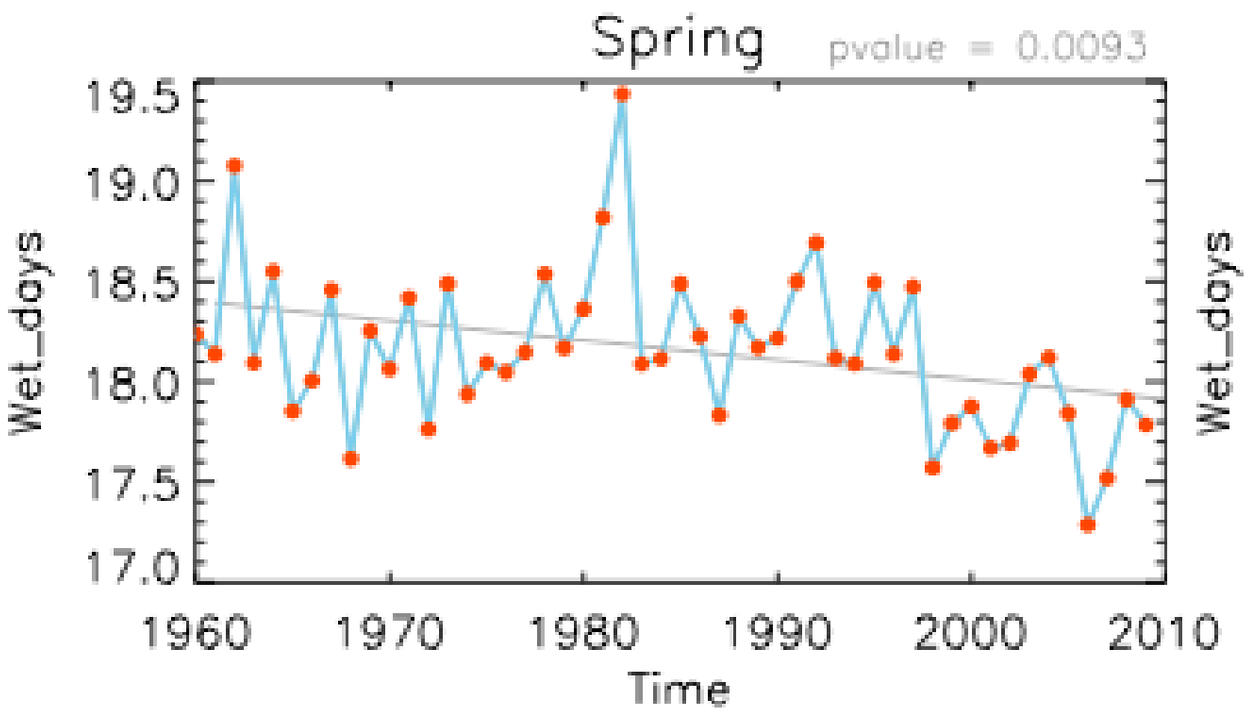
Number of Wet Days

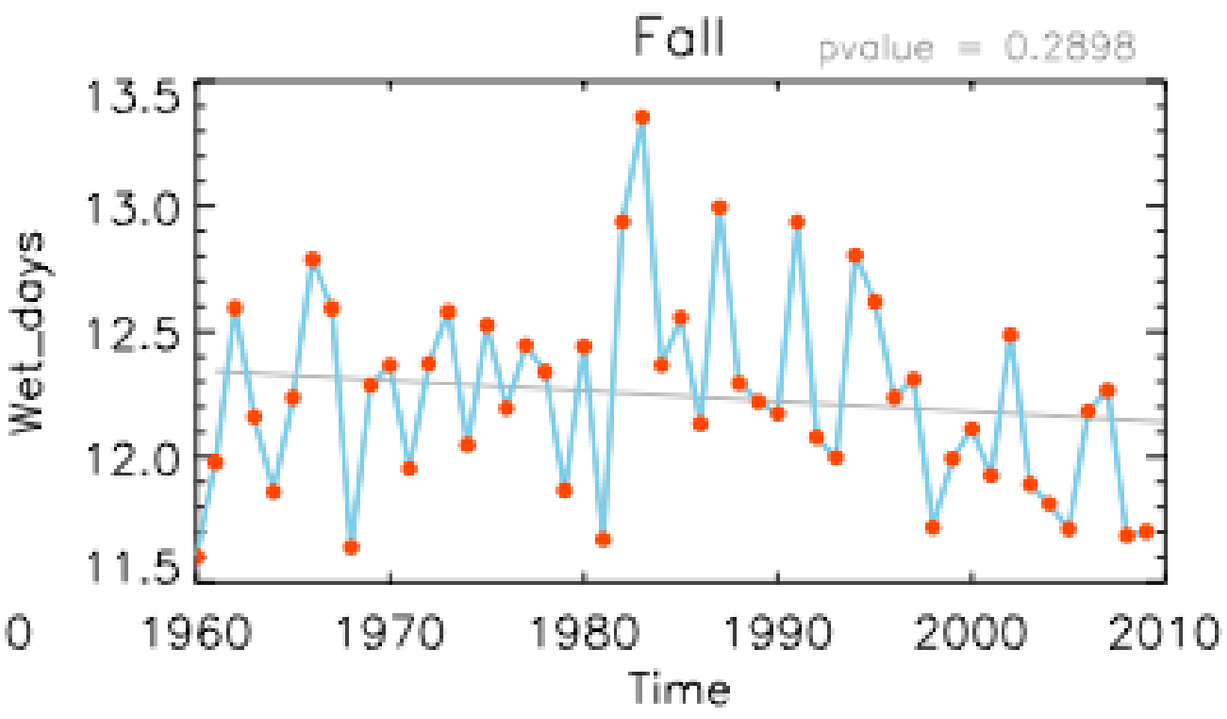
A wet day is considered to be wet by 0.1mm.

Seasonal Average Wet Days in Pacific Northwest America versus Time

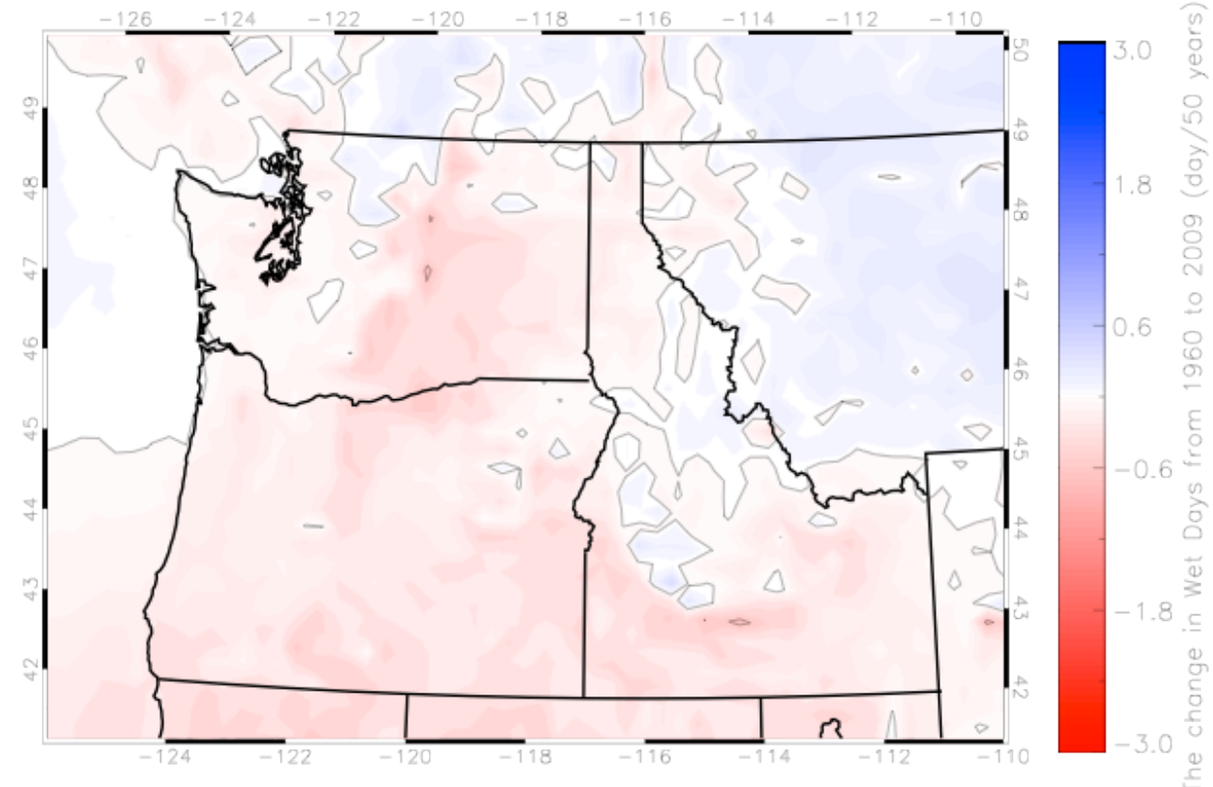




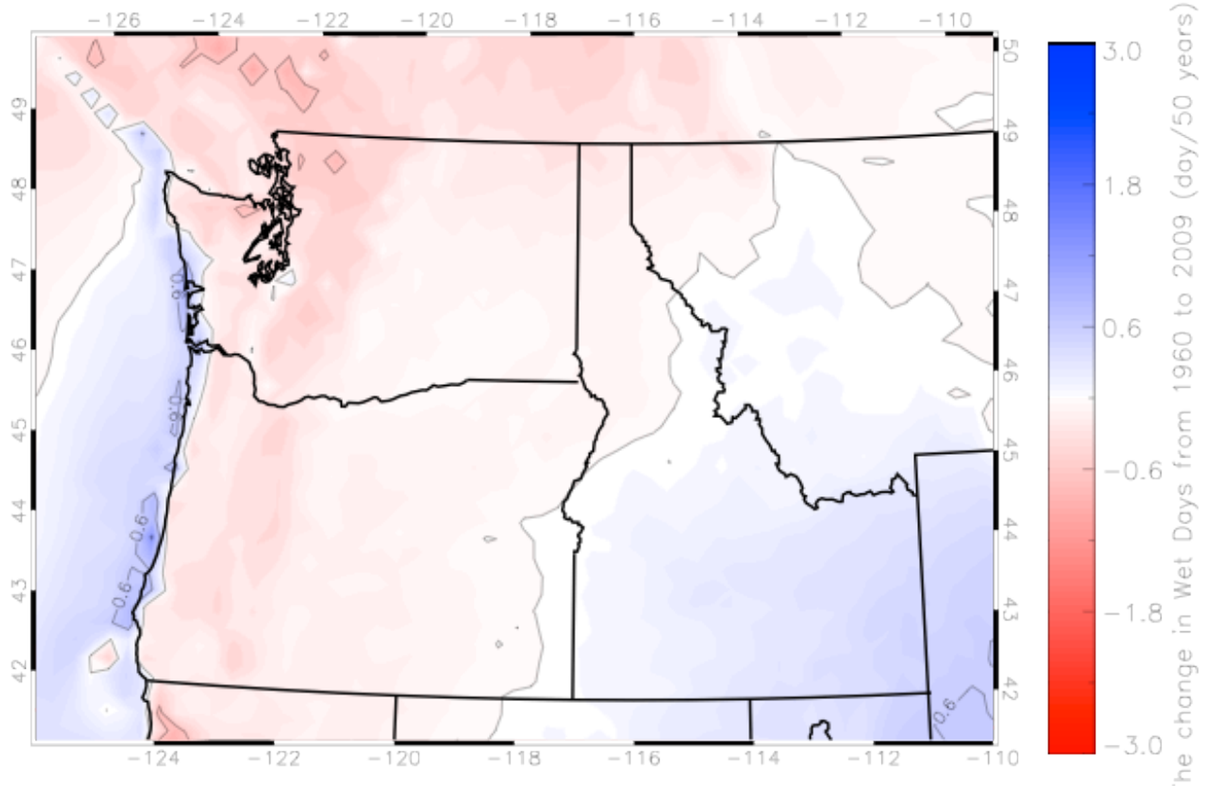




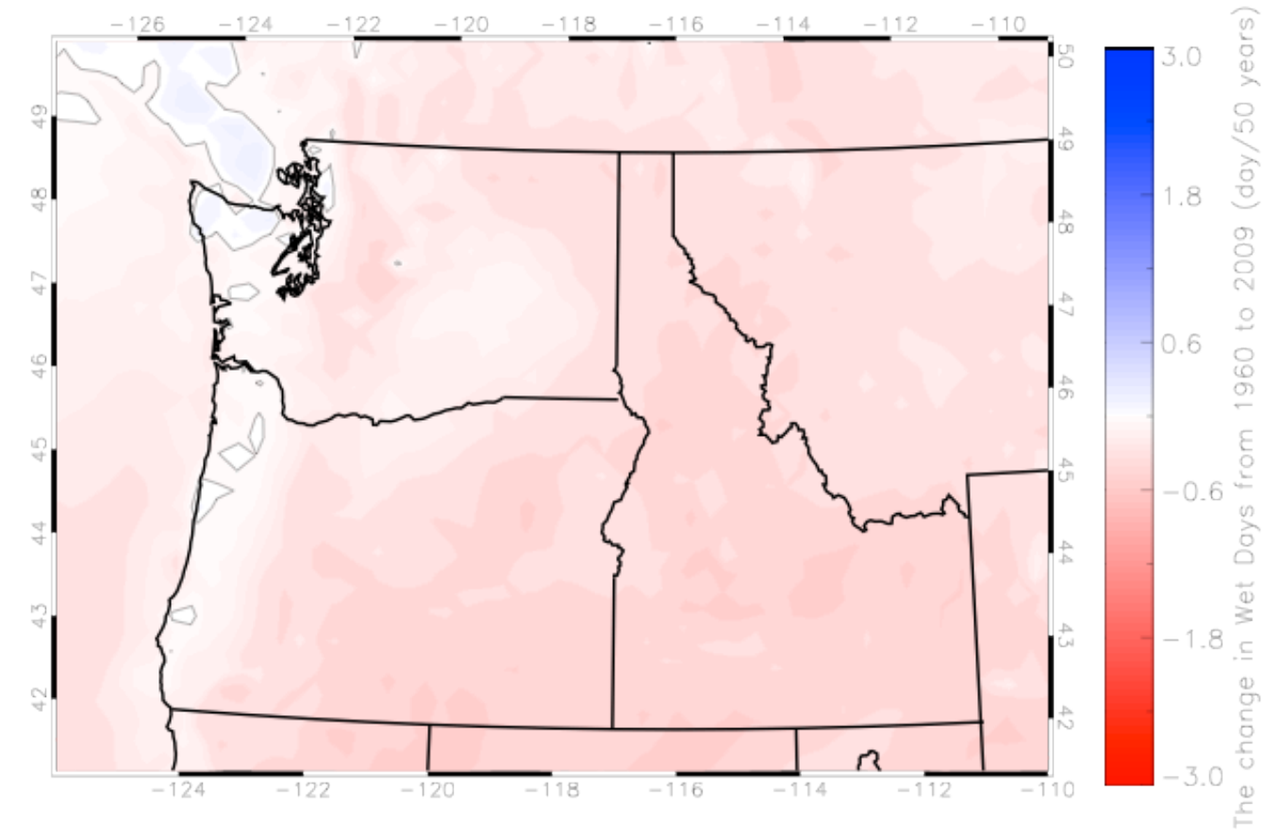
Winter Wet Days



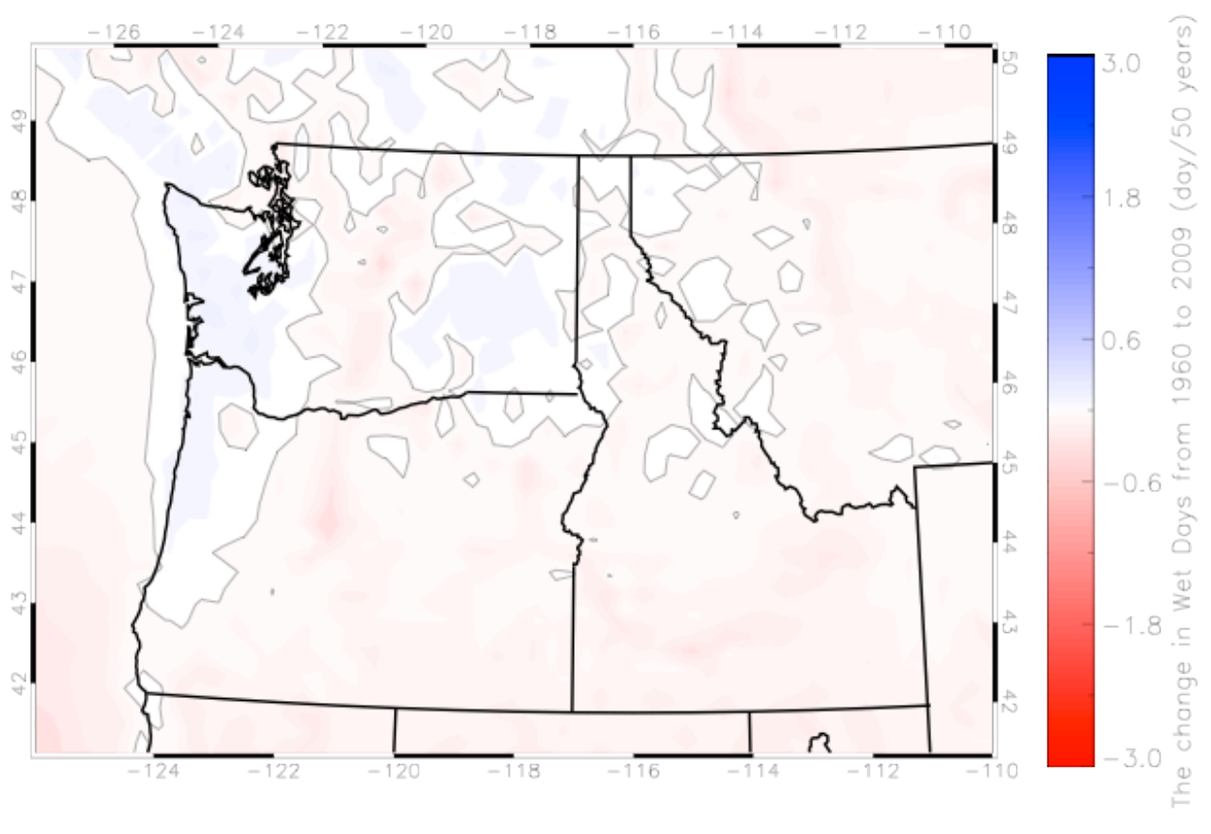
Summer Wet Days



Spring Wet Days



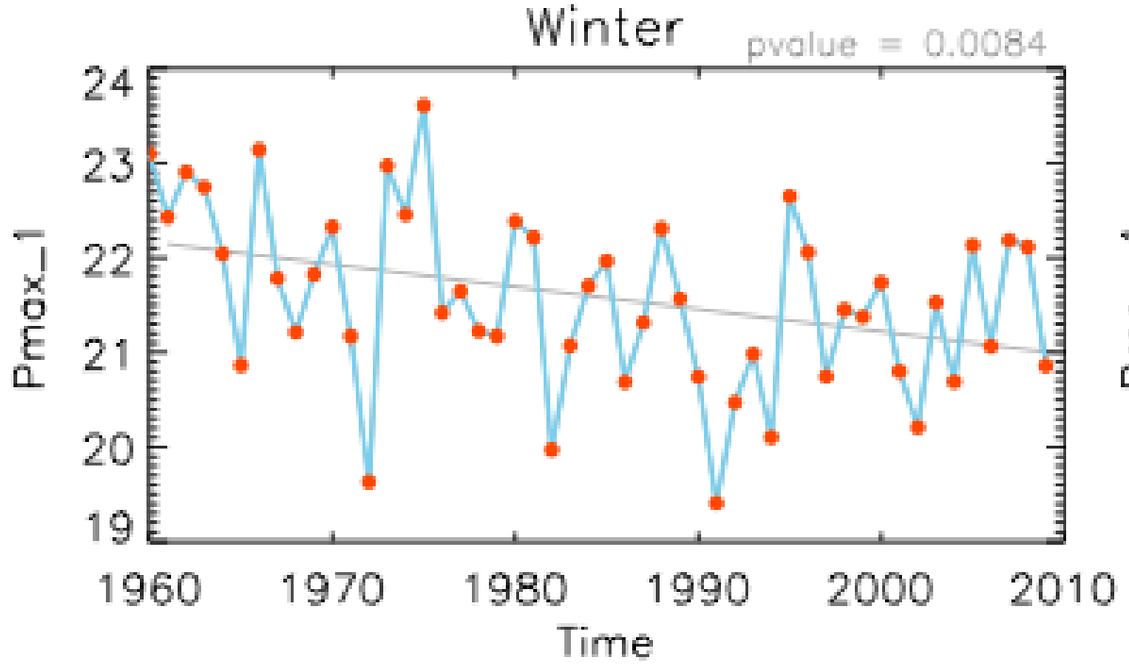
Fall Wet Days

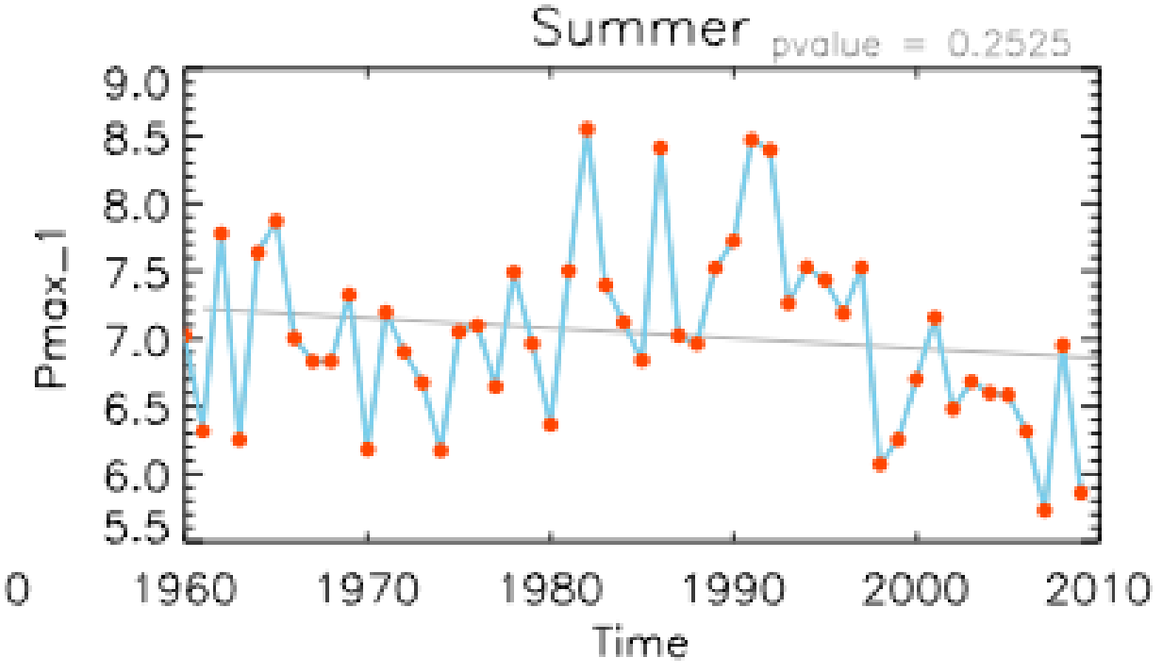


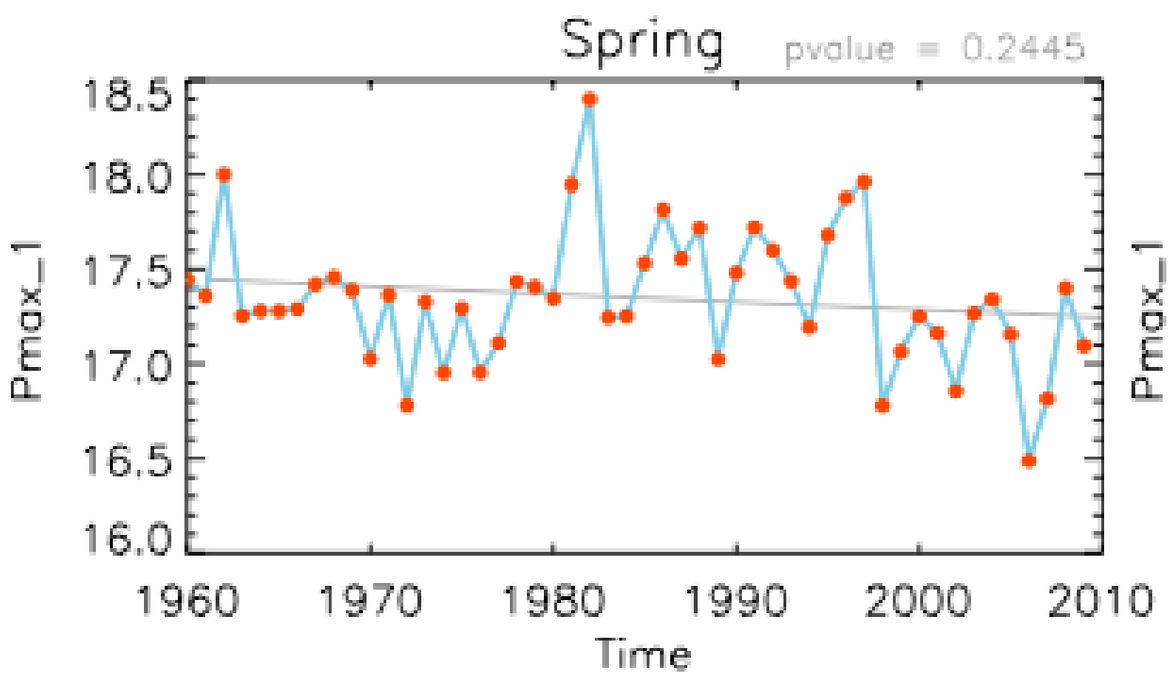
Amount of Precipitation on the Wettest Day

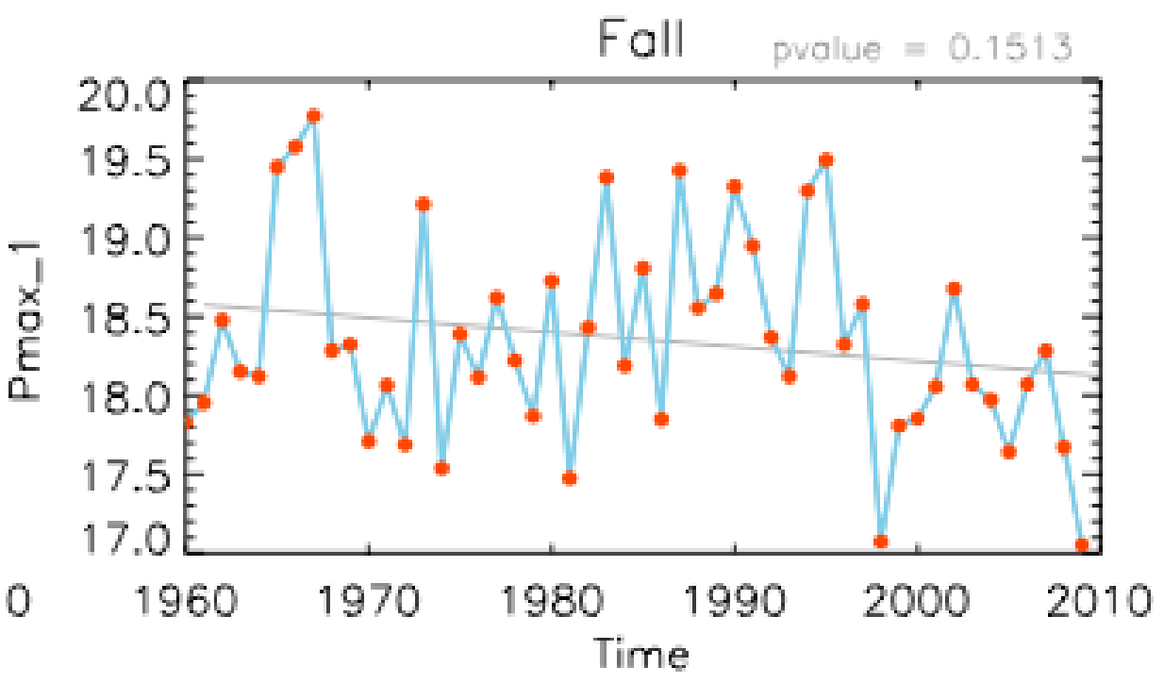
Average Maximum Precipitation

Seasonal Average Pmax_1 in Pacific Northwest America versus Time

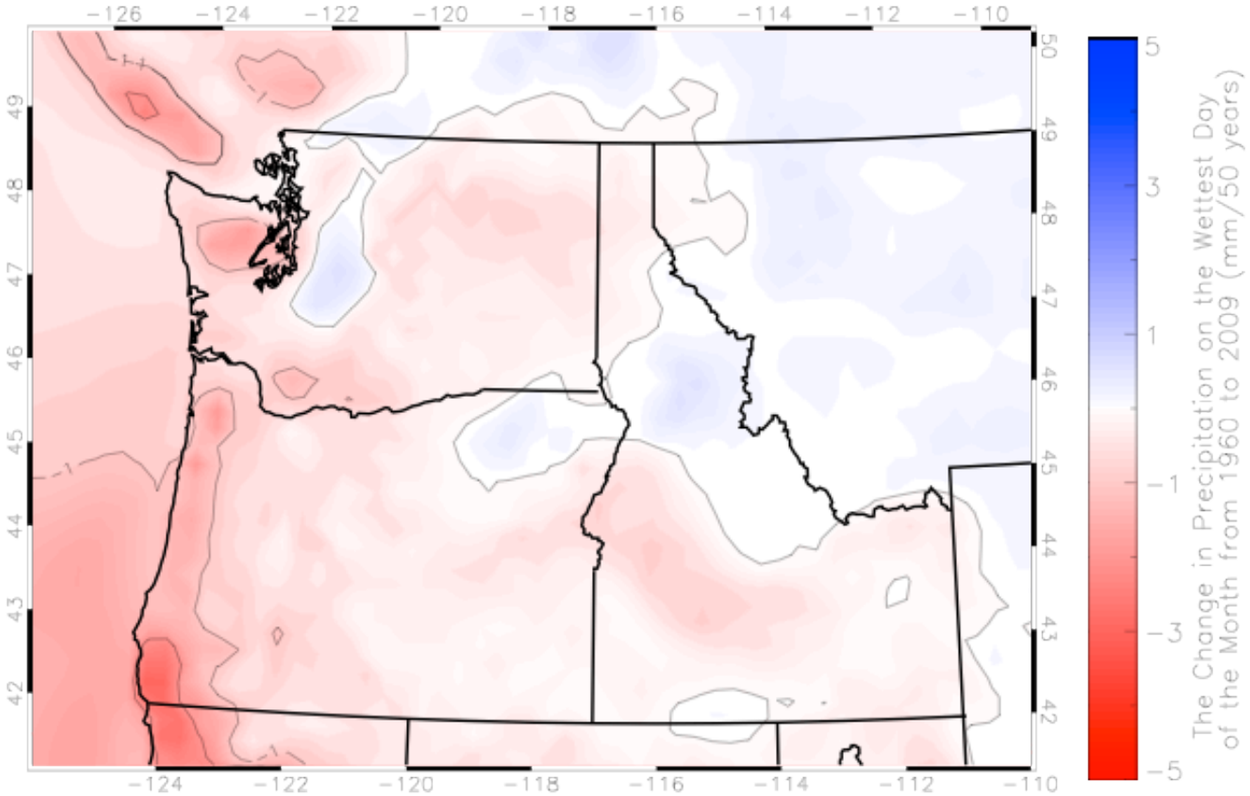




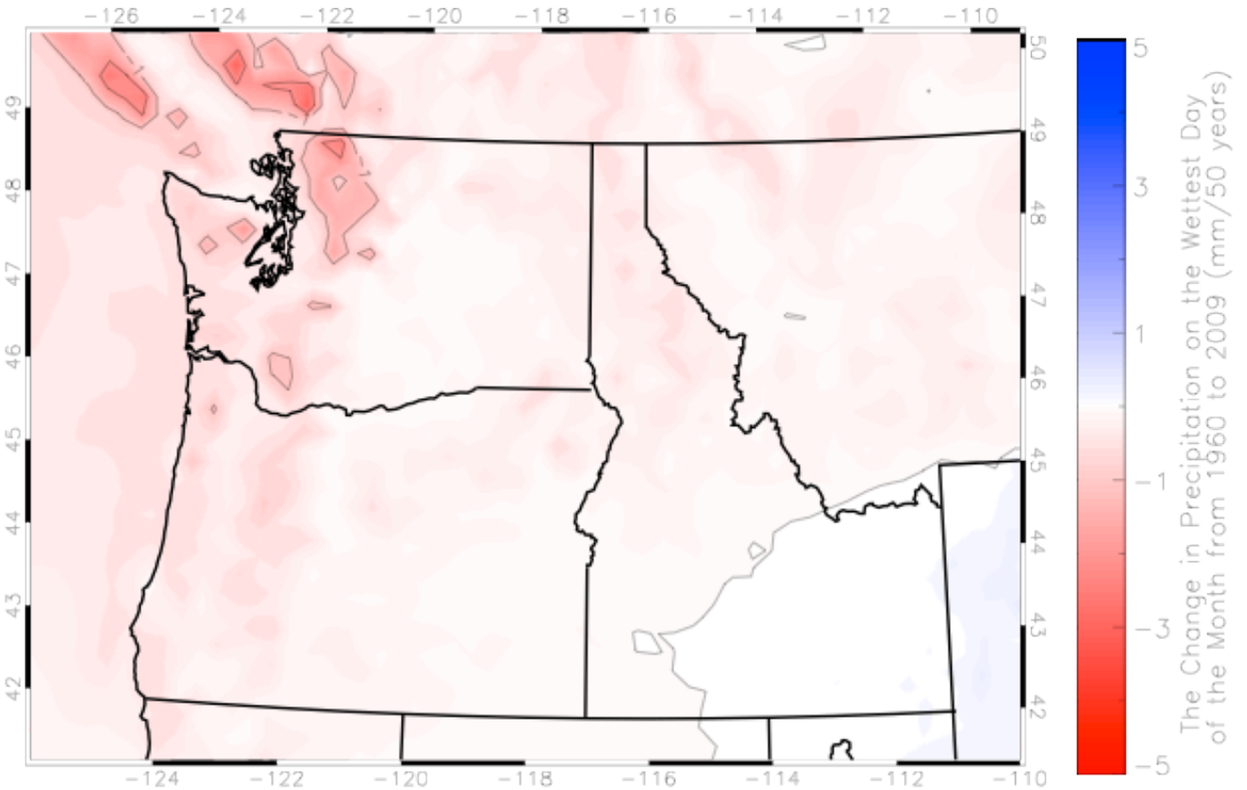




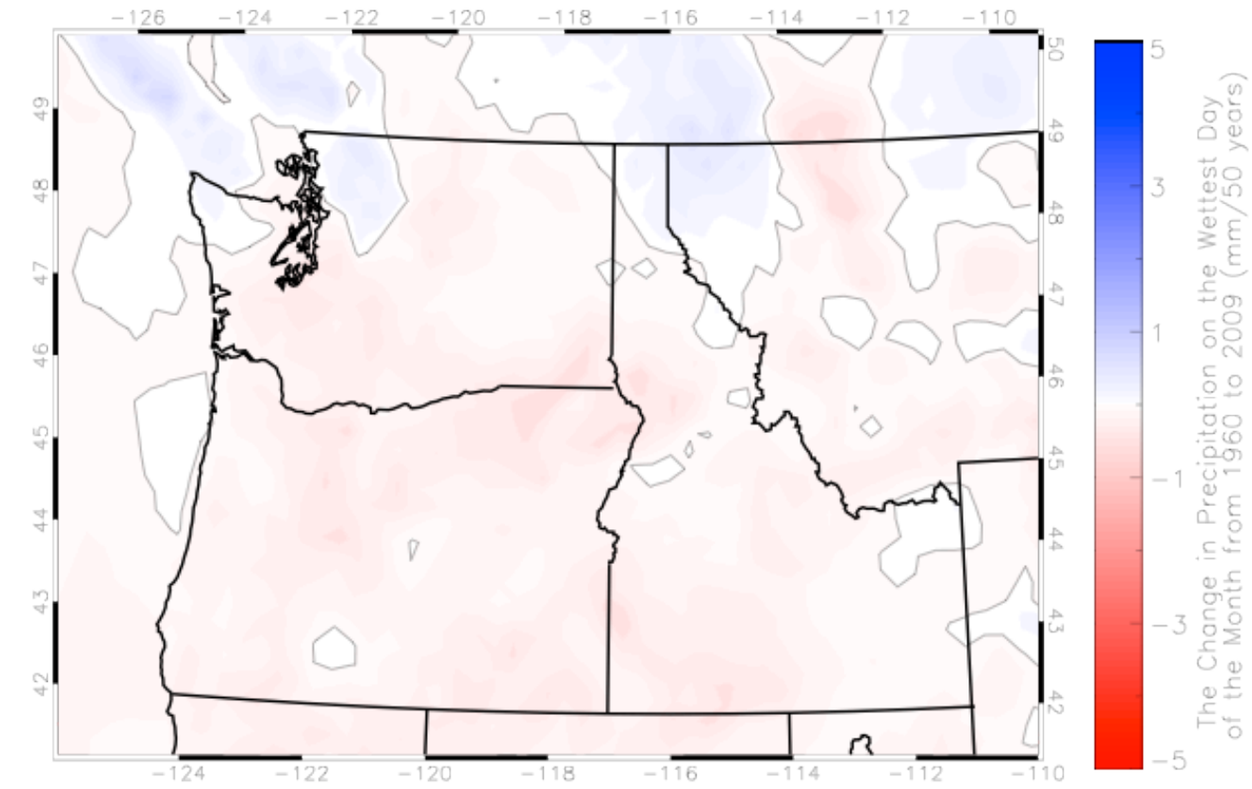
Winter Wettest Day of the Month



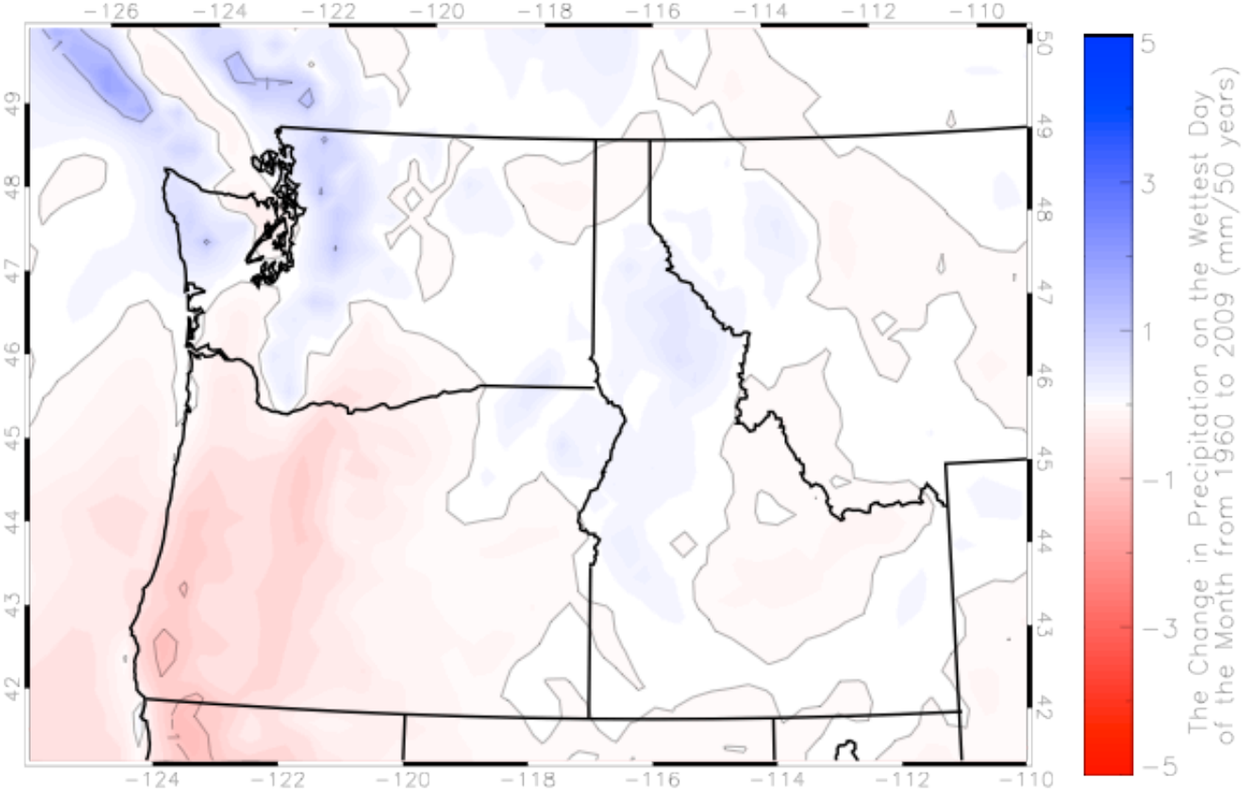
Summer Wettest Day of the Month



Spring Wettest Day of the Month



Fall Wettest Day of the Month



Conclusions

- Frost is lessening so it can lead to a longer growing season
- Snow mass is also lessening so less water for growing
- Temperatures are warming in all seasons.

Conclusions (Cont.)

- Wet days are decreasing so more water might be needed for growing
- The amount of precipitation on the largest wet day is decrease so there might be a shortage of water
- Max wind speed shows no significant changes
- Limitations: Time

Impacts of my Research

- How the PNW climate is changing
- Visualize the climate change over the past 50 years according to the RegCPDN model outputs
- Help us proactively adapt to the climate changes
- RegCPDN's next step is to look at 2030 to 2049 climate trends

Potential Ethical Issues within this Research

- Values of the models
  - When is it ok to trust the models values?
- The accepted p-value

What I learned:

- Skills: IDL
- General knowledge
- Ethics in the Research Process

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Any Questions?

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