National Weather Service

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ZSE Weather Watch

A newsletter from your Seattle ARTCC Center Weather Service Unit

INSIDE THIS ISSUE

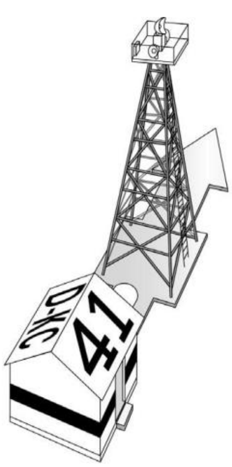

Fig 3 – *Airway beacon.*

Giant Arrows Lead the Way *the Daily Traveler Newsletter*

Every so often, usually in the vast deserts of the American Southwest, a hiker or a backpacker will run across something puzzling: a ginormous concrete arrow, as much as seventy feet in length, just sitting in the middle of scrub-covered nowhere ***(Fig. 1)***. What are these giant arrows? Some kind of surveying mark? Landing beacons for flying saucers? Earth's turn signals? No… they're navigation markers used to mark the way along the 1920s Transcontinental Air Mail Route.

Figure 1 – *Giant concrete navigation arrow.*

On August 20, 1920, the United States opened its first coast-to-coast airmail delivery route ***(Fig. 2)***, just 60 years after the Pony Express closed up shop. Detailed aviation charts didn't exist in those days, so pilots had to eyeball their way across the country using landmarks. Flying in bad weather was difficult, and night flying was just about impossible.

Figure 2 – *1920 transcontinental air mail route.*

The Postal Service solved the problem with the world's first ground-based civilian navigation system: a series of lit beacons that would extend from New York to San Francisco. Every ten miles, pilots would pass a bright yellow concrete arrow. Each arrow would be surmounted by a 51-foot steel tower and lit by a million-candlepower rotating beacon. A generator shed at the tail of each arrow powered the beacon. Now mail could get from the Atlantic to the Pacific, not in a matter of weeks, but in just 30 hours or so.

Even the dumbest of air mail pilots, it seems, could follow a series of bright yellow arrows straight out of a Tex Avery cartoon. By 1924, just a year after Congress funded it, the line of giant concrete markers stretched from Rock Springs, Wyoming to Cleveland, Ohio. The next summer, it reached all the way to New York, and by 1929 it spanned the continent uninterrupted, the envy of postal systems worldwide.

Radio and radar are, of course, infinitely less cool than a concrete Yellow Brick Road from sea to shining sea, but I think we all know how this story ends. Advances in communication and navigation technology made the arrows obsolete, so the Commerce Department decommissioned the beacons in the 1940s. The steel towers were torn down and went to the war effort, but hundreds of arrows remain. Their yellow paint is gone, their concrete cracks a little more with every winter frost, and no one crosses their path much, except for coyotes and tumbleweeds. But they're still out there.

Extreme Late-Summer Weather *by John Werth*

AUGUST 2013						
SUN	MON	TUE	WED	THU	FRI	SAT
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

Many areas across the Pacific Northwest were unusually warm and dry this past summer. In fact, many would say it was the best summer in decades! Seattle had its driest July in 60 years. Quillayute (on the north Washington coast) had its driest July in 124 years, receiving just 0.01 inches of rain during the month.

However, the pattern turned unusually stormy and wet from mid-August through the end of September. There were severe thunderstorms, tornadoes, heavy rain, damaging winds, an unusually strong cold front, and an atmospheric river over the Pacific Northwest that included leftover moisture from a Pacific typhoon. The period ended with heavy snowfall in the mountains the end of September.

The stormy pattern began on the 29th of August when the Storm Prediction Center, located in Norman, OK, advised there was a “marginal tornado threat” for the Puget Sound area that evening.

By late afternoon, small but intense thunderstorms developed over Pierce County ***(Fig. 3)***. The storms moved north to the Seattle metro area during the early evening hours with intense downpours, gusty winds, and frequent lightning. ***Figure 4*** shows a near-tornado - or wall cloud – that developed in Lakewood around 5:38 P.M. Looking at the image, one would think it was a picture of a Midwest thunderstorm, not of one located in Western Washington.

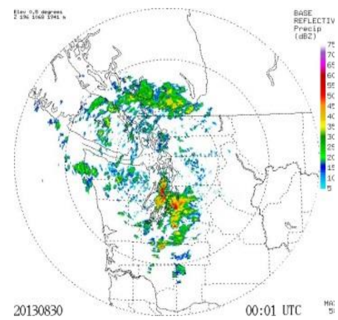

Figure 3 – *NEXRAD image of small, intense thunderstorms near Lakewood, WA*

Figure 4 *– Wall cloud over Lakewood, WA on August 29, 2013 at 5:38 PM*

SEPTEMBER 2013						
SUN	MON	TUE	WED	THU	FRI	SAT
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15	16	17	18	19	20	21
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29	30					

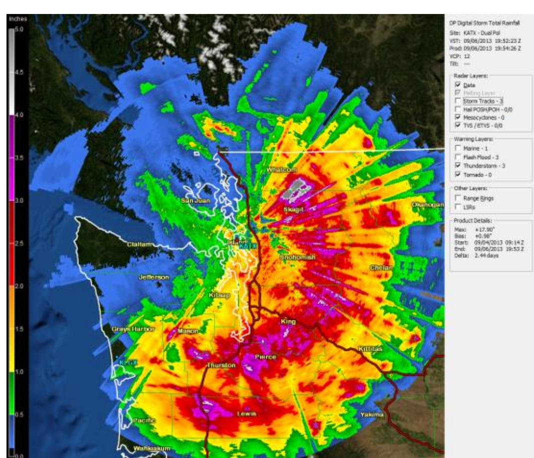

Figure 5 *– NEXRAD storm total precipitation Sept. 4-6, 2013*

In early September, an upper level low moved slowly NE across the area. Once again, there was a significant outbreak of thunderstorms across ZSE’s airspace as the low passed through the area. NWS spotters reported frequent lightning, heavy rain, wind gusts greater than 65 knots, and large hail with some of these storms. The storms eventually morphed into a massive shield of heavy rain that covered an area from northwest OR to central WA on the evening of the 5th. Heavy rain continued overnight and into the morning hours of the 6th before finally ending later in the day. Seattle’s NEXRAD radar measured storm total precipitation for the event of 1-2” in the Seattle area and 3-5” over SW Washington ***(Fig. 5)***. One weather station in the Cascades reported an incredible 8.46” of rain during the event.

Another evening of spectacular thunderstorm activity occurred on the 15th of September, just as the Seattle Seahawks were playing the San Francisco 49ers at CenturyLink Field in Seattle. Earlier in the day, the National Weather Service warned of potentially stormy weather during the game, forecasting a chance of thunderstorms with frequent lightning, heavy rain, and wind gusts 25 to 35 mph.

As it turned out, the game was delayed for 60 minutes late in the first quarter when a line of thunderstorms moved through the area ***(Fig. 6)***. The convective band extended from northeast Oregon to Vancouver Island and moved slowly north during the evening ***(Fig. 7)***. Thousands of lightning strikes were reported across area during the event ***(Fig. 8)***.

Figure 6 *– NEXRAD display of the line of thunderstorms that moved through the Seattle area during the Seahawk game.*

SEPTEMBER 2013						
SUN	MON	TUE	WED	THU	FRI	SAT
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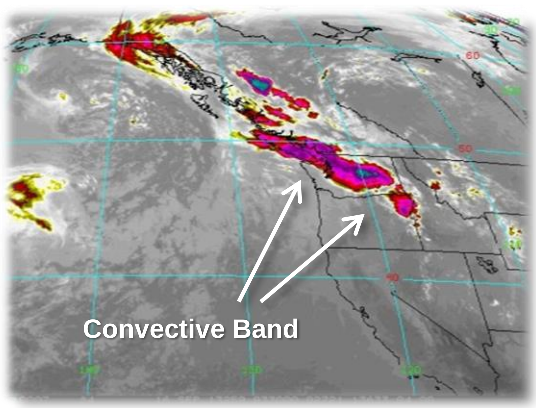

***Figure** 7 – Infrared satellite image of convection stretching from NE Oregon to Vancouver Island.*

Figure 8 *– Lightning strikes during the 3-hour period ending at 8:45 P.M.*

Just a week later, on Sunday the 22nd of September, an unusually strong cold front for late September, moved through Western Washington. The front was characterized by short bursts of very heavy rain, small hail, and strong, gusty winds. Radar images from the Langley Hill radar - located on the Washington coast near Hoquiam - showed multiple, narrow cores of intense precipitation (shown in red) separated by gaps of relatively light precipitation ***(Fig. 9)***.

During the 1970s, work by Professor Peter Hobbs and colleagues at the UW studied similar fronts with research aircraft and coastal radars. They found many of the fronts - particularly the strong ones - were not one continuous, unbroken line of precipitation, temperature change, and wind shifts. Rather, they were often ***"corrugated"*** into areas of heavy precipitation, large temperature changes, and wind shifts, separated by gaps where the changes were much more gradual.

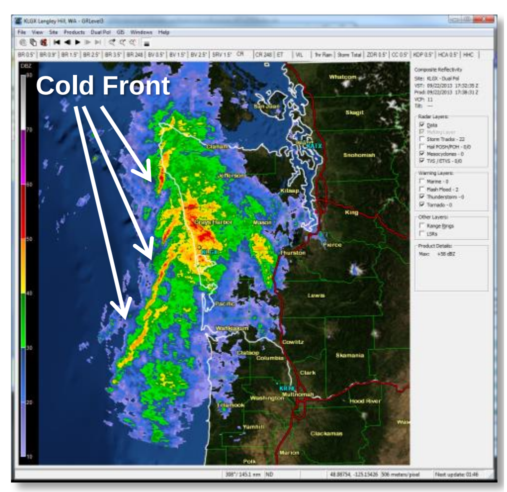

Figure 9 *–Intense cold front off the Washington*

Years later, aircraft penetrations by NOAA's P-3 Hurricane Hunter, verified these radical differences along these types of cold fronts.

SEPTEMBER 2013						
SUN	MON	TUE	WED	THU	FRI	SAT
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8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
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SEPTEMBER 2013

SUN	MON	TUE	WED	THU	FRI	SAT
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Narrow plumes of concentrated moisture in the atmosphere – called Atmospheric Rivers (ARs) – are responsible for some of the most extreme precipitation and flooding events along the West Coast. In late September, an atmospheric river carrying leftover moisture from Typhoon Pabuk, plowed into the Pacific Northwest ***(Fig. 10)***. There were two distinct surges of moisture in this river; the first on Saturday the 28th, and the second on Sunday and Monday the 29th and 30th.

Because of this event, rainfall totals for the month of September were more typical of November or December, which are the two wettest months of the year in the Pacific Northwest. Olympia had the wettest September on record with 9.36" of rain. Astoria shattered its September rainfall record with 10.70". Other locations in Washington and Oregon also experienced record September rainfall.

Along with torrential rain, the second storm also included a powerful windstorm ***(Fig. 11)***. The National Weather Service issued a "high-wind warning" for much of Western Washington, valid from 5 p.m. Sunday though 4 a.m. Monday. A strong surface low was forecast to move across northwest Washington Sunday night. As it turned out, the low ***(L in Fig. 11)*** made landfall over the northern tip of Vancouver Island. Damaging winds bypassed the Seattle area; however, wind gusts 60 to 85 mph occurred on the Washington coast and in the Olympic Mountains.

The storm delivered another punch on Monday, when a tornado touched down in Pierce County, in the town of Frederickson. The tornado damaged several industrial buildings in the area, uprooted dozens of trees, spun around and lifted several parked cars, and overturned several empty rail cars at the Boeing plant in Frederickson.

The twister ***(Fig. 12)*** was estimated to be 75 yards wide, traveled on the ground for over a mile, packed winds of 110 mph, and resulted in about $25,000 in property damage.

The final blow from this storm came when unusually cold, unstable air behind the front, brought several feet of snow to the mountains.

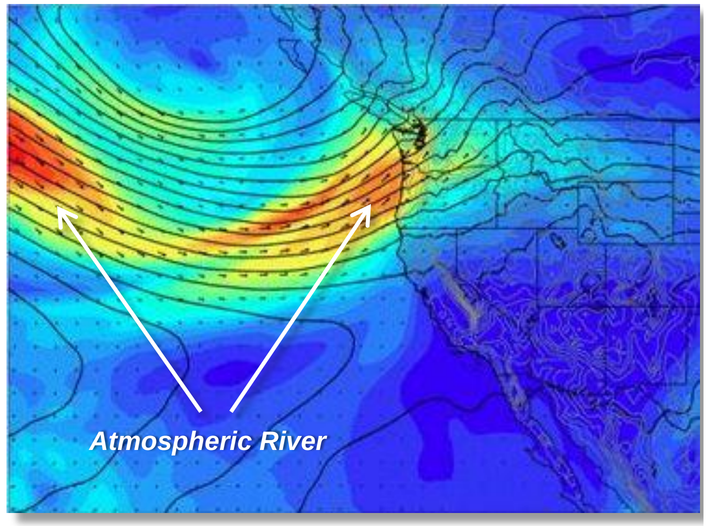


Figure 10 *– Atmospheric river September 28-30 with two, distinct surges of tropical moisture (areas in yellow and orange).*

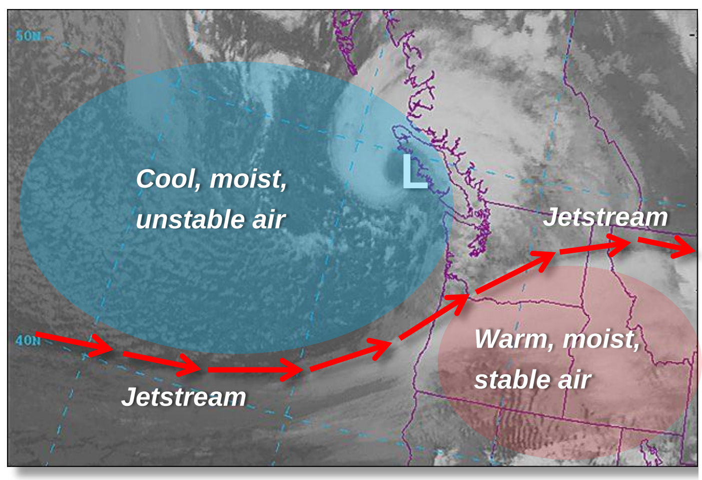


Figure 11 *– IR satellite image Sunday night, September29, 2013.*

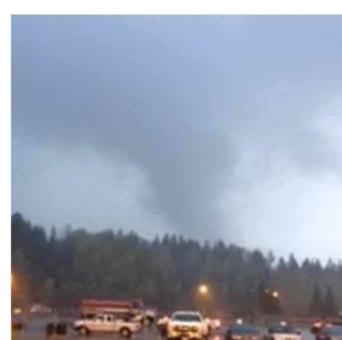


Figure 12 *– EF-1 tornado in Frederickson, WA Monday morning, September 30, 2013.*

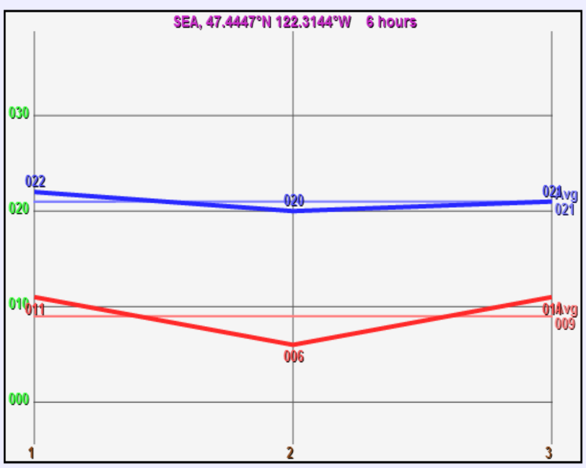
PIREP Cloud Height Analysis *by James Vasilj*

The winter months bring renewed concerns about stratus and fog for Seattle and Portland, and mid-October has also had its fair share of days with stratus lingering well into the afternoon hours at Seattle. The Seattle CWSU has a page that analyzes PIREPs to display cloud ceilings and bases near various terminals. The page can be found at http://www.wrh.noaa.gov/zse/pirepclouds.php or from the ZSE Favorites page. It will default to SEA using the past three hours of data, but can go back up to 12 hours and allows the selection of all the OEP terminals plus some other significant North American terminals. The cloud top is plotted in blue and the base in red, with the latest METAR and TAF on the right and the text output of the PIREPs below. PIREPs with cloud height information are useful to the meteorologists to help them discern cloud depth and how quickly the clouds will scatter out (if they do). The chart below is from the morning of Thursday, the 17th of October.

PIREP Cloud Height Analysis

The following is for SEA, 47.4447° latitude, -122.3144° longitude, over the past 6 hour(s).
Blue indicates cloud tops and red indicates cloud bases, including averages.
The y-axis displays the height in 100s of feet. The x-axis has reference numbers for each PIREP (listed below).
AWC's decoding algorithm is used with some extra modifications.
A chart is only produced when there is more than one cloud base and/or height available.
Some older browsers, including Internet Explorer 8, may not be able display the chart.

New Request: SEA 6 hours Submit

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3: 011/021 :: PWT UA /OV PWT040006/TM 1624/FL030/TP C172/SK OVC011-TOP021

"Oh great, now we can't talk about religion, politics, OR the weather."

2013-2014 Winter Season Outlook *by Steve Adams*

After an active late-summer pattern and a prolonged mid- to late-October dry pattern, there are few clues as to what the 2013-14 winter season will bring. The long-term seasonal outlook for the winter of 2013-14, issued by NOAA's Climate Prediction Center (CPC), shows equal chances for above or below average temperatures and precipitation for the upcoming 3-month period from November 2013 to January 2014 and from December 2013 to February 2014 ***(Fig. 13 and 14)***. A major reason for this is the El Nino Southern Oscillation (ENSO) is forecast to remain in a neutral pattern into the spring of 2014. This means no strong El Nino or La Nina pattern is forecast into spring of 2014.

Other primary, but lesser known, climate signal indicators show no clear pattern as well. While the Pacific Decadal Oscillation (PDO) suggests a slightly cooler pattern, the Atlantic Multi-decadal Oscillation (AMO) suggests a slightly warmer pattern. The graphics below are updated in the middle of each month and include outlooks out to a year in advance. These maps and more detailed explanations are available at NOAA's Climate Prediction Center's website at www.cpc.noaa.gov.

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"Protecting Life and Property"

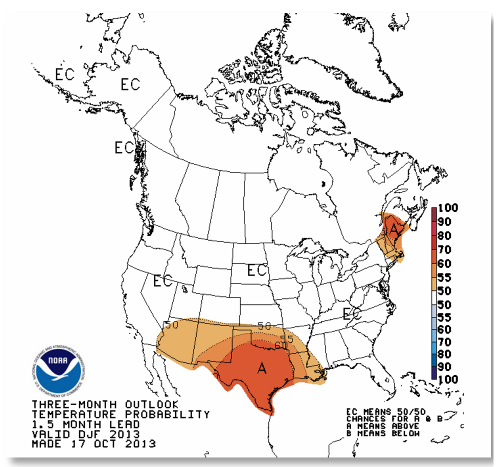

Fig. 13 *- 3-month Temperature outlook for December 2013 through February 2014*

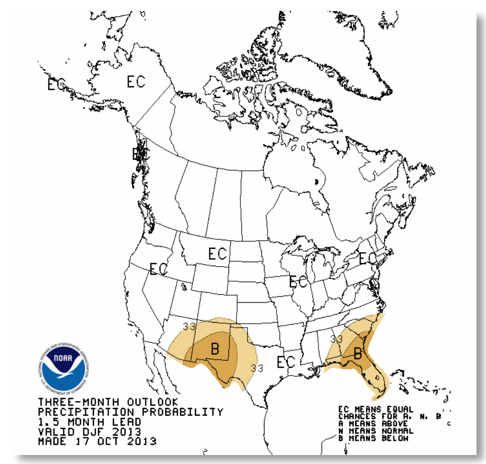

Fig. 14 *- 3-month Precipitation outlook for December 2013 through February 2014*

You can find this newsletter and previous versions of this newsletter at:

http://www.wrh.noaa.gov/zse/training.php