

Examination of the Intense Cold Frontal Passage of 19
November 2003 and Associated Low Elevation Snow
Event in Southwest Washington and Northwest
Oregon using the NWS Weather Event Simulator

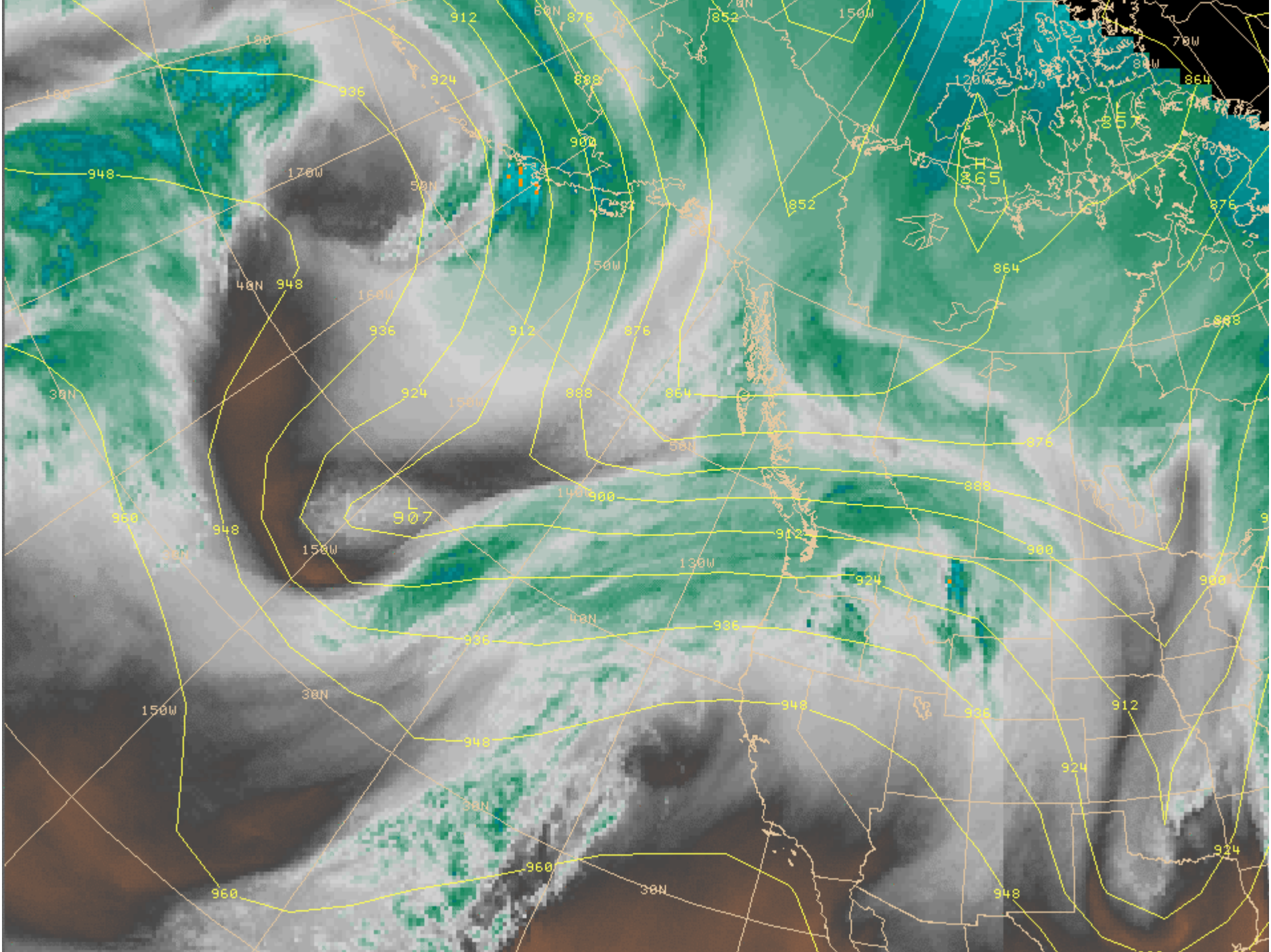
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November 18-20, 2003

Cold Front

- Strong Cold Front by Coastal Pacific Northwest Standards
- Why Look Further?
- “Weather Event Simulator” for Training
- Synopsis – November 18th, 2003

Ridging Across the Pacific
Northwest
&
Strong Jet over Northern
Washington



Moist Subtropical Plume (AMSU TPW)

Nearly Stationary Front over
Northwest Washington
(Surface Observations and Radar)
(Visible Satellite)

The Front

- Front nearly stationary over NW WA on the 18th
 - Dramatic Temperature Contrasts Across the Frontal Zone
 - Frontal Zone Sloshes South then North then South
 - Finally around 08z on the 19th the Front Moves South (Surface Obs./Radar – Vis. Sat.)
 - Dramatic Frontal Passage at Stations across WA and NW OR. (Surface Obs – Z/V radar)

Low Elevation Snow

- No Sub-freezing Air in the Columbia Basin
- No sub-freezing Air West of Cascades
- Forecasters 700-1000mb Thickness to Forecast Snow Level
 - Regressions Work Well Most Times
 - Break Down in Low Elevation Events
 - Using 18th /18Z Eta – 2500 Ft freezing level
 - MOS – Also 2500 Ft

Processes in Action

- Cold Advection
- Frontogenesis
- Very Moist Southwest Flow over Frontal Surface
- Moderate to Heavy Post-Frontal Precip.

Thermodynamics

- Latent Heat of Melting
 - Significant - Sometimes Forgotten Process
 - Cold or No Advection in the Layer
 - Even Saturated Layer Can be Cooled to 0C
 - A “top down” Process
 - Requires Heavy Precipitation

Our Specific Case

- All Key Ingredients Present
- Heavy Post Frontal Precip.
 - CFP at PDX ~ 12Z
 - 12Z-17z (Snow Began) PDX 0.82 inch
 - 17Z-20Z(snow ended) PDX 0.45 inch
- Deepening Cold Layer 12Z-20Z

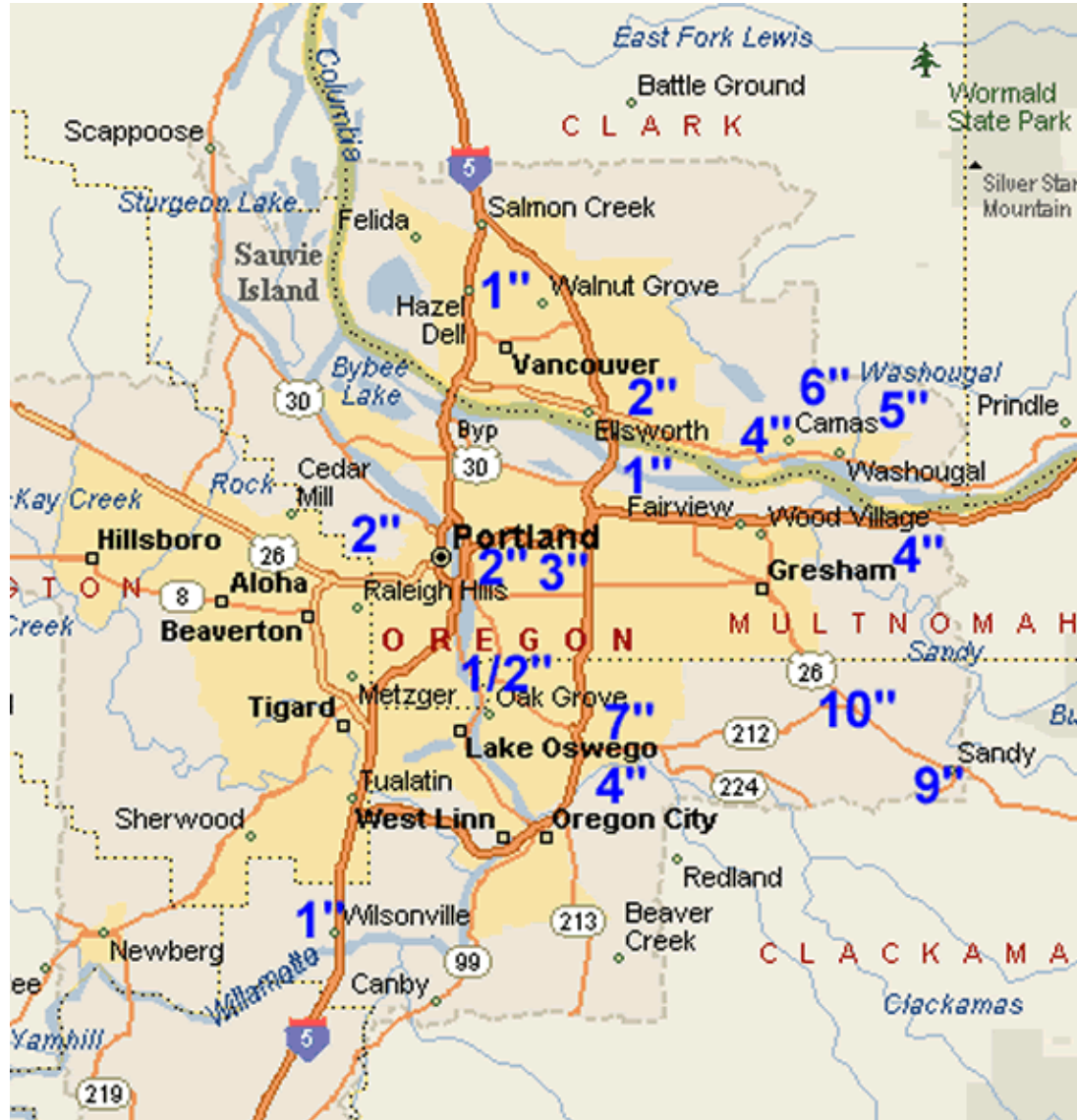
Latent Cooling Equation

- Kain et al (WAF, 2000) - and others
- $\Delta T = -193 D / \Delta p$
 - ΔT Temp. Change (C)
 - D Water Equivalent Depth of Precip. (cm)
 - Δp Depth of Above Freezing Layer (mb)

PDX Cooling

- ACARS Data (1313Z) – depth of above 0C air 200mb
- Water Equivalent From CFP to Snow Began – 2.0828 cm
- Results - Temp. Decrease of 2.0C
- ACARS Sounding (1313Z) average temp of layer was 2.5C
- Cold advection from 13-17z

“Dramatic” Results





“Frosty” Will Take Your Questions Now

(WFO Portland – Nov. 19, 2003 20Z)



Notable Quotes

- On Tue, 18 Nov 2003, Justin Sharp wrote: At 5pm there was a 23 F N/S gradient through Western Washington (37 at BLI, 60 at PDX). Just a little further north at Hope, BC it was 32F with freezing rain! Amazing.
- At 09:40 PM 11/18/2003 -0800, Greg Hakim wrote: Check out the ferry page---it's awesome. There's a 10F temperature contrast on the southern half of Whidbey with a 180 degree wind shift. Cliff, it might make a nice opener for your talk tomorrow! Greg
- Mark Albright wrote: The best I could do was 1 inch at 325 feet in Lake City. By the time I left this morning it was raining lightly and 35 F. It was another of those events which was precip intensity driven, heavy precip fell as snow, lighter precip fell as rain. Mark A.
- Brad Colman wrote: Certainly one of the largest temperatures drops I've seen here in the winter....more than 20 F drop in 3 hours at the office. I have attached a photo from this morning at my house...3 inches and still snowing. Brad
- At 10:35 AM 11/19/2003 -0800, Greg Hakim wrote: I had about the same at 375 feet in Wedgewood; there was nothing 15 blocks to the south. Greg
- Hi again...I ended up with 4 inches. The walks are shoveled....nice snow berms...and the road is plowed. Very nice....not much melting...staying around 33 F. Brad
- Wednesday, November 19, 2003 11:20 AM Subject: Re: Warm Front/Cold Front/Stationary Front - depending on when you look. From Lewis and Clark College, Portland, Oregon. Taken at 11 am this morning. 22F drop in 6 hours at PDX - do a tdd pdx. I haven't had chance to look at this in any detail but it certainly is NOT a Gorge influenced event - pressure is way higher on the west side (plus the air over the other side is warm. Looks like purely the effect of an exceptionally strong cold front (by PNW standards) and diabatics from the heavy precip. Justin

Notable Quotes

- when Jim and I left the GACC (old WSFO building on Marine Drive) at 11:45 am the big snowflakes that started when the rain changed to snow about 9:30 am had turned to little flakes. After we crossed the Columbia on I-205 it was light rain with evidence of previous snow beside the road. By about Woodland or so it looked like it had not snowed. Around Toledo we actually had some sunshine. Then we hit a wall of rain before improvement again on the way into Chehalis. After that it was easy going except Jim kept snoring - and he was driving! cdh
- Hi Bill....thanks for the shots. I did pretty well too. I ended up with 4 inches. I have attached a shot off my porch.
Brad

Introduction

- Interesting storm – May not stand out as one of the big memorable storms
 - Didn't produce fatalities
 - No damage reported
 - It was the most spectacular cold frontal passage I have seen.
 - Generated a lot of chatter among the local meteorological community
 - Produced the earliest snowfall recorded in Portland?
 - Not typical low level snow producer
 - Myth – “You can't get low elevation snow in Portland in westerly flow without sub freezing air In the Columbia Basin”
 - Not an Arctic Blast
 - Not a cold air overrunning pattern
- So Why Look further at this storm
 - Poorly forecast - forecast had concentrated on Flood threat and not on dramatic temperature change and low elevation snow
 - Low Elevation Snow forecasts are improving – better than ever in the last 10 years
 - Excellent training case for understanding some of the snow producing processes
- Weather Event Simulator
 - Version of AWIPS to display data in displaced real time or reasearch mode.
 - Displays all data available to forecasters and contains most of the tools for issuing products
 - Let's look at this case on the simulator
- Synoptic Summary (on the 18th)
 - Ridging across Pac NW
 - Strong jet across Washington (Water Vapor slide)
 - Moist subtropical plume (AMSU TPW Slide)
 - A nearly stationary front over NW Washington (Surface Ob and Radar loop)