AgWeatherNet for Wheat Growers and Eastern WA Climate

Nic Loyd
Meteorologist
AgWeatherNet

December 13, 2017
Wheat Academy; Pullman, WA
AgWeatherNet: Background and *Wheat Tools*
Climate Review / Outlook
Seasonal Outlooks: **Methodology**
Eastern WA Climate: Normals, Extremes, and Variability
Summary/Questions/Discussion
6 Different Jobs:

- Quality Assurance Analyst (*Bad Data ID, Replacement*)
- Community Liaison (*User Assistance, Media Interviews, News Releases*)
- Climatologist (*Historical Context of Weather/Climate Data - Summaries*)
- Forecaster (*Outlooks*)
- Presenter (*Talks/Posters*)
- Researcher (*Studies, Research Projects, etc.*)
**Background**

- **AWN**: Began as Public Agriculture Weather System (PAWS)-1989
- 178 weather stations and growing

- Updated every **15 min**
- Captures **microclimates**
What’s available on AWN?

- **Website:** [www.weather.wsu.edu](http://www.weather.wsu.edu)
- **Mobile site →** access data - phone
- **Measured Weather data (T, RH, etc.)**
- **Derived Fields (GDD, etc.)**
- **Decision Support System**
- **Tools/Publications**
Measured Weather Data

- Surface (5 foot) Air Temperature (°F)
- Relative Humidity (%)
- Rainfall (Inches)
- Wind Speed (mph)/Direction
- Solar Radiation (W/m²)
- Soil Temperature (8” depth)
- Air Pressure
- Leaf Wetness
Data Displays

Grandview NE
Yakima County
Oct 21 08:00 AM
Air Temp: 40.8°F
Wind: NE@2 mph
Precip: 0″

Dewpoint: 38.1°F
Rel. Humidity: 90%
Insolation: 52 W/m²
2″ Soil Temp: 49.8°F
8″ Soil Temp: 60.7°F
Air Pressure: 1022 hPa
Leaf Wetness: 0.24

Today’s High: 47°F
Today’s Low: 38.3°F
Wind Gust: 3.5 mph
Latitude: 46.27°
Longitude: -119.85°
Elevation: 972 ft

Welcome!
Powered By AgWeatherNet
Today's latest weather, October 24, 2017

Data values are averages for 15-minute period ending at the time given, except precipitation which is the running total for the day since midnight. Sort data by clicking on column headers. Click on a row for expanded details. Search for keywords or values in the search field. Select which columns are visible, print, or export as .CSV using the controls below.

<table>
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<th>Station</th>
<th>Time (PDT)</th>
<th>Air Temp °F</th>
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<th>Since 23 Oct</th>
<th>Dew Point</th>
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# Weekly Soil Temperature

## Soil Temperature

Soil temperature (°F) summary for 7 days ending **Oct 23, 2017**

| Station | 2 in | 8 in | 2 in | 8 in | 2 in | 8 in | 2 in | 8 in | 2 in | 8 in | 2 in | 8 in | 2 in | 8 in | 2 in | 8 in | 2 in | 8 in | 2 in | 8 in | 2 in | 8 in | 2 in | 8 in | 2 in | 8 in | 2 in | 8 in |
|---------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| **Adams County, Washington** |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| Hutton  | 54.8 | 54.6 | 53.0 | 53.5 | 53.7 | 53.6 | 53.8 | 53.8 | 54.8 | 54.8 | 53.8 | 53.8 | 53.8 | 53.8 |
| Linclon | 51.9 | 52.2 | 53.0 | 53.4 | 51.5 | 51.2 | 50.8 | 50.6 | 52.0 | 52.0 | 50.6 | 50.6 | 50.6 | 50.6 |
| Ritzville| 49.3 | 49.7 | 49.8 | 49.9 | 49.6 | 48.8 | 48.6 | 47.6 | 48.6 | 48.6 | 47.6 | 47.6 | 47.6 | 47.6 |
| Washburn West| 48.7 | 48.1 | 49.0 | 50.1 | 52.6 | 52.2 | 50.9 | 52.4 | 48.9 | 49.4 | 51.5 | 51.5 | 50.9 | 49.6 |
| WSU Oroville| 50.3 | 51.0 | 52.8 | 52.0 | 52.0 | 48.8 | 51.2 | 51.1 | 51.0 | 48.8 | 48.4 | 48.4 | 48.4 | 48.4 |
| **Asotin County, Washington** |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| Anatone  | 49.0 | 50.9 | 50.9 | 50.9 | 46.9 | 46.9 | 47.2 | 48.8 | 48.8 | 45.6 | 45.6 | 45.6 | 45.6 | 45.6 |
| **Benton County, Washington** |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| Alder Ridge| 59.6 | 61.5 | 59.6 | 61.4 | 59.3 | 58.8 | 59.0 | 58.8 | 59.0 | 58.8 | 59.0 | 58.8 | 59.0 | 58.8 |
| Badger Canyon| 55.3 | 56.6 | 56.8 | 56.6 | 53.7 | 54.9 | 54.7 | 54.7 | 54.7 | 54.7 | 54.7 | 54.7 | 54.7 | 54.7 |
| Benton City| 57.2 | 56.0 | 56.0 | 55.6 | 56.0 | 55.6 | 55.6 | 55.6 | 55.6 | 55.6 | 55.6 | 55.6 | 55.6 | 55.6 |
| Benton City West| 55.4 | 56.0 | 55.9 | 55.5 | 55.5 | 55.5 | 55.5 | 55.5 | 55.5 | 55.5 | 55.5 | 55.5 | 55.5 | 55.5 |
| Canoe Ridge| 59.4 | 59.9 | 59.9 | 60.1 | 59.6 | 59.6 | 59.6 | 59.6 | 59.6 | 59.6 | 59.6 | 59.6 | 59.6 | 59.6 |
| Carlton  | 53.6 | 53.7 | 53.9 | 53.7 | 50.0 | 51.4 | 51.6 | 51.6 | 51.6 | 51.6 | 51.6 | 51.6 | 51.6 | 51.6 |
| Chelan   | 54.9 | 55.4 | 55.9 | 55.6 | 55.8 | 55.8 | 55.8 | 55.8 | 55.8 | 55.8 | 55.8 | 55.8 | 55.8 | 55.8 |
| Cle Elum | 54.7 | 55.0 | 55.8 | 55.5 | 55.2 | 55.2 | 55.2 | 55.2 | 55.2 | 55.2 | 55.2 | 55.2 | 55.2 | 55.2 |
| Eidy    | 51.5 | 51.6 | 51.6 | 51.3 | 50.4 | 50.4 | 50.4 | 50.4 | 50.4 | 50.4 | 50.4 | 50.4 | 50.4 | 50.4 |
| Finley  | 58.1 | 59.0 | 58.9 | 58.9 | 58.8 | 58.9 | 58.9 | 58.9 | 58.9 | 58.9 | 58.9 | 58.9 | 58.9 | 58.9 |
| Fournié | 57.3 | 57.8 | 57.9 | 58.0 | 58.0 | 58.0 | 58.0 | 58.0 | 58.0 | 58.0 | 58.0 | 58.0 | 58.0 | 58.0 |
| Graeagle | 60.6 | 61.1 | 61.4 | 61.2 | 61.2 | 61.2 | 61.2 | 61.2 | 61.2 | 61.2 | 61.2 | 61.2 | 61.2 | 61.2 |
| Grandview| 51.6 | 52.4 | 52.9 | 54.4 | 51.4 | 53.9 | 54.7 | 54.7 | 54.7 | 54.7 | 54.7 | 54.7 | 54.7 | 54.7 |
| H雀land| 55.5 | 56.1 | 56.9 | 56.6 | 56.8 | 56.8 | 56.8 | 56.8 | 56.8 | 56.8 | 56.8 | 56.8 | 56.8 | 56.8 |
| *Hunsh above 1,000 ft.*|     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| McCloud | 54.2 | 54.6 | 54.3 | 54.3 | 53.4 | 53.4 | 53.4 | 53.4 | 53.4 | 53.4 | 53.4 | 53.4 | 53.4 | 53.4 |
| McFarland| 54.4 | 55.3 | 55.6 | 55.6 | 55.6 | 55.6 | 55.6 | 55.6 | 55.6 | 55.6 | 55.6 | 55.6 | 55.6 | 55.6 |
| McWillover| 55.4 | 55.6 | 55.7 | 55.8 | 55.8 | 55.8 | 55.8 | 55.8 | 55.8 | 55.8 | 55.8 | 55.8 | 55.8 | 55.8 |
| Payton | 56.0 | 56.6 | 57.8 | 57.6 | 57.6 | 57.6 | 57.6 | 57.6 | 57.6 | 57.6 | 57.6 | 57.6 | 57.6 | 57.6 |
| Pasco    | 54.4 | 54.6 | 55.1 | 55.2 | 54.9 | 54.9 | 54.9 | 54.9 | 54.9 | 54.9 | 54.9 | 54.9 | 54.9 | 54.9 |
| Red Mountain| 57.8 | 58.7 | 59.7 | 58.8 | 58.8 | 58.8 | 58.8 | 58.8 | 58.8 | 58.8 | 58.8 | 58.8 | 58.8 | 58.8 |
| Red Mountain North| 55.2 | 55.9 | 54.4 | 54.3 | 54.3 | 54.3 | 54.3 | 54.3 | 54.3 | 54.3 | 54.3 | 54.3 | 54.3 | 54.3 |
Decision Support System - GDD
Decision Aids

- Set Alerts (Low Temperature)
- “Push” Technology
- Desired information arrives via email or text
- Wheat Yield Model
Wheat Grain Yields

A decision tool, based on available soil water in late March and historical spring rainfall, to determine whether to plant SW, or instead leave the land fallow and plant WW in late summer. This model is based on the Washington State University (WSU) Extension publication Predicting Wheat Grain Yields Based on Available Water.

Available soil water is best determined via soil samples collected just prior to making the decision whether or not to plant spring wheat. Soil testing labs do a good job of providing accurate available water values in one-foot increments to a depth of four feet as part of a soil test. If you have not had your soil tested, you can use the less accurate method of calculating available soil water based on soil texture and rainfall.

Do you know the available soil water as of March 31st to a depth of 4 feet?

Total available water content (4 foot) as of March 31st: 0 inches

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<th>Month</th>
<th>Observed Rainfall</th>
<th>Accumulated Observed Rainfall</th>
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<th>Avg</th>
<th>Max</th>
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<td>11.10</td>
<td>0.13</td>
<td>0.76</td>
<td>1.68</td>
<td>0.87</td>
<td></td>
</tr>
<tr>
<td>May</td>
<td>0.73</td>
<td>11.83</td>
<td>0.10</td>
<td>0.97</td>
<td>2.33</td>
<td>0.73</td>
<td></td>
</tr>
<tr>
<td>June</td>
<td>0.21</td>
<td>12.04</td>
<td>0.00</td>
<td>0.83</td>
<td>2.64</td>
<td>0.21</td>
<td></td>
</tr>
</tbody>
</table>

All values in inches

To estimate spring wheat yield based on more or less rain, adjust the values in the 'Model Inputs (Rainfall)' column to your desired rainfall amounts.

Enter your estimated cost of production in dollars per acre, and projected sale price in dollars per bushel for an estimated net revenue in dollars per acre.

Model Results

- Predicted Yield (bu/acre): 1.43
- Production Cost ($/ac): 3.20
- Sale Price ($/bu): 7.30
- Predicted Net ($/ac): 7.24

Applications Beyond Agriculture

Weekly Outlooks

Warnings: when critical conditions are expected (frost, pest and disease issues, etc.)
Outlooks

- **Synopsis of Expected Weather**
- **Highlight Key Parameters**
- **Air Temperature**
- **Precipitation**
- **Wind**
- **Any Extreme or Unusual Conditions**
What is Available on AWN?

- Weather Monitoring / Decision Support for Growers/Public
- Monitoring and Predicting Crop Quality/Yield
- Air / Soil Temperature Data
- Rainfall/Wind Data
- GDD Calculator
- Wheat Yield Model
- Weekly Weather Outlooks
Central Washington Temperature Anomalies by Biennium

Recent Unprecedented Warmth
Why So Warm?
Dec/Jan 2016/2017 Pattern: What a Difference a Month Makes
Aug 2017 Circulation Pattern
Summary of Recent Conditions

- It was a very warm and very dry summer/early autumn of 2017

- Aug 2017 was the **warmest Aug** on record (1895) for WA state (5.2 deg **above** normal)

- The **unprecedented warmth** of the mid 2010s was briefly interrupted by a **cold winter** of 2016/2017
Very Smoky Early September
September 7 Smoke
Sep 5 Atmospheric Circulation Pattern
Winter/Spring Climate Outlook

- Conflicting signals regarding Temperature and Precipitation (near normal)
- The recent trend has been toward more wintry conditions

Tools:
- Dynamical Models (NMME)
- Statistical Indicators (ENSO, SSTA)
- Trends etc.
Dynamical Forecast - January

CFSv2 monthly z700 anomalies (m; shaded) and total (dm; contours)

NWS/NCEP/CPC

Initial conditions: 28Nov2017–7Dec2017
Why ENSO?

- We have both a dynamical and statistical understanding of the cycle and its impacts
- Some sense for how ENSO works
- Observational record of the impacts
- Only one factor; explains less than half of observed variability
- Nonetheless: Having one identifiable parameter that explains any significant amount of inter-seasonal variance is beneficial
Normal Winter Conditions - Tropical Pacific Ocean
Earlier this year, most dynamical models suggested a robust El Niño event for this winter. However: Statistical models (history) and observations were less certain. Now appears that weak La Niña conditions are likely. The deck is less stacked against “wintry conditions” than before.
ENSO Forecast

CFSv2 forecast Niño3.4 SST anomalies (K)

- Latest 8 forecast members
- Earliest 8 forecast members
- Other forecast members
- Forecast ensemble mean
- NCDC daily analysis

Last update: Fri Dec 8 2017
Initial condition: 28 Nov 2017 – 7 Dec 2017
February ENSO Forecast

CFSv2 forecast Niño3.4 SST anomalies (K)

Latest 8 forecast members
Earliest 8 forecast members
Other forecast members
Forecast ensemble mean
NCDC daily analysis
April 2017 SST Anomalies
Weak La Niña Composite
Weak El Niño Pattern
ENSO Impacts – T (Courtesy CPC)

JFM Temperature Distribution for Climate Div. #073

Temperature (°F)

El Nino  Neutral  La Nina
ENSO Impacts – P (Palouse)
Palouse Cold Season T vs ENSO
Palouse Cold Season P vs ENSO

Palouse Nov to Mar Precipitation vs ENSO Phase

ENSO Phase
SE
ME
WE
NP
NN
WL
ML
SL

Precipitation (Inches)
Central Basin NDJFM T vs ENSO

The graph shows the Central Basin Nov to Mar Mean Temperature ($^\circ$F) against ENSO Phase. The ENSO phases include Strong EN, Moderate EN, Weak EN, Neutral +, Neutral -, Weak LN, Moderate LN, Strong LN, and Mean. The temperature ranges from 34.0 to 37.5 $^\circ$F.
Central Basin NDJFM Precip vs ENSO Phase

- **Strong EN**: Precipitation (Inches) is around 5.50
- **Moderate EN**: Precipitation (Inches) is around 5.75
- **Weak EN**: Precipitation (Inches) is around 6.00
- **Neutral +**: Precipitation (Inches) is around 6.25
- **Moderate LN**: Precipitation (Inches) is around 6.50
- **Weak LN**: Precipitation (Inches) is around 6.75
- **Strong LN**: Precipitation (Inches) is around 7.00
- **Mean**: Precipitation (Inches) is around 7.25

The graph illustrates the relationship between Central Basin November to March precipitation and ENSO phase conditions.
Yes, El Niño tends to be warm and dry, while La Niña tends to be cool and wet.

However, there are other nuances:

- Strong EN are very warm, but not necessarily dry.
- Strong LN are very wet, but not necessarily cool.
- EN or neutral can be dry.
- Weak LN can be quite cold.
Trends

- Mostly positive (warming over time) for Air Temperature
- More complex for Precipitation
- Trends vary by time of year and region
Late 2017/Early 2018 Outlook

- Weak La Niña favored for 2017/2018 winter

- Uncertain Temperature Outlook: Slightly cooler than normal (Conflicting Signals: La Niña vs Trends)

- No clear precipitation signals (near/slightly above normal)

- Interesting weather is possible
Preparing Seasonal Outlooks

- **Methodology:**
  - Use **dynamical** and **statistical** models / tools

- **Dynamical**: Atmospheric Science based *(Theory)*

- **Statistical**: Historical Analog based *(Observation/Empirical Data)*

- **Outlooks** can be **different**

- Which tools are used and how are they weighted?
Models and Tools

- **NMME** (National Multi-Model Ensemble)
- Circulation Pattern (Indirect; 500 mb GPH) and Parameters (Direct; Air T, Precip, etc.)
- **ENSO** (El Niño Southern Oscillation)
- PDO, SSTA, etc.
- Soil Moisture / Snow Cover Anomalies
- **Trends** (*Recent* times vs *Normal*)
Seasonal Forecasts are not, and never will be perfect. They will provide more accuracy than random guessing, especially over the long term. Possible that individual seasonal forecasts, especially with modest odds, will be wrong at times. Over several years, the “house” will always win. Always will be variability within a season.
Climate Overview – Eastern WA

- **Temperate region**: Continental and Marine Influences / 4 distinct seasons
- **Temperatures** are *Moderate* overall but *variable*
- **Precipitation** is low to moderate, and mainly falls during the cold season
- **Ritzville**: *Summers* are hot and dry
- **Highs/Lows**: Mid to upper 80s / 50s
- **Winters** and cool and changeable
- **H/L**: Mid to upper 30s / 20s
- 83 days of measurable Precip / year
- Only 3 of 0.5” or more
Extremes

- Above 110 deg during major heat waves
- Below zero during arctic outbreaks (can be as low as -20 deg)
- Typically, 1.5” / month during winter, less than 0.5” / month during mid summer to early autumn
- High Precipitation months can be above 4”
- Low P months can feature 0” (completely dry), except in the late autumn/winter
- Dry years may have well below 10” of P, wet years may may see 15”+
<table>
<thead>
<tr>
<th>Month</th>
<th>Temperature (°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>5</td>
</tr>
<tr>
<td>February</td>
<td>10</td>
</tr>
<tr>
<td>March</td>
<td>15</td>
</tr>
<tr>
<td>April</td>
<td>20</td>
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<tr>
<td>May</td>
<td>25</td>
</tr>
<tr>
<td>June</td>
<td>30</td>
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<tr>
<td>July</td>
<td>35</td>
</tr>
<tr>
<td>August</td>
<td>40</td>
</tr>
<tr>
<td>September</td>
<td>45</td>
</tr>
<tr>
<td>October</td>
<td>50</td>
</tr>
<tr>
<td>November</td>
<td>55</td>
</tr>
<tr>
<td>December</td>
<td>60</td>
</tr>
<tr>
<td>Annual</td>
<td>65</td>
</tr>
</tbody>
</table>

Ritzville Historical Monthly Mean Temperatures
Averages and Extremes

Coolest
Average
Warmest
Ritzville Historical Monthly Total Precipitation Averages and Extremes

<table>
<thead>
<tr>
<th>Month</th>
<th>Precipitation (Inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>0</td>
</tr>
<tr>
<td>February</td>
<td>1</td>
</tr>
<tr>
<td>March</td>
<td>2</td>
</tr>
<tr>
<td>April</td>
<td>3</td>
</tr>
<tr>
<td>May</td>
<td>4</td>
</tr>
<tr>
<td>June</td>
<td>5</td>
</tr>
<tr>
<td>July</td>
<td>4</td>
</tr>
<tr>
<td>August</td>
<td>3</td>
</tr>
<tr>
<td>September</td>
<td>2</td>
</tr>
<tr>
<td>October</td>
<td>1</td>
</tr>
<tr>
<td>November</td>
<td>0.5</td>
</tr>
<tr>
<td>December</td>
<td>0</td>
</tr>
</tbody>
</table>
Ritzville Precipitation By Year

Ritzville Total Annual Precipitation Trend

Precipitation (Inches)

Year

Ritzville Mean Max Temps

- Month:
  - January
  - February
  - March
  - April
  - May
  - June
  - July
  - August
  - September
  - October
  - November
  - December
  - Annual

- Temperature (°F):
  - Coolest
  - Average
  - Warmest

Ritzville Monthly Mean Maximum Temperatures
Averages and Extremes

Coolest
Average
Warmest
Ritzville Mean Min Temperatures

<table>
<thead>
<tr>
<th>Month</th>
<th>January</th>
<th>February</th>
<th>March</th>
<th>April</th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>August</th>
<th>September</th>
<th>October</th>
<th>November</th>
<th>December</th>
<th>Annual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temp (°F)</td>
<td>-5</td>
<td>5</td>
<td>15</td>
<td>25</td>
<td>35</td>
<td>45</td>
<td>55</td>
<td>65</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Coolest
Average
Warmest

Ritzville Monthly Mean Minimum Temperatures
Averages and Extremes

Month

Temperature (°F)
### Ritzville Monthly Maximum Temperatures

<table>
<thead>
<tr>
<th>Month</th>
<th>January</th>
<th>February</th>
<th>March</th>
<th>April</th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>August</th>
<th>September</th>
<th>October</th>
<th>November</th>
<th>December</th>
<th>Annual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coolest Temperature (°F)</td>
<td>30</td>
<td>35</td>
<td>40</td>
<td>45</td>
<td>50</td>
<td>55</td>
<td>60</td>
<td>65</td>
<td>70</td>
<td>75</td>
<td>80</td>
<td>85</td>
<td>90</td>
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<tr>
<td>Average Temperature (°F)</td>
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<td>95</td>
<td>100</td>
<td>105</td>
<td>110</td>
<td>115</td>
<td>120</td>
<td>125</td>
<td>130</td>
<td>135</td>
<td>140</td>
<td>145</td>
<td>150</td>
</tr>
<tr>
<td>Warmest Temperature (°F)</td>
<td>150</td>
<td>155</td>
<td>160</td>
<td>165</td>
<td>170</td>
<td>175</td>
<td>180</td>
<td>185</td>
<td>190</td>
<td>195</td>
<td>200</td>
<td>205</td>
<td>210</td>
</tr>
</tbody>
</table>

#### Ritzville Monthly Maximum Temperatures Averages and Extremes

- **Coolest**
- **Average**
- **Warmest**

![Bar chart showing monthly temperature trends in Ritzville](chart_image.png)
Ritzville Monthly Minimum Temperatures

Averages and Extremes

<table>
<thead>
<tr>
<th>Month</th>
<th>January</th>
<th>February</th>
<th>March</th>
<th>April</th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>August</th>
<th>September</th>
<th>October</th>
<th>November</th>
<th>December</th>
<th>Annual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temp (°F)</td>
<td>-25</td>
<td>-15</td>
<td>-5</td>
<td>5</td>
<td>15</td>
<td>25</td>
<td>35</td>
<td>45</td>
<td>55</td>
<td>45</td>
<td>35</td>
<td>25</td>
<td>15</td>
</tr>
</tbody>
</table>

Coolest
Average
Warmest
Palouse Temperature Anomaly Trend

![Palouse Smoothed Annual Temperature Anomaly Trend](image)
Monthly T Standard Deviations

<table>
<thead>
<tr>
<th>Month</th>
<th>Standard Deviation (°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>3</td>
</tr>
<tr>
<td>February</td>
<td>5</td>
</tr>
<tr>
<td>March</td>
<td>2</td>
</tr>
<tr>
<td>April</td>
<td>3</td>
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<tr>
<td>May</td>
<td>4</td>
</tr>
<tr>
<td>June</td>
<td>5</td>
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<tr>
<td>July</td>
<td>6</td>
</tr>
<tr>
<td>August</td>
<td>7</td>
</tr>
<tr>
<td>September</td>
<td>4</td>
</tr>
<tr>
<td>October</td>
<td>3</td>
</tr>
<tr>
<td>November</td>
<td>4</td>
</tr>
<tr>
<td>December</td>
<td>5</td>
</tr>
</tbody>
</table>
Spring vs Autumn Asymmetry

Spring is *Long*, Autumn is *Short*

Unsettled Spring causes quick end to winter, but slow start to summer

Drier, calmer Autumn causes summer to linger, but winter to begin relatively early
Thresholds

- Typically 34 days / year above 90 F
- 3 days / year below 0 F
- 28 days / year with highs below 32 F
Eastern WA has one of the least severe (lack of dangerous weather) climates, yet one of the most variable.

Rarely have severe thunderstorms, hurricanes, etc.

Potential exists for heat, cold, drought, heavy rainfall/flooding, winter storms, wind storms, dense fog, etc.
Rapid Pattern Shifts are Possible

![Graph showing WA Recent Monthly Temperature Anomalies](image)
“Just One More Thing”

- [www.weather.wsu.edu](http://www.weather.wsu.edu)
- **Weather data** available
- **178** sites across WA and OR
- Decision Support System

- **Eastern WA** has a *variable* climate, but usually not an *extreme* climate
- *Seasonal Forecasting*: Not perfect, but slightly better than random guessing
Questions?

- Questions and Comments are Welcome
- Nic Loyd
- Email: nicholas.loyd@wsu.edu
- Telephone Number: (509)786-9357
- Address: 24106 N. Bunn Road, Prosser, WA 99350

Thank you!