

# **An Unconventional High Wind Event: The Wind Storm of November 18 and 19, 2003**

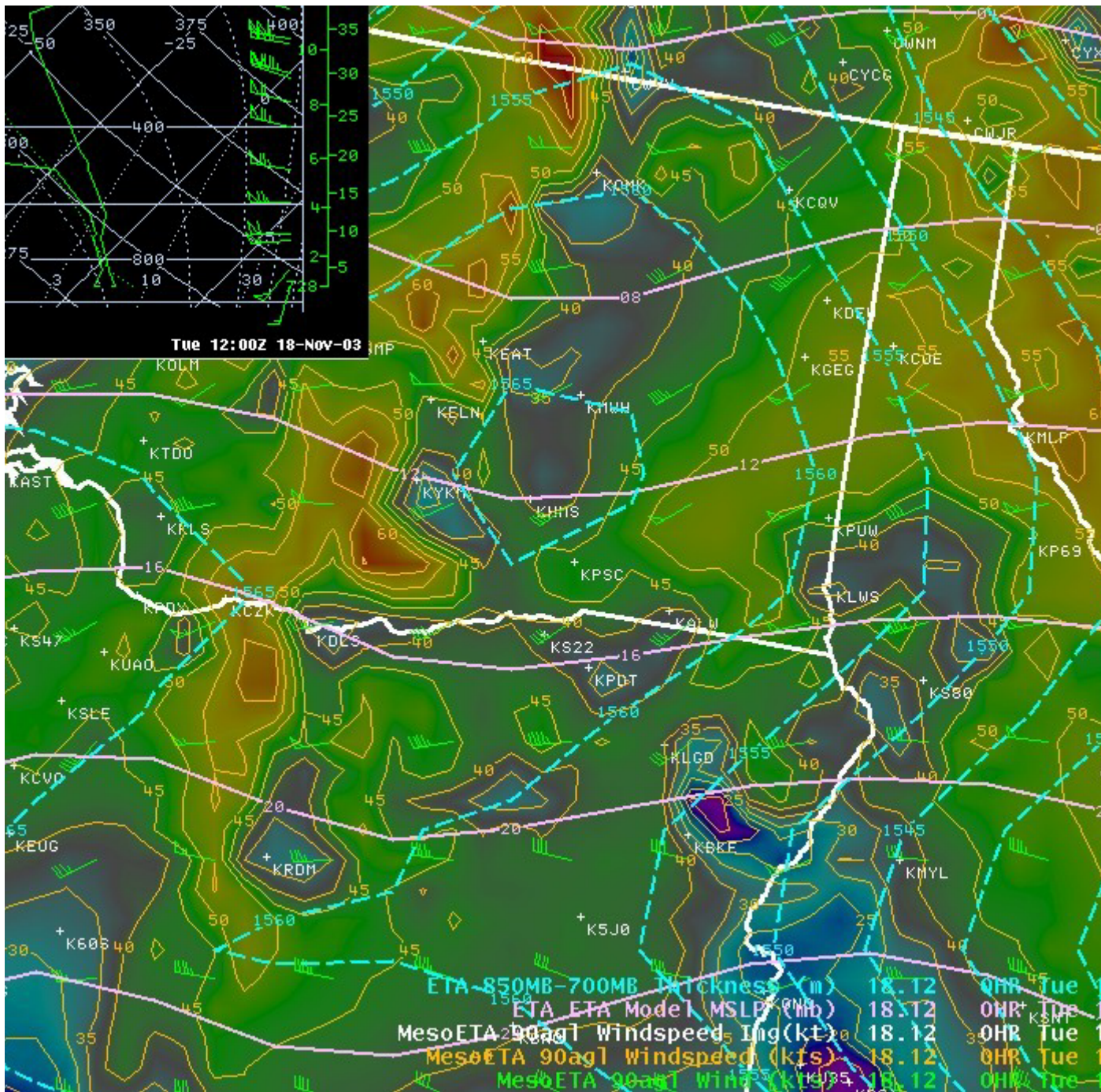
Matt Fugazzi, WFO Spokane, Washington



## **Event Description:**

In the early morning hours of November 18, 2003 a warm front moved through eastern Washington and north Idaho from the south. Behind this front sustained winds of 25 to 35 mph with gusts to 55 mph created scattered power outages as branches and occasional downed trees took out power lines throughout the Spokane and Coeur d'Alene area. Winds remained in the Wind Advisory criteria range through the day on November 18th and decreased to breezy and even light conditions at some locations during the night.

The winds of November 18th appear to have been largely caused by warm sector random mixing of stronger winds aloft down to the surface during the day. The gradient was moderate but not unusually strong. The 12z 11/18/03 RAOB indicated 50 knots a few thousand feet aloft. The Eta40 90mb agl initialization reflected this reality fairly well.



12Z Nov 18, 2003 MesoEta (Eta40) initialization with 12Z OTX RAOB skew T inset

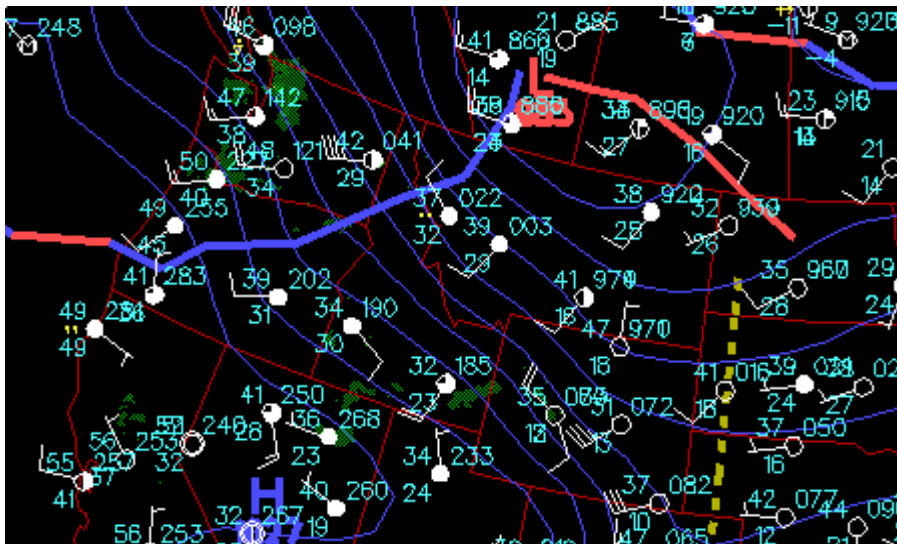
During the early morning hours of November 19th the winds returned but were much stronger. While sustained winds remained generally in the 25 to 35 mph range, gusts well into the High Wind Warning criteria range were noted over much of the eastern Columbia Basin of Washington and the Coeur d'Alene Area zone of Idaho. Between 6:00 am and 7:00 am reports of damaging winds were noted by local media broadcasts reporting trees falling on houses and widespread power outages throughout Spokane. At



7:01 am a wind gust of 61 mph was recorded at the Spokane Weather Service office. At 7:04 am Fairchild Air Force Base recorded a wind gust of 68 mph which ripped a roof off of a recreation center. Farther to the south Pomeroy recorded a gust of 65 mph. At 7:38 am the Spokane airport measured a 63 mph gust. During this period the South Hill neighborhood in Spokane was especially hard hit with Avista power reporting over 16,000 customers without power. By the 8:00 am hour the focus of damaging winds moved into the Coeur d' Alene region. While the official highest gust at the Coeur d' Alene airport was only 55 mph, fallen trees were reported over much of the Coeur d' Alene Area zone. Some of these trees had diameters of up to 3 feet. By noon winds had settled down into the breezy to windy range as a cold front passed through with scattered rain showers.

## Eastern Washington High Wind Pattern Review:

The classic high wind pattern for the Spokane CWA involves a deepening surface low tracking across southern British Columbia. This creates a strong southwest to northeast pressure gradient across the Columbia Basin. This pattern was characterised by the situation on February 2, 1999.

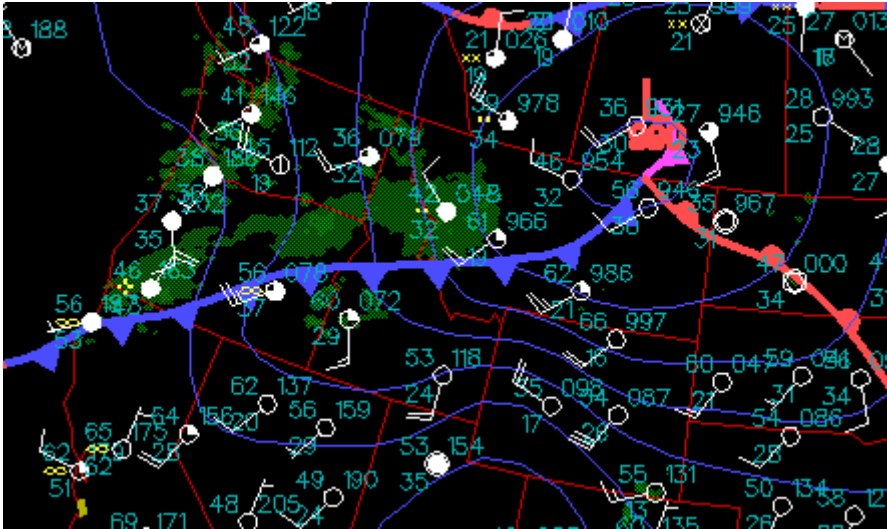


00Z Feb 3, 1999 MSLP and Fronts (4mb contour interval)

Note the 23.5 mb pressure difference between Yakima and Lethbridge, Alberta, near the center of the surface low. This storm produced widespread and long running sustained winds of 35 to 50 mph with gusts in the 60 to 70 mph range on valley floors throughout the Columbia Basin and north Idaho. A detailed study of this storm by Don Moore is on the local studies page.

## Synoptic Setting on November 19, 2003 and Evolution of the Low Level Jet:

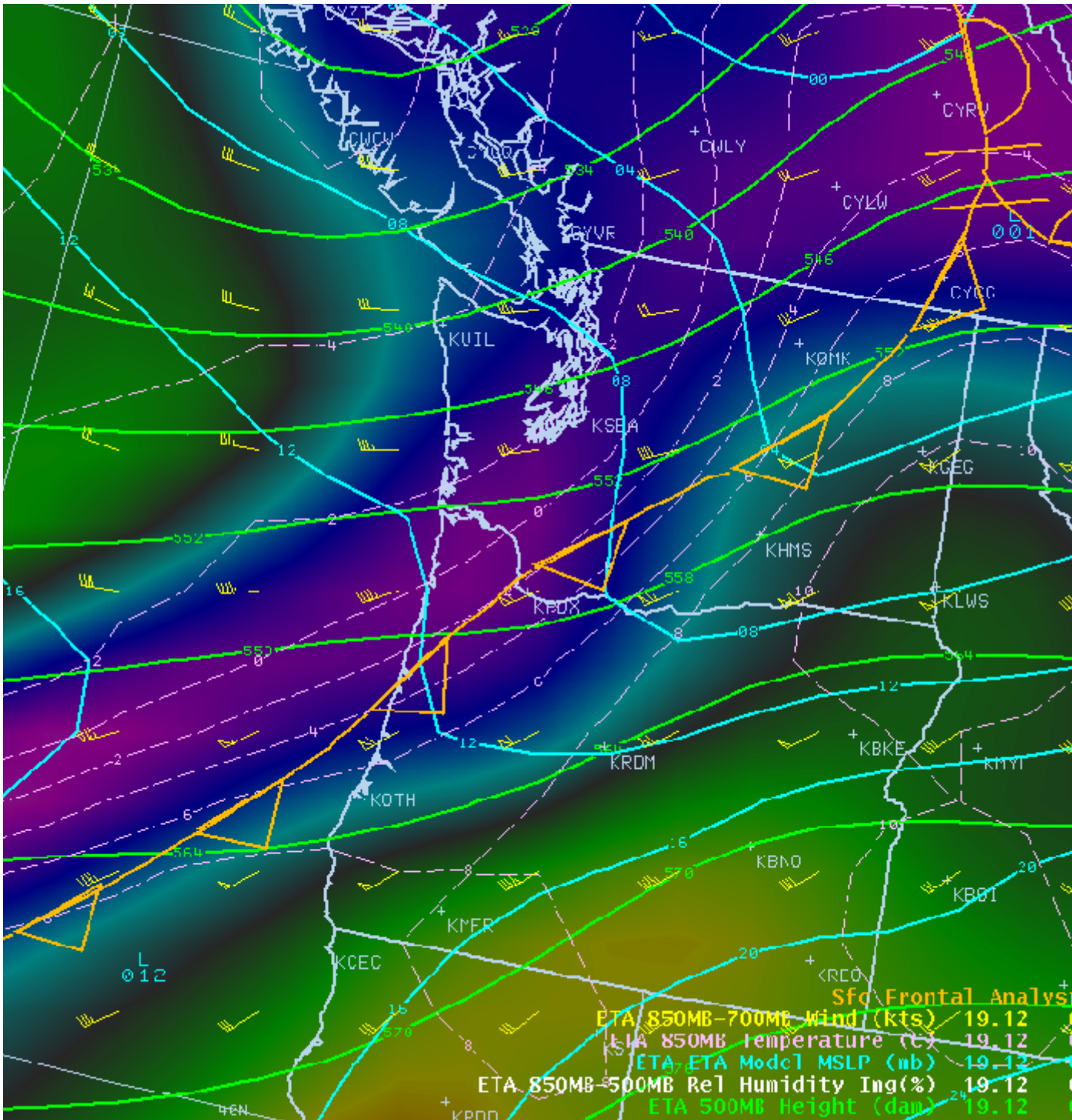
While the synoptic situation on November 19, 2003 featured a surface low tracking through southern B.C., the pressure gradient was much weaker. The gradient between Yakima and Lethbridge was only 13.4 mb. Sustained surface winds behind the cold front held in the 15 to 30 mph range over eastern Washington through the afternoon of November 19th with this gradient.



00Z November 20, 2003 MSLP and Fronts (4mb contour interval)

November 19th was primarily a scattered damaging wind gust event that influenced the region from dawn until around 9:00 am. Damaging wind reports were concentrated in a southwest to northeast swath from about Pomeroy to Lake Pend Oreille. The width of this swath stretched from Ritzville WA to Coeur d'Alene ID. From the 12Z Eta80 initialization below it is apparent that this was not a gradient induced wind event. Available evidence suggests a Low Level Jet stream began to haphazardly translate to the surface as dawn broke over the region. The 12z surface analysis indicates a cold front approaching the region in the hours before the event began.

Note the 850mb-700mb wind barbs in the image below indicating a low level 50 to 70 knot speed max along the cold front. Note the relatively unremarkable southerly MSLP gradient (blue solid lines).

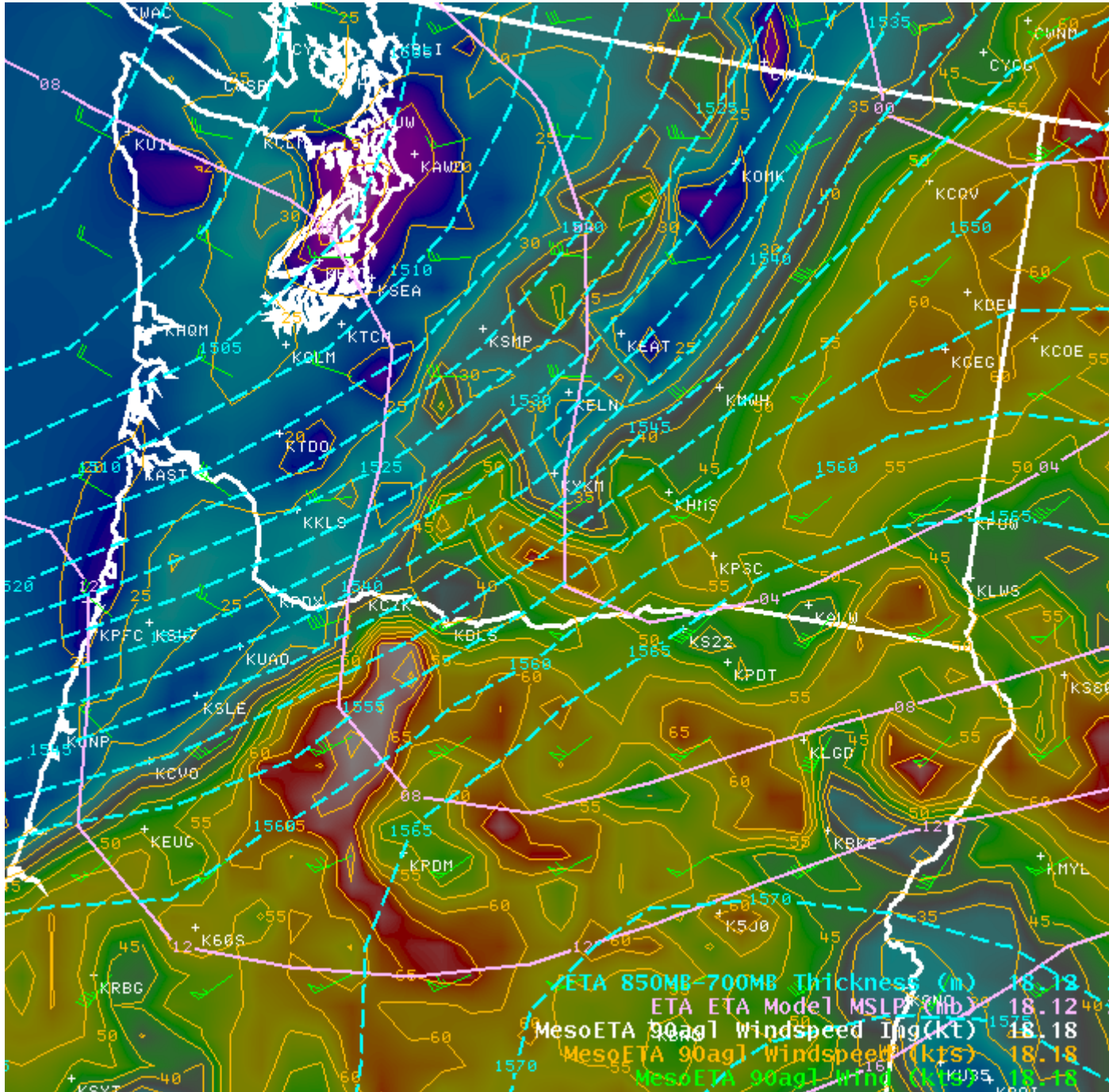


12Z 11/19/03 Eta80 initialization

It appears that the approaching cold front and possibly terrain channeling along the eastern rim of the Columbia Basin created this wind stream. Air flow long the strong temperature gradient ahead of the front (the surface temperature dropped 15 degrees at COE in 1/2 hour as the front passed), as well as the reduced surface friction in the

marginally decoupled morning air mass lead to a low level wind speed maximum. Terrain channeling along the higher terrain on the eastern flank of the Columbia Basin may have aggravated the situation and enhanced the low level speed maximum.

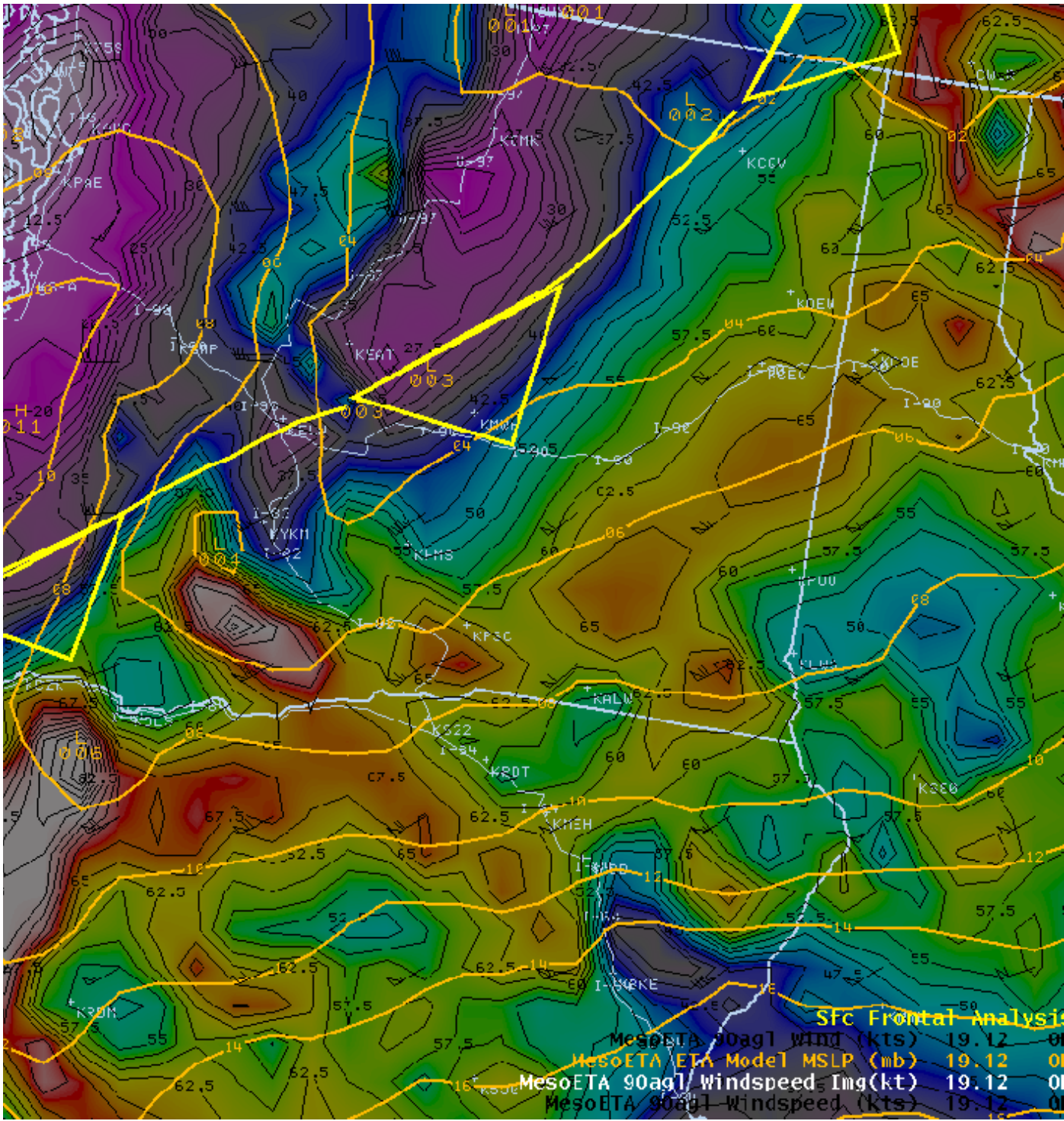
The 24hr Eta40 90 millibar agl wind **forecast** valid for 12Z November 19th reflected this scenario, although the speed maximum was under forecast by about 15 Kts.



Mesoeta (Eta40) 90agl Wind (image and isotachs) MSLP and 850-700 mb thickness 24hr Fcst valid for 12Z 11/19/03

The Eta40 **initialization** for 12Z 11/19/03 revealed the speed max along this axis, but still under-initialized the strength when compared to the balloon sounding at OTX for the initialization time.



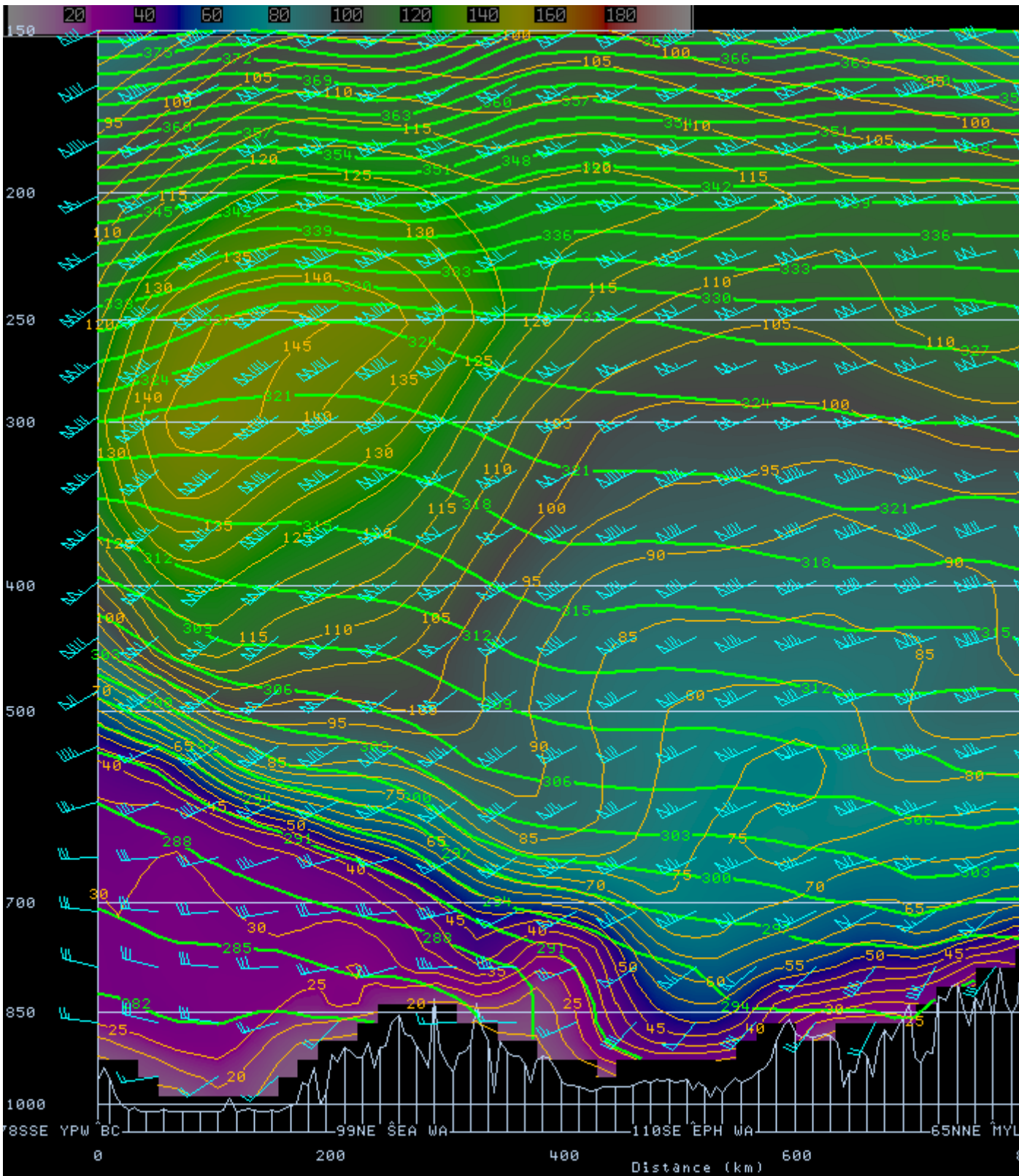


12Z MesoEta (Eta40) initialization 90agl windspeed(isotachs, barbs and image), MSLP and NCEP front analysis.

Support for a terrain influence on this Low Level Jet comes from the Eta80 and GFS80 models 90agl progs which **did not** indicate any speed maximum along this terrain. The Eta40 model's improved terrain resolution was successful in discerning this speed maximum.



The Eta40 **forecast** cross section below bisecting the Columbia Basin also detected the low level speed maximum. Note the cold front isentropic slope spilling out of the Cascades and into the basin (the valley in the center of the terrain trace) with a higher wind speed appendage descending to near the surface immediately ahead of the front.

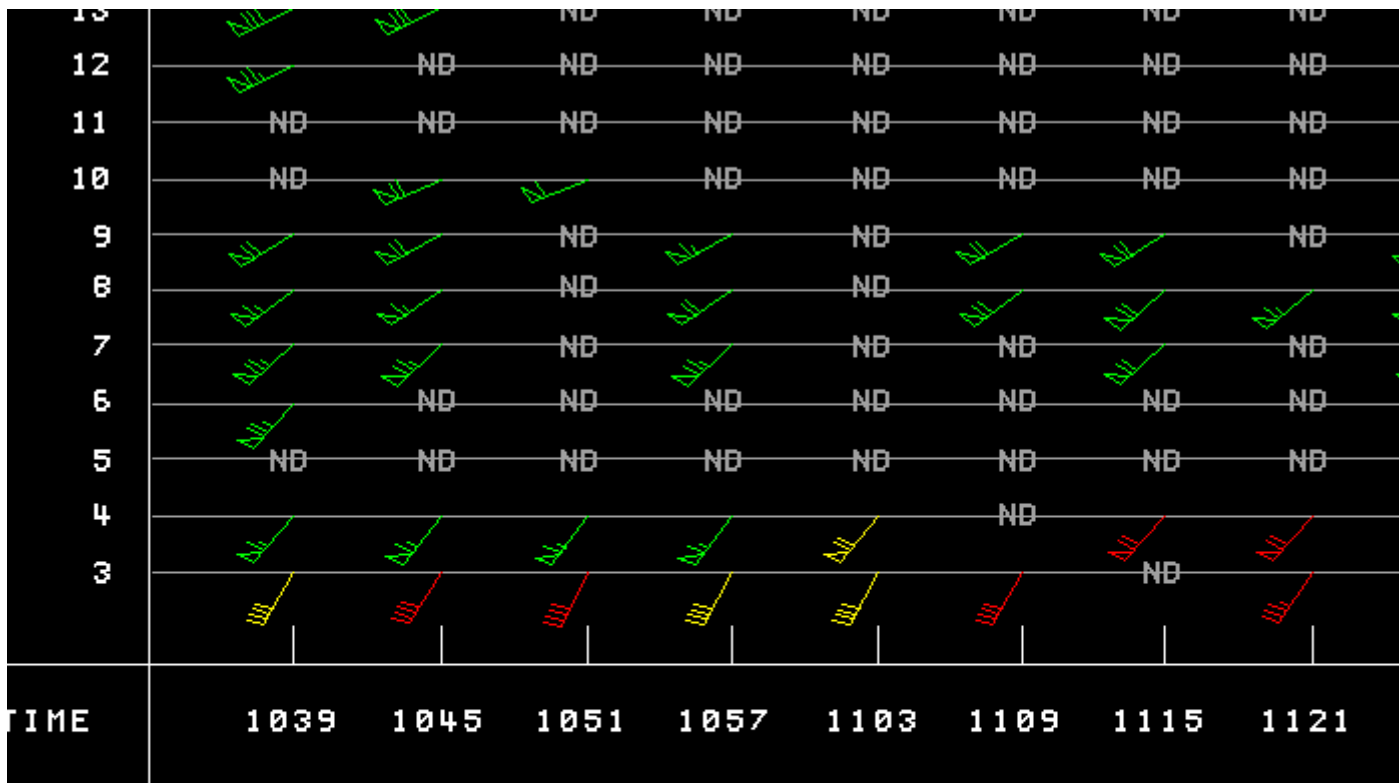


MesoETA lineG	Wind (kts)	18.12
MesoETA lineG	Windspeed (kts)	18.12
MesoETA lineG	Windspeed Img(kt)	18.12
MesoETA lineG	Potential Temp (K)	18.12

24hr MesoEta (Eta40) forecast cross section wind and isentropic field for 12Z 11/19/04.

The existing Wind Advisory that was in effect for November 18th was continued by the overnight shift through the 19th, with no evidence on the Eta80 and GFS80 models to suggest things would be worse on the 19th (persistence forecast). The higher resolution Eta40 products presented above were not used in the forecast process.

The first hint of trouble came from the Spokane WSR88D VAD wind profile during the early morning hours of November 19th before the event began. Note the 70 knot wind barb 3000 to 4000 feet aloft on the VWP at 1115Z-1121Z. The red flagged barbs were noted but greeted with suspicion until the impending RAOB "ground truth" was available to validate this VWP data.



**kotx VAD Wind Profile (RMS kts)**

VAD Wind Profile KOTX WSR88D for November 19, 2003

Soon after, the 12Z RAOB balloon run confirmed very strong winds just above the surface. Note the 70+ knot speed maximum from 277 to 1584 meters above the surface.



Station: Spokane, WA  
MicroART Observation Program

Ascension: 642-2 Release: 1  
Version 2.97 Print: 1

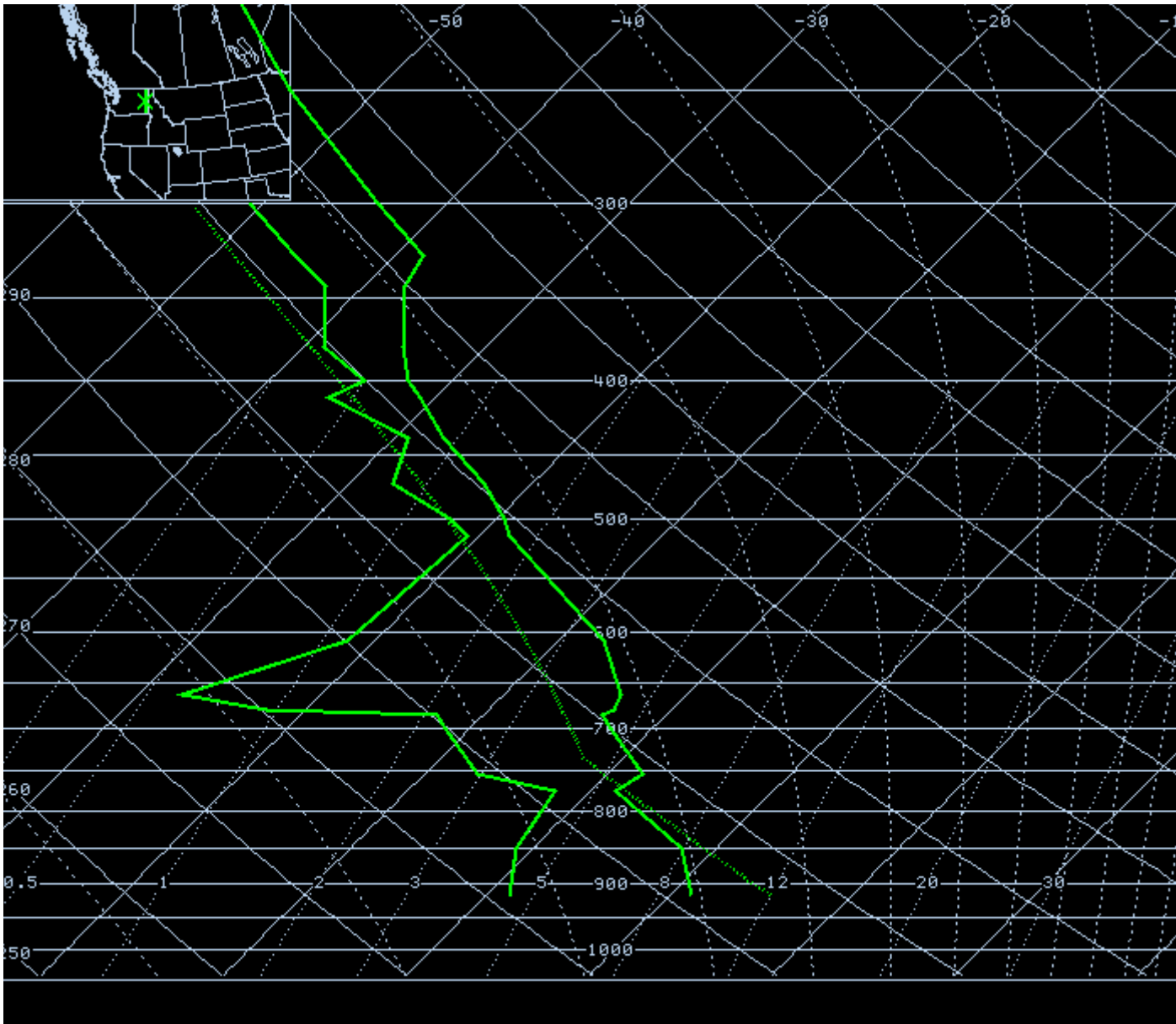
TIME(min)	HEIGHT(M-AGL)	DIR	SPEED	HEIGHT(FT-MSL)	NOTES
0	0	210	28	2388	SIG
1	277	214	70	3297	SIG
2	606	218	72	4377	
3	924	220	74	5420	
4	1241	224	72	6460	
5	1584	230	70	7585	
6	1943	236	69	8763	
7	2276	241	68	9856	SIG
8	2580	243	70	10853	
9	2848	243	72	11732	
10	3109	241	75	12588	
11	3392	241	80	13517	
12	3726	242	81	14613	
13	4087	244	81	15797	SIG

MicroArt RAOB output 12Z November 19, 2003.

In addition, the wind sensor on Rattlesnake Ridge (around 3000 feet MSL) on the KHMS 12Z METAR recorded 70 knots at 11Z.

Based on this evidence the existing Wind Advisory was upgraded to a High Wind Warning. Two hours later the severe wind and damage reports began streaming in.

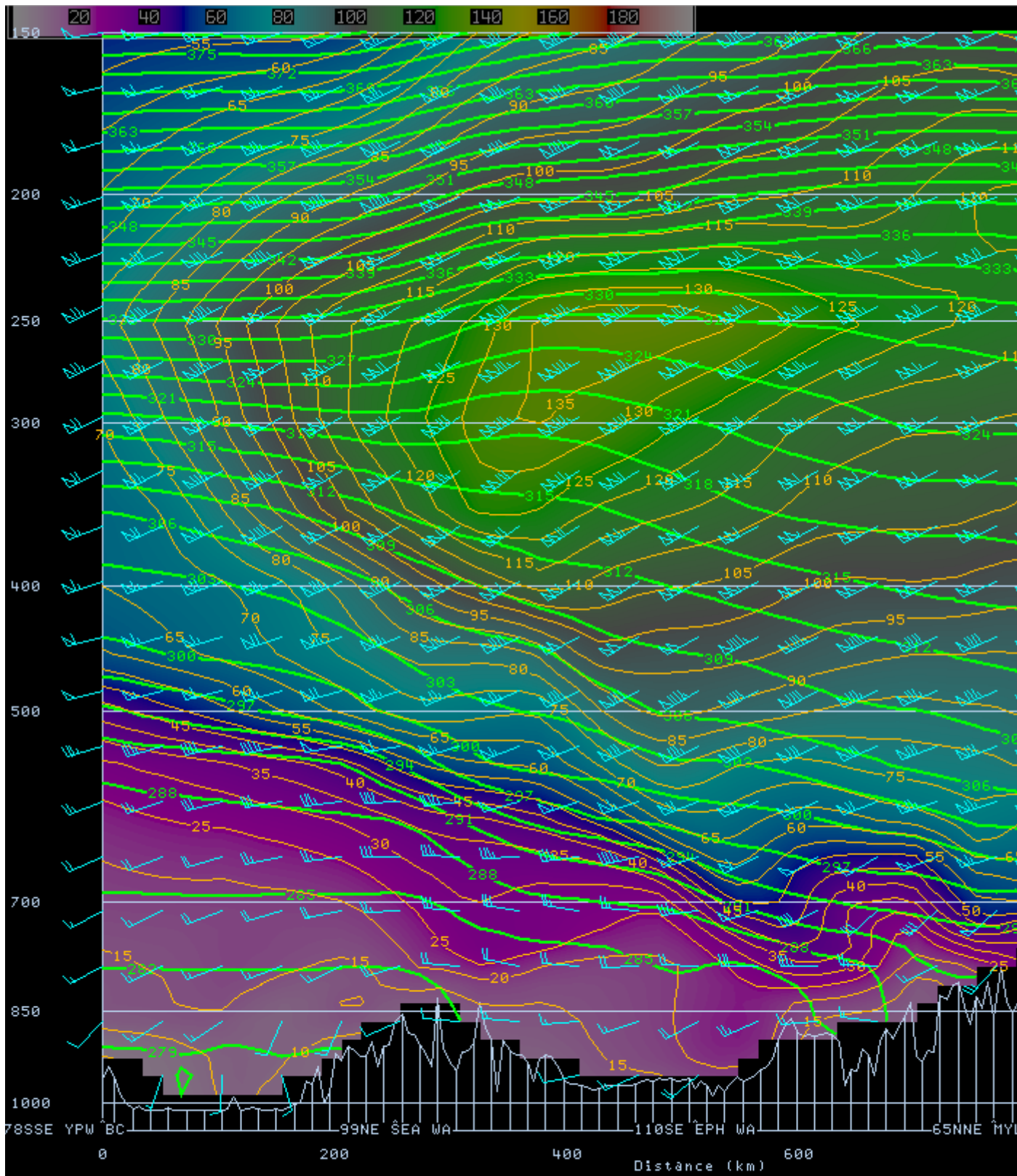
Later, the 12Z 19 Nov 2003 OTX Skew T sounding revealed that the boundary layer had not de-coupled during the night, allowing the strong winds to begin surfacing as the dawn broke over the region.



12Z 11/19/03 KOTX Skew T.

As the cold front passed through the region, the damaging winds abated from west to east. By 9:00 am the event had effectively ended. Behind the front the winds shifted more westerly and continued in the sub-advisory breezy to windy category but no more gusts of over 40 mph were recorded at any observation stations for the rest of the day. As the cold front swept eastward into the panhandle mountains, RAWS stations in this region did not note any remarkable wind gusts. This suggests the denser air mass behind the front shouldered below the jet and forced it high enough in the atmosphere to no longer affect the surface, and high enough so that the air flow was no longer channeled along the mountains.

The Eta40 forecast cross section for 21Z 11/19/03 (below) supports this scenario.



MesoETA lineG Wind (kts) 18.1  
 MesoETA lineG Windspeed (kts) 18.1  
 MesoETA lineG Windspeed Img(kt) 18.1  
 MesoETA lineG Potential Temp (K) 18.1



33hr MesoEta (Eta40) forecast cross section wind and isentropic field for 21Z 11/19/04.

## Conclusions:

When pattern recognition suggests the potential for high winds over the Spokane CWA, in addition to inspecting the forecast gradient over the region, the potential for a low level jet translating to the surface should also be checked. This scenario is especially possible if a moderate or strong cold front is expected to sweep through the region.

In this case the MesoEta(Eta40) 30agl, 60agl and 90agl wind field forecasts did a good job in resolving a warm sector Low Level Jet.

The model apparently did well with the strength of this jet in the general warm sector environment ([morning of November 18th](#)) with no incoming cold front.

The model underestimated the magnitude of this jet streak as it was being compressed between the cold front and higher terrain ([morning of November 19th](#)), however the MesoEta(Eta40) model was the only model that identified any Low Level Jet streak at all.

In the future, when the gradient analysis suggests little or no threat of High Wind Warning criteria, the Eta40 30agl, 60agl and 90agl wind products may be useful to diagnose the potential for High Wind Criteria gusts from turbulent mixing, frontal shear and possibly terrain channeling over the eastern Columbia Basin rise. While not explored in this study, the MM5 model, also with improved terrain resolution, may be valuable.