

WINTER 2020-2021

Mark Nelsen

A MILD LA NIÑA WINTER



FOX 12
OREGON

FOX 12
PLUS 

Winter 2020-21

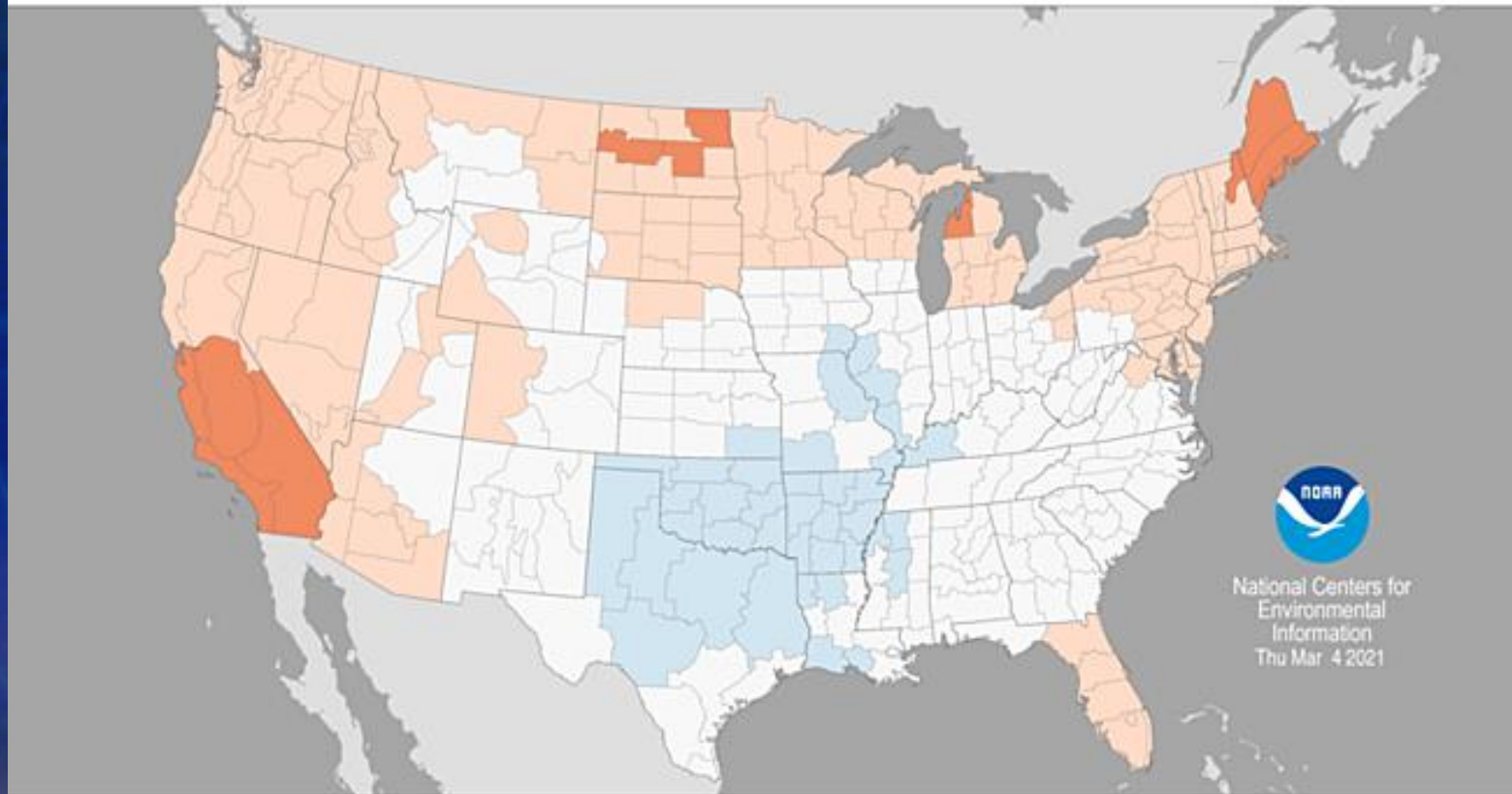
- Warmest La Niña winter in Western Oregon in 70 years
- **November-March** = A mild winter saved by 5 wintry days in the lowlands of NW Oregon & SW Washington
- Low Cascade snowpack until mid-February, then two weeks of big snowstorms...La Niña redeemed in Cascades
- Still waiting for regional arctic blast.
7th consecutive winter without a widespread arctic outbreak.
(December 2013 was the last)

Winter Temperature Anomaly

Divisional Average Temperature Ranks

December 2020–February 2021

Period: 1895–2021



National Centers for
Environmental
Information
Thu Mar 4 2021



Record
Coldest



Much
Below
Average



Below
Average



Near
Average



Above
Average



Much
Above
Average



Record
Warmest



OFFICIAL SNOW TOTAL: 10.1"

at PQR (NWS Office)

7.6" Downtown (KGW-TV)

PIC BY OCA HOEFLEIN

PORTLAND THIS WINTER

FIRST. LIVE. LOCAL.
WEATHER

2020-21



10.1
inches
WINTER
SNOWFALL

1 measurable snow/ice event

SNOW

.1"	Feb 11
6.1"	Feb 12
3.8"	Feb 13
.1"	Feb 14

FRZ RAIN/ICE

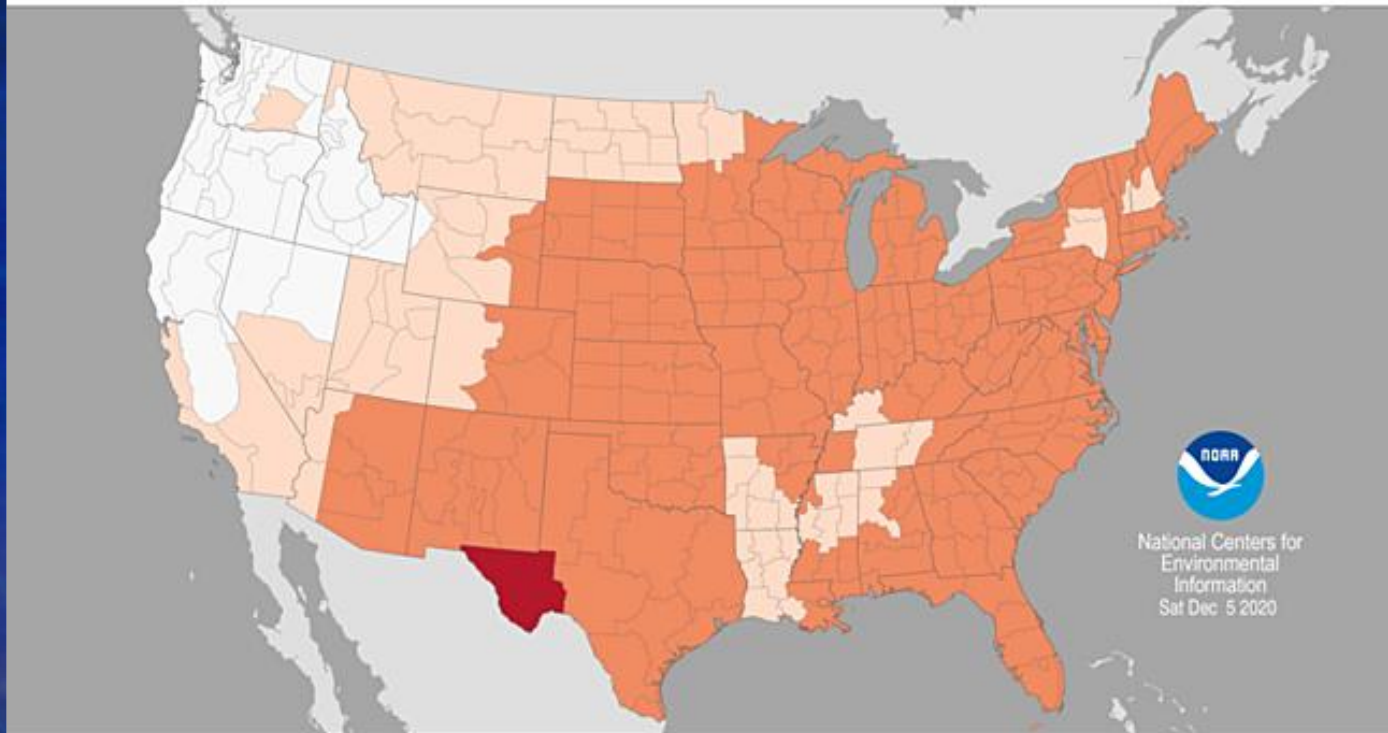
.75"
Feb 12/13/14

THE USA VIEW

Divisional Average Temperature Ranks

November 2020

Period: 1895–2020



National Centers for
Environmental
Information
Sat Dec 5 2020

Record
Coldest

Much
Below
Average

Below
Average

Near
Average

Above
Average

Much
Above
Average

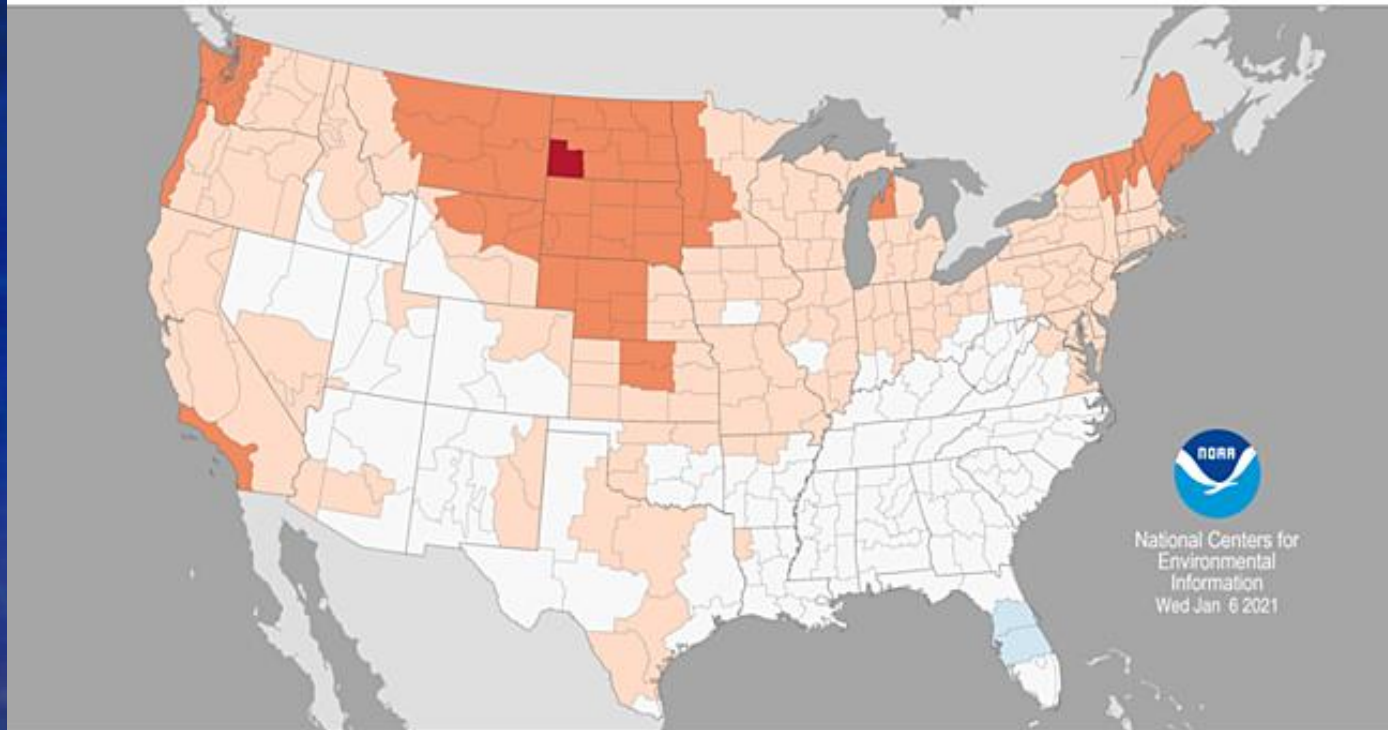
Record
Warmest

THE USA VIEW

Divisional Average Temperature Ranks

December 2020

Period: 1895–2020



National Centers for
Environmental
Information
Wed Jan 6 2021

Record
Coldest

Much
Below
Average

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Average

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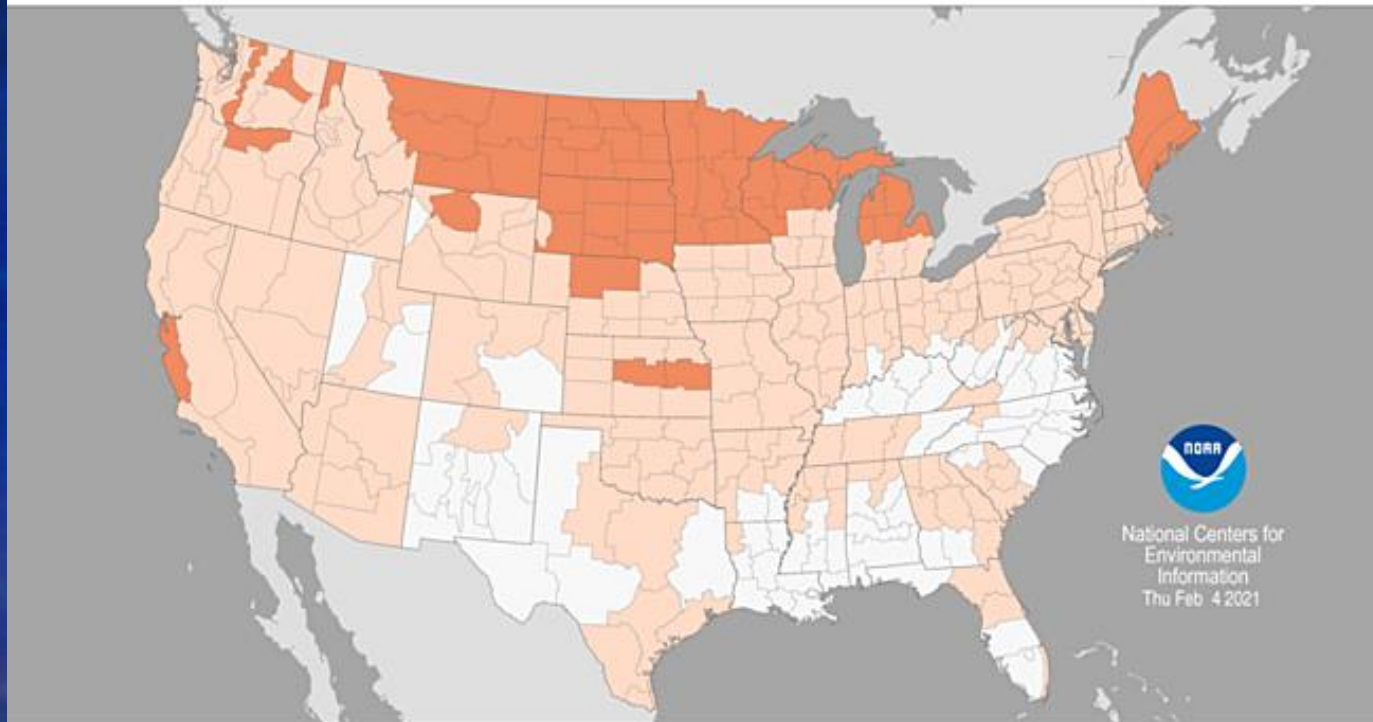
Record
Warmest

THE USA VIEW

Divisional Average Temperature Ranks

January 2021

Period: 1895-2021



National Centers for
Environmental
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Thu Feb 4 2021

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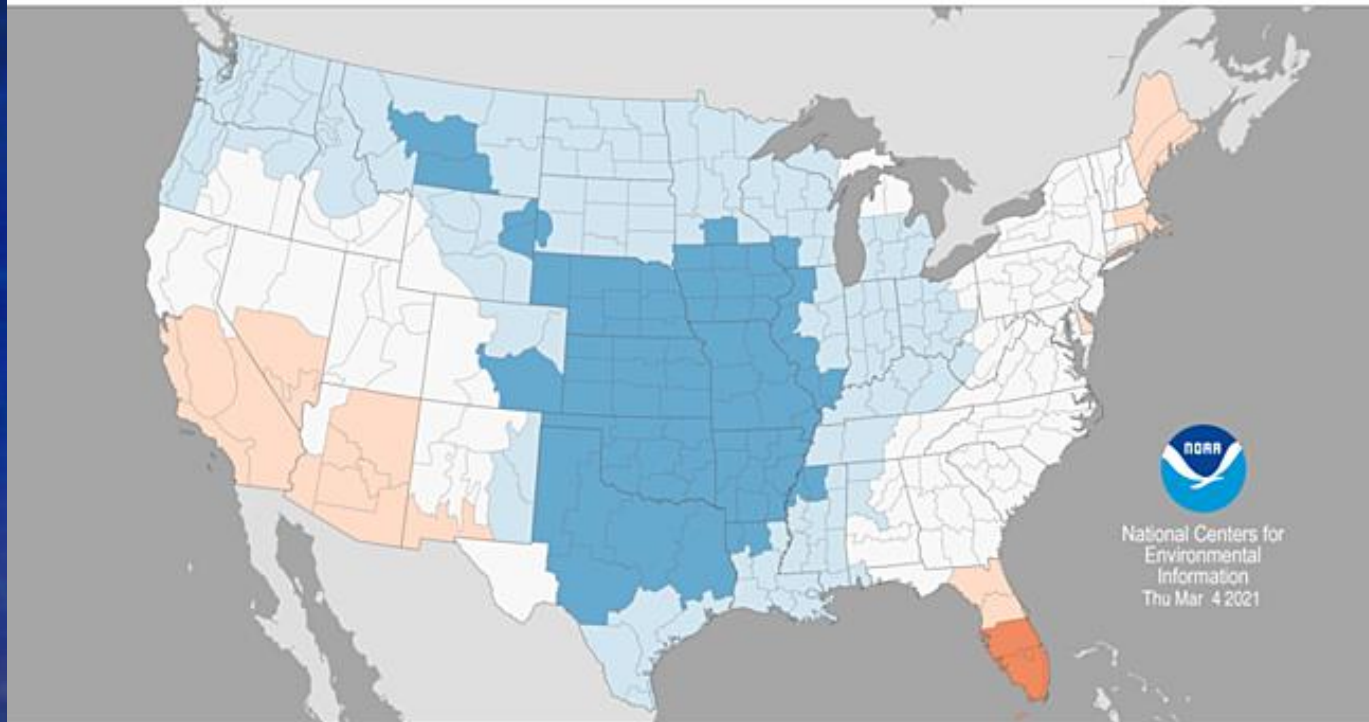
Record
Warmest

THE USA VIEW

Divisional Average Temperature Ranks

February 2021

Period: 1895-2021



National Centers for
Environmental
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Thu Mar 4 2021

Record
Coldest

Much
Below
Average

Below
Average

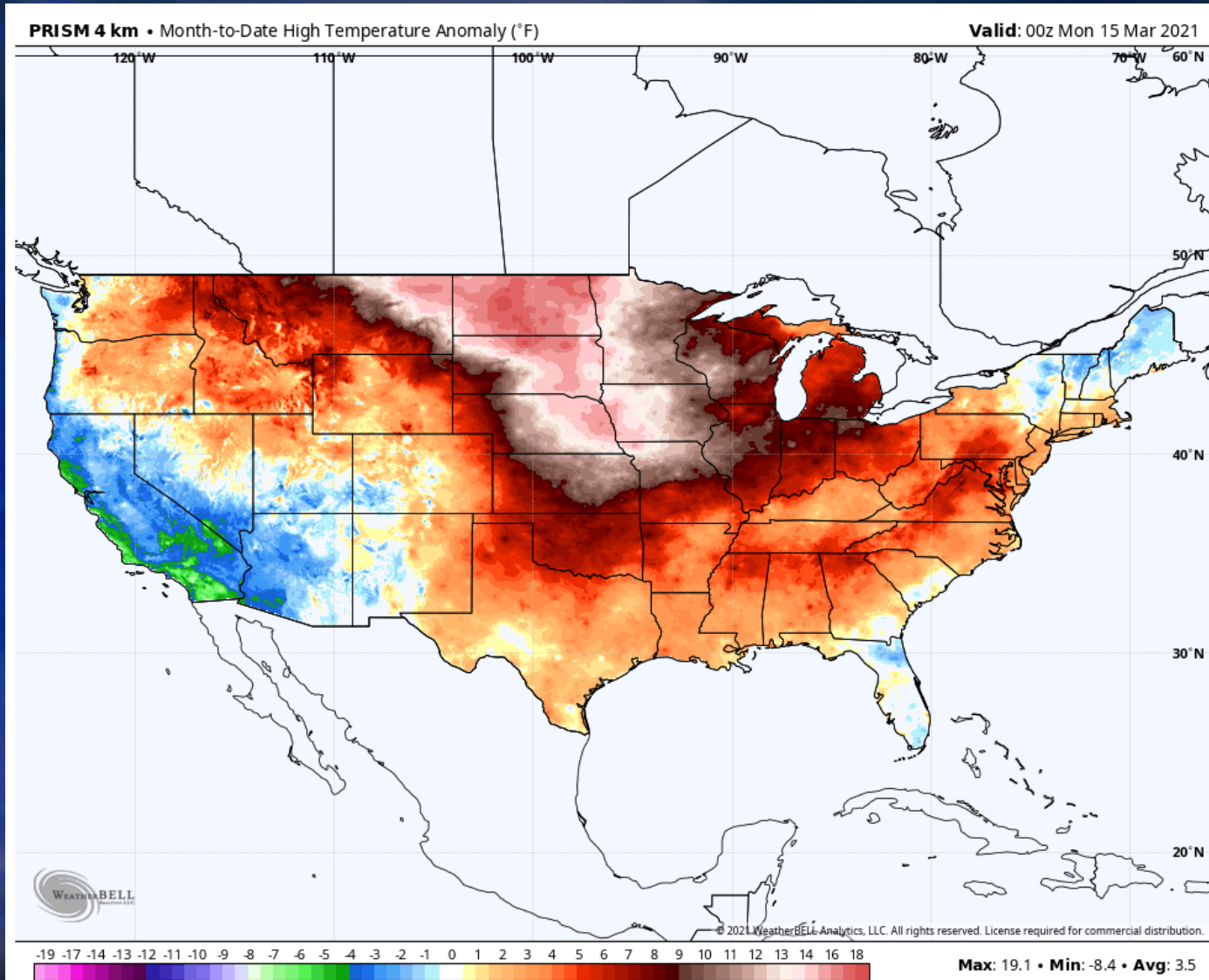
Near
Average

Above
Average

Much
Above
Average

Record
Warmest

Warm March across USA so far...

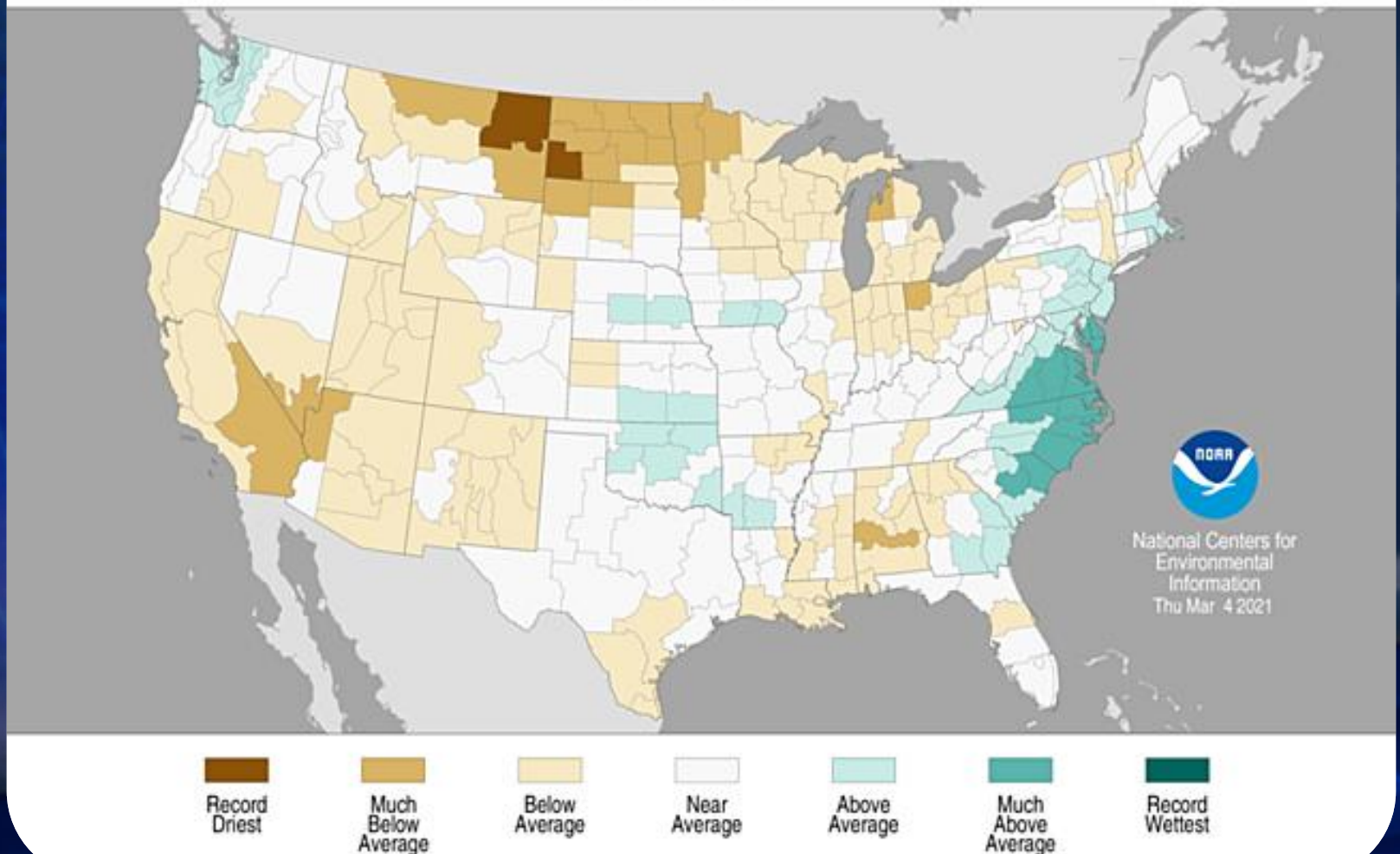


Winter Precip Anomaly

Divisional Precipitation Ranks

December 2020–February 2021

Period: 1895–2021



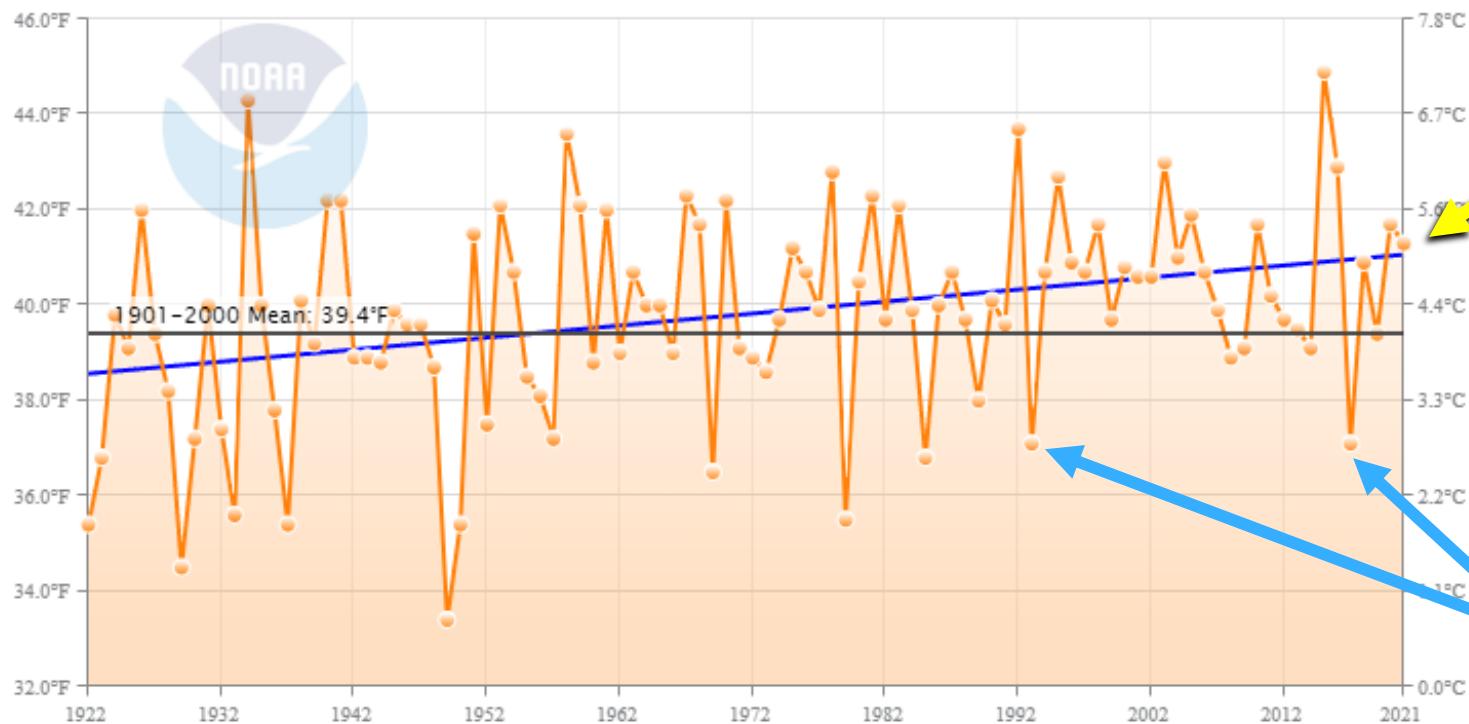
Western Valleys Winter Temperature

(the past 100 years)

Another mild one. Last “cold” winter was 2016-17

Last Winter
in Oregon
Zone 2
(Willamette
Valley)

Oregon, Climate Division 2 Average Temperature
December–February



The last two
cold winters
(92-93 & 16-17)

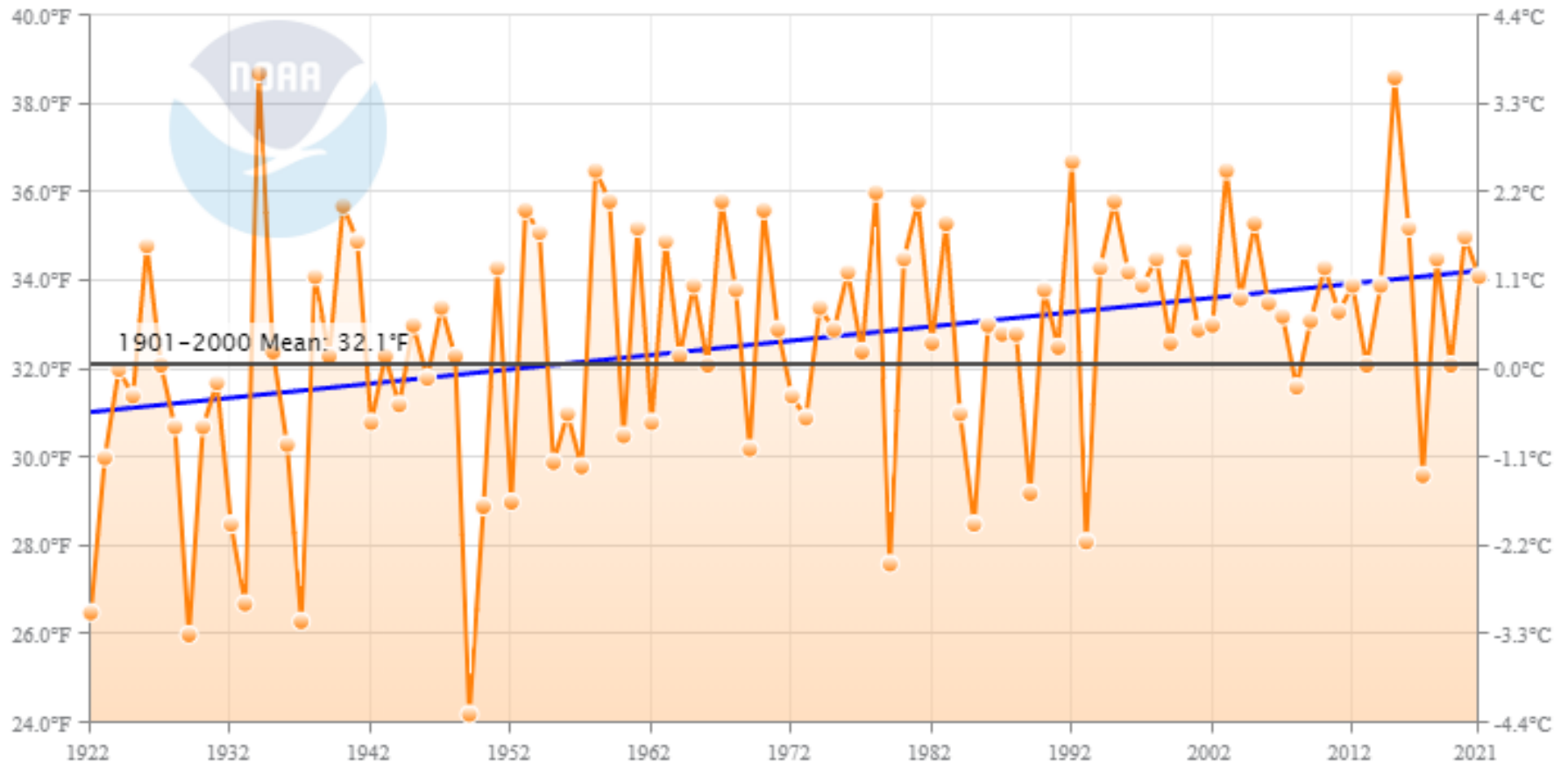
Oregon Winter Temps

(the last 100 years)

Slow Warming Trend (0.3/decade)

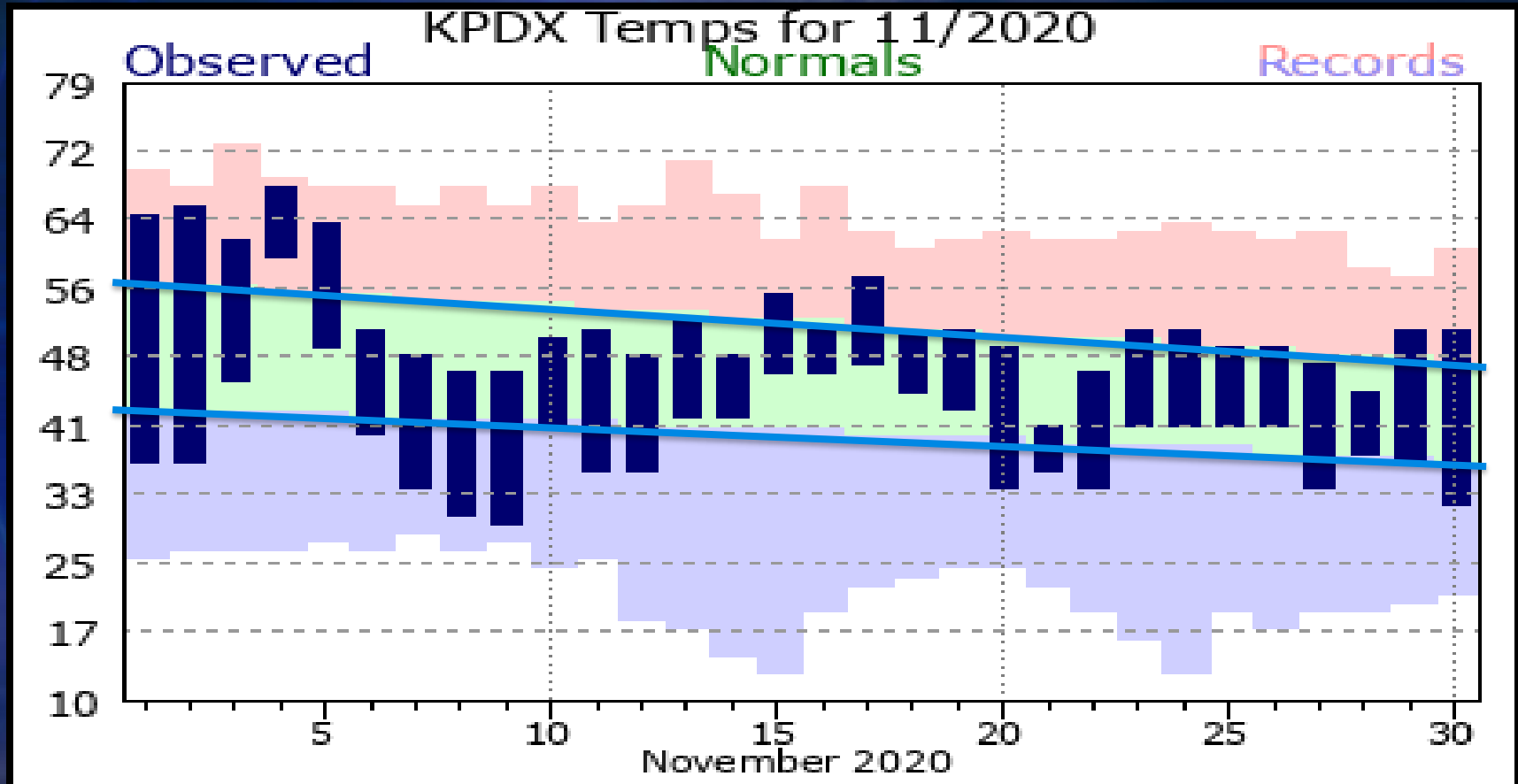
Oregon Average Temperature
December–February

1922–2021 Trend
(+0.3°F/Decade)



NOVEMBER

Nothing interesting...typical mild & wet weather. No storms



NOVEMBER 2ND

FIRST. LIVE. LOCAL.
WEATHER

58° TEMP RISE IN ONE DAY! IN CENTRAL OREGON



80°
Afternoon High



22°
This Morning

REDMOND

Nov 2nd
3,000 ft.

In the
"High Desert"

NOVEMBER

Nice ski season start higher up on Mt. Hood mid month

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WEATHER

SNOW DEPTH

SUNDAY AFTERNOON, NOVEMBER 15TH

12"

GOVERNMENT
CAMP

43"

TIMBERLINE

44"

MT. HOOD
MEADOWS

26

35

35

NOVEMBER

Weak tornado November 10th

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WEATHER

ST. HELENS TORNADO

12:20 PM TUESDAY

EF-0

60-65 mph wind

1.7 mile path / Damage 200 yards wide

- Passed through St. Helens
- Roof damage to home, large limbs down
- 3rd Oregon tornado in 2020

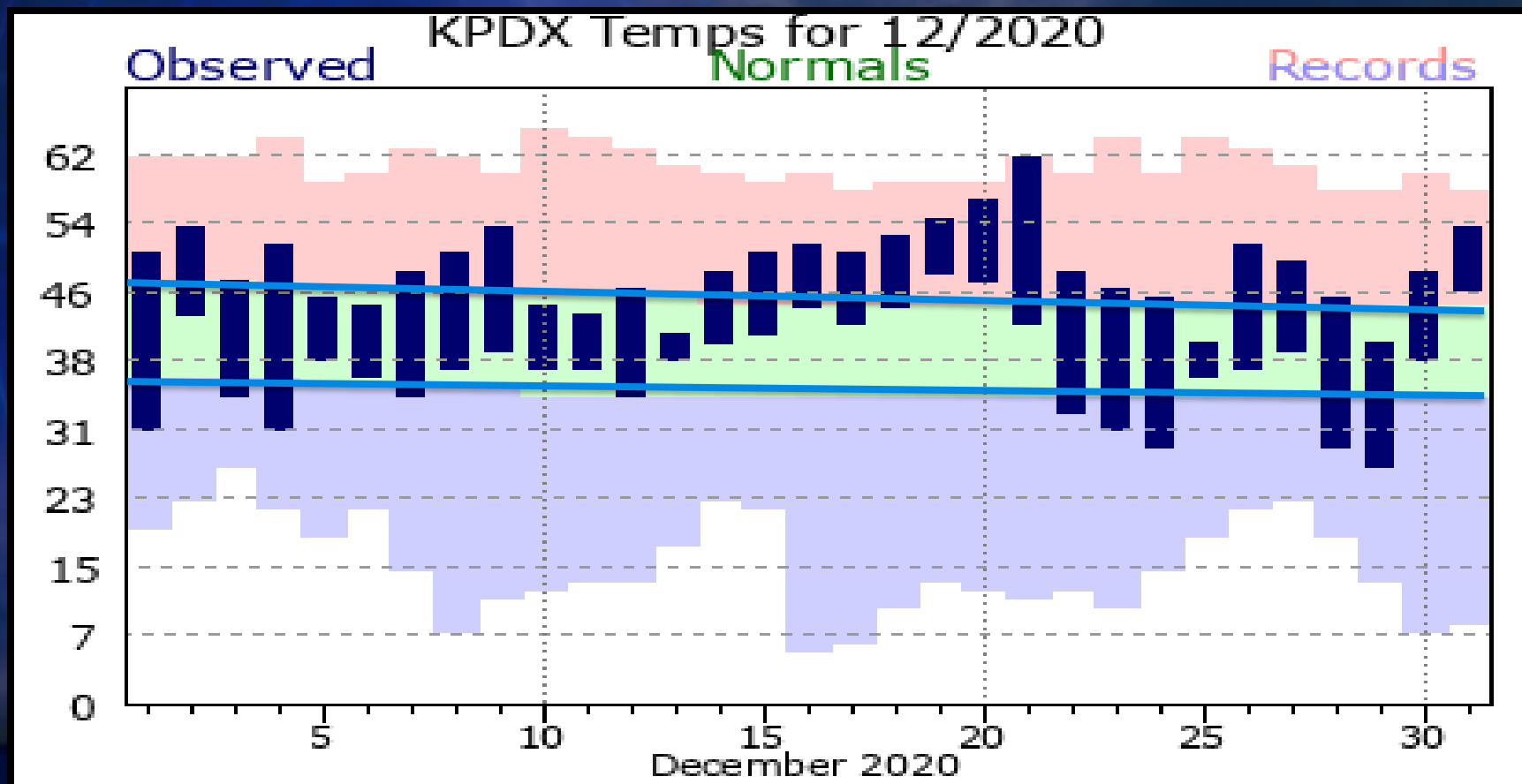
No injuries or deaths



**BETTER CALL
GRANDMA!**

DECEMBER

Nothing to see here...mild and wet. Very warm mid-month

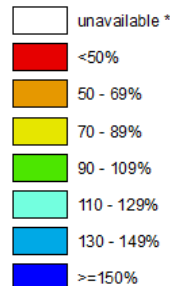


Snowpack slips below average as we headed into January...

JANUARY 1ST

Oregon SNOTEL Current Snow Water Equivalent (SWE) % of Normal

Current Snow Water Equivalent (SWE)
Basin-wide Percent
of 1981-2010 Median

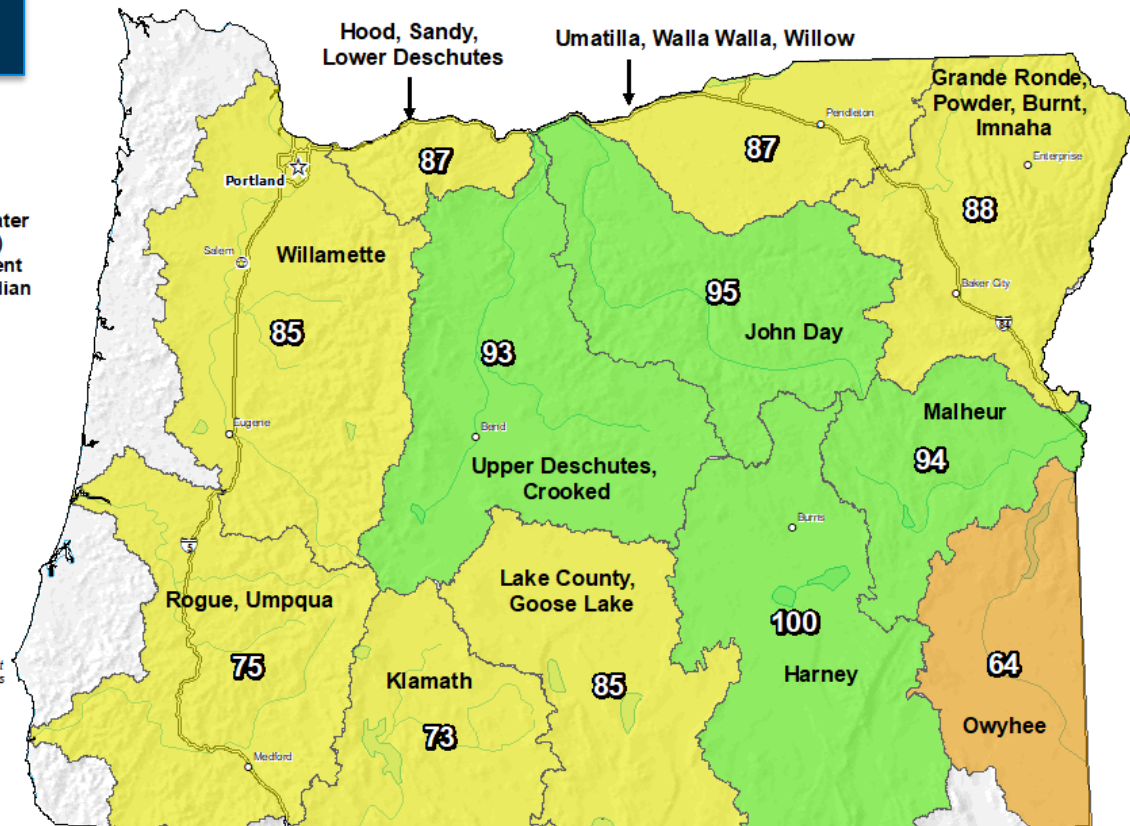


* Data unavailable at time
of posting or measurement
is not representative at this
time of year

Provisional Data
Subject to Revision



The snow water equivalent percent of normal represents the current snow water equivalent found at selected SNOTEL sites in or near the basin compared to the average value for those sites on this day. Data based on the first reading of the day (typically 00:00).



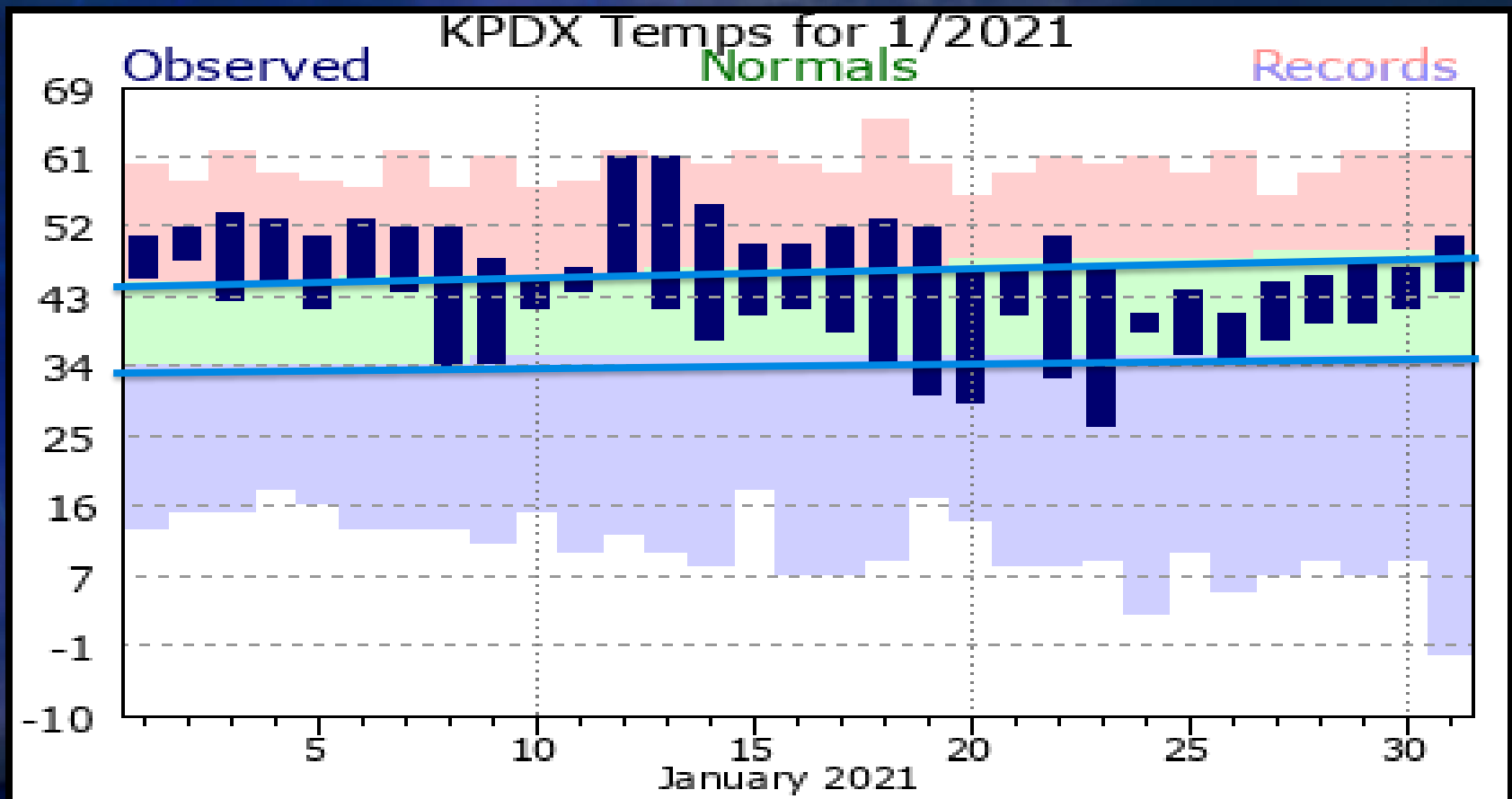
0 10 20 40 60 80 100 Miles

Prepared by:
USDA/NRCS National Water and Climate Center
Portland, Oregon
<http://www.wcc.nrcs.usda.gov>

JANUARY

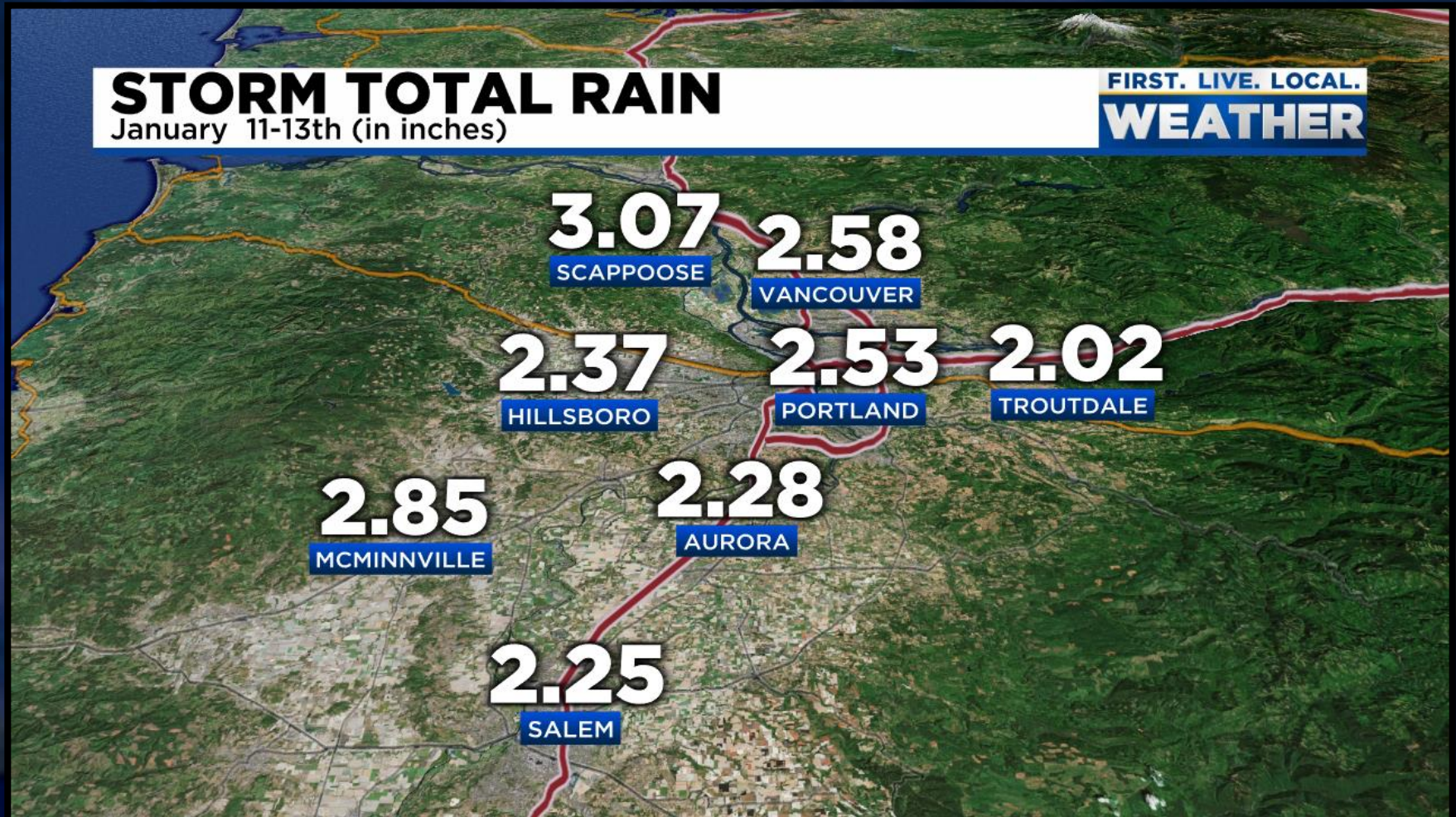
Another mild & wet month...

Didn't need to turn off outside chicken coop water line until mid-February!



JANUARY

Finally! Rain & windstorm mid-January
Lots of river flood warnings, most = minor flooding



JANUARY

Finally! Rain & windstorm mid-January
Lots of river flood warnings, most = minor flooding

THE BIG NUMBERS

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WEATHER

HEAVIEST IN CASCADES & COAST RANGE

9.90"	June Lake (Cascades)
9.70"	North Fork (Bull Run Watershed)
8.72"	Log Creek (Bull Run Watershed)
8.60"	Haskins Dam (Coast Range)
8.50"	Falls City

JANUARY

Finally! Rain & windstorm mid-January
Lots of river flood warnings, mainly minor flooding



JANUARY

JANUARY 12th/13th WIND STORM

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WEATHER

PEAK GUST AT PDX

SW
50
mph

11:59pm JAN 12TH

Peak gusts
WESTERLY
30-45 mph
for most

Final cold front with
atmospheric river
pushes a rare surge of
westerly wind across
northern Willamette Valley

PEAK WIND GUSTS JAN 12/13

FIRST. LIVE. LOCAL.
WEATHER

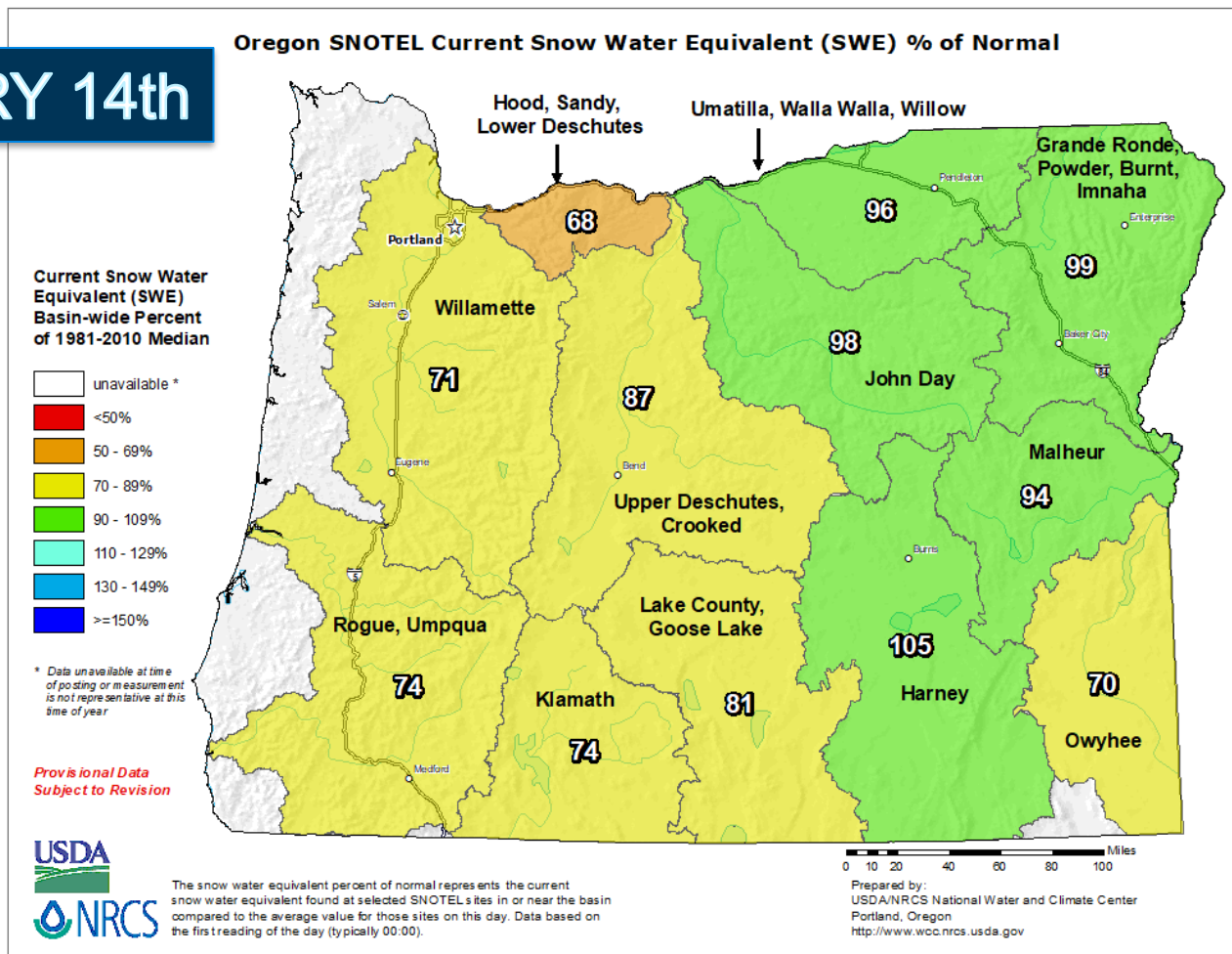
IN MPH



JANUARY

Atmospheric river melts more of Cascade snowpack

JANUARY 14th



JANUARY

RECORD WARM FIRST 1/2 WINTER

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WEATHER

OF 50° DAYS
December 1st-January 19th

31 PORTLAND
MOST ON RECORD

35 SALEM
MOST IN 100 YEARS

40 ASTORIA
MOST ON RECORD



JANUARY

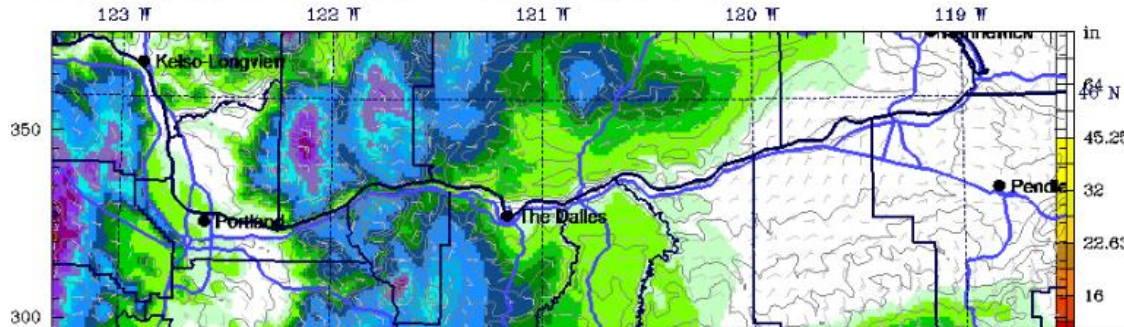


First snow of season
for some in lowlands
January 26th



JANUARY 26TH

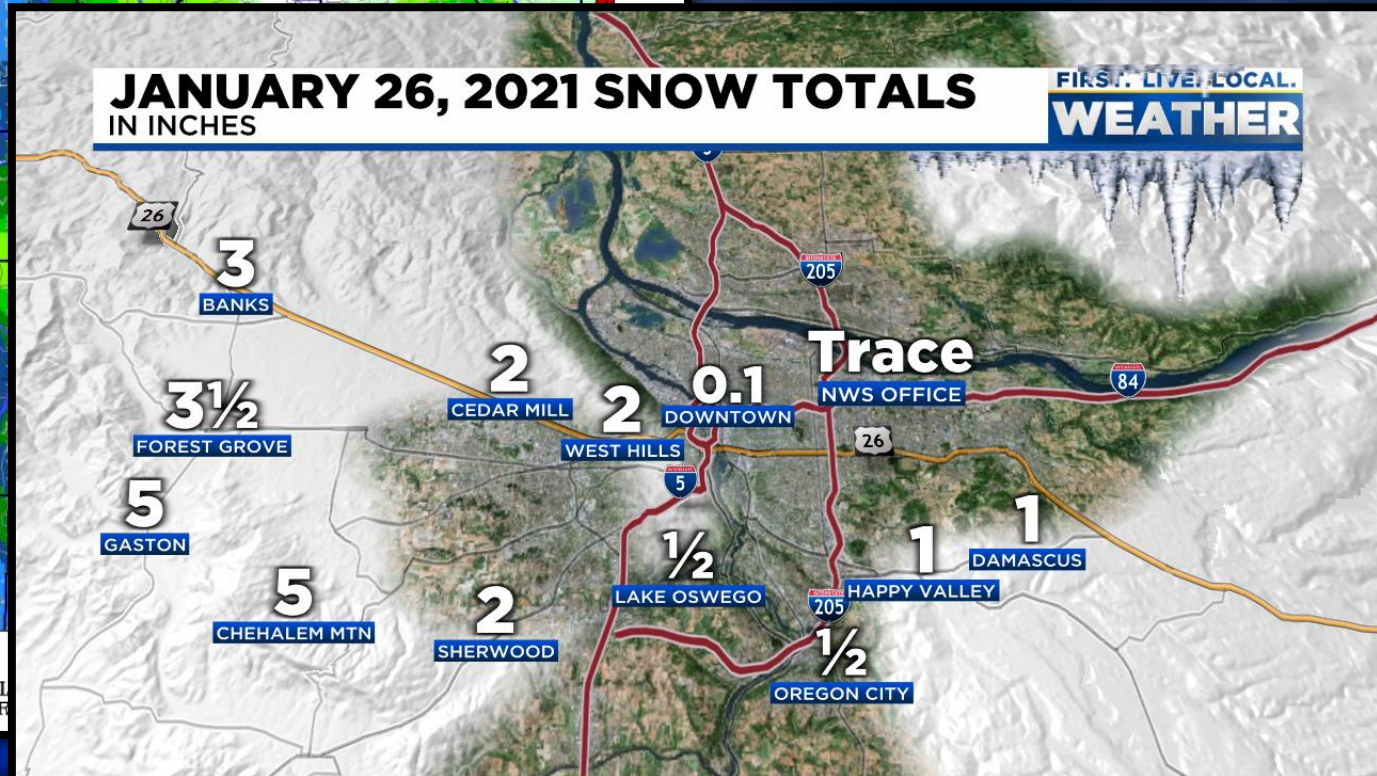
UW WRF-GFS 1.33km Domain Init: 12 UTC Tue 26 Jan 21
Fest: 18.00 h Valid: 06 UTC Wed 27 Jan 21 (22 PST Tue 26 Jan 21)
Accumulated Model Snowfall (inches)
Wind at 10m (full barb = 10kts) Terrain (interval 200m)



IT FINALLY
SNOWED!
(for some)

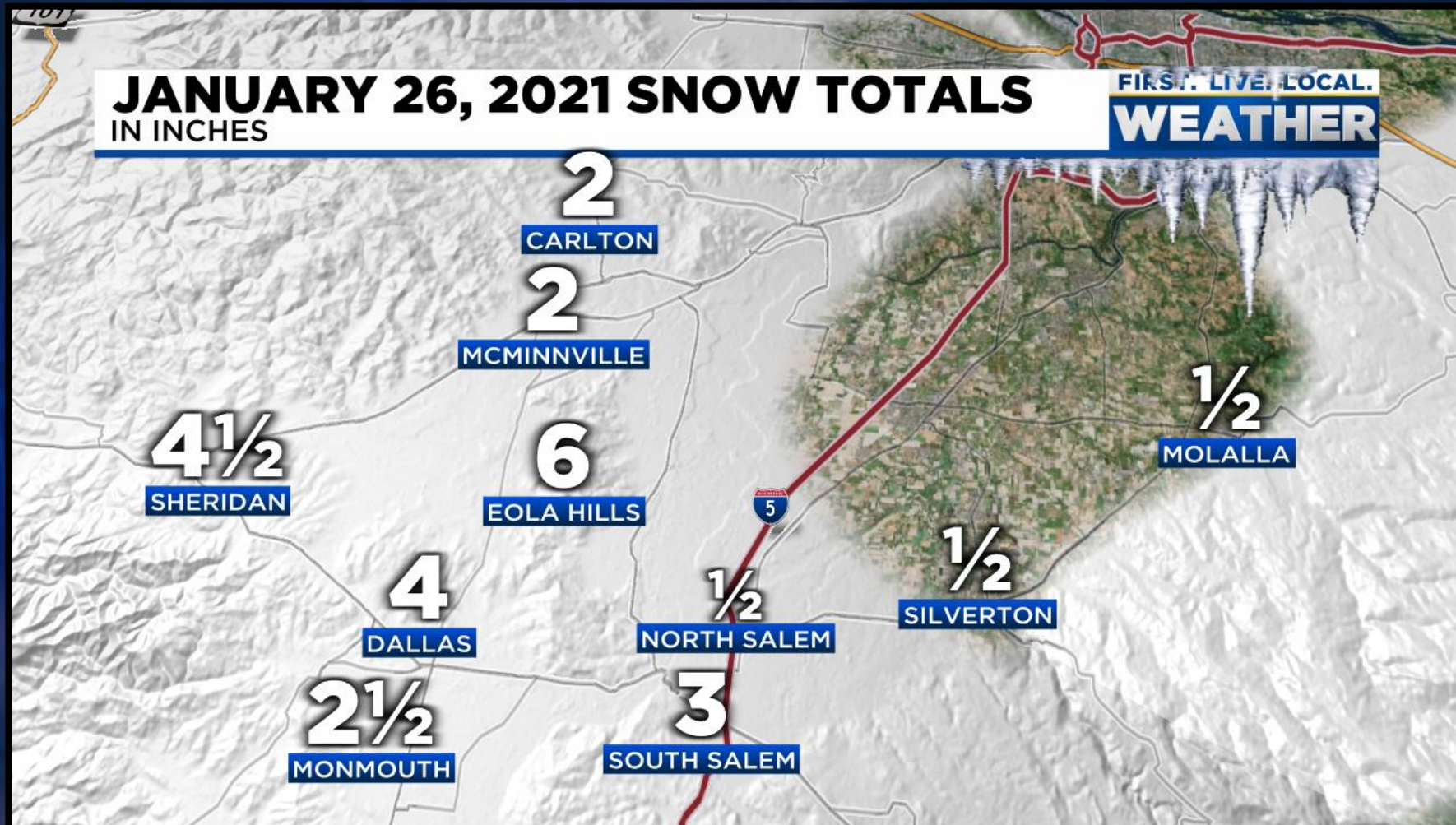
JANUARY 26, 2021 SNOW TOTALS IN INCHES

FIRST. LIVE. LOCAL.
WEATHER



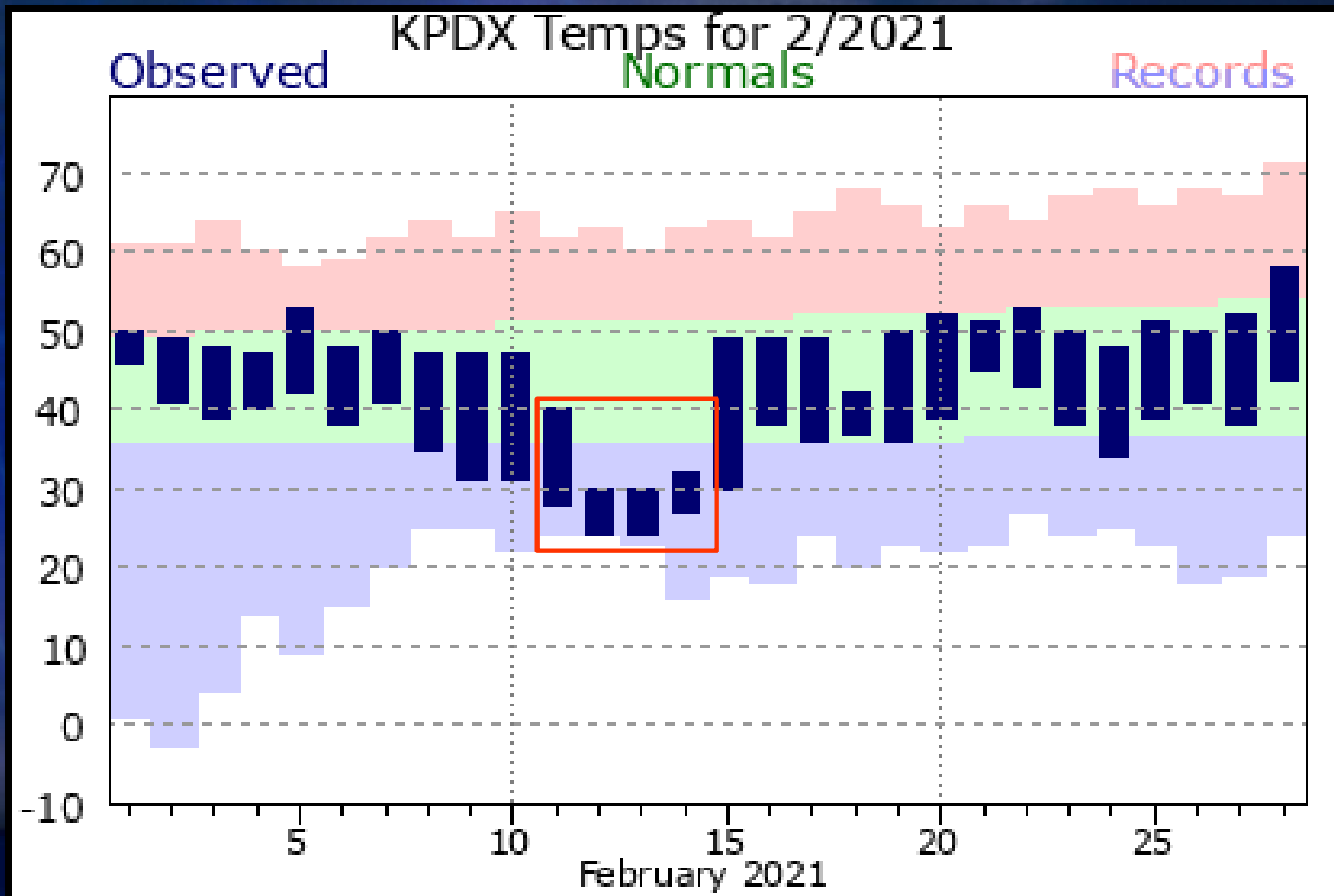
Model Info: V4.1.3 No Cu YSU PBL
LW: RRTMG SW: RF

JANUARY 26TH



FEBRUARY

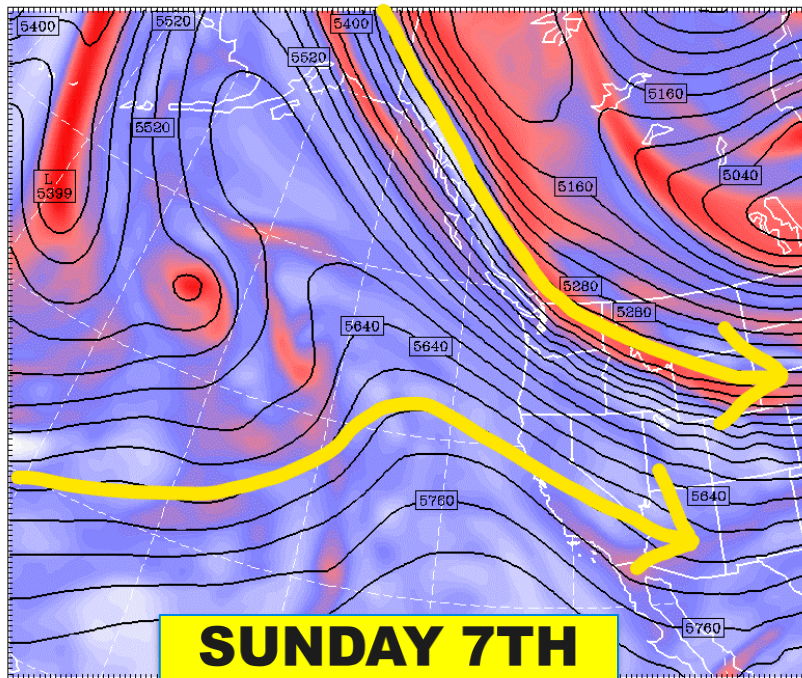
Typical temps...except for 11th-14th
4 COLD & MEMORABLE DAYS!



HISTORIC ARCTIC AIRMASS SURGES INTO MIDDLE OF USA MID-FEBRUARY

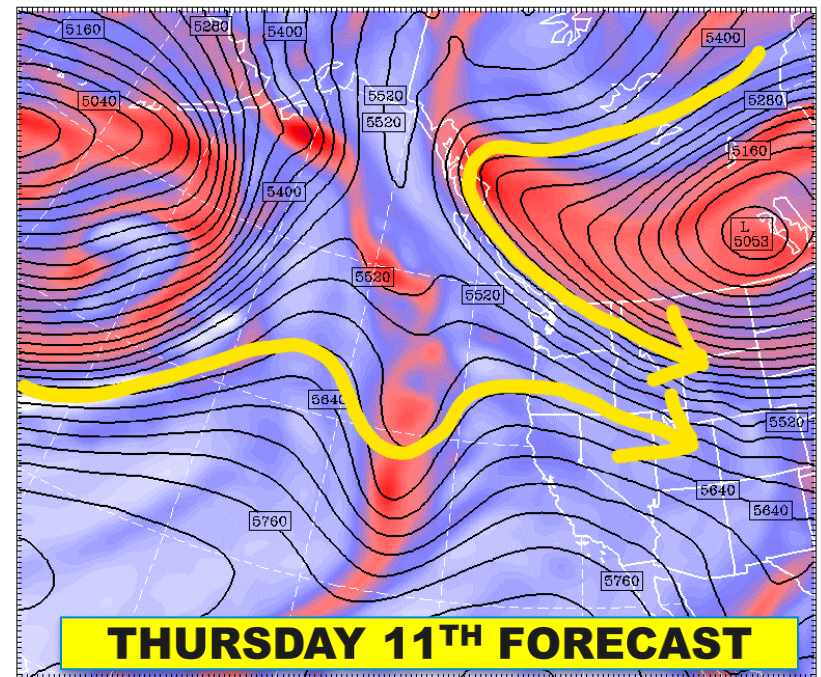
- Some of cold air surges over Rockies and down into Columbia Basin
- Flowed over Cascades and through Gorge Thursday, February 11th
- Models struggled with details...but they all had the general forecast correct

UW WRF-GFS 36km Domain
Fest: 15 h
Absolute vorticity
Geopotential Height at 500mb (m)
Init: 12 UTC Sun 07 Feb 21
Valid: 03 UTC Mon 08 Feb 21 (19 PST Sun 07 Feb 21)
at pressure = 500 hPa
sm= 2



CONTOURS: UNITS=m LOW= 5010.0 HIGH= 5820.0 INTERVAL= 30.000
0 3 6 9 12 15 18 21 24 27 30 33 36 39 42 45 48 $10^{-5} s^{-1}$
Model Info: V4.1.3 G-D Ens YSU PBL Thompson Noah-MP 36 km, 37 levels, 216 sec
LW: RRTMG SW: RRTMG DIFF: full KM: 2D Smagor INIT: RAP+GFS

UW WRF-GFS 36km Domain
Fest: 96 h
Absolute vorticity
Geopotential Height at 500mb (m)
Init: 12 UTC Sun 07 Feb 21
Valid: 12 UTC Thu 11 Feb 21 (04 PST Thu 11 Feb 21)
at pressure = 500 hPa
sm= 2



CONTOURS: UNITS=m LOW= 4980.0 HIGH= 5820.0 INTERVAL= 30.000
0 3 6 9 12 15 18 21 24 27 30 33 36 39 42 45 48 $10^{-5} s^{-1}$
Model Info: V4.1.3 G-D Ens YSU PBL Thompson Noah-MP 36 km, 37 levels, 216 sec
LW: RRTMG SW: RRTMG DIFF: full KM: 2D Smagor INIT: RAP+GFS

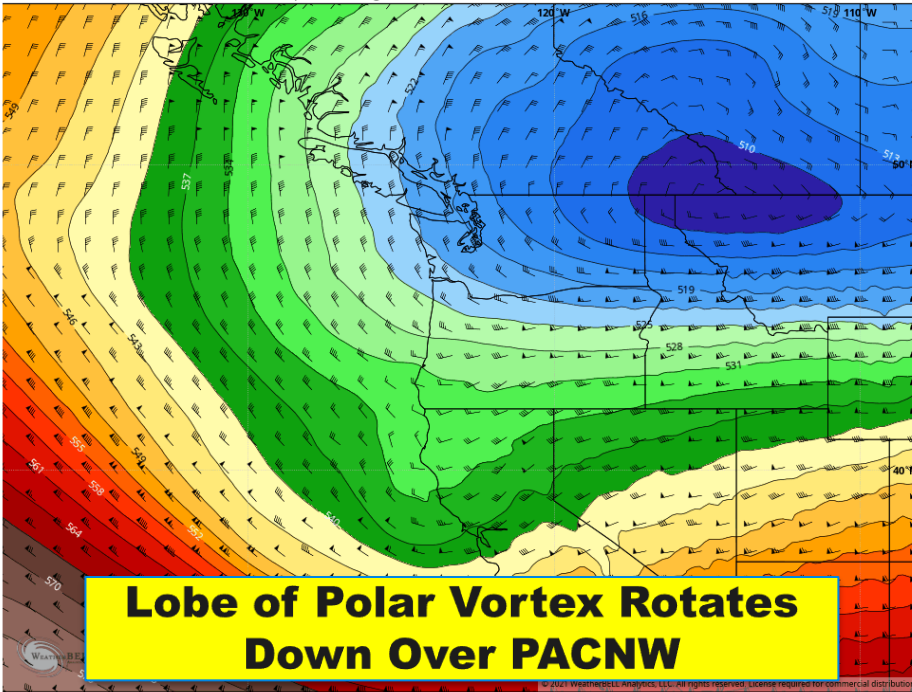
HISTORIC COLD AIRMASS SURGES SOUTH INTO MIDDLE OF USA

THIS GEM MODEL FORECAST DID **NOT** HAPPEN

**FORECAST FOR SATURDAY
FEBRUARY 13TH**

GEM 0.15° Init 12z 7 Feb 2021 • 500mb Geopotential Height (dm) and Wind (kt)

Hour: 156 • Valid: 00z Sun 14 Feb 2021

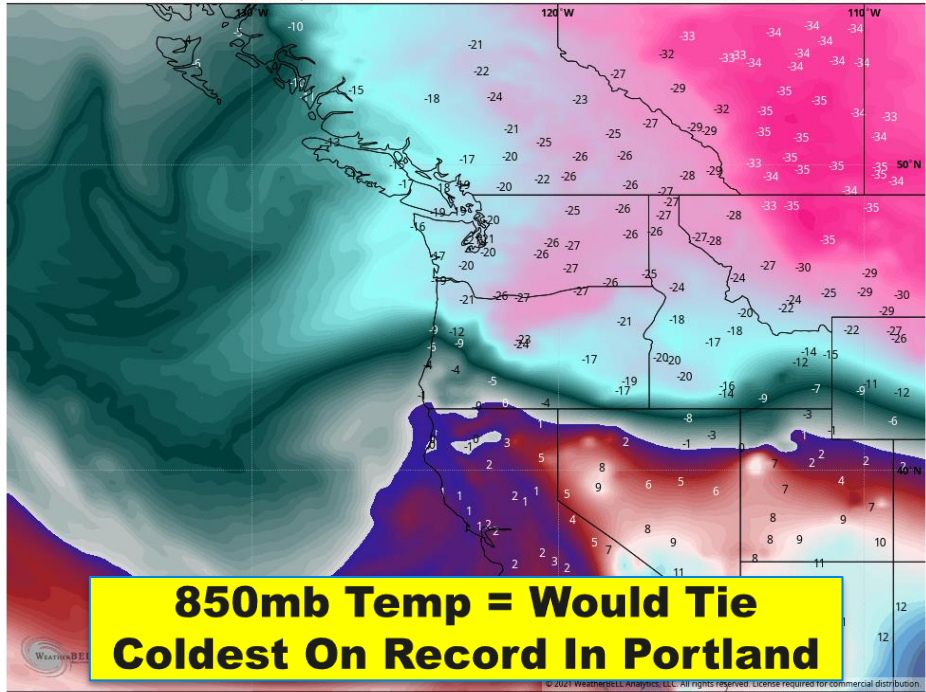


**Lobe of Polar Vortex Rotates
Down Over PACNW**

Max: 579.1 • Min: 508.1

GEM 0.15° Init 12z 7 Feb 2021 • 850mb Temperature (°C)

Hour: 156 • Valid: 00z Sun 14 Feb 2021



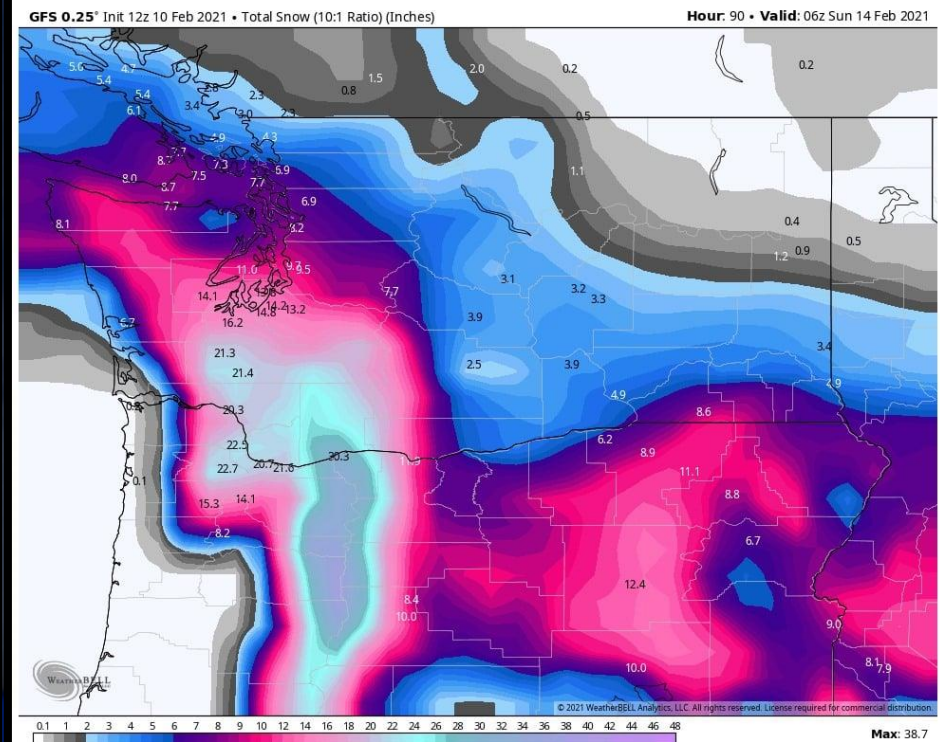
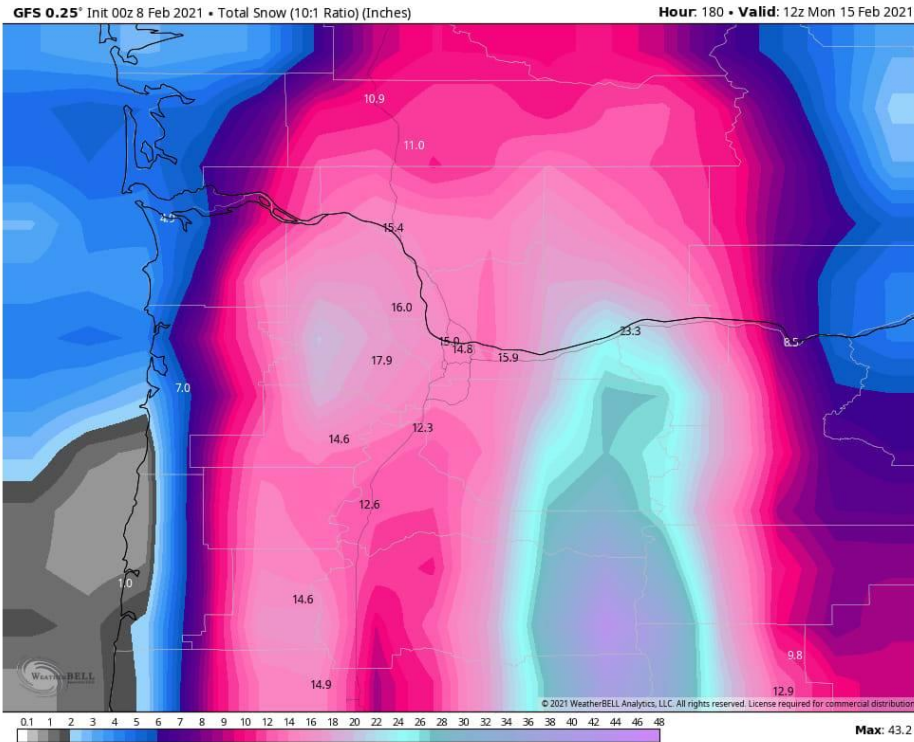
**850mb Temp = Would Tie
Coldest On Record In Portland**

Max: 14.6 • Min: -35.8

BUT HOW MUCH SNOW MIGHT WE SEE?

- Don't forecast specific snow totals until 2-3 days ahead of event
- Model ensembles were extremely helpful with this event

GFS OPERATIONAL MODEL FORECAST FROM 7TH & 10TH

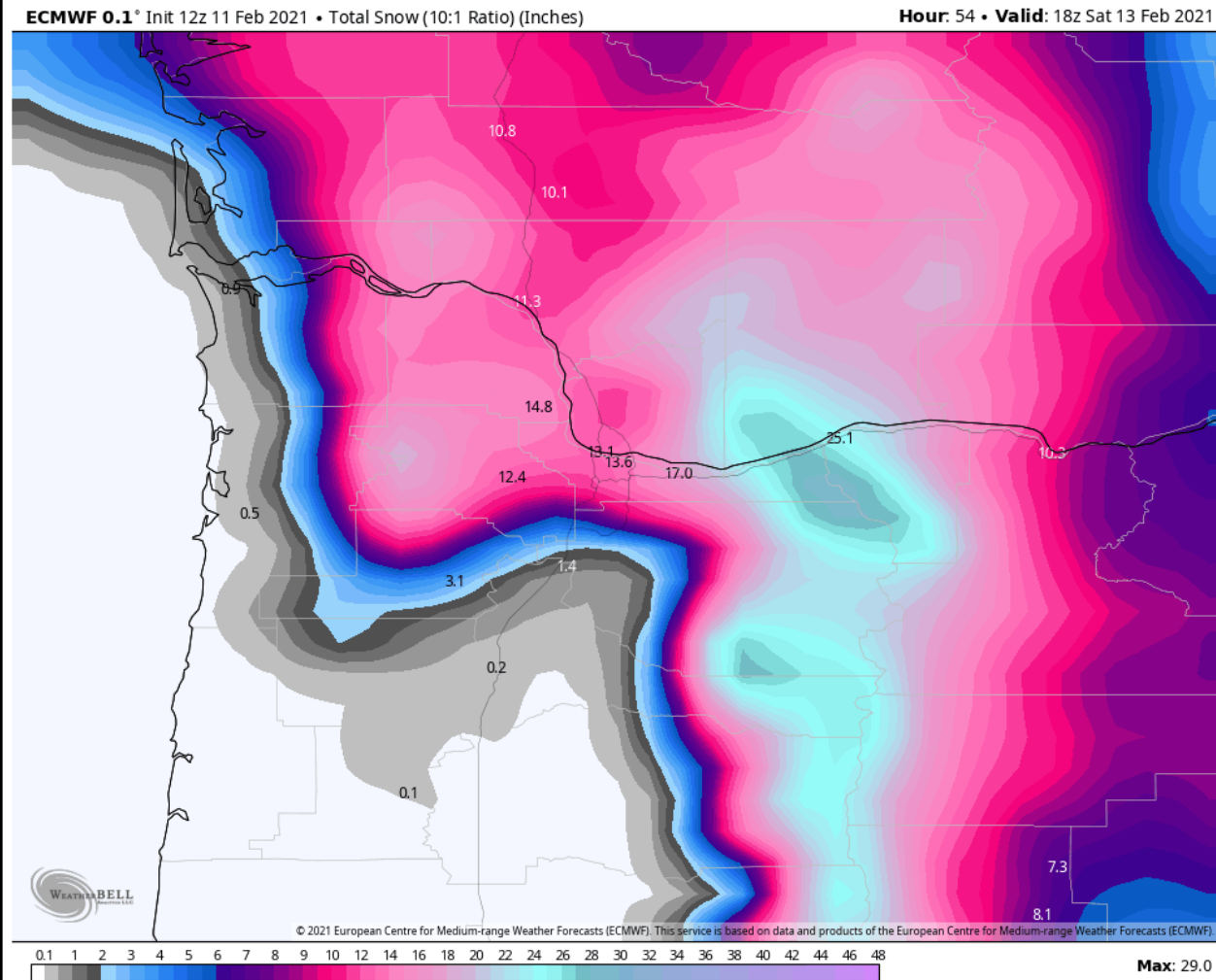


BUT HOW MUCH SNOW MIGHT WE SEE?

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ECMWF

ECMWF MODEL FORECAST FROM 7TH - 11TH



A GREAT EXAMPLE!

USING ENSEMBLES INSTEAD OF OPERATIONAL RUNS DAYS AHEAD OF TIME

Forecasts from Sunday evening the 7th...Thanks to Chris Callais

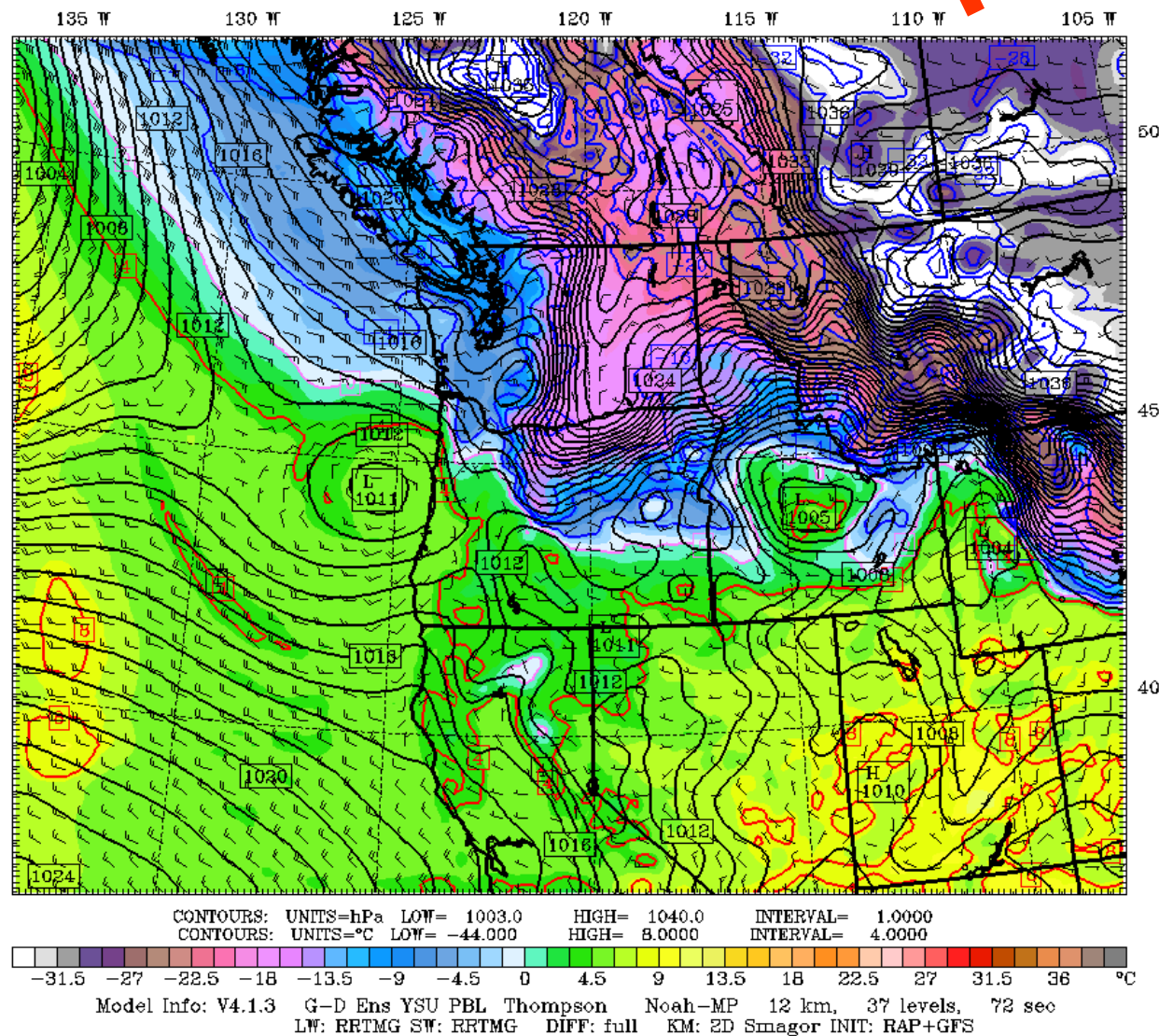
Model	Day 1 Mon 2021-02-08		Day 2 Tue 2021-02-09		Day 3 Wed 2021-02-10		Day 4 Thu 2021-02-11		Day 5 Fri 2021-02-12		Day 6 Sat 2021-02-13		Day 7 Sun 2021-02-14		Day 8 Mon 2021-02-15	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
ECMWF-EPS																
GFS-ENS																
GFS-ENS-BC																
CMC-ENS																
GFS	36	45	32	46	32	46	23	36	19	24	19	25	21	34	29	37
ECMWF	37	46	32	44	31	42	26	42	27	48	36	43	34	45	36	44
Ensemble Mean																
Operational Mean																
Climo	36	50	36	50	36	51	36	51	36	51	36	51	36	51	36	51

Several
surface lows moved
toward coastline
Thursday-Monday

Maps from Thursday AM
WRF-GFS run

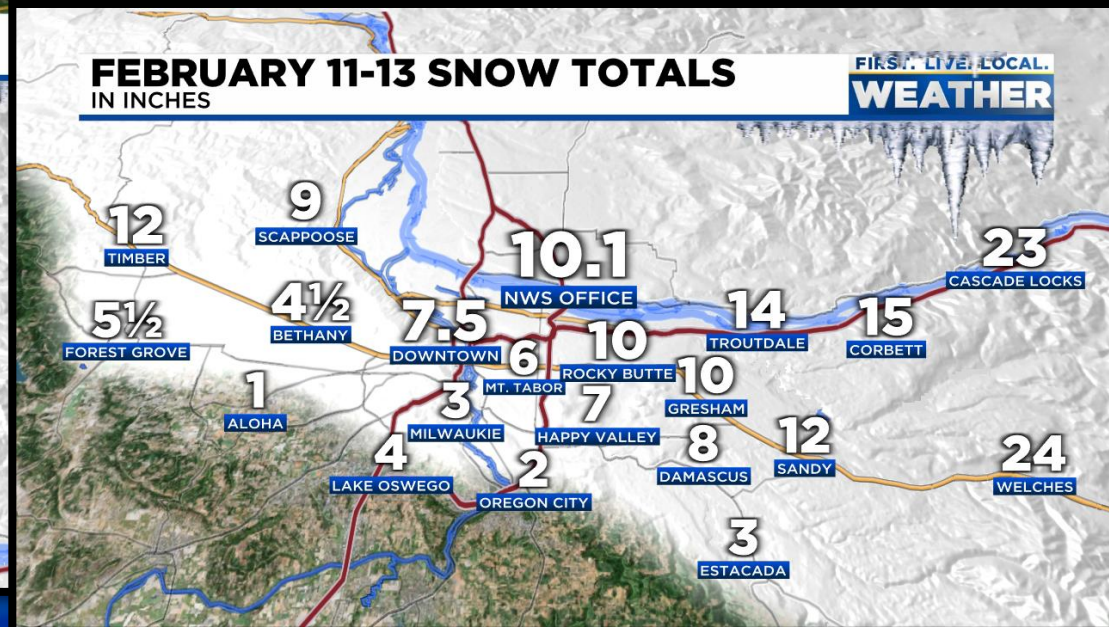
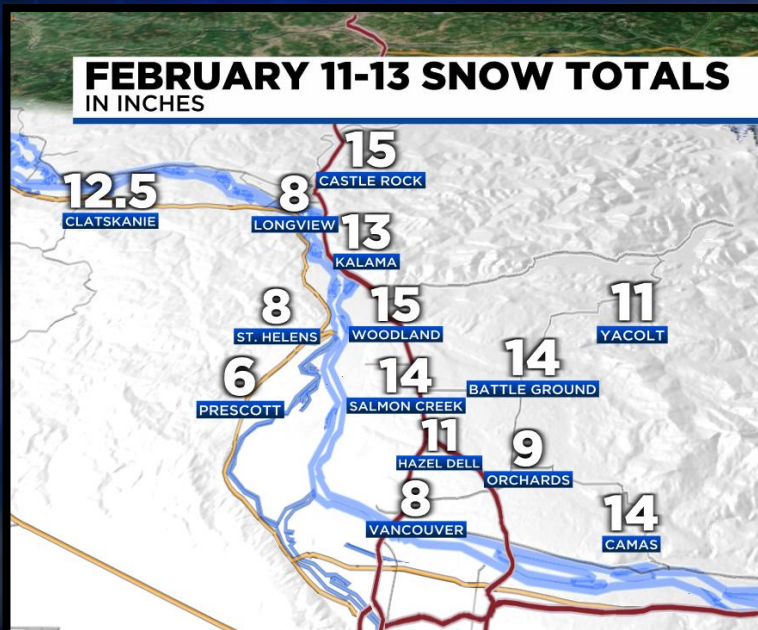
UW WRF-GFS 12km Domain
Fest: 27 h
Temperature at 925 mb (°C)
Sea Level Pressure (hPa)
Wind at 10m (full barb = 10kts)

Init: 12 UTC Thu 11 Feb 21
Valid: 15 UTC Fri 12 Feb 21 (07 PST Fri 12 Feb 21)



MODELS FORECAST 3 “WAVES” OF PRECIPITATION

- Ended up as 2 main surges (+ *very light snow first evening = nervous forecasters*)
 - Freezing drizzle in-between in metro
-
- | | | |
|------------------------------------|--------|--------------------------------|
| 1) Thursday night - Friday sunrise | (.04") | (all snow @ PDX) |
| 2) Friday 8am-Saturday 6am | (.97") | (mainly metro snow, ice south) |
| 3) Saturday 6am-Sunday 10am | (.09") | (mixed precip) |
| 4) Sunday 10am-Monday 10am | (.47") | (all freezing rain) |

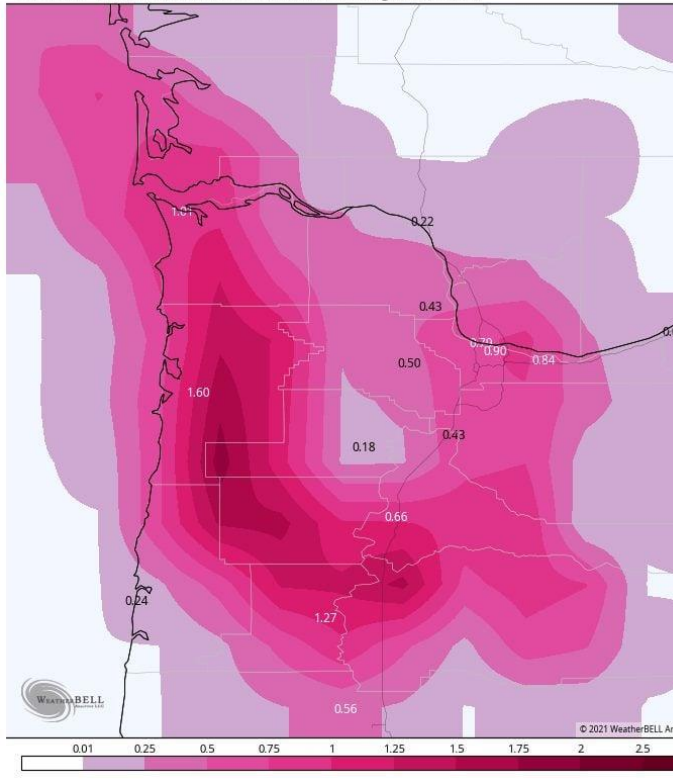


ICE STORM SOUTH METRO & VALLEY

- Models did a relatively good job showing thick icing south/west edge of cold airmass coming out of Gorge
- But didn't produce enough ice east side of valley

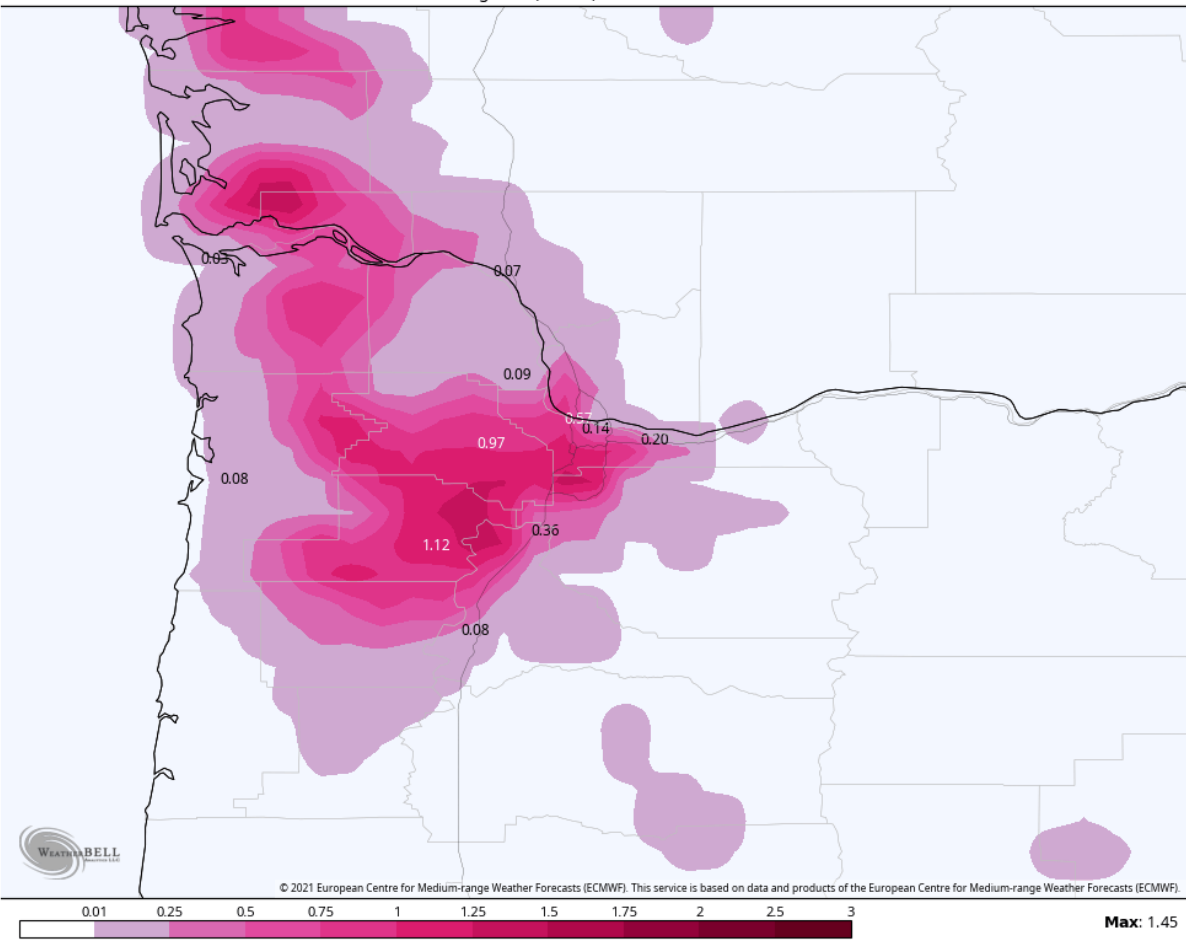
GFS 0.25° Init 12z 10 Feb 2021 • Accumulated Freezing Rain (Inches)

Hour: 114 • Valid: 06z Mon 15 Feb 2021



ECMWF 0.1° Init 12z 10 Feb 2021 • Accumulated Freezing Rain (Inches)

Hour: 82 • Valid: 22z Sat 13 Feb 2021



ICE STORM SOUTH METRO & VALLEY

- Models did a relatively good job showing thick icing south/west edge of cold airmass coming out of Gorge
- But didn't produce enough ice east side of valley

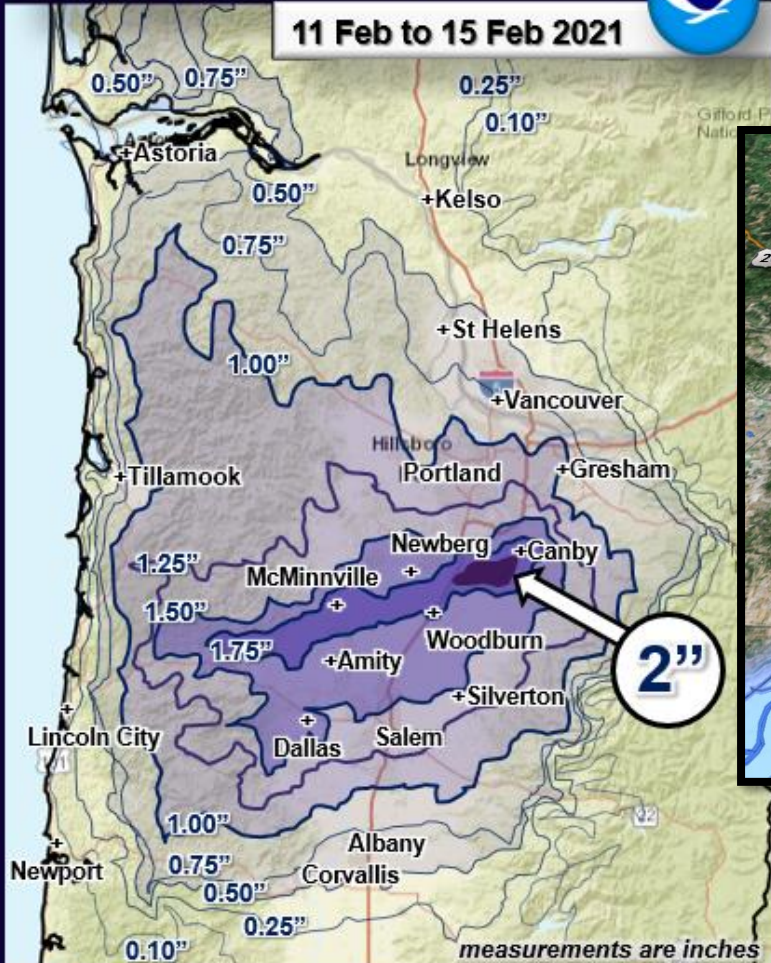


ICE STORM SOUTH METRO & VALLEY

- Historic Ice Storm south metro to central Willamette Valley
- Worst since January 1943?

Total Ice Accumulation

11 Feb to 15 Feb 2021



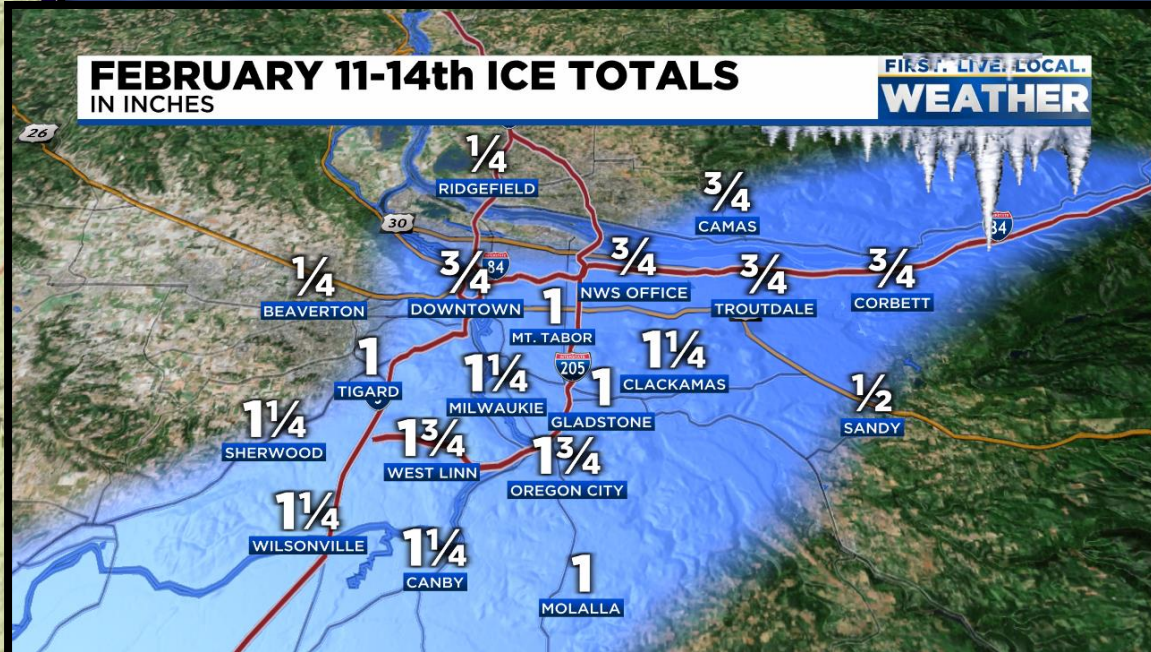
measurements are inches

@NWSPortland

www.facebook.com/NWSPortland

FEBRUARY 11-14th ICE TOTALS IN INCHES

FIRST LIVE LOCAL
WEATHER



ICE STORM SOUTH METRO & VALLEY

- Historic Ice Storm south metro to central Willamette Valley

PAST PDX ICE STORMS

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WEATHER

STORM	PEAK # OF PGE OUTAGES	% OF PGE CUSTOMERS
JANUARY 1979	125,000	27%
JANUARY 1980	150,000	31%
DECEMBER 1996	140,000	20%
JANUARY 2004	58,000	8%
DECEMBER 2016	25,000	3%
FEBRUARY 2021	350,000	40%

PAST PGE OUTAGE #s

FIRST. LIVE. LOCAL.
WEATHER

STORM	Peak # of PGE customers out	Longest Outages
2021 Snow/Ice	350,000	14 days?
2008 Snow/Ice	130,000	7 days
2006 Wind	250,000	4.5 days
1996 Ice	140,000	5 days
1995 Wind	300,000	6 days
1962 Columbus Day	262,000	14 days

MILL CITY

GOOD FORECASTS BY NWS & PORTLAND MEDIA LEADING UP TO EVENT

1. No crazy model snow maps unleashed on social media (*whew!*)
2. Winter Storm watches/warnings issued well ahead of event
3. General idea of “*snowy north half metro, icy south half*” worked out well
4. Lots of meteorological minefields to navigate that week!

IMHO: SNOW/ICE STORM WAS FORECAST BETTER THAN ANY OF PAST 25 YEARS
(January 1998, January 2004, December 2008, January 2017, February 2021)

Tuesday evening blog post (9th)

It seems increasingly likely that SOMETHING is in the works along the I-5 corridor for late this week. **Some sort of snow/ice/cold “event” is on the way for some part of the corridor between Seattle and Eugene.** Maybe even out to portions of the coastline.

It’s still too far out (4 days) to know how things will play out in detail, but at this point it’s fair to make these statements:

1. Some, or maybe a large, part of western Oregon and/or western Washington lowlands will get a significant snowfall (2-4”+) within the next 7 days.
2. The chance for a widespread “arctic freeze” is low right now in our viewing area west of the Cascades. At this point widespread temps below 20 degrees appear unlikely.

Sunday evening blog post (7th)

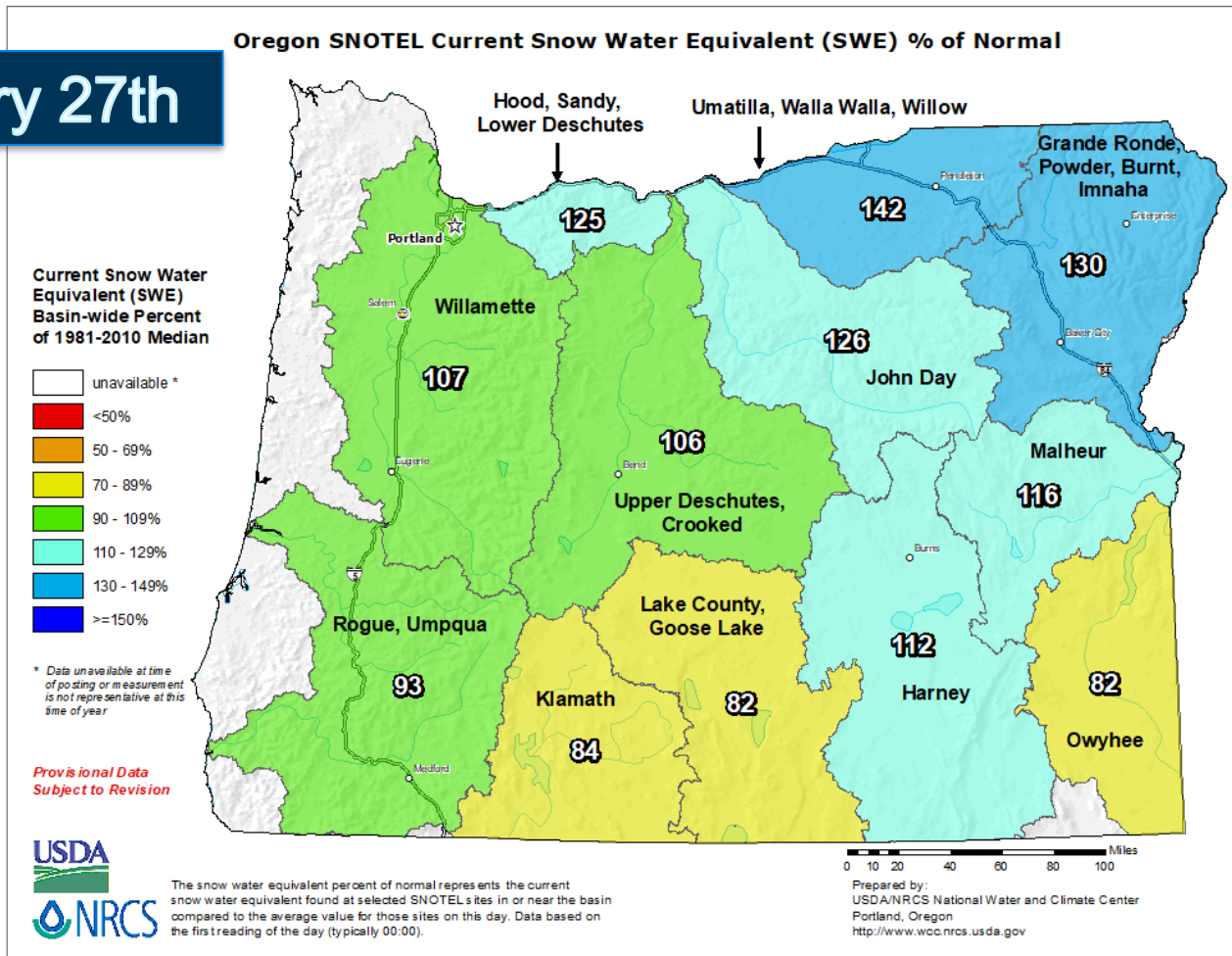
THE MAIN POINTS THIS EVENING

- o An approaching snow/ice storm from late Thursday through early Sunday **could be an epic one for some of us in the lowest elevations.** That’s for any time in winter, but especially so this late in the season. **This could be the biggest February snowstorm of my career** for at least parts of the metro area! **Somewhere between 2-12” is a first good estimate of total snow during that time.** Heaviest north and east metro, including Longview/Kelso. Lighter south & west due to more of the precip falling as freezing rain instead of snow.
- o As some models have been hinting, **two waves of precipitation from Thursday through Saturday likely won’t be separate “storms”, but seem like one continuous event.** However there should be a bit of a break before a third, and warmer system arrives later Sunday.
- o **Much of the metro area will remain mainly frozen from Thursday night to Sunday morning**

2+ WEEKS OF BIG CASCADE SNOWFALL 11TH-28TH

Washington & Northern Oregon mountains
have a deep snowpack on ground by end of February

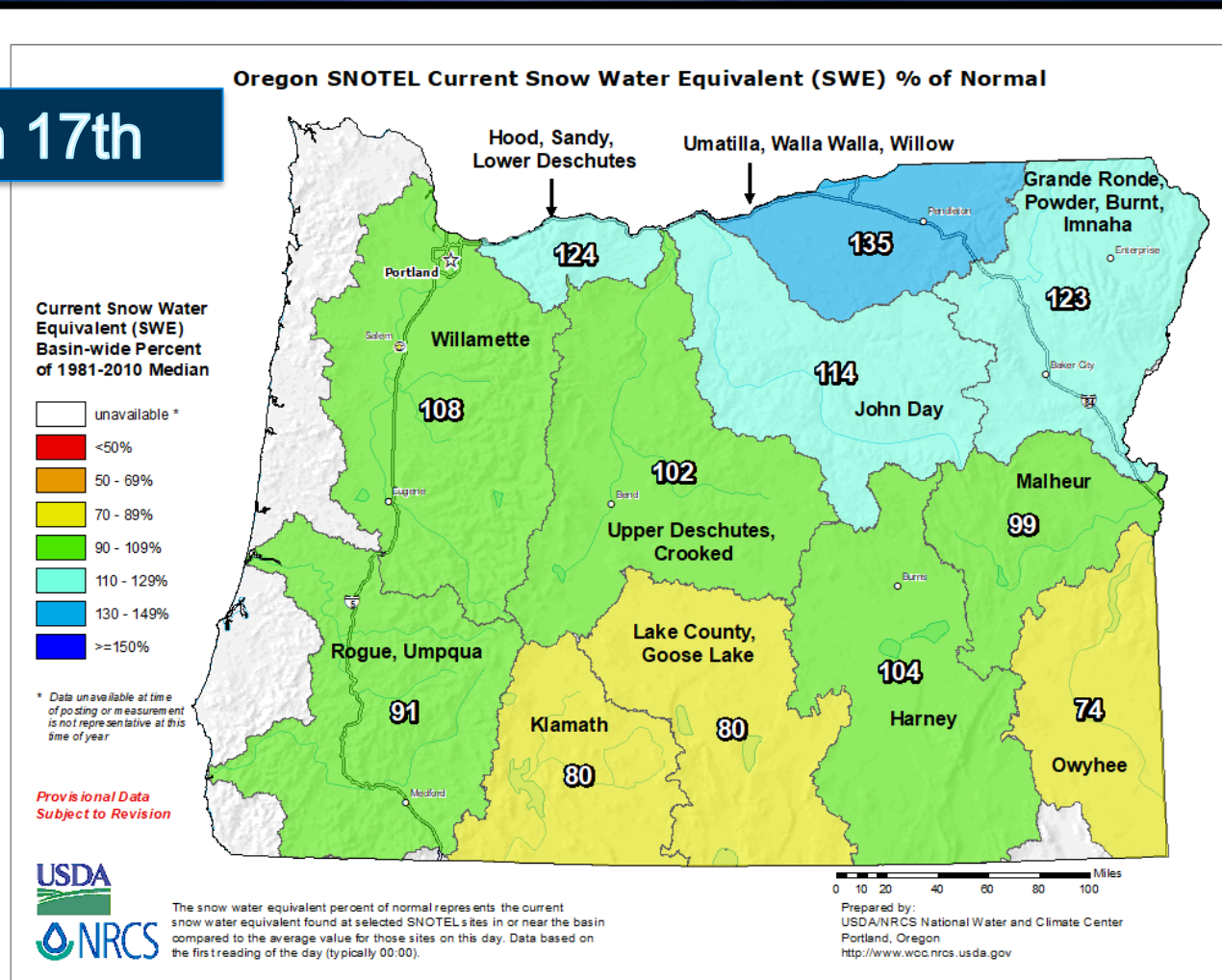
February 27th



MID-MARCH CASCADE SNOWPACK

Still good northern Oregon, below normal for parts of southern Oregon

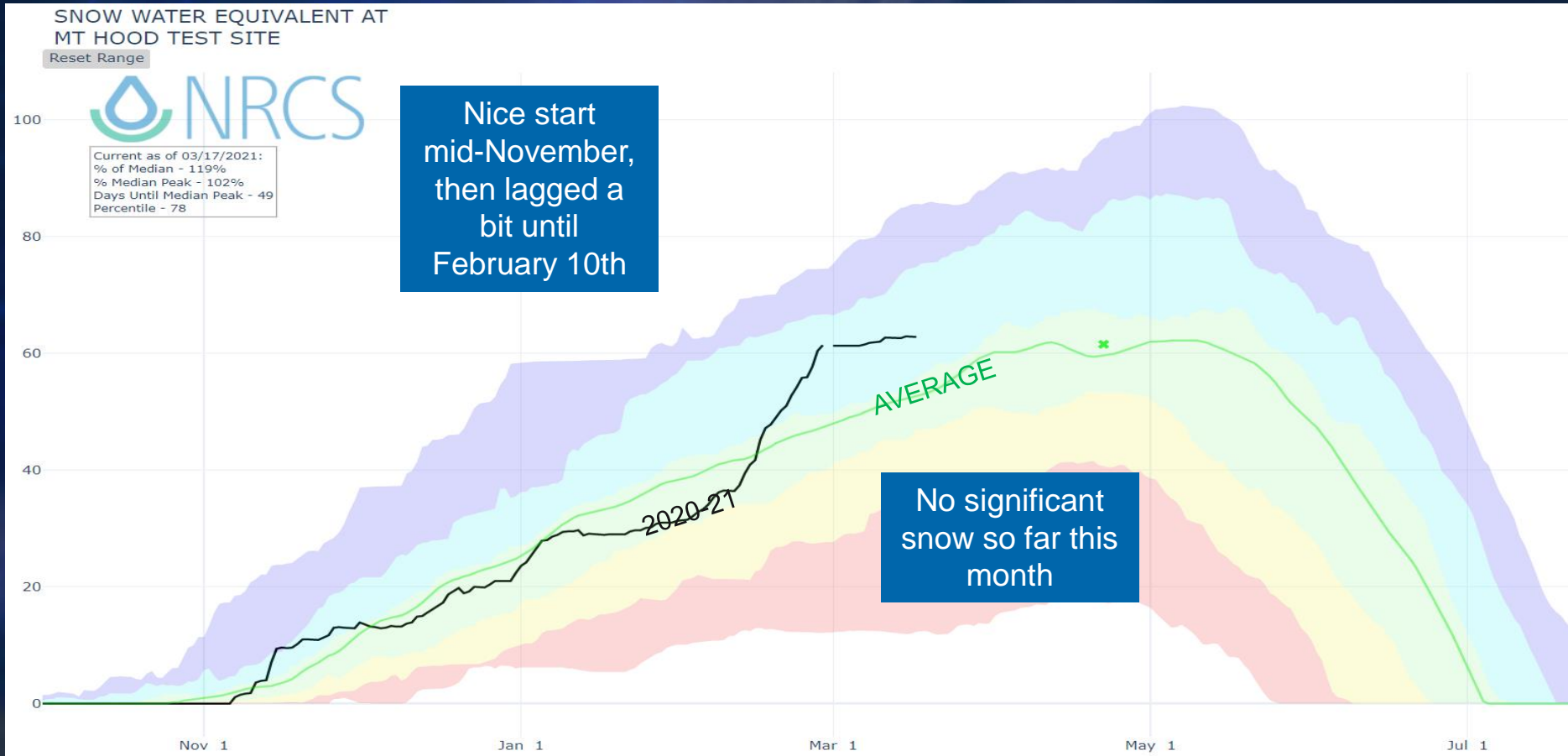
March 17th



Mountain Snowpack @ 5,400'

Bottom of Pucci Lift @Timberline

Water Year Precipitation: **ABOVE AVERAGE**
Snowpack: **ABOVE AVERAGE**

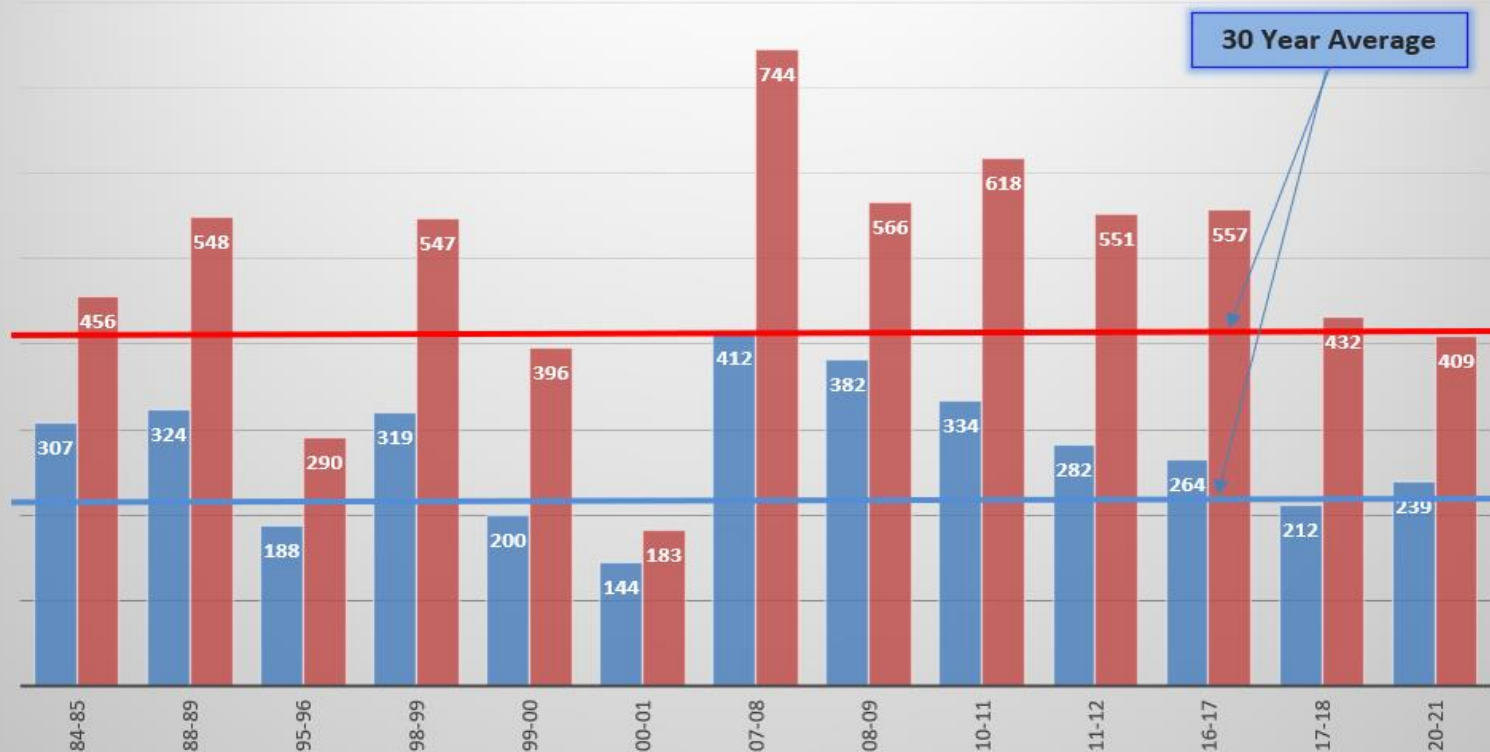


Cascade Snowfall

1. Nice start above 4,000' in late November
2. Skiing conditions just "okay" until mid-February
3. Mt. Hood snowfall up to about normal for entire season

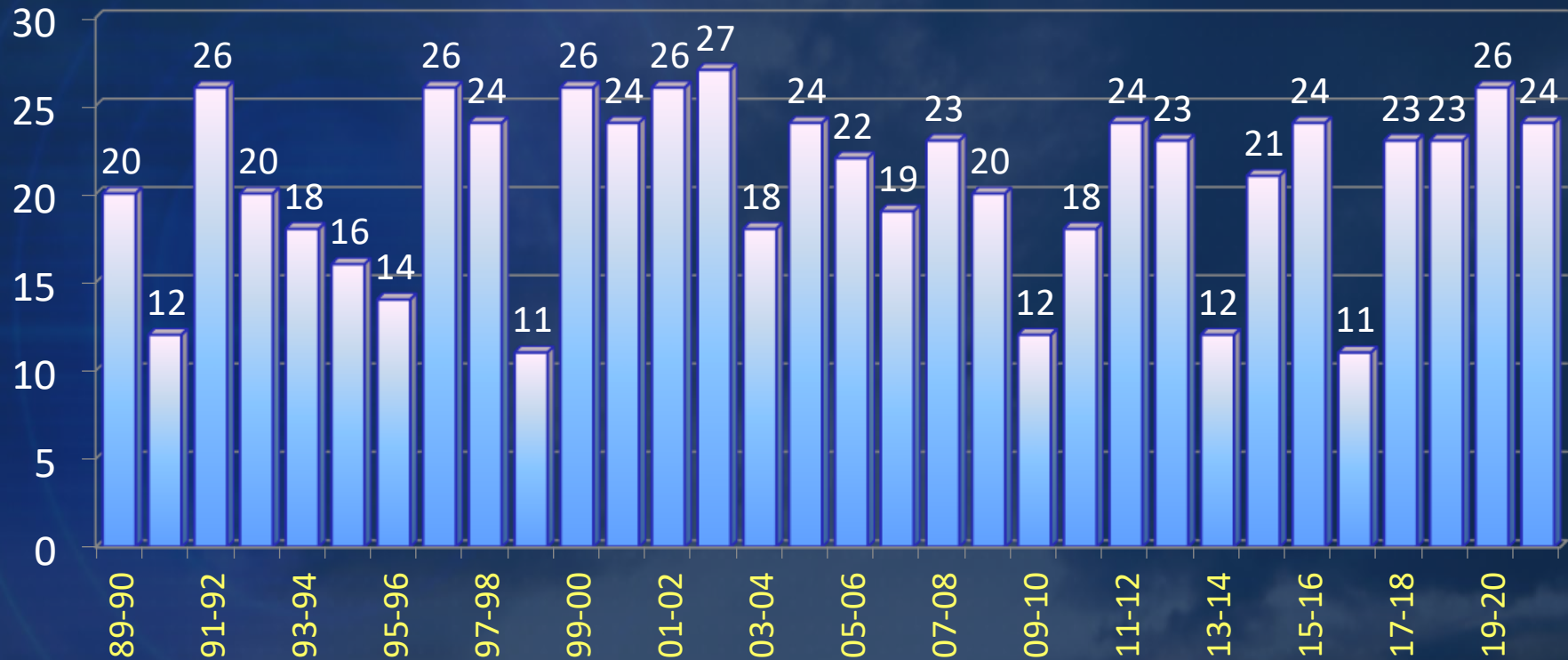
Winter Snowfall On Mt. Hood During La Nina Winters

Meadows vs. **Gov't Camp** (in inches)



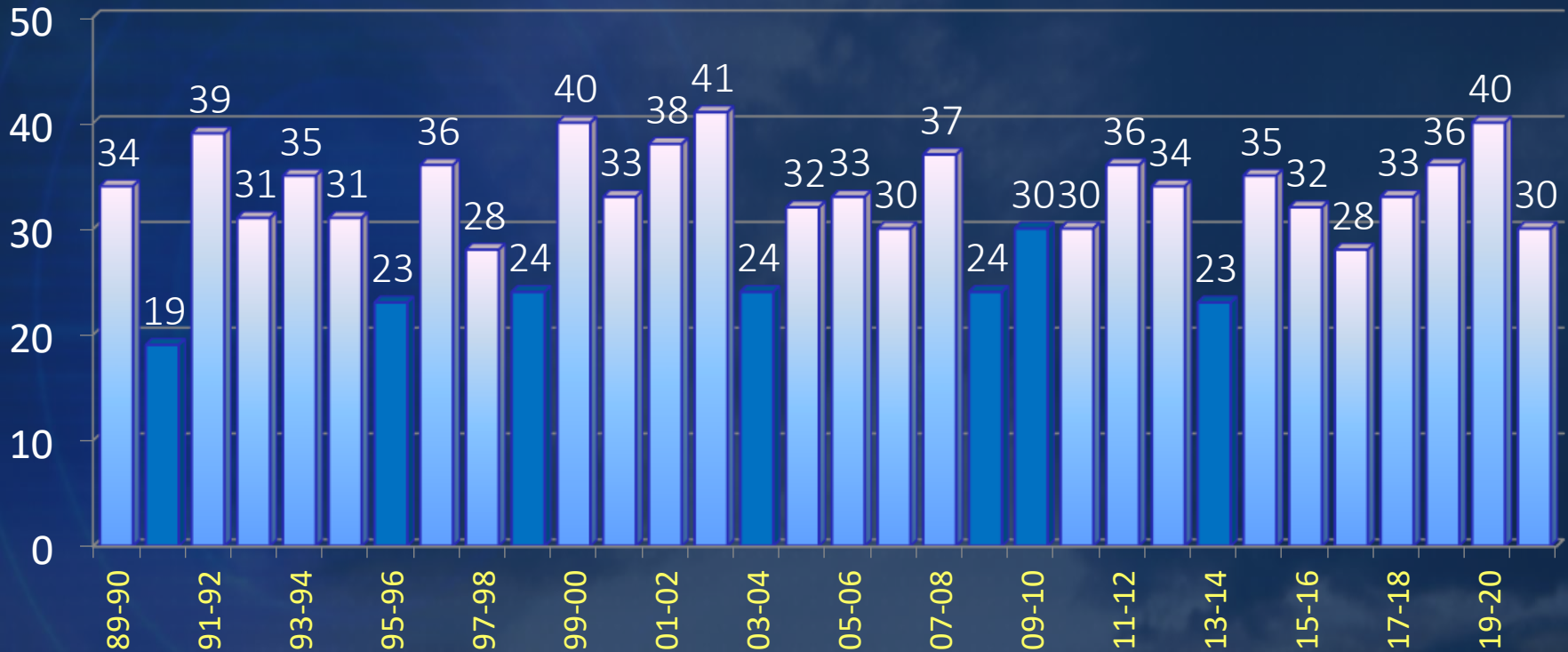
Winter temps go easy on our gardens

Winter Minimum Temperature @PDX



A Better Measure of an Arctic Blast

Coldest Daytime High at PDX



Blue = Widespread PACNW Arctic Air Outbreak

Last “arctic blast” was December 2013















Previous events: Nov 2010, Dec 2009, Dec 1998, Dec 1990

PORTLAND HISTORICAL ARCTIC BLAST INFO								
GREEN BOX = SIGNIFICANT/HISTORIC EVENTS, BUT NOT A REGIONWIDE ARCTIC AIR OUTBREAK								
YELLOW BOX = REGIONWIDE ARCTIC AIR OUTBREAK								
Month/Year	Lowest 500mb Height	Lowest 500/1000 Thk	Coldest 850mb T	Coldest 925mb T	Lowest Dewpoint	PDX Coldest		Comments
						High	Low	
February 2021			-0.7	-1.9		30	24	Edge of historic cold airmass
January 2017			-9.3	-5.2		28	11	Cool airmass at first, then lo
Early Feb 2014	532	524	-7.3	-7.7	1	23	19	NOT ARCTIC BLAST Strong e
Dec 2013	529	514	-14.1	-9	-2	28	12	Little/no snow metro area.
Late Feb 2011			-10	-7		32	18	
Nov 2010			-12.5	-9		30	18	Mainly dry cold blast from n
Dec 2009			-12.3	-10		30	12	3 consecutive below freezing
Dec 2008			-9.3	-8		24	20	Huge snow event. Big storm
Jan 2004			-8.1	-3		24	18	NOT ARCTIC BLAST Major sr
Dec 1998	526	506	-17.5	-13		24	11	Not too much east wind, the
Late Jan 1996			-7	-7		23	14	Extremely cold and windy, lo
Jan 1993			-8	-5		31	22	
Dec 1990	515	505	-22.1	-17	-4	19	12	Coldest 850mb temp on reco
Feb 1990	527	507	-12	-7		34	20	
Feb 1989	515	505	-16.7	-15	-6	15	9	
Nov 1985	533		-10.7	-9	10	25	13	Didn't technically meet crite
Dec 1983	531		-16.1	-12	-4	20	12	
Jan 1980	516		-14.5			27	13	Short, but heaviest snow on
Dec/Jan 1978-79	537		-13.5	-10	2	19	13	14 days @/below 33 degree

Been working on arctic air events, along with Tanis Leach...slow progress

One Forecaster's Score Card

Tanis Leach – OSU AMS Student Chapter President

Category	October Prediction	December Prediction	Actual	October Score	December Score
Water Year (Oct 1 st -Sep 30 th) Rain	37-47"	33-43"	Pacing for 34"		
Lowest Temperature	<20°F	<20°F	24°F		
Average Temperature Departure	Near to up to 3 degrees below average.	Near to up to 3 degrees below average.	+1.5°F (1991-2020 calculated averages)		
Peak Gust	45-55 mph	45-55 mph	50 mph		
Mt. Hood April 1 st Snow Depth	110-180%	110-180%	TBD		
Valley Snow	2-8"	3-10"	PQR: 10.1" Valley Average: 6.2"		
Peak Time	(indirectly mentioned) Mid Jan-Mid Feb	Mid Jan-Early Feb	Mid Jan-Mid Feb		

LEGEND

BUST



TREND BUST



PARTIAL



TBD



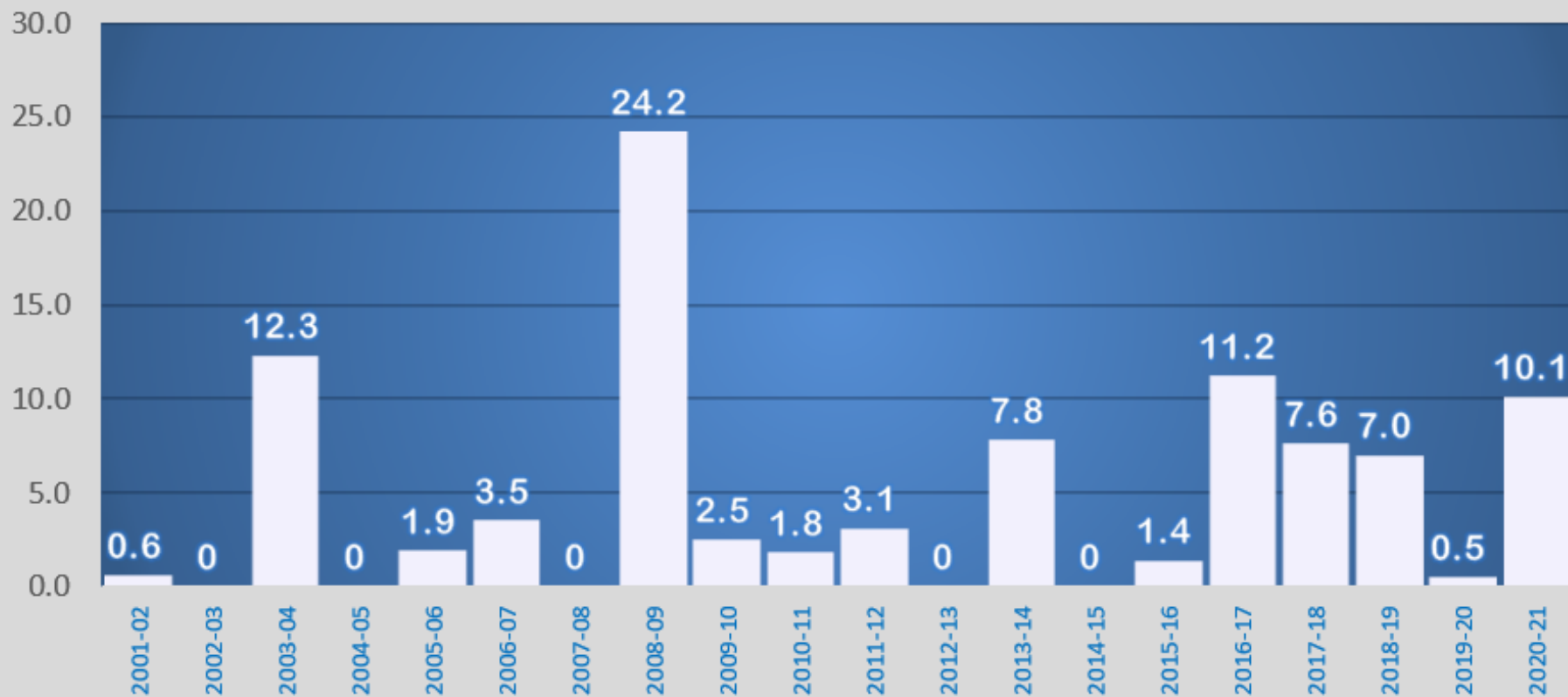
TREND HIT



HIT

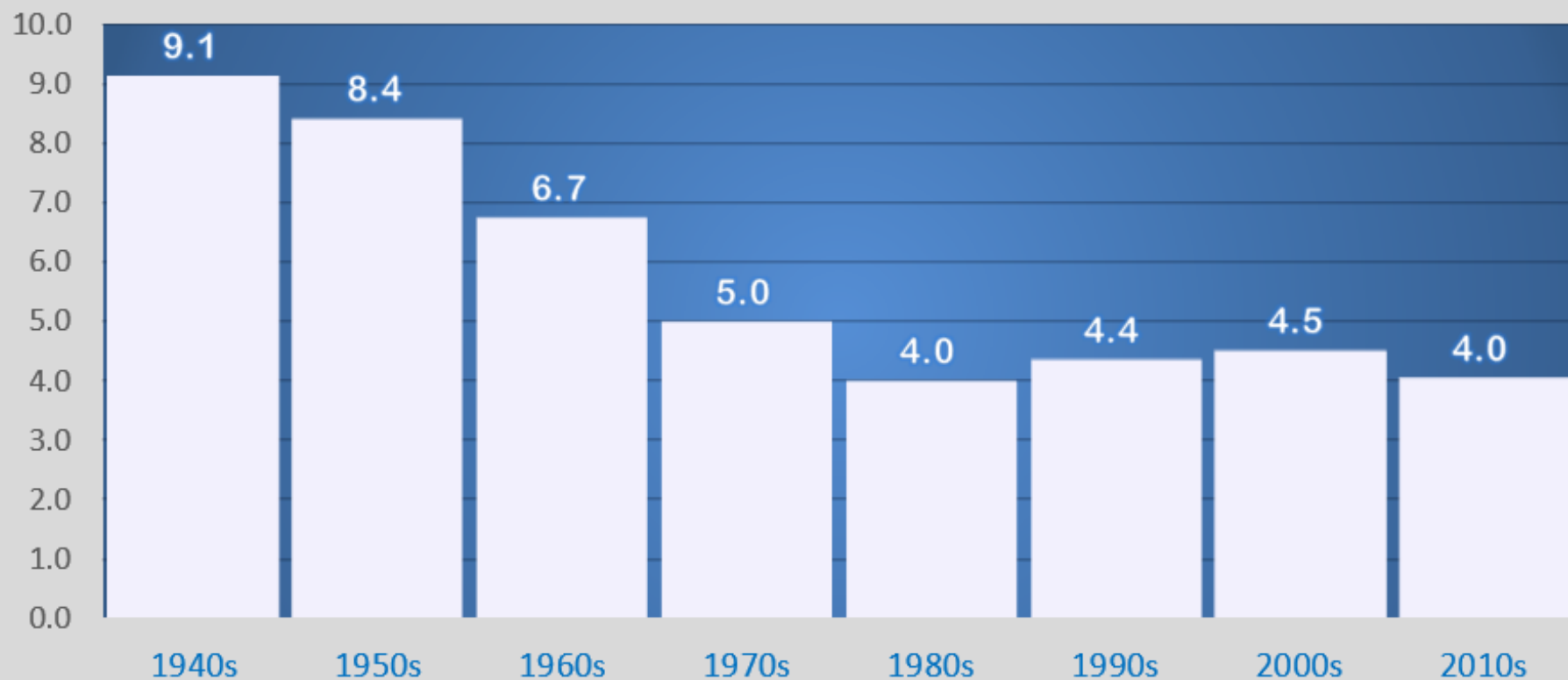


PORTLAND (NWS-PARKROSE)
SNOWFALL THE LAST 20 WINTERS (inches)



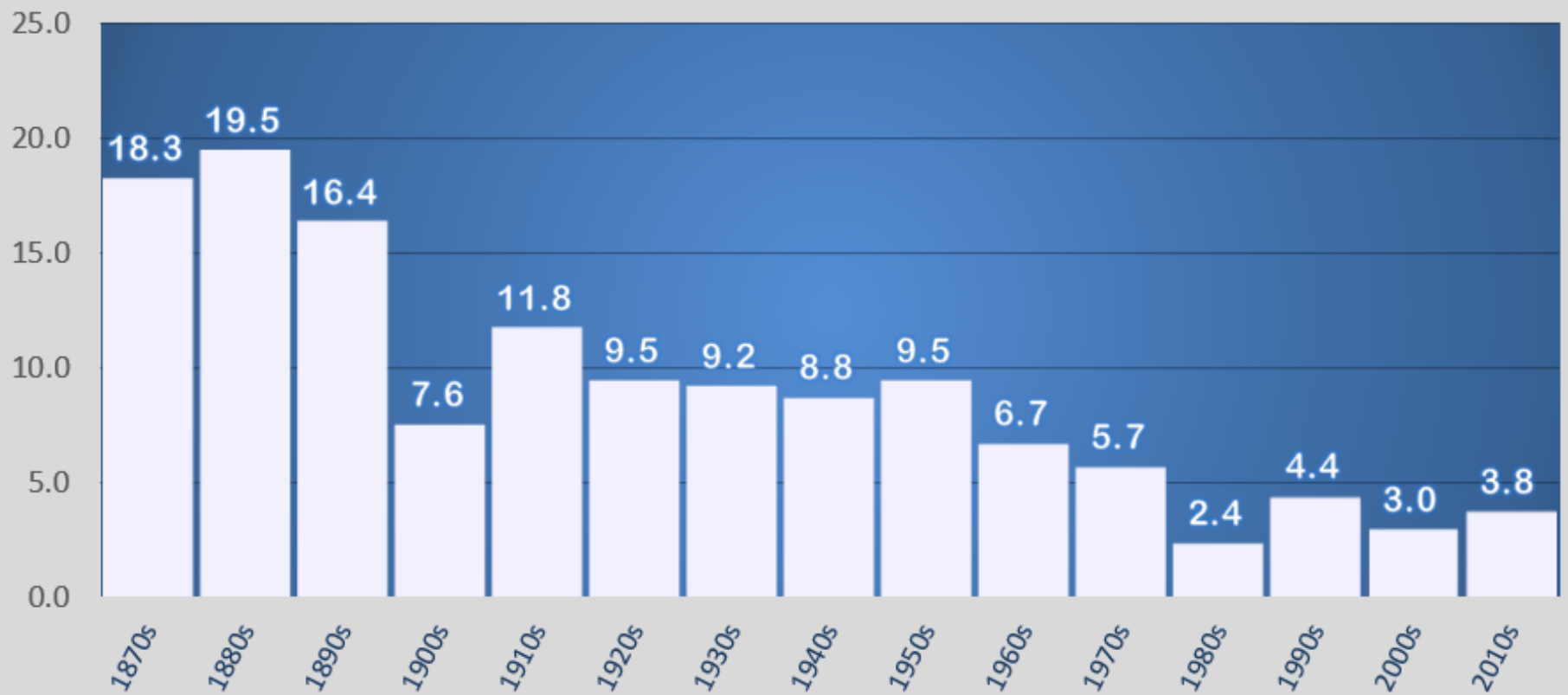
OFFICIAL PORTLAND SNOWFALL

Average per winter in inches (Portland Airport & NWS Office)



DOWNTOWN PORTLAND SNOWFALL

Average per winter in inches

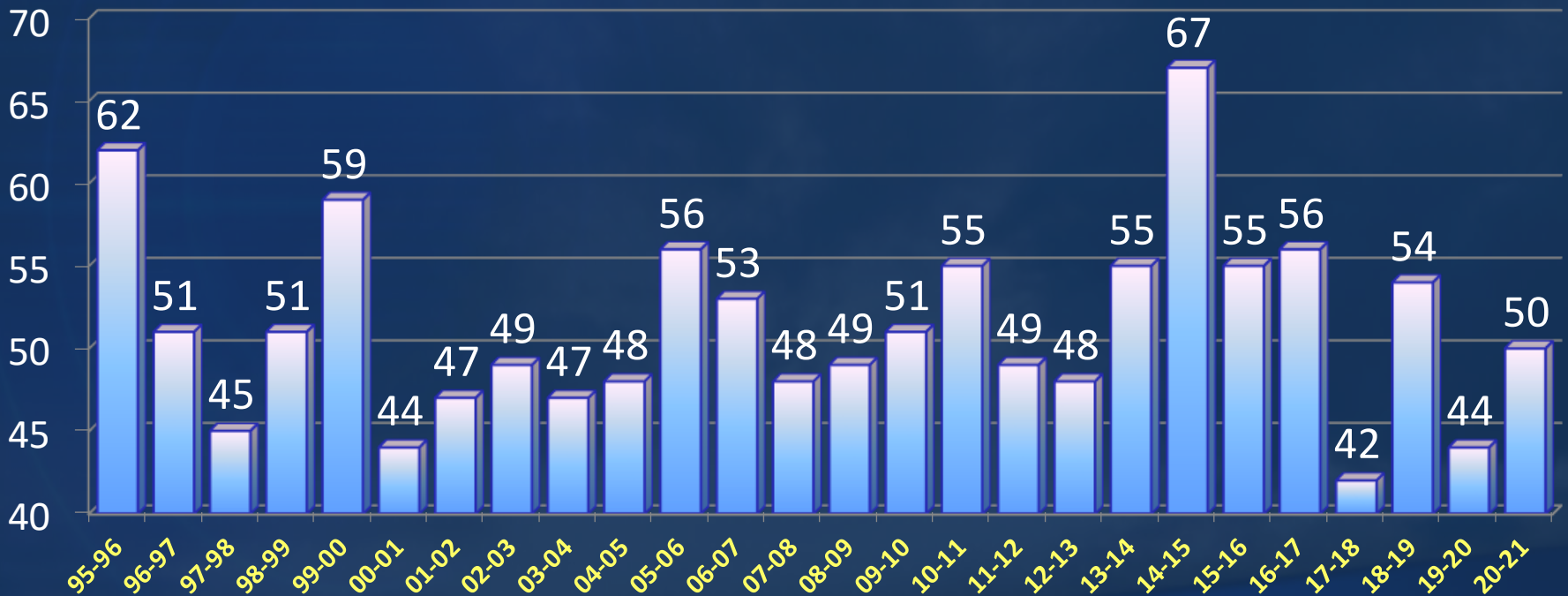


No Wind Storms

25 winters without a major REGIONAL storm

Yearly Peak Wind Gust at PDX in MPH

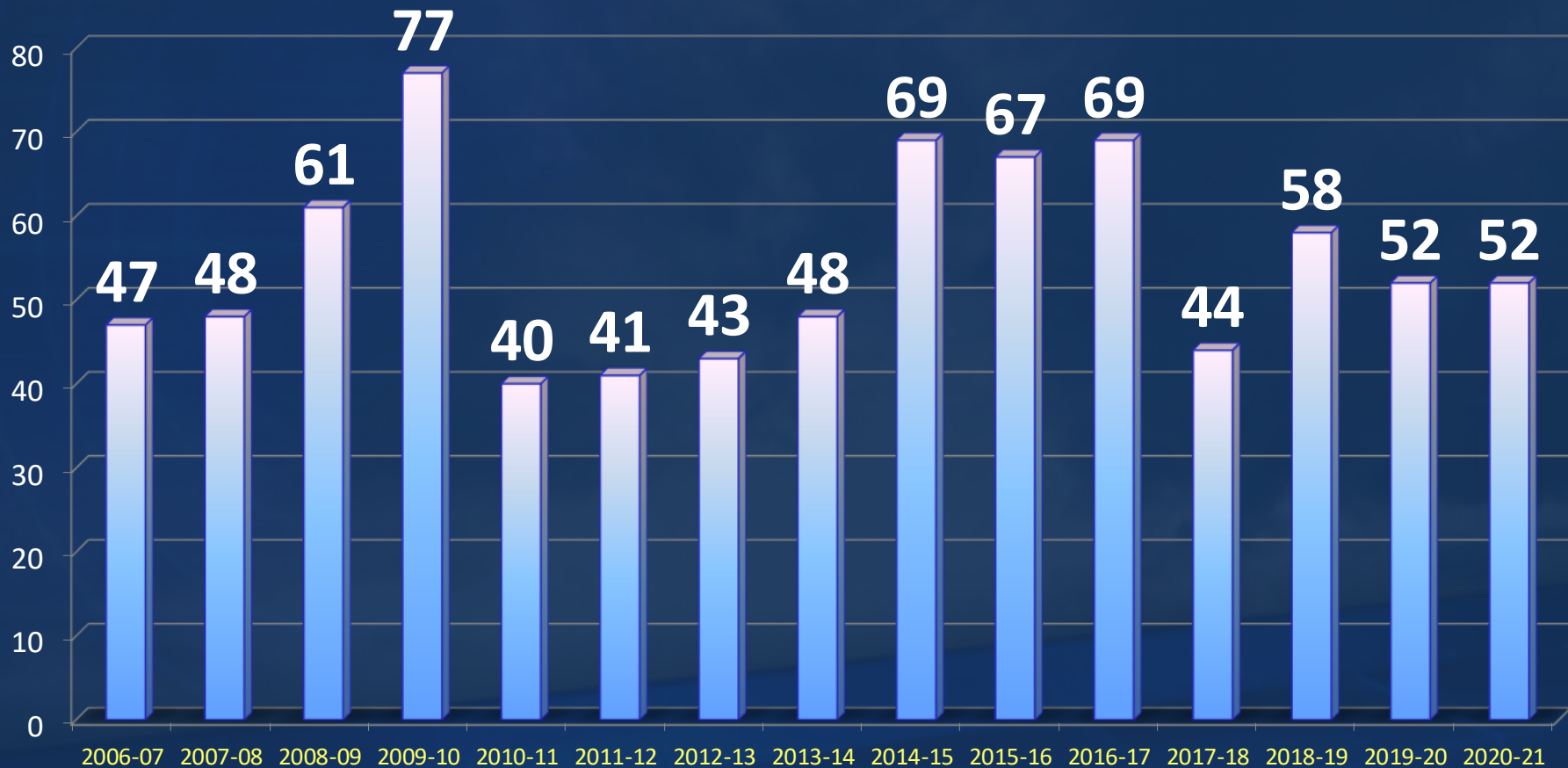
(Generally southerly)



EASY EAST WIND SEASON

No long periods of extreme wind...somewhat "normal"

Days with peak easterly gusts 25+ mph at Troutdale (Nov-Feb)



FINAL THOUGHTS

1. If pattern shifted just 100 miles farther north; it would have rained Valentine's weekend!
2. The “wet” part of La Niña turned out correct, but warmer than forecasters expected and far less active than a typical event.
3. Could we have **ANOTHER** winter with measurable snow at PDX for 2021-22?