

# Northwest Weather

**Implementation techniques of daily forecasting tools for planting, frost and pesticide applications and long range outlook for spring and early summer 2015**

# Forecasting tools

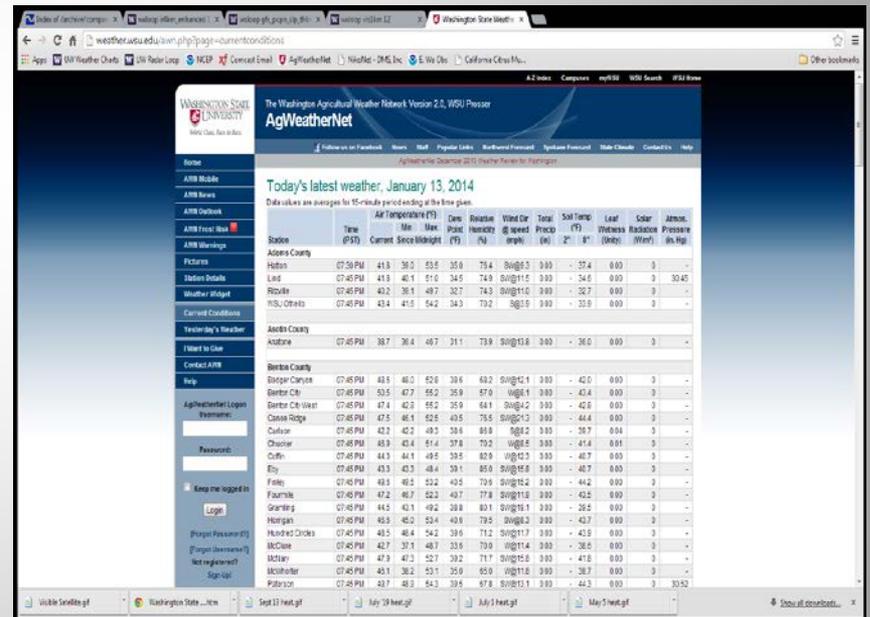
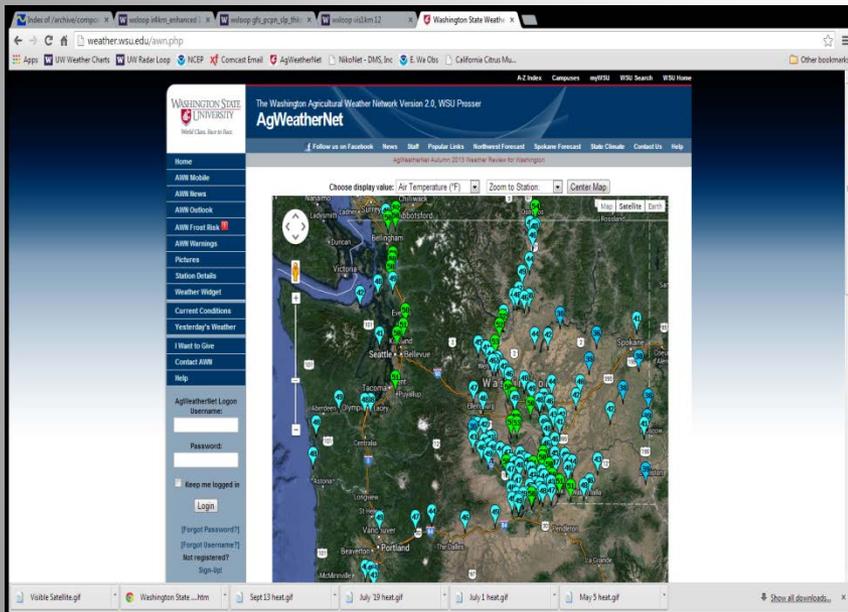
- Surface Observations
- Satellite Imagery
- Radar
- Computer Forecast Models
- Experience

# Observations

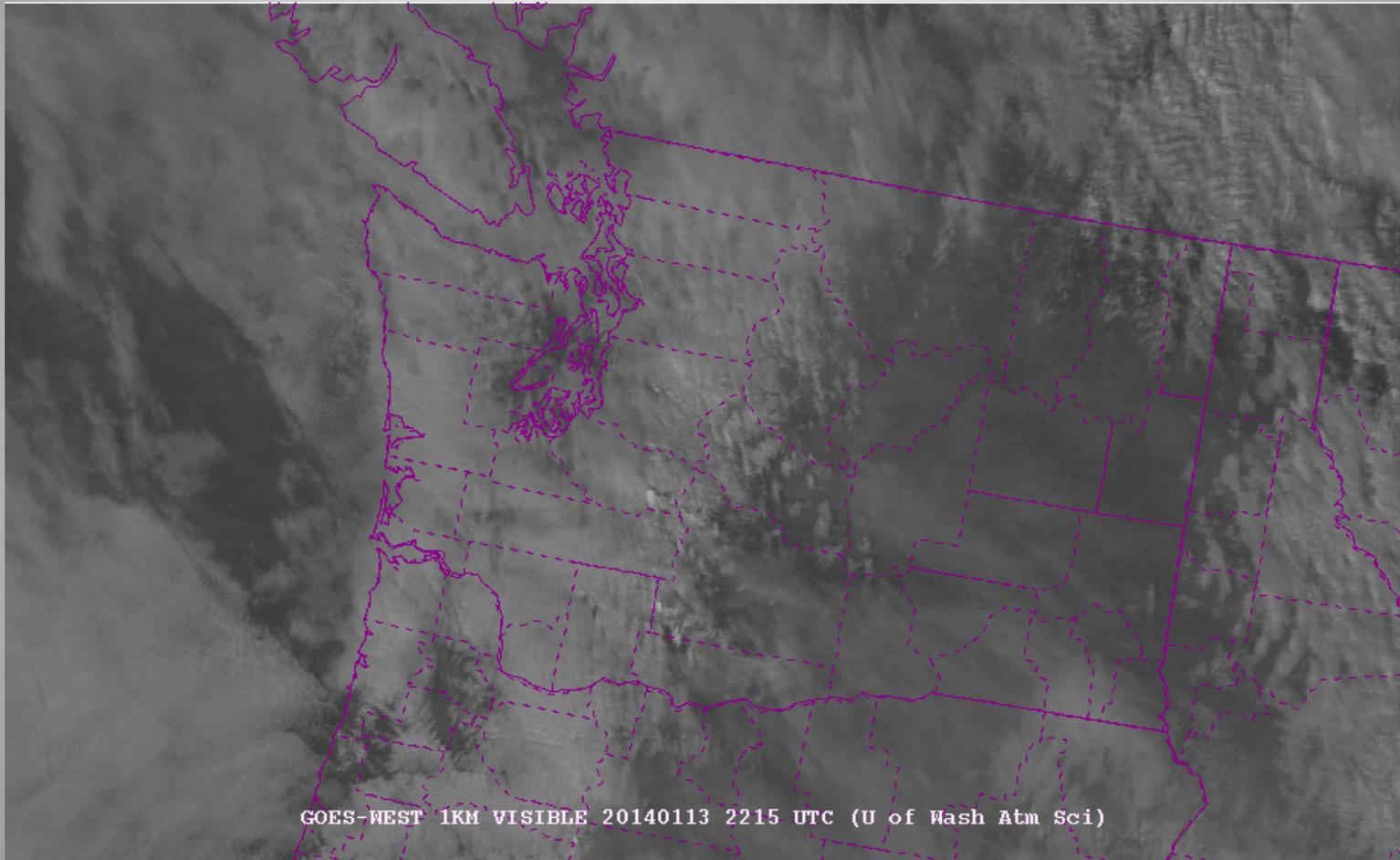
- AgWeatherNet – Washington Agricultural Weather Network
- ASOS Observation stations – NWS automated reporting stations at manned sites.
- Mesonet Observation stations – Other automated reporting station at unmanned locations

# AgWeatherNet

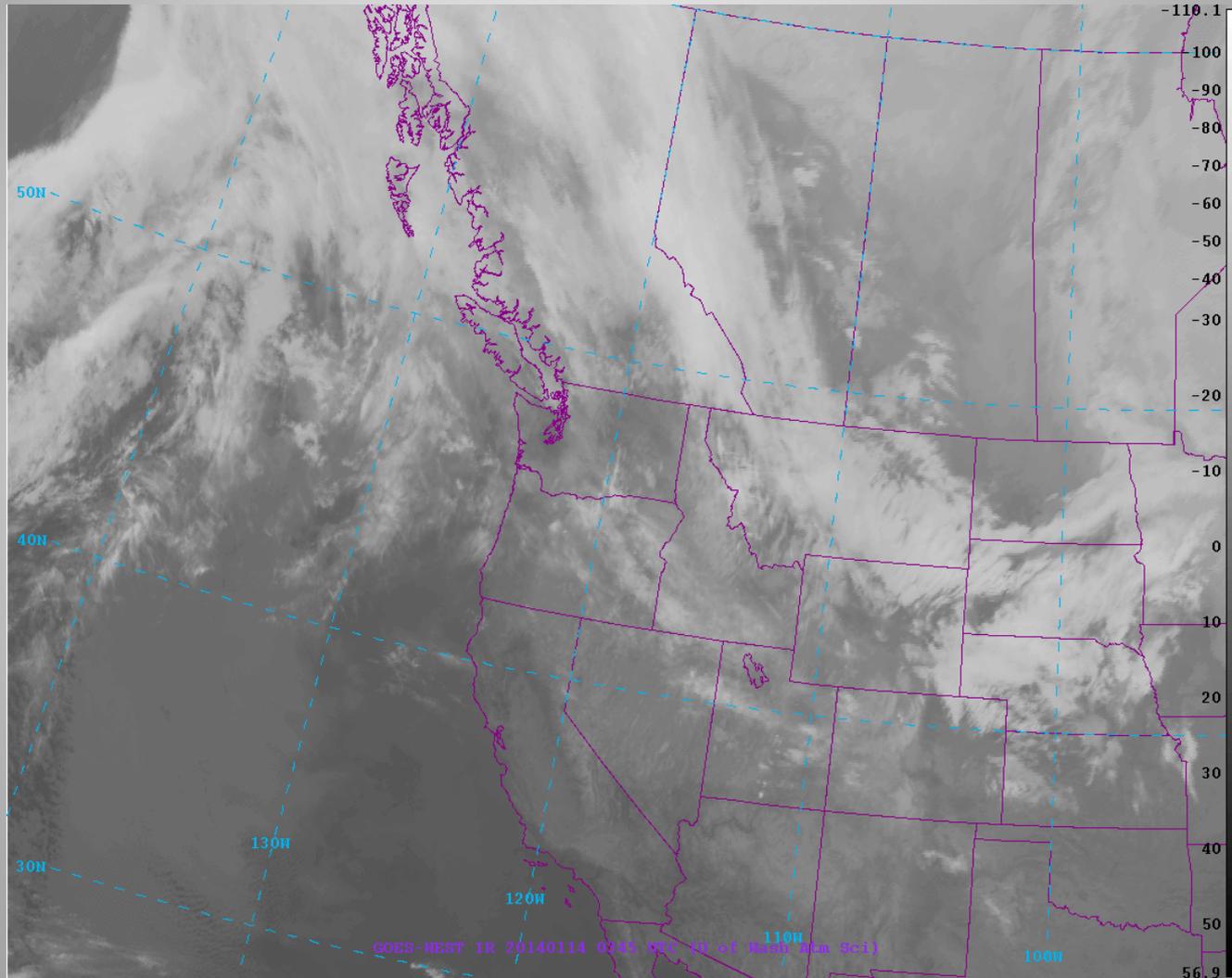
Over 100 automated observation stations throughout central Washington



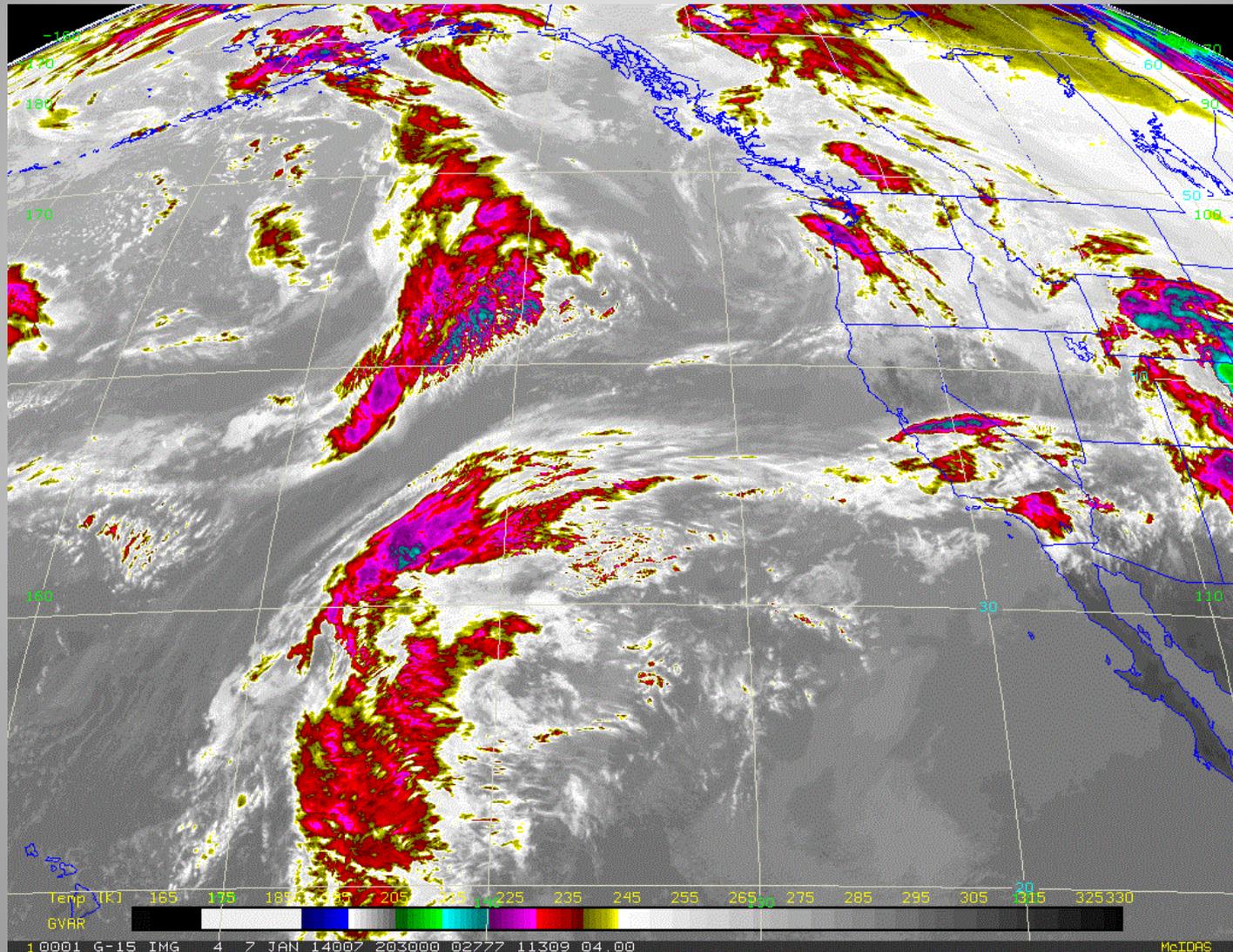
# Visible Satellite Imagery

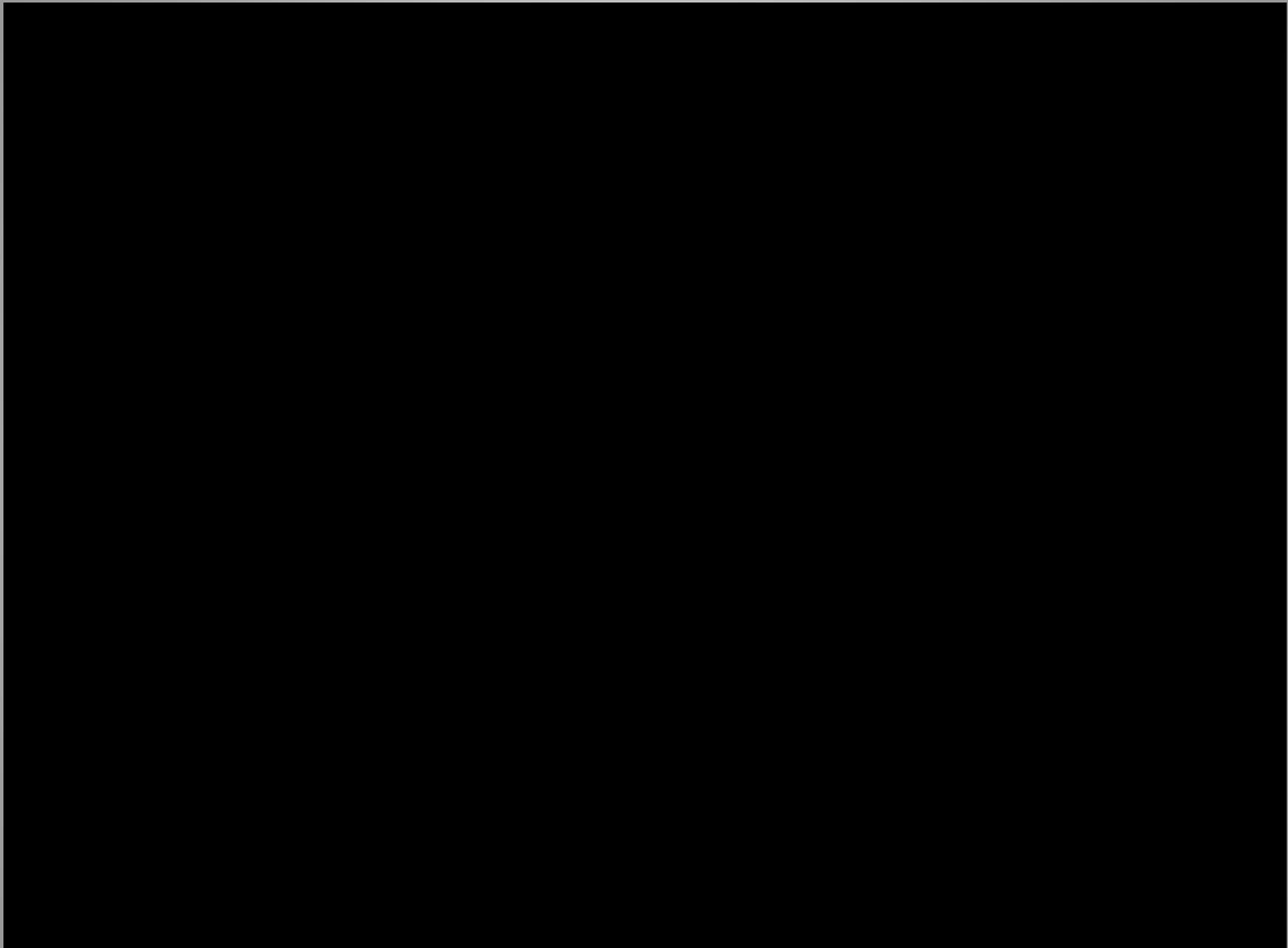


# Infrared Satellite Imagery



# Enhanced Infrared Satellite

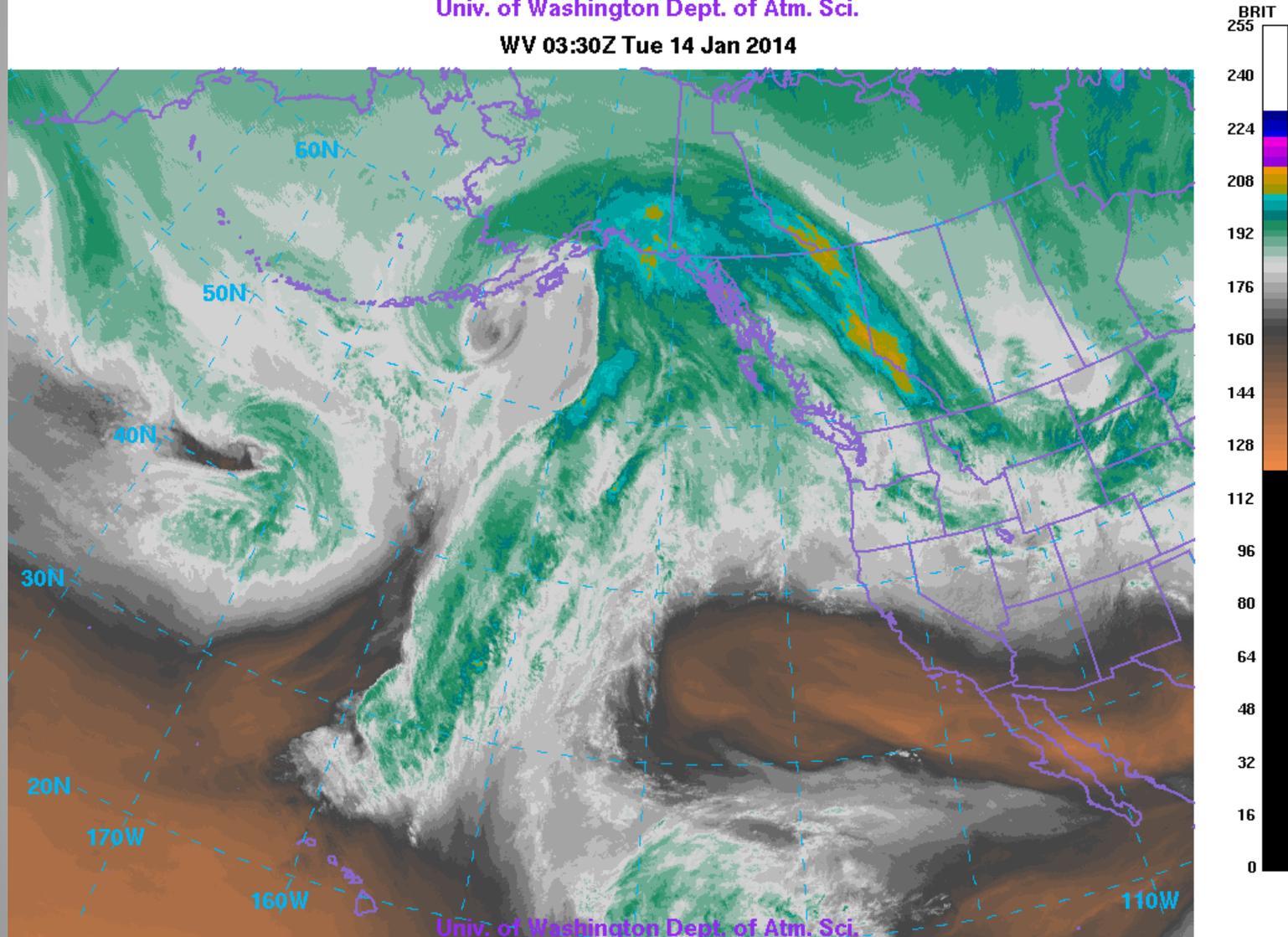




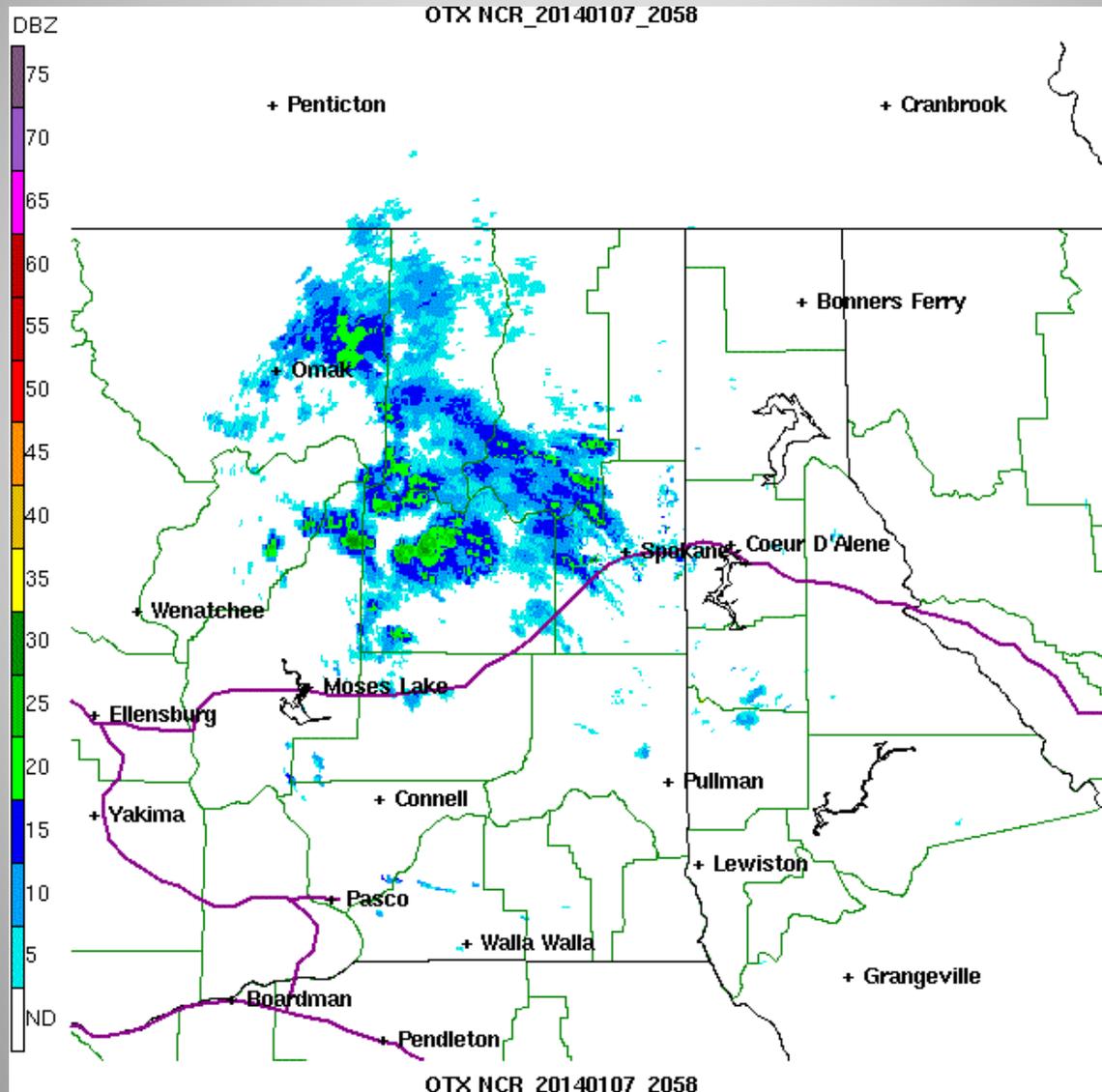
# Water Vapor Satellite Imagery

Univ. of Washington Dept. of Atm. Sci.

WV 03:30Z Tue 14 Jan 2014



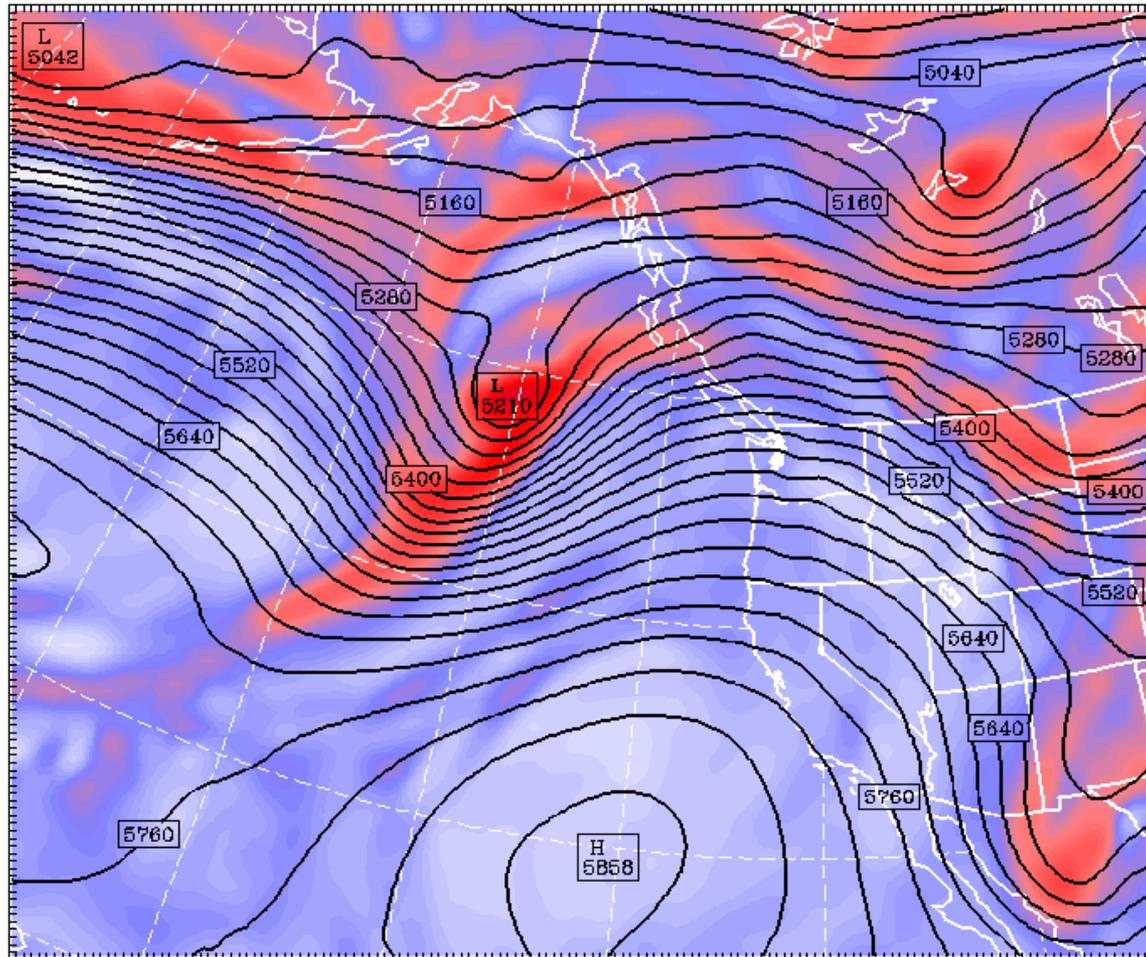
# Radar Imagery



# Computer Forecast Models

- The basic idea of computer weather forecast modeling is to sample the state of the atmosphere at a given time and then use the equations of fluid dynamics and thermodynamics to estimate the state of the atmosphere some time in the future
- The main inputs into the computer models are observations at the surface over both land and water, and observation up through the atmosphere from radiosondes

Geopotential height at 500mb (m)

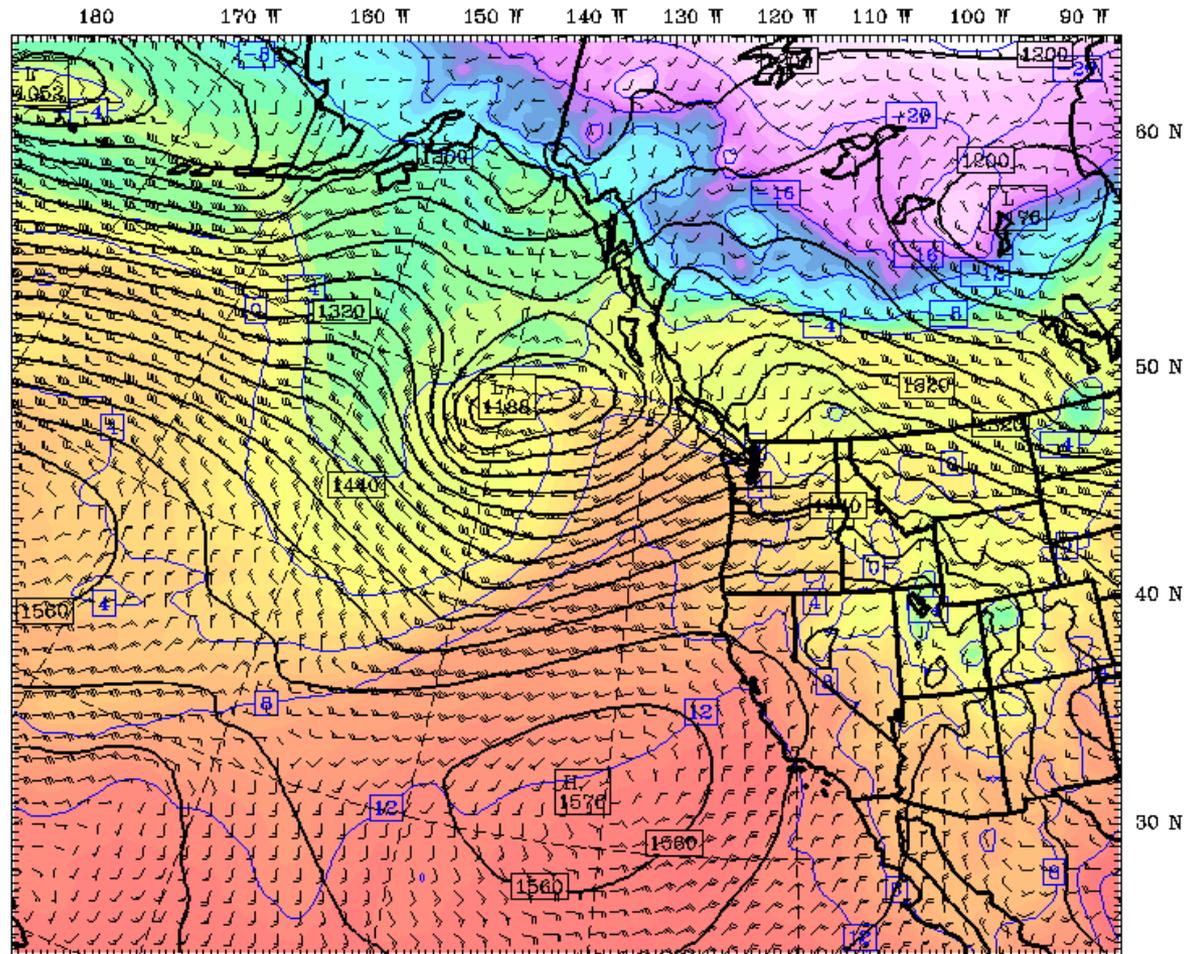


CONTOURS: UNITS=m LOW= 4980.0 HIGH= 5850.0 INTERVAL= 30.000

500 mb – the Jet Stream



Geopotential height at 850mb (m)  
Wind at 850mb (full barb = 10kts)

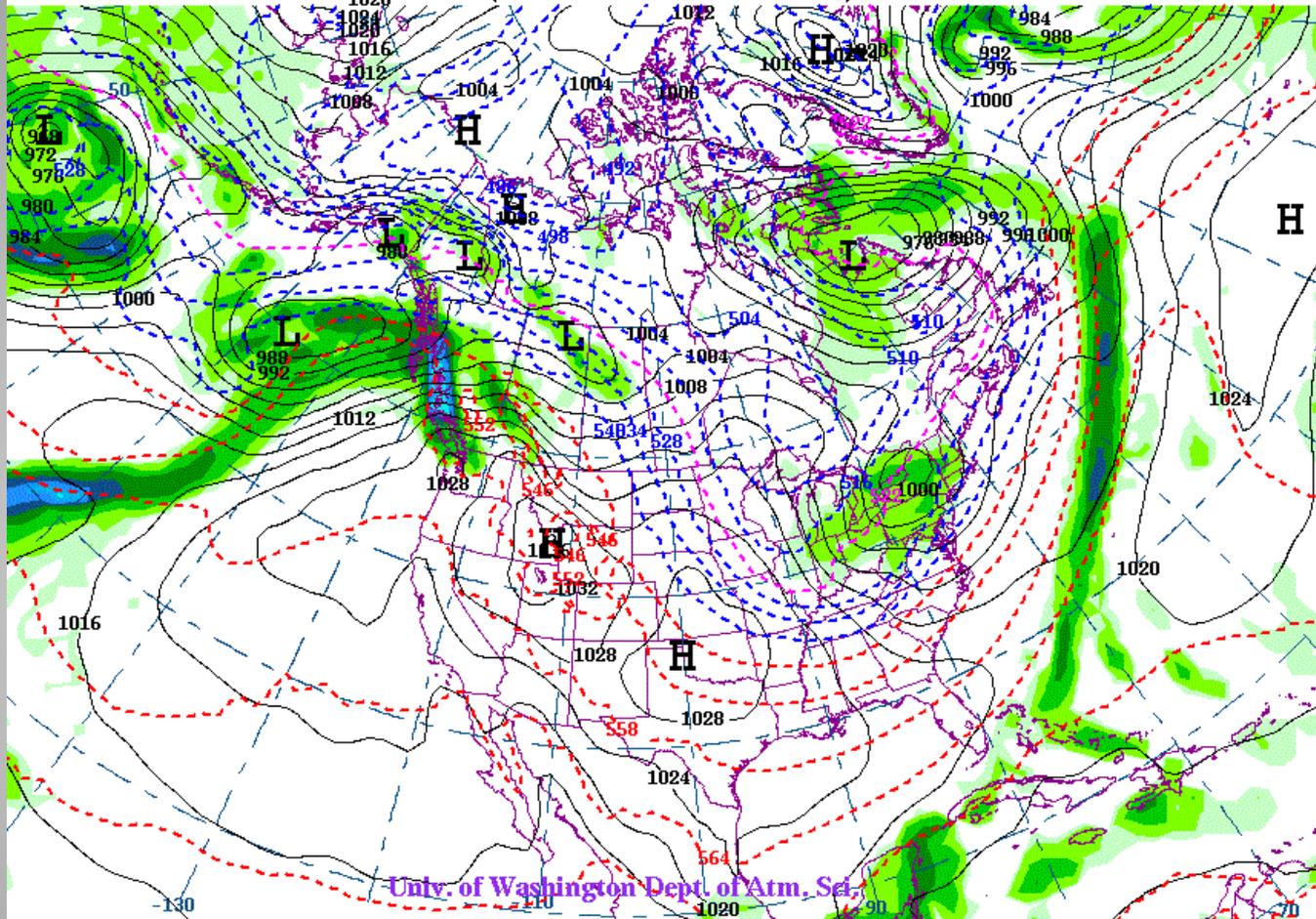


CONTOURS: UNITS=m LOW= 1080.0 HIGH= 1560.0 INTERVAL= 30.000  
CONTOURS: UNITS=°C LOW= -24.000 HIGH= 16.000 INTERVAL= 4.0000

850 mb

180 Hr Fcst 6-Hr Pcpn (in)/SLP (mb)/1000-500 mb Thickness valid 00Z Wed 15 Jan 2014

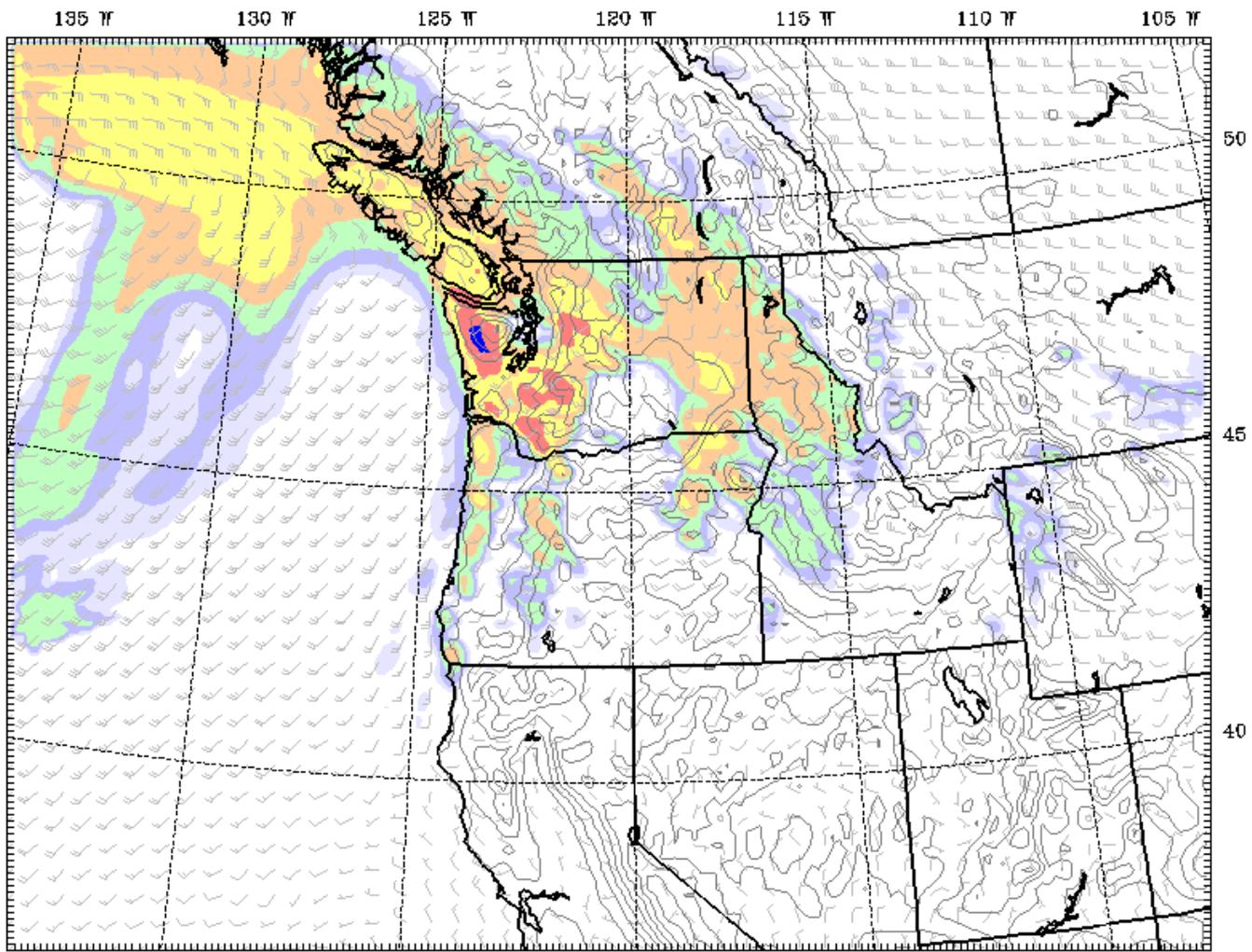
(GFS initialized 12Z Tue 07 Jan 2014)



Surface Weather

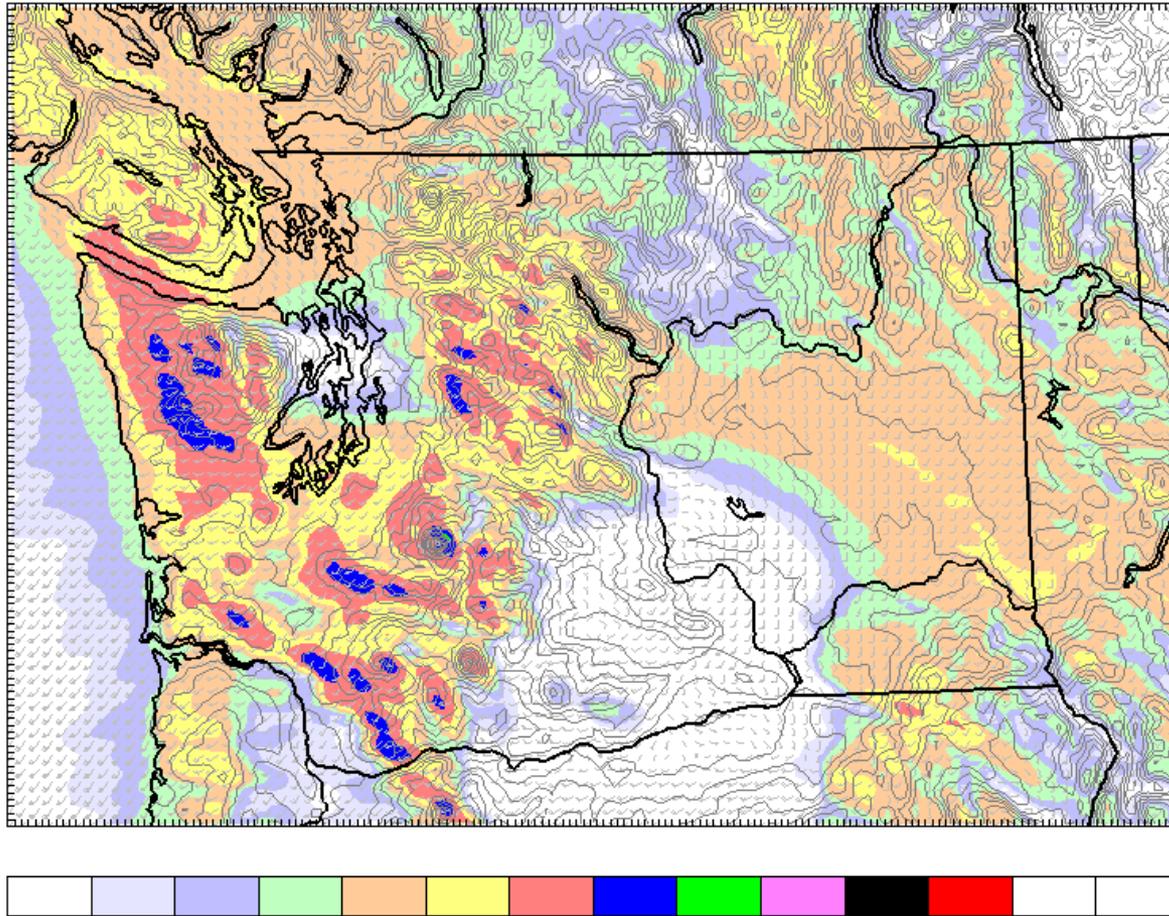


wind at 10m (10m barb - 10kts)

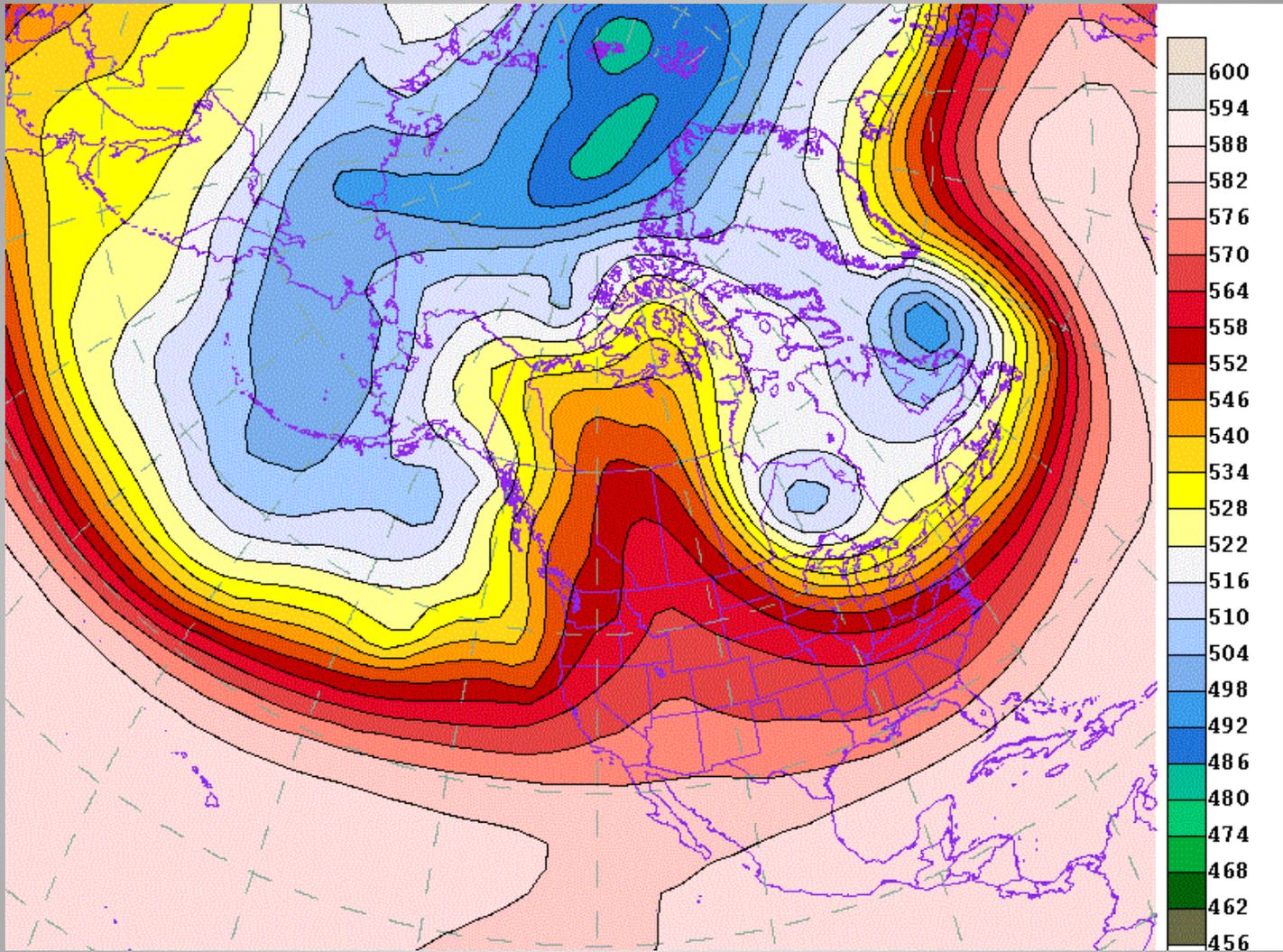


Precipitation

wind at 10m (full barb - 10kts)



Precipitation – Higher Resolution



Long Range Weather Charts - out to 16 days



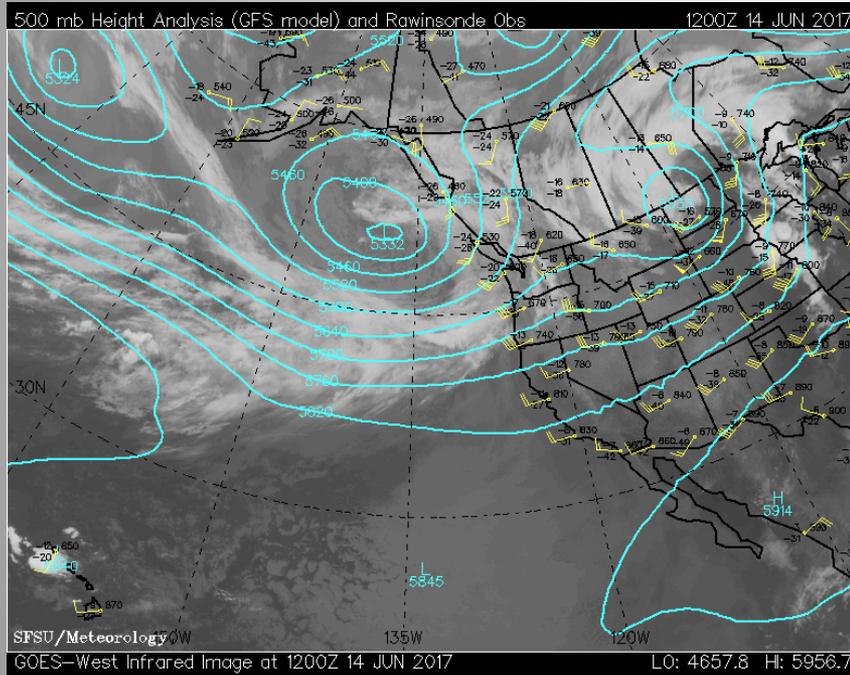
# Experience

- Started career as a forecast meteorologist in 1984
- Have forecasted primarily for central Washington since 1994
- Gain a knowledge base of specific weather patterns and the type of surface weather conditions associated with each pattern

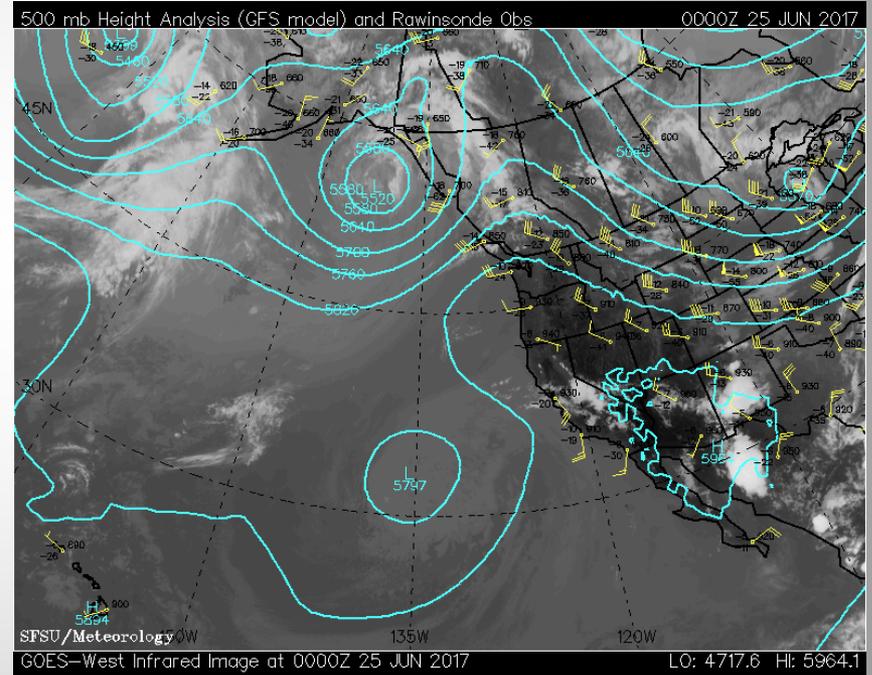
# Brief Review of our Summer and Autumn Weather for central Washington

- Used 3 NWS office locations ... Moses Lake, Pasco and Yakima
- For June, afternoon highs ranged 1.8 to 4.4 degrees above average with overnight lows ranging from -1.1 to .3.7 degrees above normal. Precipitation from .18 to .46 below average
- 4 to 7 days of rainfall for the month
- 2 to 4 days of hazy weather

The weather through the first half of June was quite active over the state before high pressure begin to gradually build into the state later in the month



June 14th

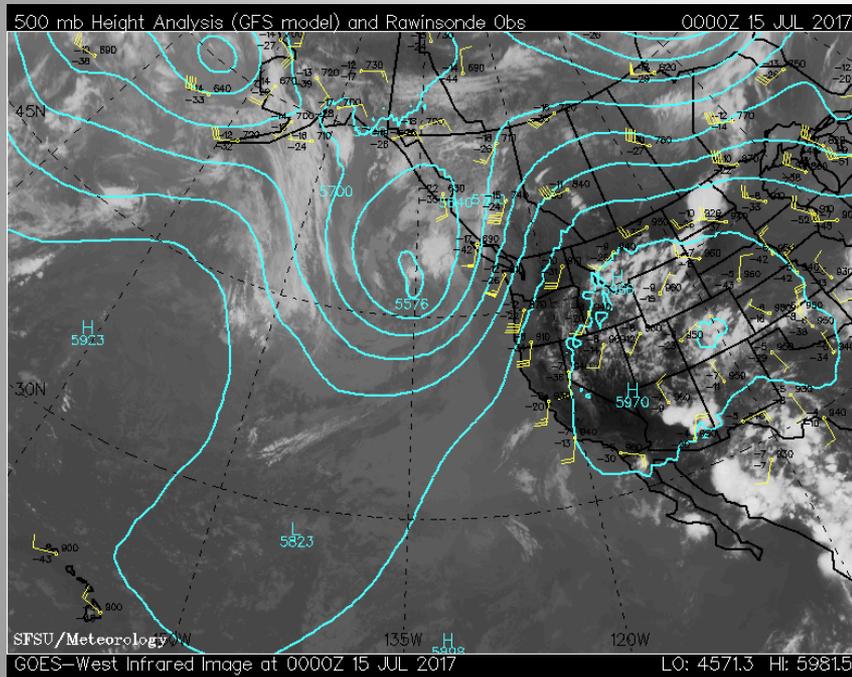


June 25th

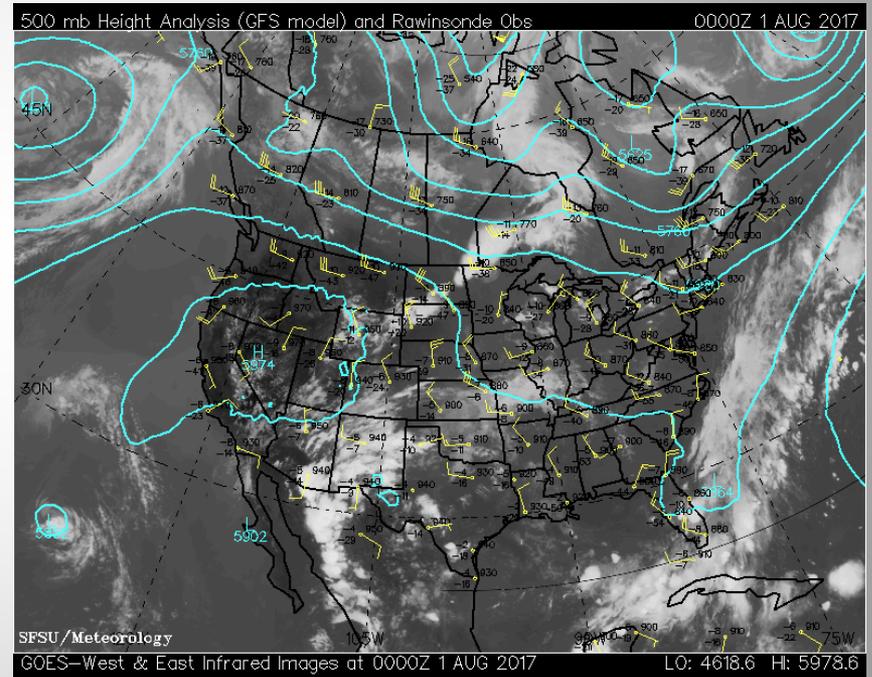
# July

- High pressure over the southwestern U.S. began to expand to the north and west, extending into the Northwest. While storm activity remained prevalent off the B.C. coast, most of this activity remained to the north of the state with only occasional minor disturbances moving over the areas.
- Afternoon highs ranged 3.9 to 7.3 degrees above average with overnight lows ranging from 1.4 to 5.5 degrees above normal. Only a trace amount of rain fell at Pasco
- No hazy days for Moses Lake, 4 reported at Yakima and 12 were reported at Pasco

High pressure remained strong enough over the western U.S. that an active weather pattern along the British Columbia coast remained north of the state with only occasional minor disturbances moving over the area. The high pressure strengthened late in the month



July 14th

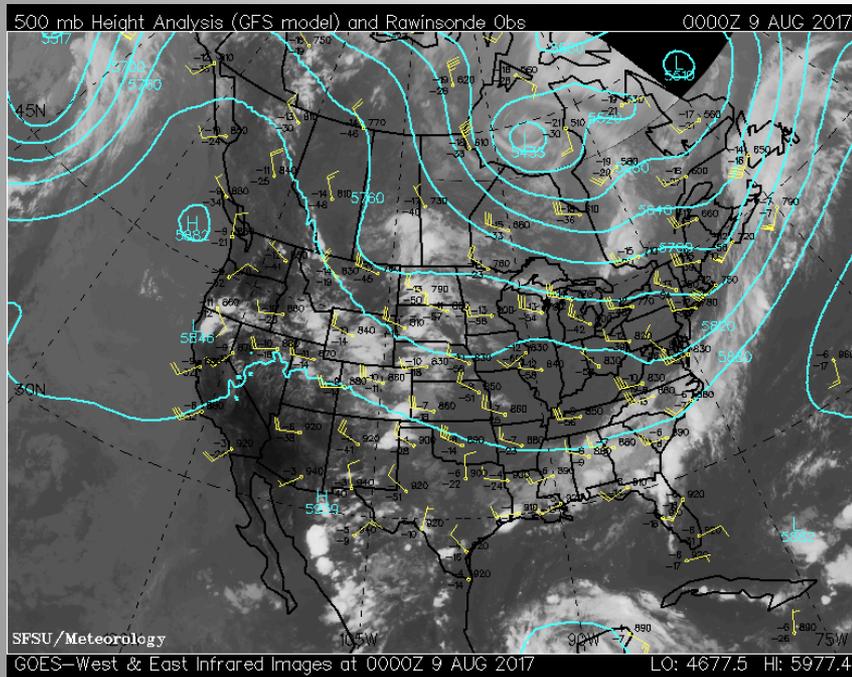


July 31st

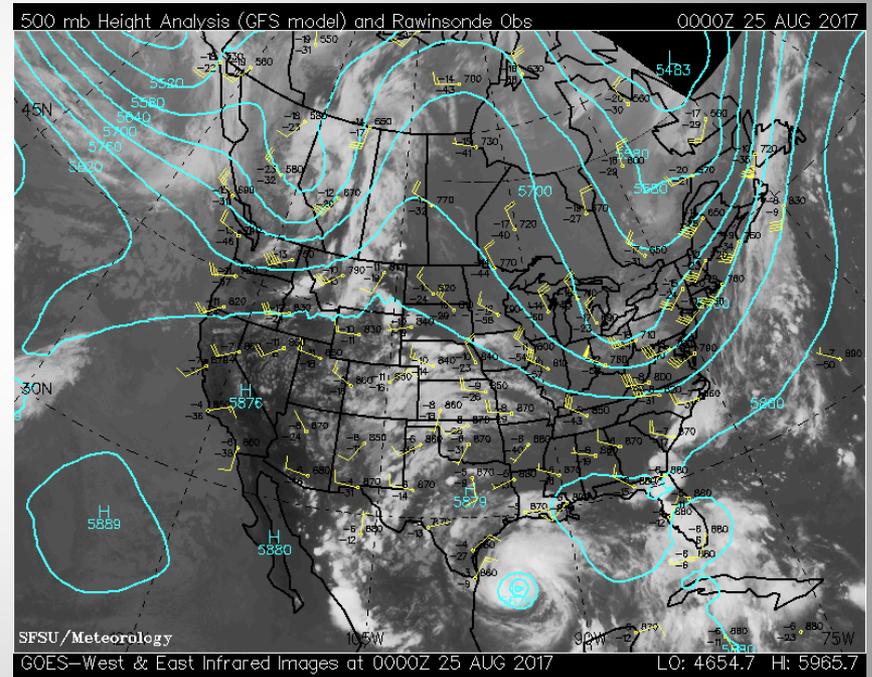
# August

- High pressure continued to dominate the overall weather pattern, weakening somewhat from the 18<sup>th</sup> through the 25<sup>th</sup> of the month before strengthening again for the last week.
- Afternoon highs ranged 4.1 to 7.9 degrees above average with overnight lows ranging from .4 to 6.0 degrees above normal, Yakima seeing the warmest overnight weather compared to average. Rainfall from .13 to .23 below average
- 15 days of hazy weather for Moses Lake, 19 for Yakima and 23 for Pasco

High pressure remained strong enough over the western U.S. that an active weather pattern along the British Columbia coast remained north of the state with only occasional minor disturbances moving over the area from the 18<sup>th</sup> through the 24<sup>th</sup>. The high pressure strengthened late in the month



August 9th

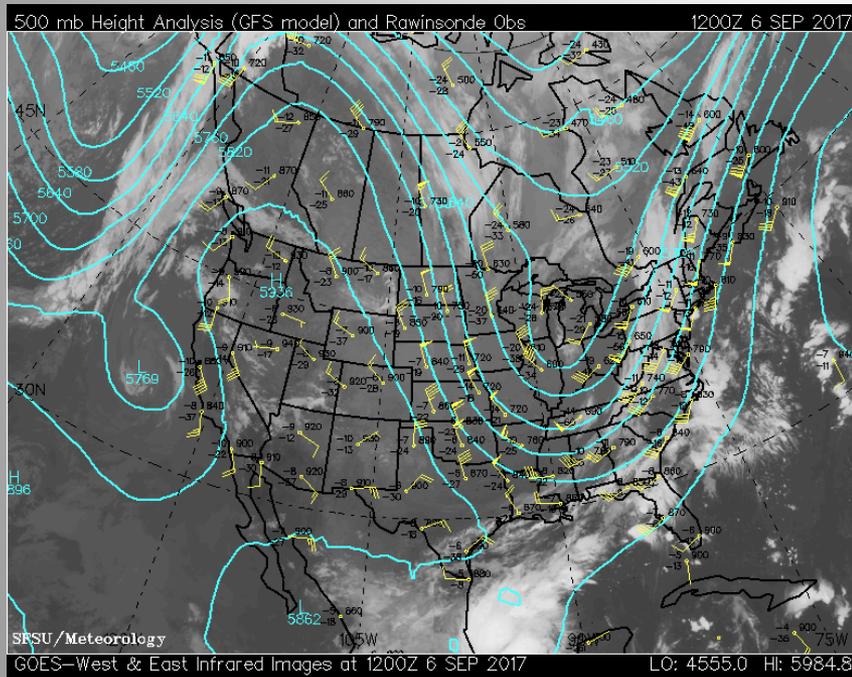


August 24

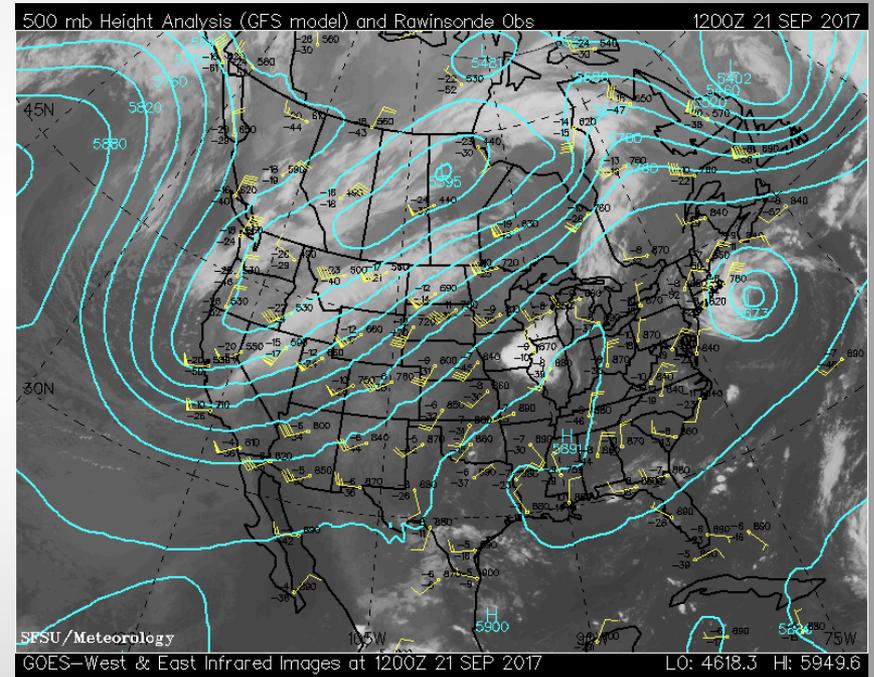
# September

- For the first 1/2<sup>rd</sup> of September high pressure remained rather strong over the state, but it began to weaken around the 12<sup>th</sup> with a much cooler trough of low pressure swinging over the state during the 3<sup>rd</sup> week resulting in cooler than average weather and the threat of spotty showers. High pressure then returned for the last week of the month.
- Afternoon highs ranged .5 to 3.4 degrees above average with overnight lows ranging from 1.9 to 5.5 degrees above normal, Yakima again with the warmest overnight weather compared to average. Rainfall from .20 to .27 below average
- 16 to 20 days of hazy weather reported over the region

Strong high pressure over the West Coast continues to dominate the weather pattern through much of the first half of the month before we saw the first significant change in the overall weather pattern around the last week of the summer.



September 6

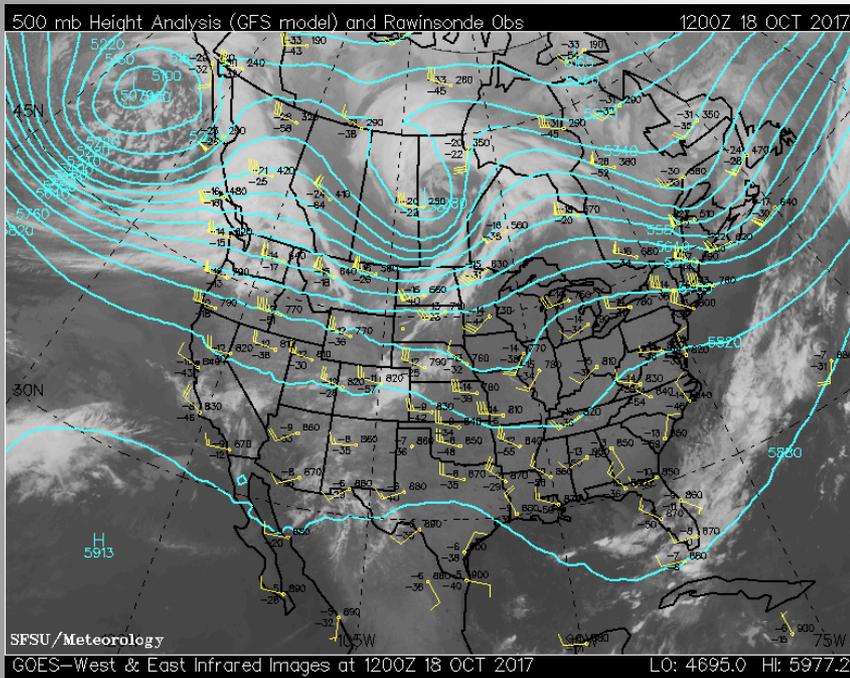


September 21

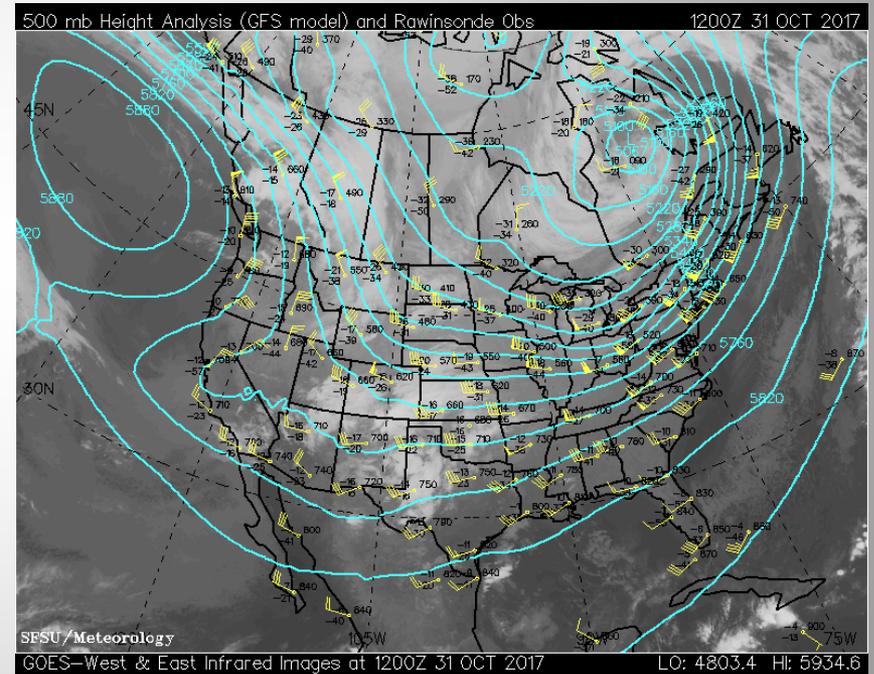
# October

- Weak high pressure remained in place for the first week, and built back into the state for the last week of the month, but in between a strong westerly jet stream produced an active weather pattern with frequent threats of rainfall.
- Afternoon highs ranged closer to average, from .3 degrees below normal for Pasco to 1.3 degrees above normal for Yakima. Overnight lows also ranged from .3 degrees below above normal in Yakima to 1.4 degrees above average for Moses Lake. Rainfall from .02 to .25 above average
- This active weather pattern helped to diminish the Northwest fires due to the wet conditions for the middle of the month

An active weather pattern developed over the state for the middle of the month leading to an active weather pattern for a few week before high pressure returned during the last week of October.



October 18



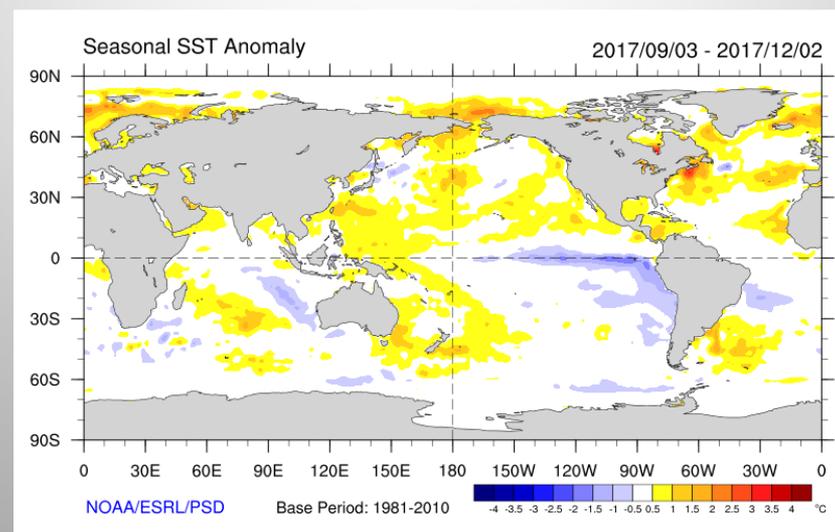
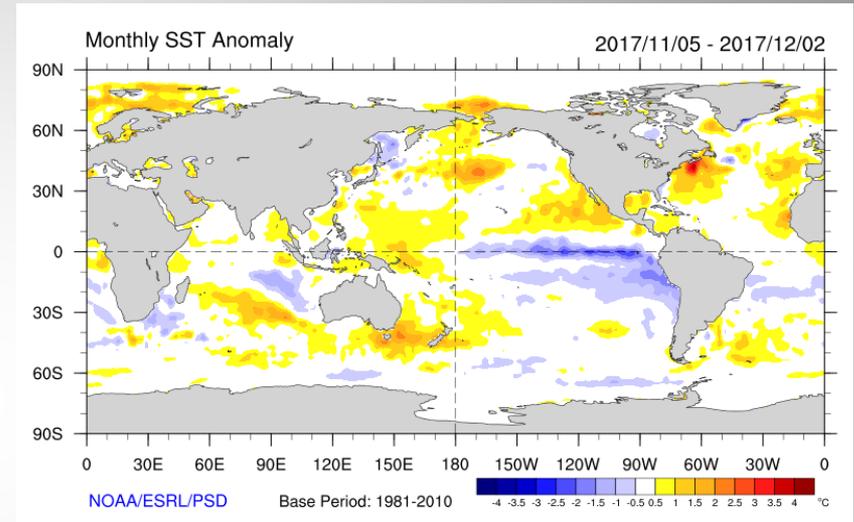
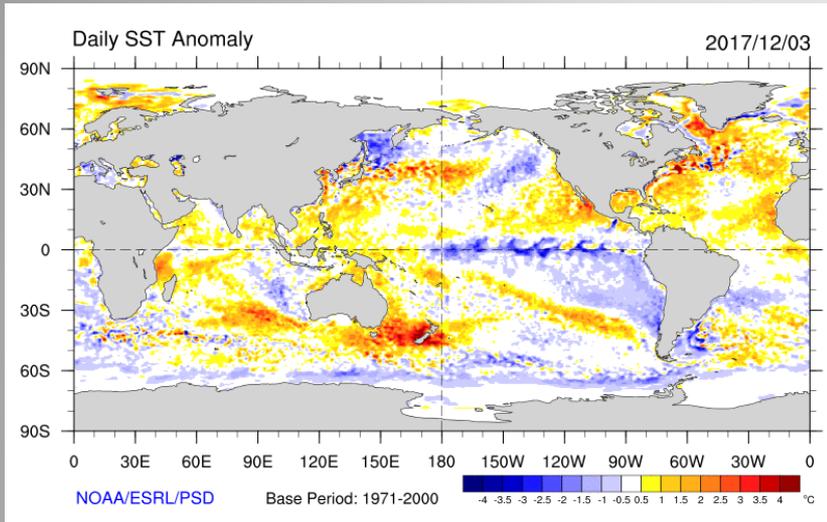
October 31

# November

- Cold and relatively dry weather as experienced during the first week of the month (5 nights with lows from the upper teens to middle 20s), but an active westerly jet stream dominated the weather conditions for most of the rest of the month. Frequent storm activity raced through the state.
- Even with the cool start to the month, afternoon highs ranged slightly above average from .2 to 2.2 degrees above normal. Overnight lows ranged 1.1 degrees above normal for Pasco, 1.7 above for Moses Lake and 5.5 degrees above normal in Yakima.
- Rainfall from .08 to .69 above average, wettest at Moses Lake with 1.89" of rain

What does this mean for the winter season into the beginning of spring?

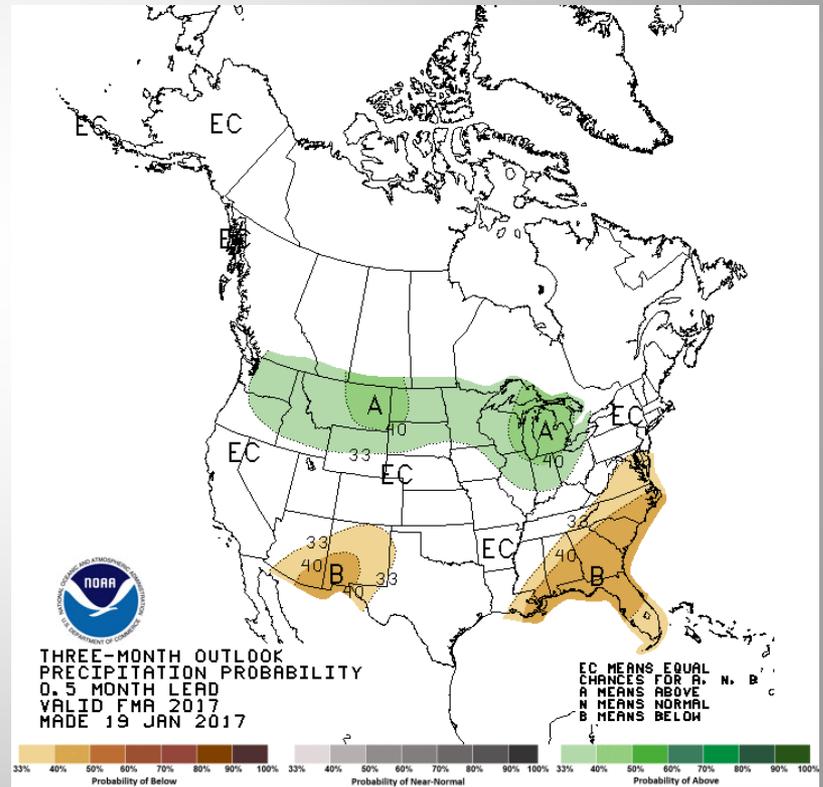
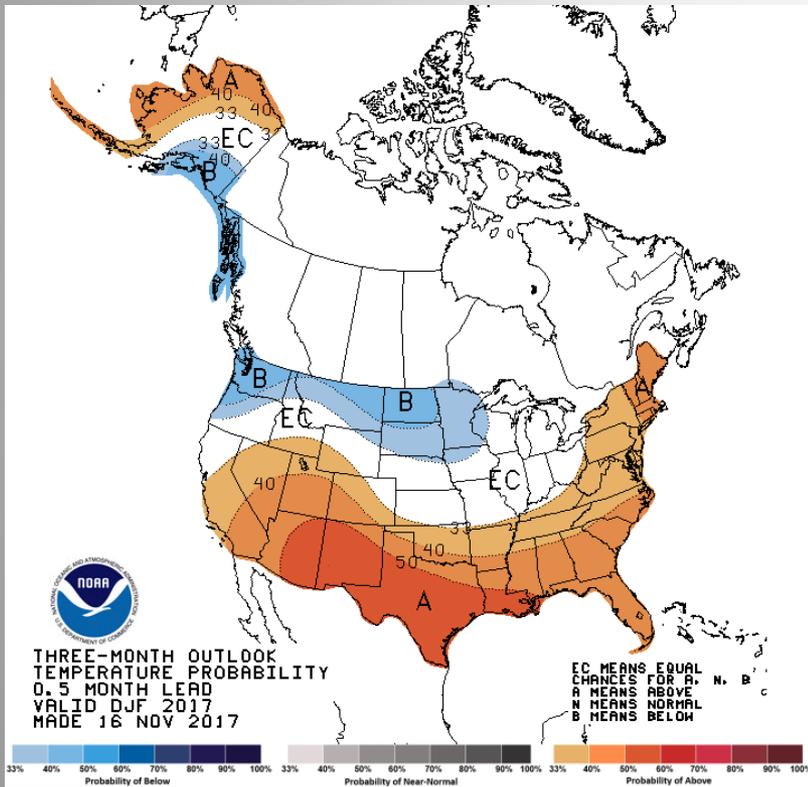
# Sea Surface Temperature Anomalies for late summer and fall



# National Weather Service long range outlook

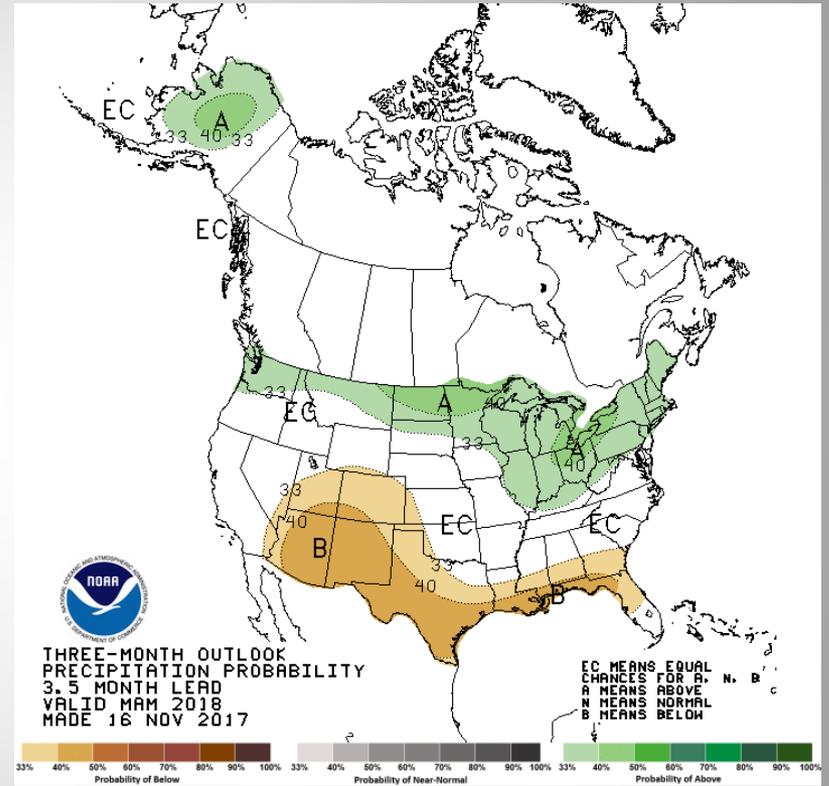
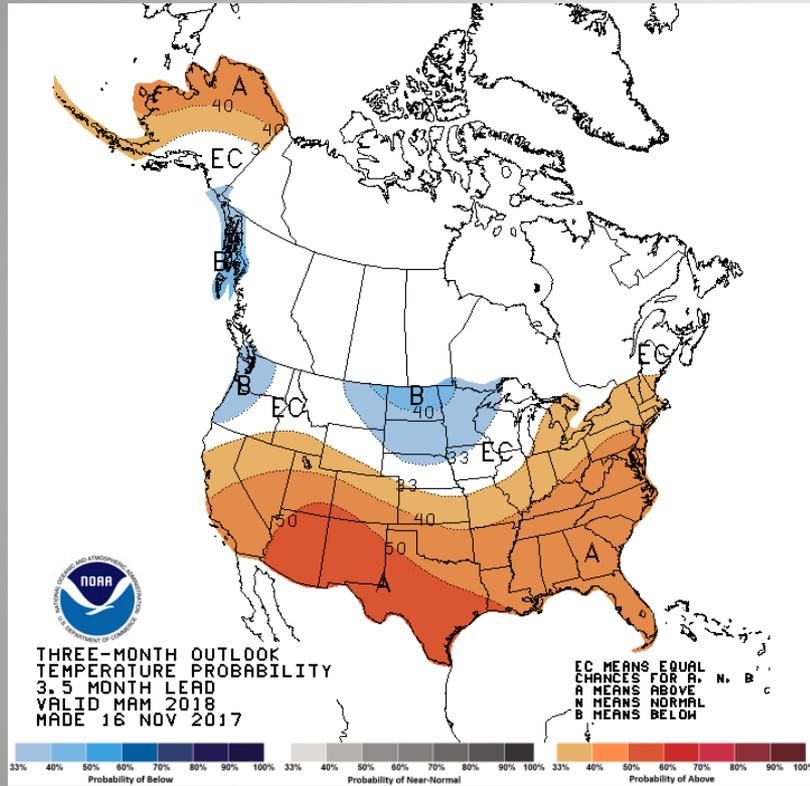
## Temperature outlook December through February

## Precipitation outlook December through February



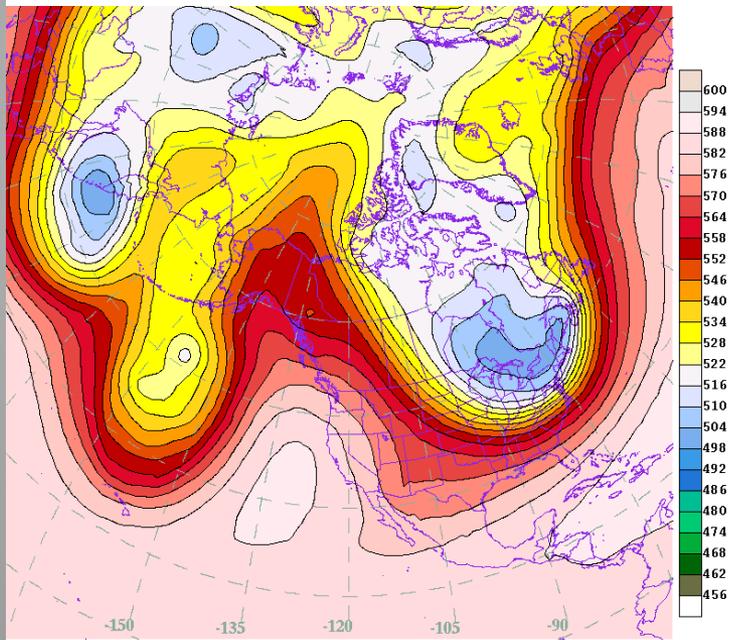
# Temperature outlook March through May

# Precipitation outlook March through May



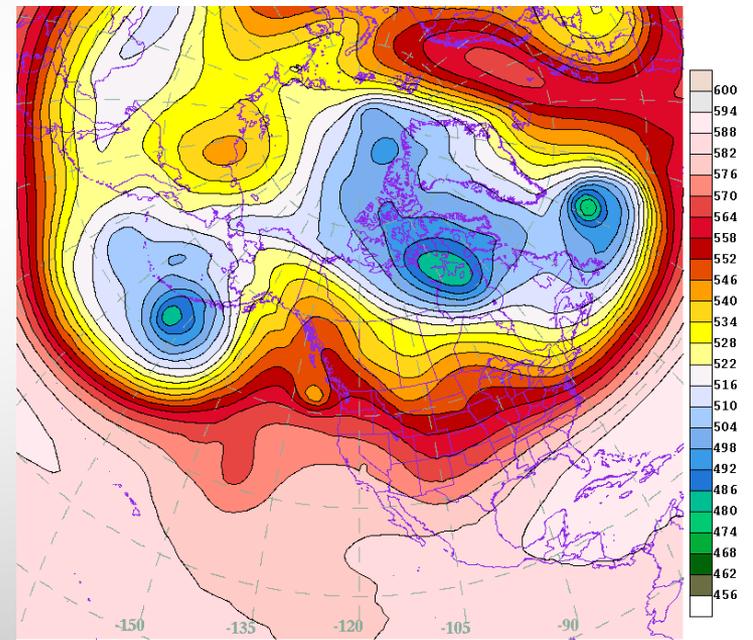
- A strong ridge of high pressure is expected to dominate the overall weather pattern for the next 10 days producing a very stagnant atmosphere resulting in a low overcast and areas of fog with temperatures mainly in the lower to middle 30s. This high pressure is expected to weaken slightly between the 16<sup>th</sup> and 20<sup>th</sup> of the month but no strong, organized storm presently are anticipated for the region. High pressure is also anticipated to rebuild during the last 1/3rds of the month with again a stable but stagnant atmosphere over central Washington.

228 Hr Fcst 500 MB Heights (dekameters) valid 00Z Thu 14 Dec 2017  
(initialized 12Z Mon 04 Dec 2017)



Univ. of Washington Dept. of Atm. Sci.

348 Hr Fcst 500 MB Heights (dekameters) valid 00Z Tue 19 Dec 2017  
(initialized 12Z Mon 04 Dec 2017)



Univ. of Washington Dept. of Atm. Sci.

**For mid December through mid January** look for *cooler than average temperatures*, especially for daytime highs, as high pressure is expected to remain strong over the Northwest. There is the decent potential that the high pressure will shift back to the west off the coast during the first half of January leaving the state under a general northerly to northwesterly upper level wind flow. This northwest flow would allow for possible colder Canadian or Arctic air to drop into the state from time to time leading to well below average temperatures during any occurrence. *Precipitation amounts for this time frame will be well below normal levels* with infrequent threats of any rain or snow.

**For mid January through mid March** expect to see continued at least slightly *cooler than average temperatures* but with *above average precipitation*. I anticipate high pressure will form further to the west over the western Gulf of Alaska leaving the region under a persistent trough of low pressure. As a result we should see frequent storm activity dropping out of the eastern half of the Gulf of Alaska which will swing through the Pacific Northwest, each system bringing strong threats of precipitation. This general westerly to northwesterly flow will be a good snow producer for the mountains and central Washington could see areawide snow cover depending on the track any individual storm takes.

**For spring season** we should see continued *cooler than average temperatures and above average precipitation*. Much like last spring a greater than normal frequency of storm activity is anticipated to move through the Northwest. Daytime highs will be below normal with overnight lows generally slightly warmer than average due to the active weather conditions and these conditions also should lead to a number of wind events as well. At this time I anticipate another slow start to the summer season with close to normal temperatures and precipitation for the July and August. We will see.

# WeatherWatch Forecast Service

## Pacific Weather Consulting

- 5 day agricultural weather forecast sent daily with 10 forecast variables during the growing season, including drying conditions, expected evapotranspiration and overnight dew formation
- 6 to 10 outlooks issued on Monday and Thursday
- Frost forecast during the spring frost season
- 800 phone number for consultation when additional information or clarification is needed

# Daily Fruit Frost Forecast during frost season

## TONIGHT'S WEATHERWATCH FROST FORECAST FOR THURSDAY - APRIL 18, 2013 PREPARED BY METEOROLOGIST TIM CREEK - Toll free 866-994-2278

**Discussion** .... A minor weather system will be sliding over the region during the overnight hours of tonight, producing cloudy skies and even the chance of a few spotty showers. Southerly and southwesterly winds will not be strong but will be breezy in many areas during the second half of the night, and the bottom line is that no threat of frost is to be expected in any area with lows primarily in the 40s. We should continue to see non-critical temperatures through Sunday morning due to the unsettled nature of the atmosphere, but the threat of frost may return briefly for the early part of next week at least in the coolest locations. For tonight though look for mild temperatures and possibly the chance of spotty light rain showers. **This afternoons dew points:** North Central WA ... 30 to 37, Columbia Basin .... 33 to 40, Yakima valley ..... 33 to 40. I expect most values gradually rise overnight. **Tonight's Inversion** ... Weak in most areas, at least moderate in the coolest areas but frost is not expected.

Location	Lows Tonight Safe ≥36	Last Night Lows	Total BDU 2013	Total BDU 2012	Location	Lows Tonight Safe ≥36	Last Night Lows	Total BDU 2013	Total BDU 2012
E. Oroville	safe	37.5	693	552	Naches	safe	39	907	661
Ellisforde	safe	34.5	768	639	Cowiche	safe	42.5	758	525
S. Tonasket	safe	30.5	762	652	Gleed	safe	41	700	484
Pogue Flat	safe	31.5	742	543	Pomona	safe	38	895	650
Malott	safe	34.5	700	587	Altatum	safe	40.5	745	522
Brewster Flat	safe	33.5	684	580	Moxee	safe	28.5	938	725
Brewster	safe	39.5	751	639	Yakima	safe	40	na	na
Manson	safe	34	na	na	Parker	safe	39	1058	810
Boyd District	safe	36	506	317	Wapato	safe	34.5	978	813
South Chelan	safe	39.5	629	482	Lwr Konnowac Pass Rd	safe	38	1029	826
Brays Landing	safe	42.5	701	587	Buena	safe	34.5	1063	839
Orondo	safe	43.5	785	642	Toppenish	safe	35.5	1072	861
WSU Wenatchee	safe	40	882	664	Outlook	safe	35	870	677
E. Wenatchee	safe	42	734	557	Sunnyside	safe	36.5	980	783
Malaga	safe	42.5	835	665	Port Sunnyside	safe	31.5	1030	880
Wenatchee Hghts	safe	41.5	427	354	Snipes	safe	40.5	931	772
N Cashmere	safe	38	878	645	Mabton East	safe	32.5	1027	879
Dryden	safe	39	na	na	WSU Hamilton	safe	35.5	998	850
Leavenworth	safe	na	na	na	WSU Roza	safe	38	880	710
Stemilt Hill	safe	na	na	na	WSU Prosser	safe	35	980	814
Quincy	safe	41	704	584	Benton City West	safe	39.5	955	810
Ephrata	safe	34.5	816	703	North Pasco	safe	43	972	805
Moses Lake	safe	35.5	830	732	Badger Canyon	safe	46.5	1017	869
Frenchman Hills	safe	36.5	790	606	Finley	safe	42	1051	900
Royal City West	safe	39.5	758	590	Wallula	safe	46.5	976	882
Royal Slope East	safe	41.5	702	604	Fishhook	safe	39	934	792
Othello	safe	31	762	670	PK McClenny	safe	32.5	948	838
Wahluke Slope	safe	46.5	852	702	Aldertale	safe	36.5	1131	845
Mattawa	safe	45	958	818	Roosevelt	safe	43	1066	836
Basin City	safe	37	841	746	College Place	safe	40.5	1041	849
Radar Hill	safe	34	857	752	Walla Walla	safe	37	871	742

Actual last night lows and blossom degree units based on 43 degrees from 2/1/13 provided by AgWeatherNet at <http://weather.wsu.edu>.

# Early morning outlook

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## WEATHERWATCH

### OUTLOOK FOR THE COLUMBIA AND NORTHERN UMATILLA BASIN, AND THE LOWER YAKIMA VALLEY

Monday – September 23, 2013 from The Weather Center (866)-994-2278

**SUMMARY / DISCUSSION** .... Weather conditions over the next few days will be cool and somewhat unsettled as an upper level trough of low pressure slowly moves over the region. Variable cloudiness is expected much of the time with westerly breezes in areas. Isolated showers are possible, mainly for Tuesday, but still most locations will remain dry. Temperatures will be seasonably cool and maybe slightly below average in many areas.

	Today	Tonight	Tomorrow
<b>Weather</b>	Partly sunny skies with scattered clouds through the day. West to southwest breezes in areas	Scattered clouds, partly cloudy to mostly clear with cool temperatures	Partly cloudy skies with the chance of isolated showers in areas, otherwise cool and mostly dry weather
<b>High/Low Temperatures</b>	67 to 72	45 to 50	65 to 70
<b>Winds</b>	West winds 5 to 15 mph, possibly gusty in areas	Light west winds	Light southwest winds
<b>Precipitation Chance &amp; Amounts</b>	Dry weather is expected in most areas, 10% threat of isolated showers	Dry weather is likely	20% threat of a few spotty showers but with most areas will likely be dry

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# 5 day WeatherWatch forecast

Tri-Cities.pdf - Adobe Reader

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## WEATHERWATCH

### OUTLOOK FOR THE LOWER COLUMBIA BASIN - TRI-CITIES AREA

PREPARED BY METEOROLOGIST TIM CREEK  
Monday - September 23, 2013 from The Weather Center - Toll free 866-994-2278

Discussion ...Weather conditions for the next 48 hours or so will remain unsettled as an upper level trough of low pressure will be slowly sliding over the Pacific Northwest. Presently the trough is centered along the northern British Columbia leaving the region under a strong westerly jet stream through the afternoon. Scattered cloudiness and cool temperatures will continue for the day but the threat of any precipitation will remain rather low. The trough will slowly slide southward along the coast overnight and will take a position along the southwest B.C. coast by tomorrow afternoon, and this will tend to increase the instability in the atmosphere locally. As a result we should see an increase in scattered clouds and the threat of a few spotty showers for tomorrow along with minor cooling. The upper level trough is then expected to drop southward into the Great Basin for the middle and latter part of this week with a ridge of high pressure rebuilding back into the area from the west. As a result we should see increased sunshine and warmer weather for late in the week, at least for Thursday and Friday before the next weak weather system slides up to the Northwest coast for next weekend.

#### FIVE DAY DETAILED FORECAST

	Today	Tue, Sep 24	Wed, Sep 25	Thu, Sep 26	Fri, Sep 27
Weather	Variable clouds, generally partly sunny skies with cool and breezy weather. Isolated showers are possible but with most areas remaining dry	Partly cloudy skies with cool temperatures and a slightly increased chance of isolated showers	Partly to mostly sunny skies, cooler than average temperatures and dry weather conditions	Mostly sunny skies, cool and dry weather conditions	Mostly sunny skies with slightly warmer weather
Hours of Sunshine		7 to 8	10 to 11	12	11 to 12
Morning Low Temperatures		43 to 48	40 to 45	39 to 44	40 to 45
High Temperatures	67 to 72	65 to 69	66 to 70	66 to 70	69 to 73
Spin Dewpoints	45 to 49	43 to 47	38 to 43	38 to 43	40 to 45
Drying Conditions	Possibly moderate due to afternoon breezes	Poor	Poor	Poor	Poor
Expected Evapotranspiration	.16 to .20"	.13 to .18"	.13 to .18"	.13 to .18"	.14 to .18"
Overnight Dew Formation	Moderate to heavy overnight dew	Heavy overnight dew	Heavy overnight dew	Heavy overnight dew	Moderate to heavy overnight dew
Winds	West to southwest winds 10 to 20 mph in areas	Light west winds	Light west to northwest winds	Light west to northwest winds	Light winds
Precipitation Chance & Amount	15% threat of isolated showers this afternoon but with dry weather expected in most areas	25% of isolated showers but again most areas should remain dry for the day	Dry weather is expected	Dry weather is expected	Dry weather is expected

# 6 to 10 day outlook issued Mondays and Thursdays

Tri-Cities.pdf - Adobe Reader

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### 6 TO 10 DAY OUTLOOK

	Sat, Sep 28	Sun, Sep 29	Mon, Sep 30	Tue, Oct 01	Wed, Oct 02
Weather	Increased clouds, becoming partly cloudy for the day. Isolated showers possible late in the day and overnight	Scattered clouds, partly to mostly sunny skies with mild and dry weather expected for the day	Mostly sunny skies with slightly warmer weather expected at this time	Partly to mostly sunny skies with mild and dry weather expected to continue	Partly to mostly sunny skies with scattered clouds, mild and dry weather
Low Temperatures:	46 to 51	48 to 53	47 to 52	48 to 54	47 to 52
High Temperatures:	70 to 75	74 to 79	75 to 80	75 to 80	75 to 80
Chance of Rainfall	Dry weather is likely, 20% threat of isolated showers late in the day and overnight	Dry weather is expected	Dry weather is expected	Dry weather is expected	Dry weather is expected

### LONG RANGE 30 DAY OUTLOOK

Through the month of October

The weather for at least the first half of October is expected to be relatively mild and dry as the primary storm track is expected to remain north of the state much of the time. Afternoon temperatures should be slightly warmer than average with typically cool overnight lows, the threat of precipitation remaining rather low much of the time. The overall storm track is then expected to become more active during the second half of the month with more typically frequent threats of precipitation. I still expect near or slightly above average temperatures with closer to normal precipitation. A strong westerly jet stream is then expected to develop over the region for the last week or so of October into the first of November.

### CLIMATOLOGICAL AVERAGES

Lower Columbia Basin	Max Temperature	Min Temperature	Precipitation Amounts
September	Near 80	Near 50	0.3 to .5 inches

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