

Wind Enhancement in the Tanana Valley Drainages Under a High Pressure Regime

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National Weather Service

General Overview

- There have been several occasions over the past few years when the combination of High pressure building over the west coast, extending northeast over the eastern Brooks Range and becoming quasi-stationary, produces higher than expected winds to some of the interior drainages.
- This situation can occur anytime during the year but is especially significant during the summer due to fire weather concerns.
- Winds in the Fairbanks bowl are usually not enhanced and generally remain light.

continued

- Though not as significant during the winter, this situation can bring significantly warmer temperatures and poor driving conditions due to icy roads.
- Shows that the generic use of “calm winds in the valleys and gusty winds in the hills” will not always convey the conditions.

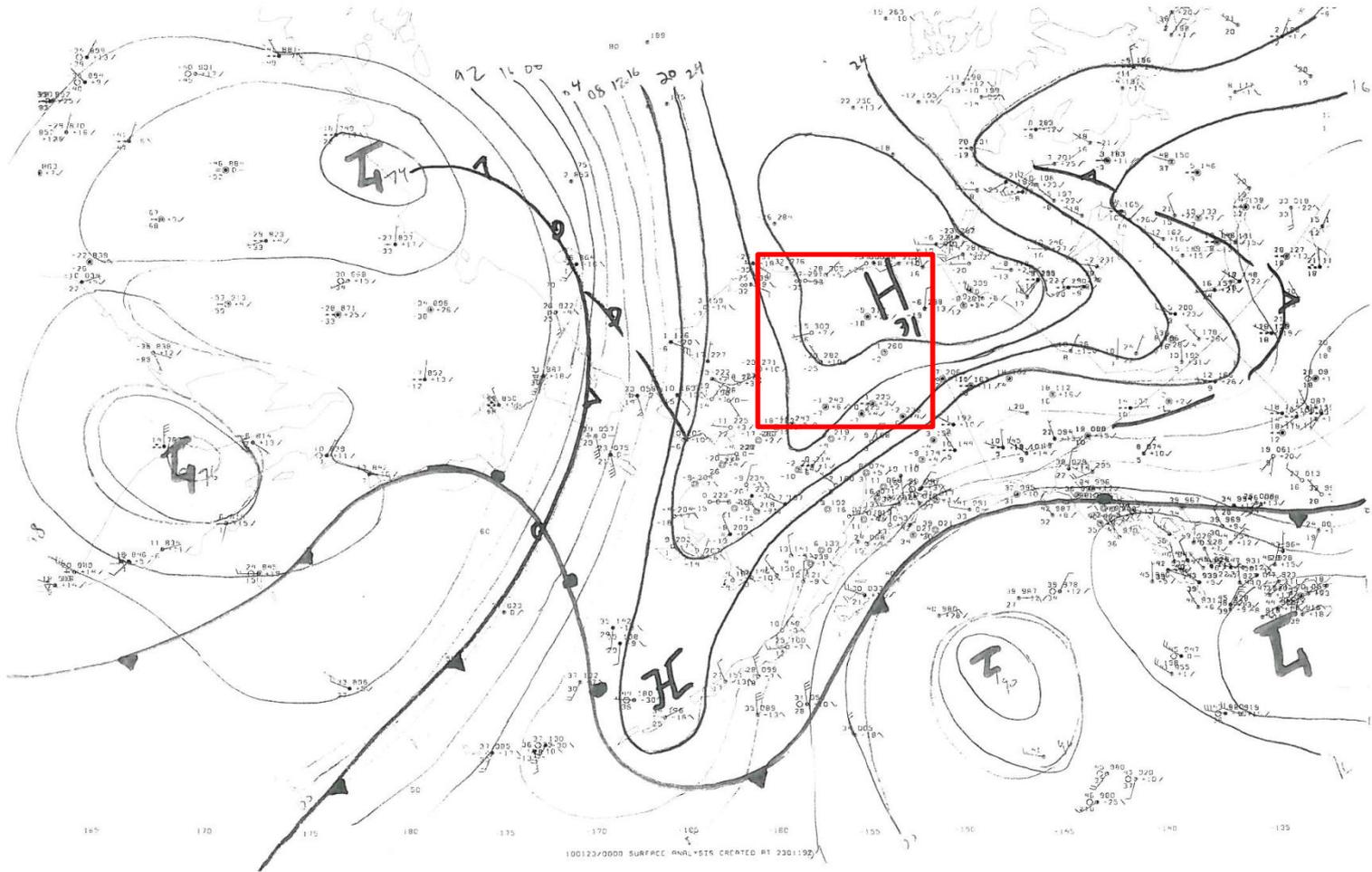
Example

- The attached winter time charts show the ridge building from the Alaska Peninsula up the east coast, then to the northeast across the Brooks Range and becoming quasi-stationary over the eastern Brooks Range.
- The gradient is not very strong across the central interior; however, the winds in the Chatanika and Salcha River drainages were reported by the COOP observers to be in the 10-20 mph hour range and gusty.
- Temperatures in these areas were also 20 to 30 degrees warmer than what was forecast for the area.

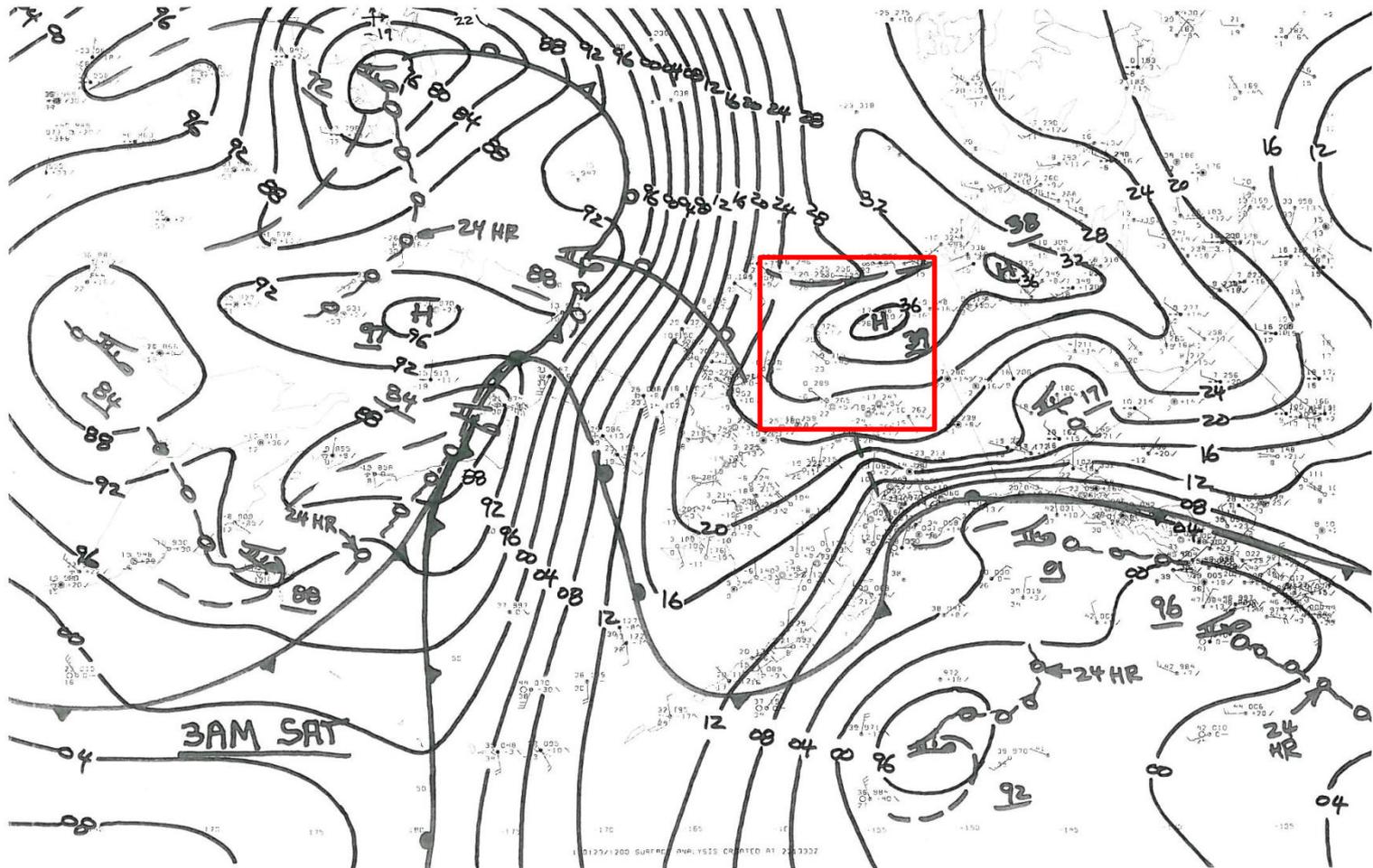
Synoptic Situation

Surface

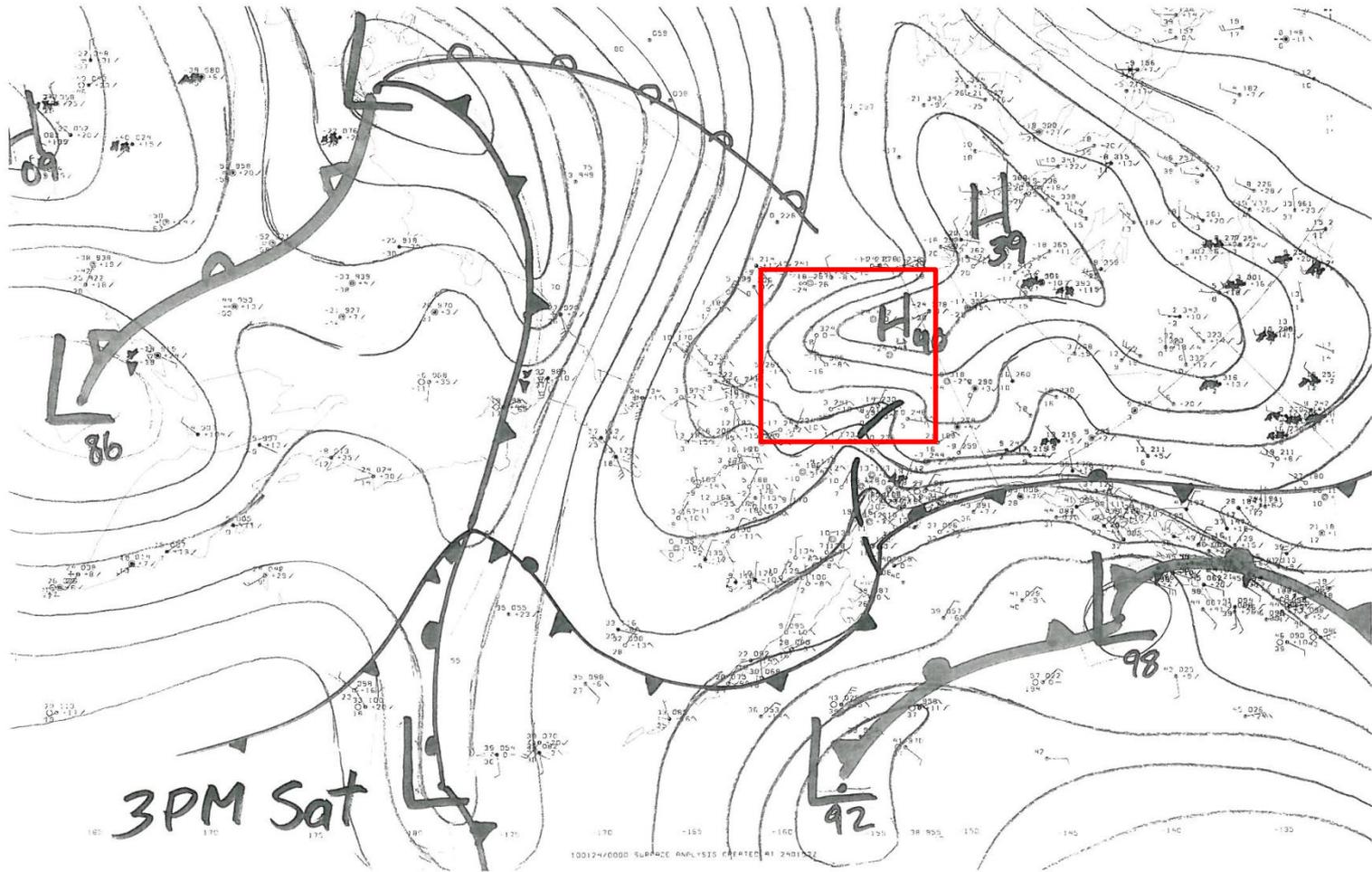
- High pressure at the surface will build across the west coast extending into the eastern Brooks Range to the north of Fairbanks with low pressure to the south, usually stalled in the northern Gulf of Alaska.
- The High will eventually pinch off and settle over the eastern Brooks Range and remain quasi-stationary.
- A seemingly insignificant gradient will develop at the surface, but a strong gradient is not required for the enhancement of the normal drainage winds.



100123/0000



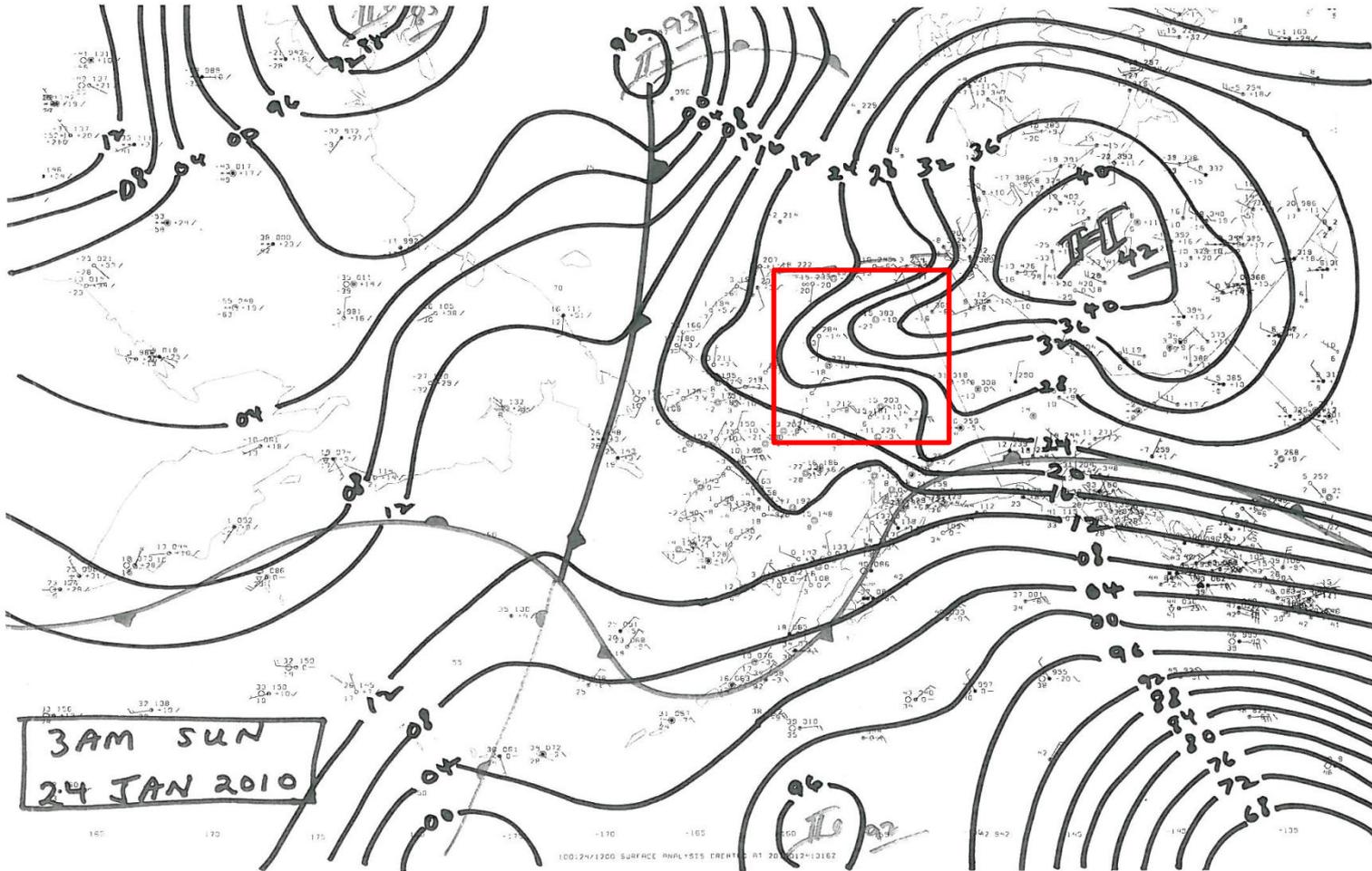
100123/1200

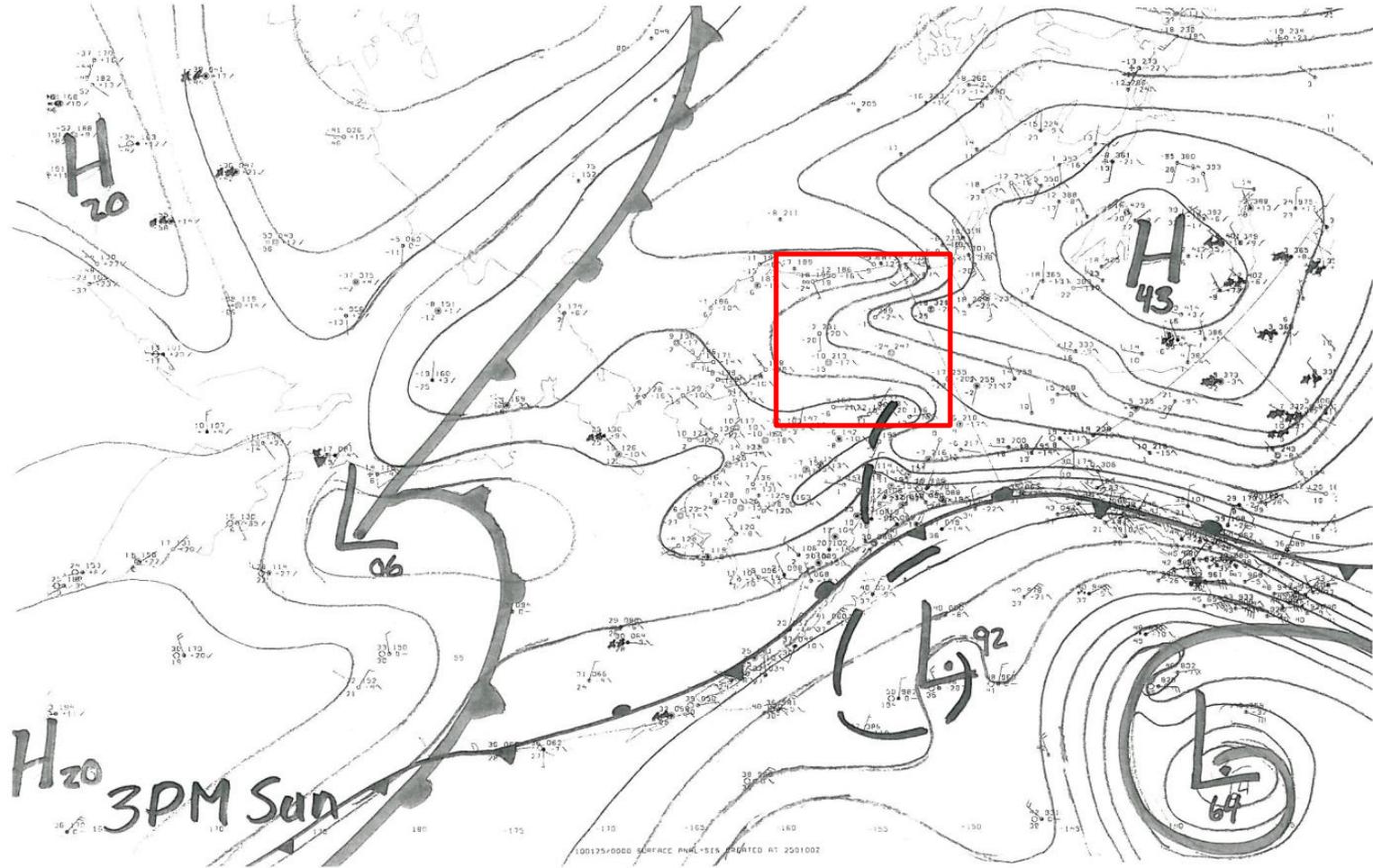


3PM Sat

100124/0000

1001240000 SURFACE ANALYSIS CREATED 41 240127





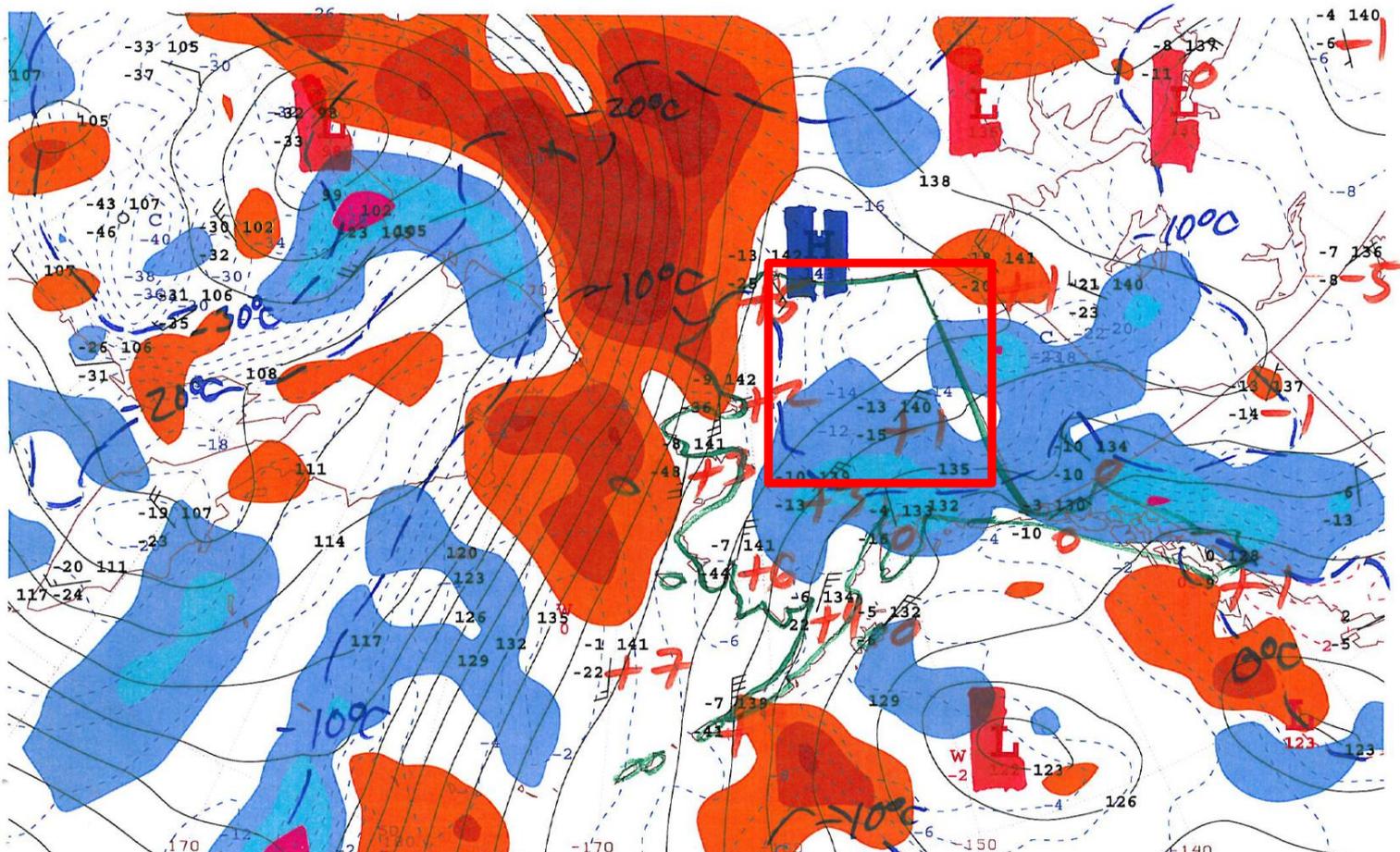
H₂₀ 3PM Sun

100125/0000

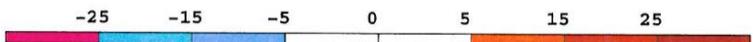
100175/0000 SURFACE PNHLSIS DERIVED AT 250100Z

850 mb

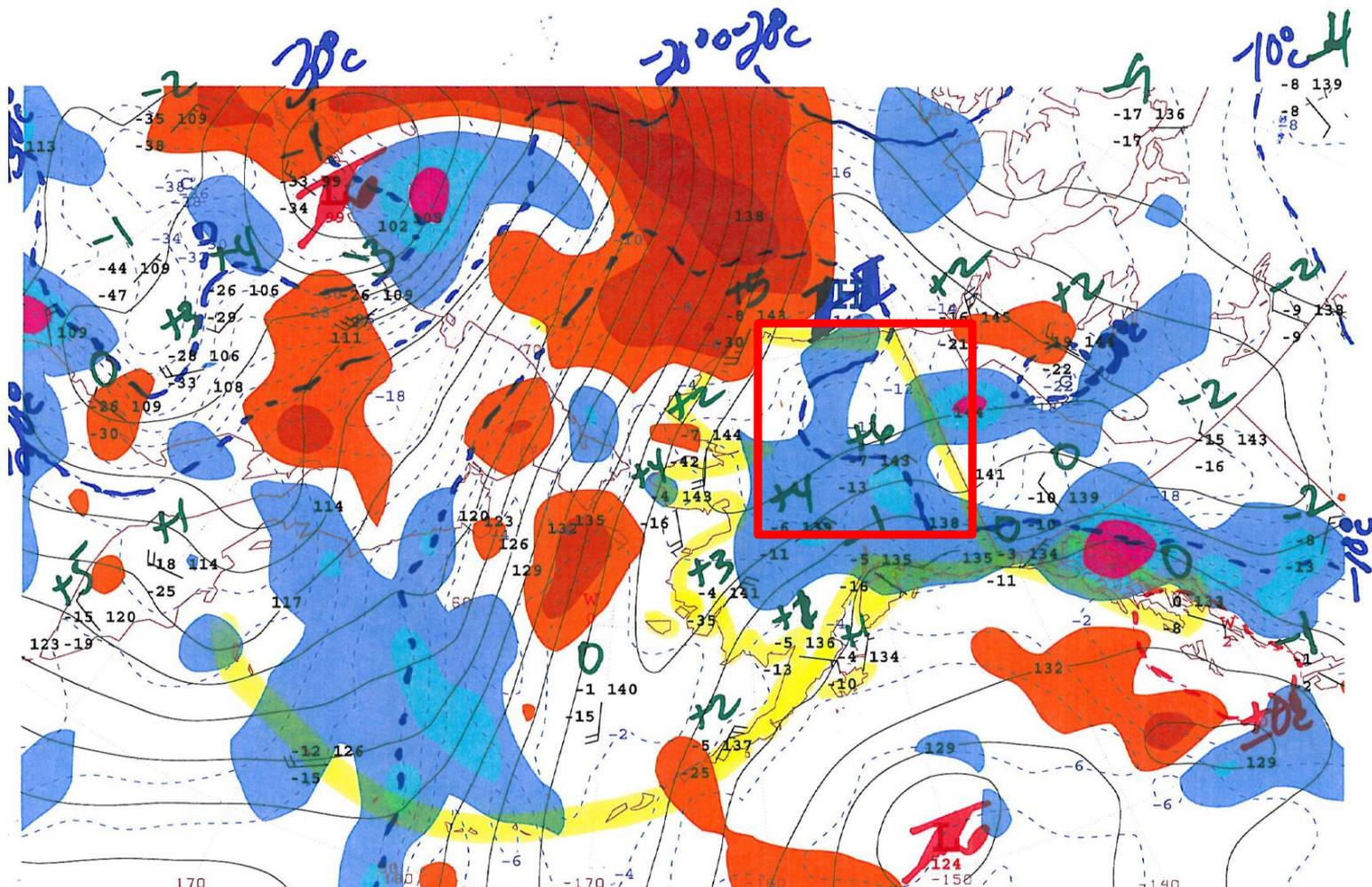
- Moderate flow across the area of 10 to 15 knots.
- A trof extending from the low in the gulf may be present.
- Some thermal gradient may be present between Fairbanks and the Canadian border.



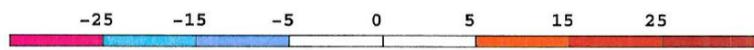
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 TMP ADV (C/5 *10**-5)



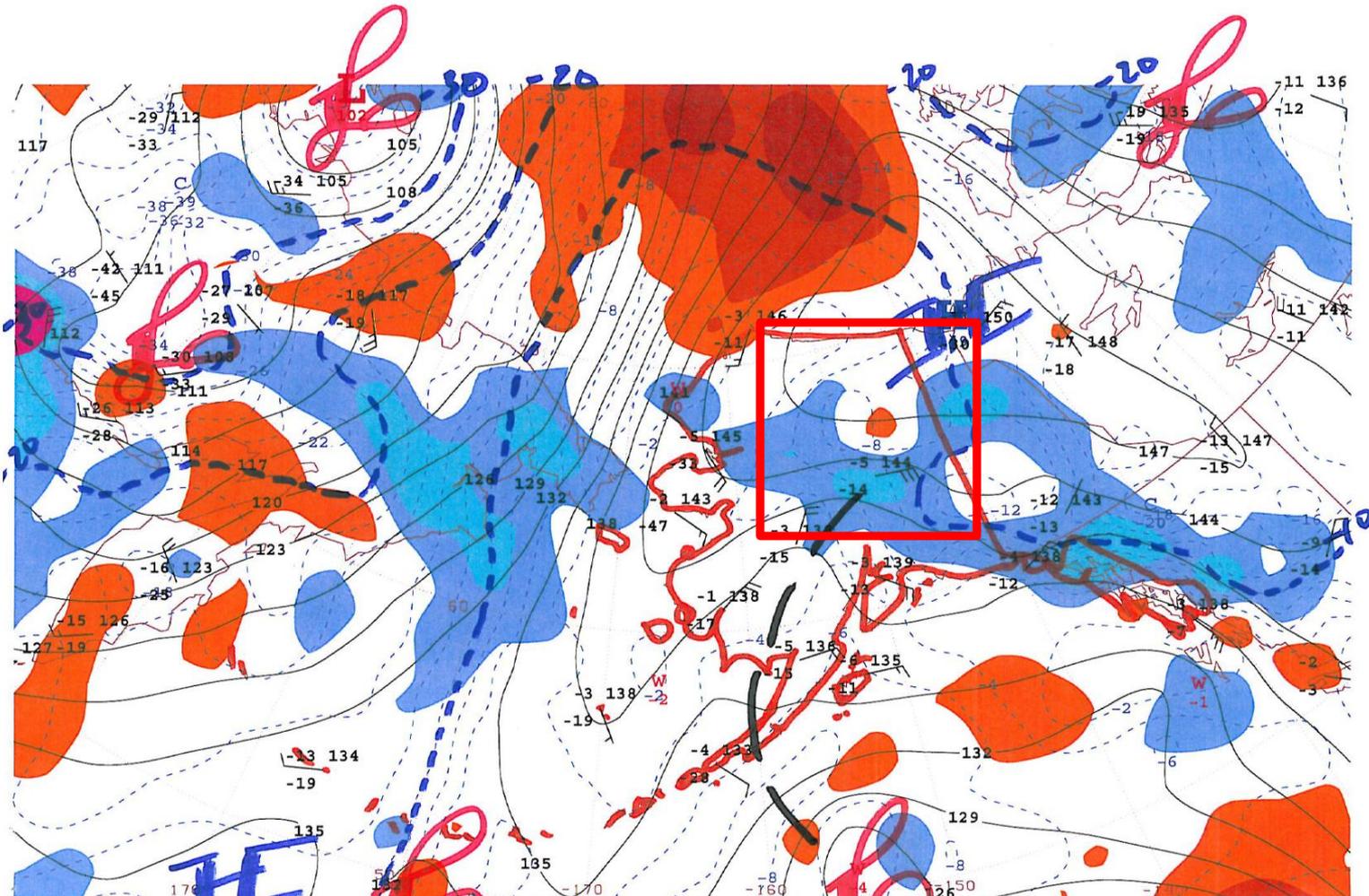
850MB
 3PM FRI



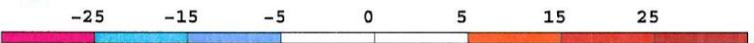
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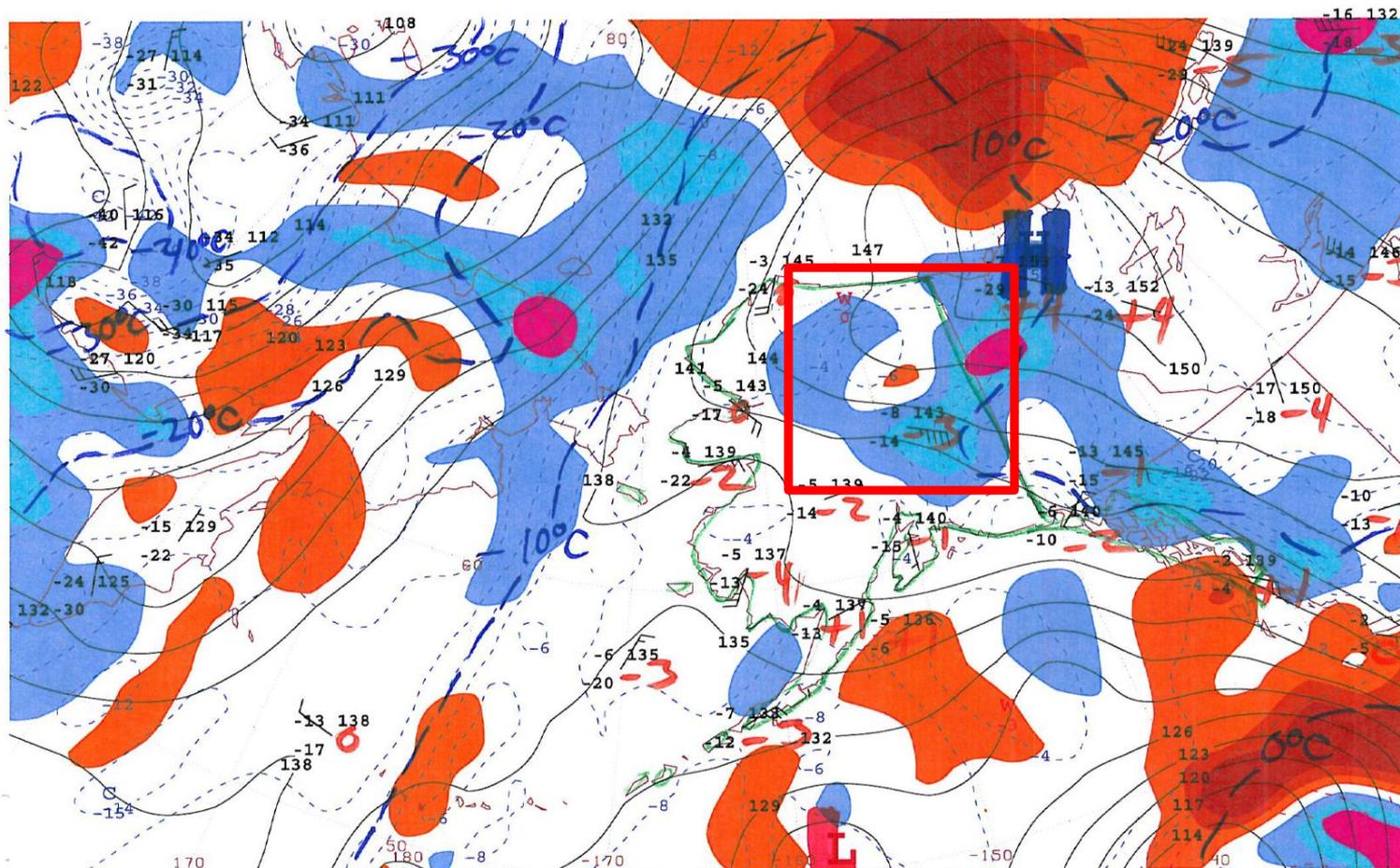
850MB
 3AM SAT



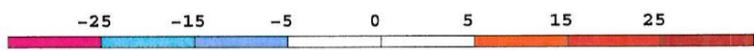
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 TMP ADV (C/B *10**-5)



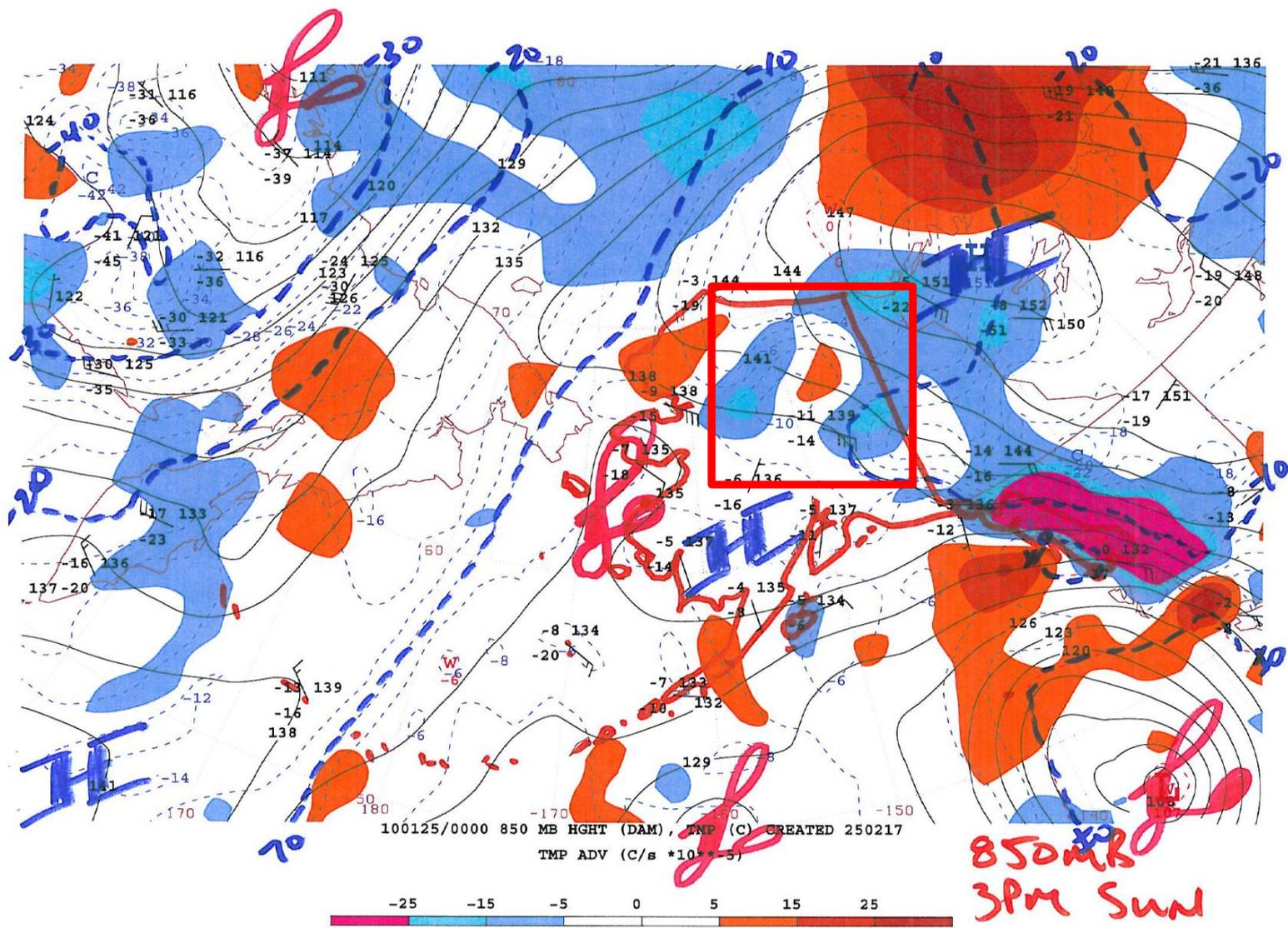
850 MB
 3PM SAT



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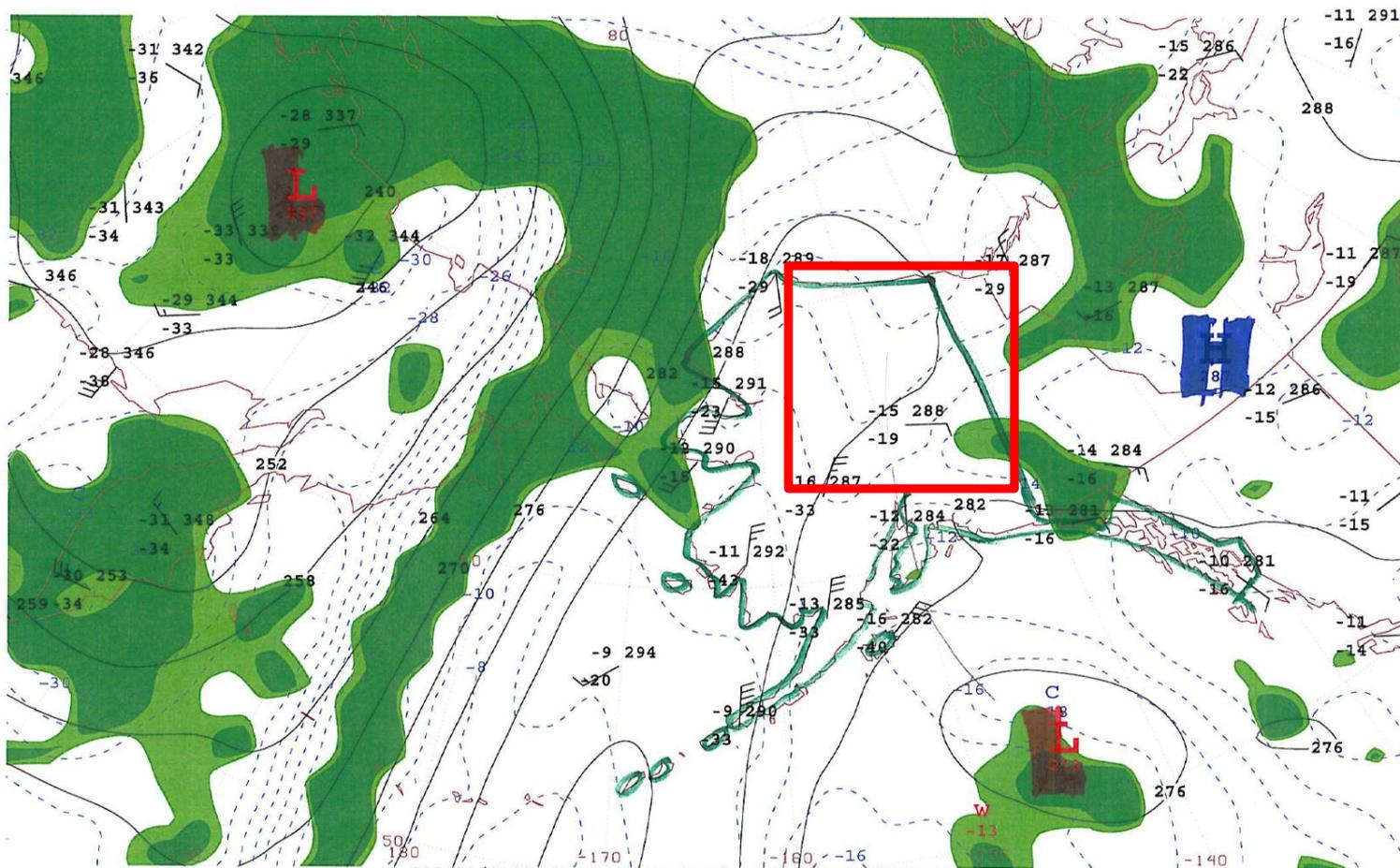


**850MB
 3AM SUN**



700 mb

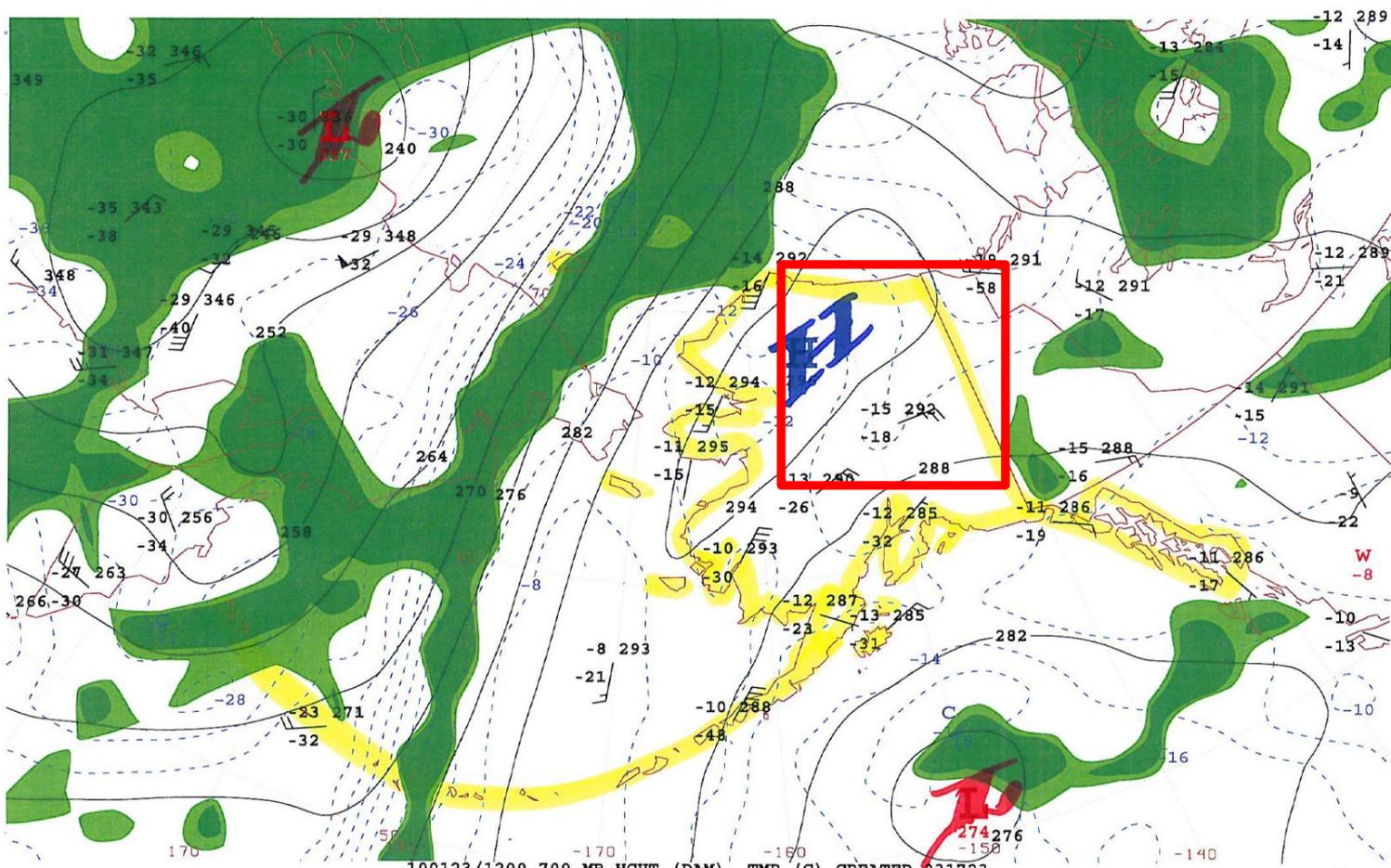
- Moderate flow across the area that increases through time for no apparent reason.
- A trof extending from the low in the gulf may be present.
- No significant thermal gradient is present.



100123/0000 700 MB HGT (DAM), TMP (C) CREATED 230336
 REL HUM (%) (COLOR FILL)



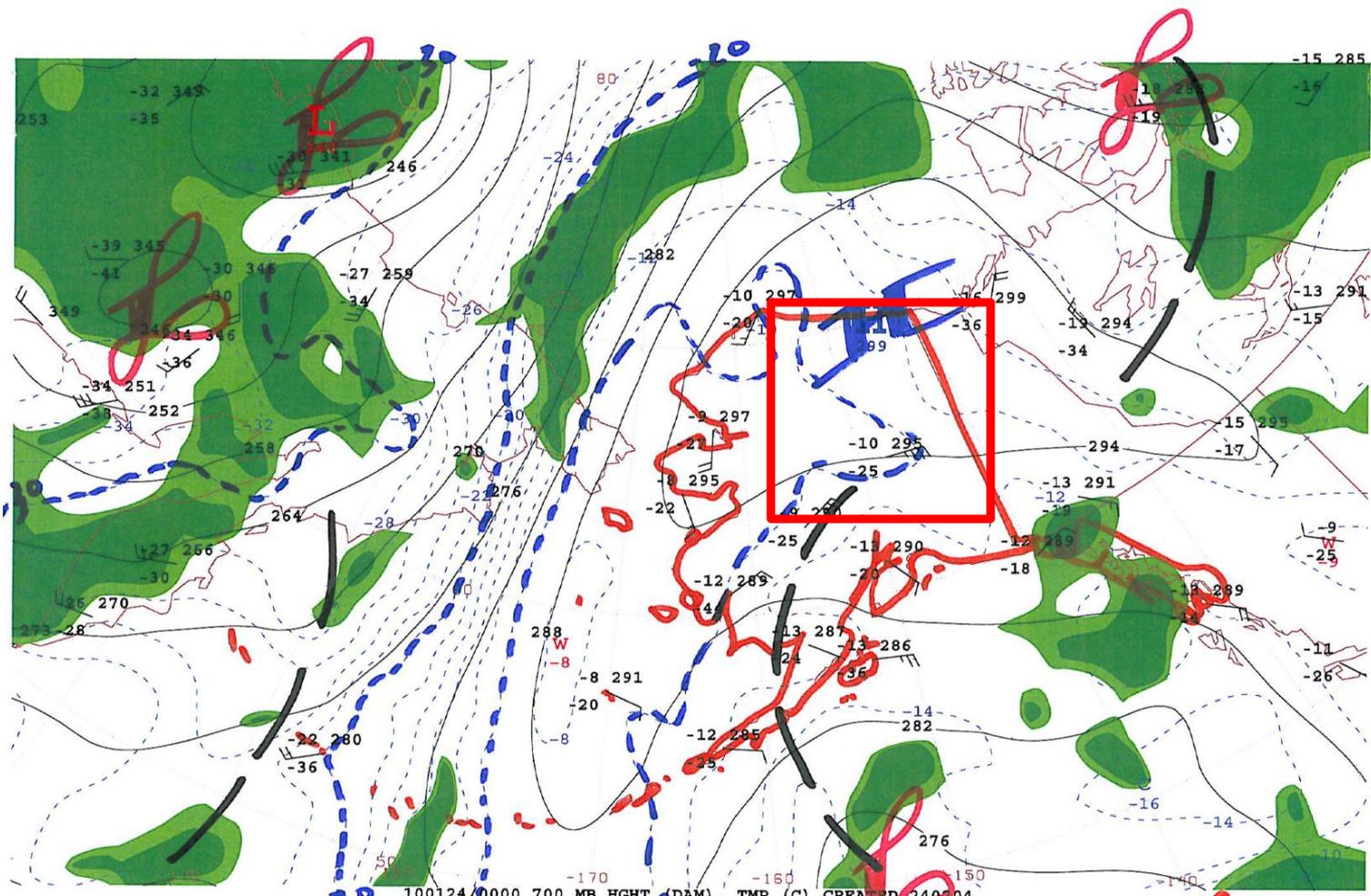
*700MB
 3PM FRI*



100123/1200 700 MB HGHT (DAM), TMP (C) CREATED 231723
 REL HUM (%) (COLOR FILL)

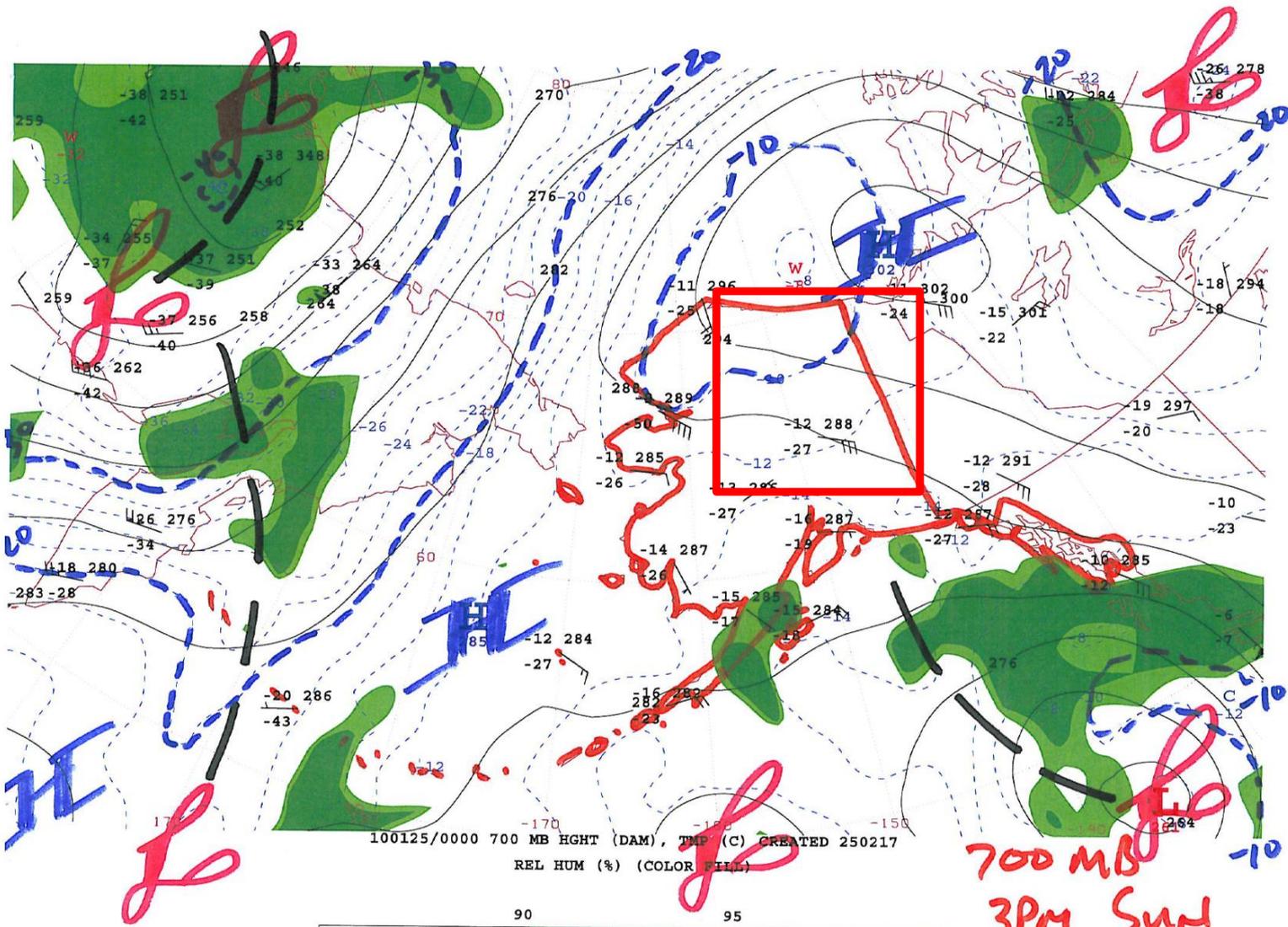


700MB
 3AM SAT



700MB
 3PM SAT

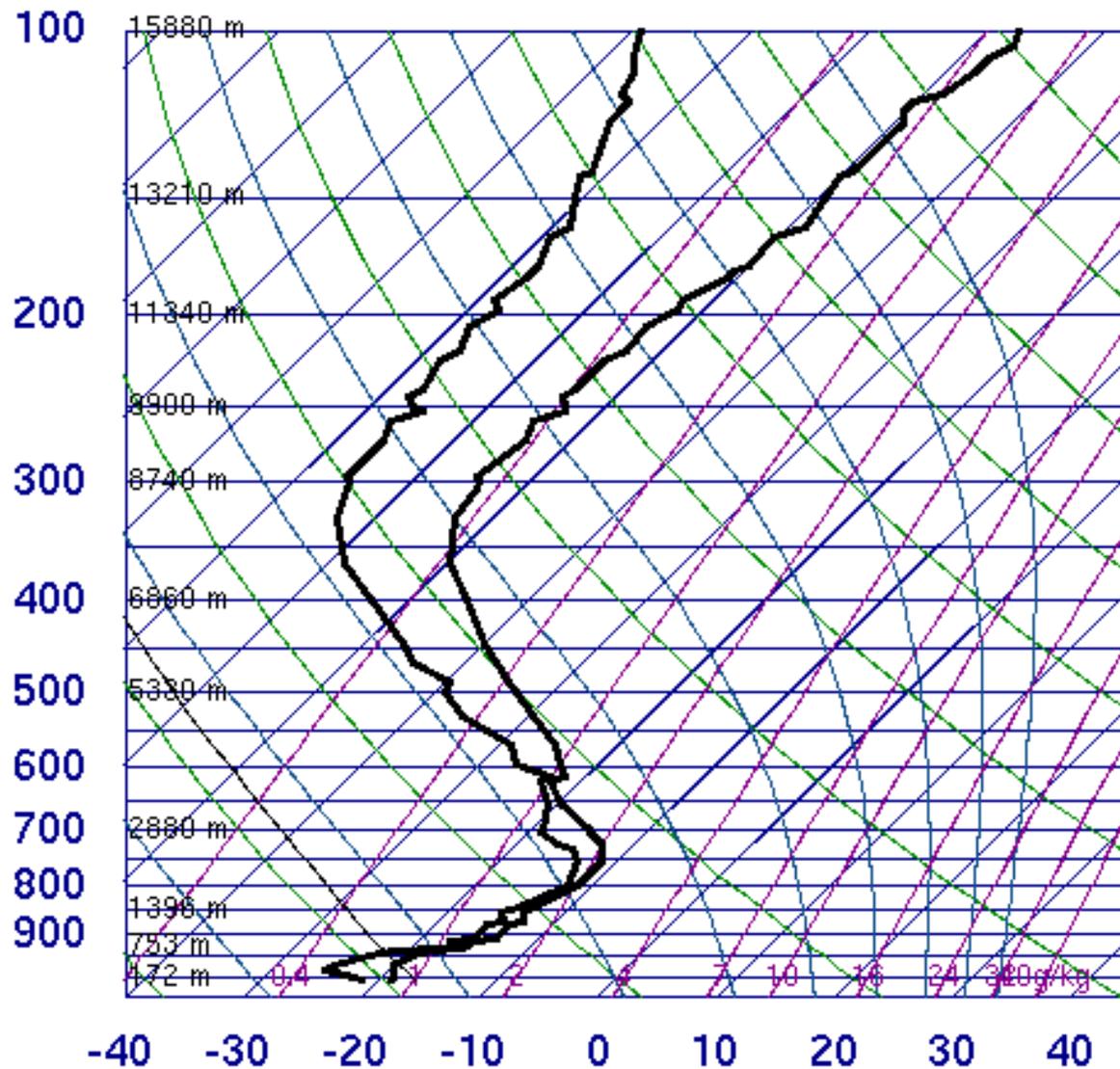




Fairbanks Skew-t

- We can actually see the inversion strengthen through time.
- Winds at the surface remain light, while winds aloft increase from the east-northeast turning east and peaking at about 40 knots.

70261 PAFA Fairbanks



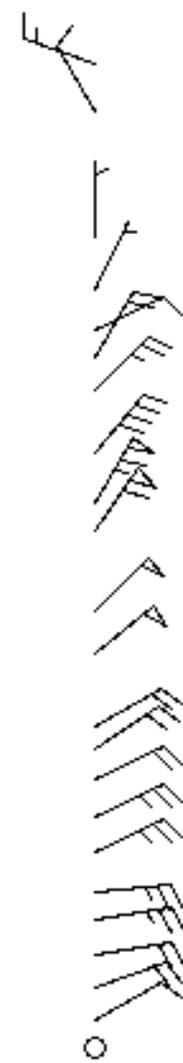
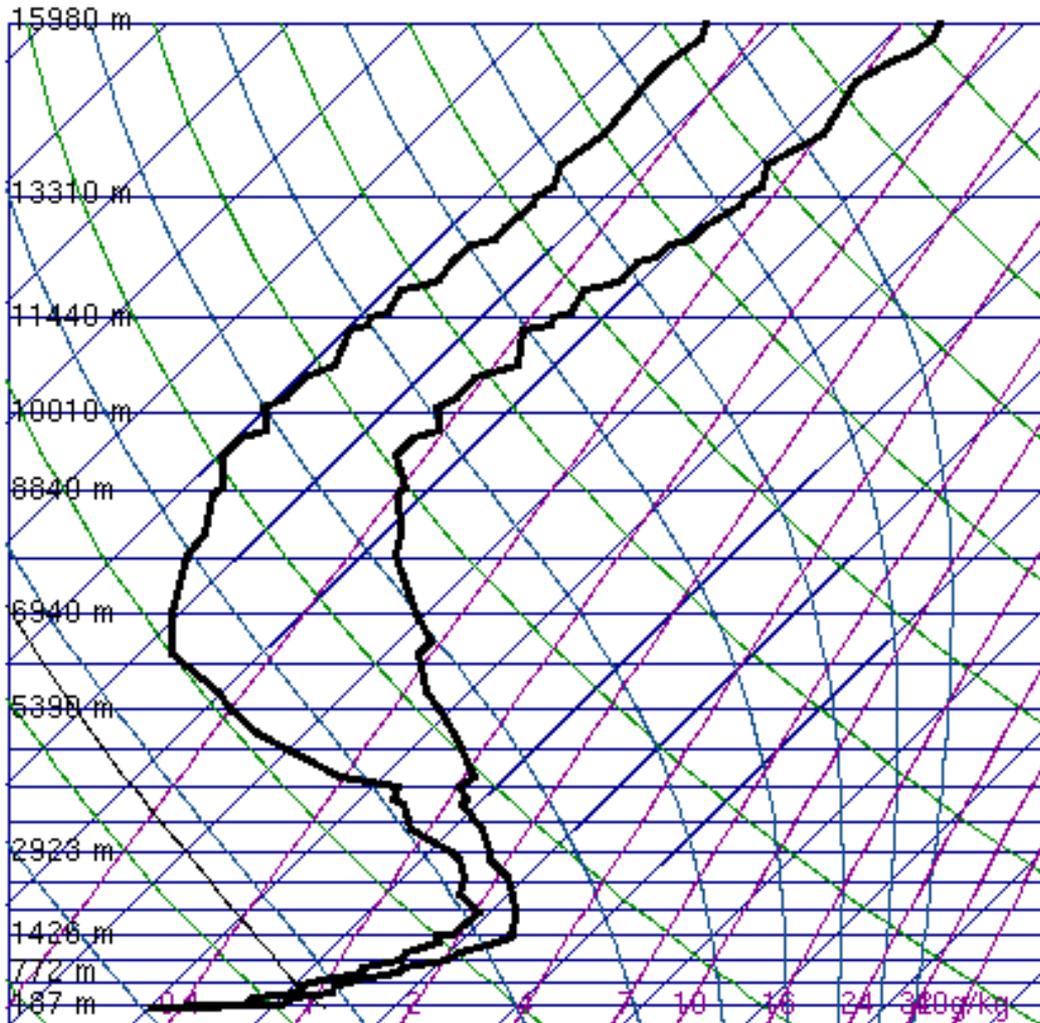
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SLON	-147.86
SELV	138.0
SHOW	13.70
LIFT	28.95
LFTV	28.99
SWET	44.99
KINX	1.00
CTOT	18.20
VTOT	19.80
TOTL	38.00
CAPE	0.00
CAPV	0.00
CINS	0.00
CINV	0.00
EQLV	-9999
EQTV	-9999
LFCT	-9999
LFCV	-9999
BRCH	0.00
BRCV	0.00
LCLT	248.4
LCLP	903.8
MLTH	255.7
MLMR	0.58
THCK	5158.
PWAT	5.88

00Z 23 Jan 2010

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100

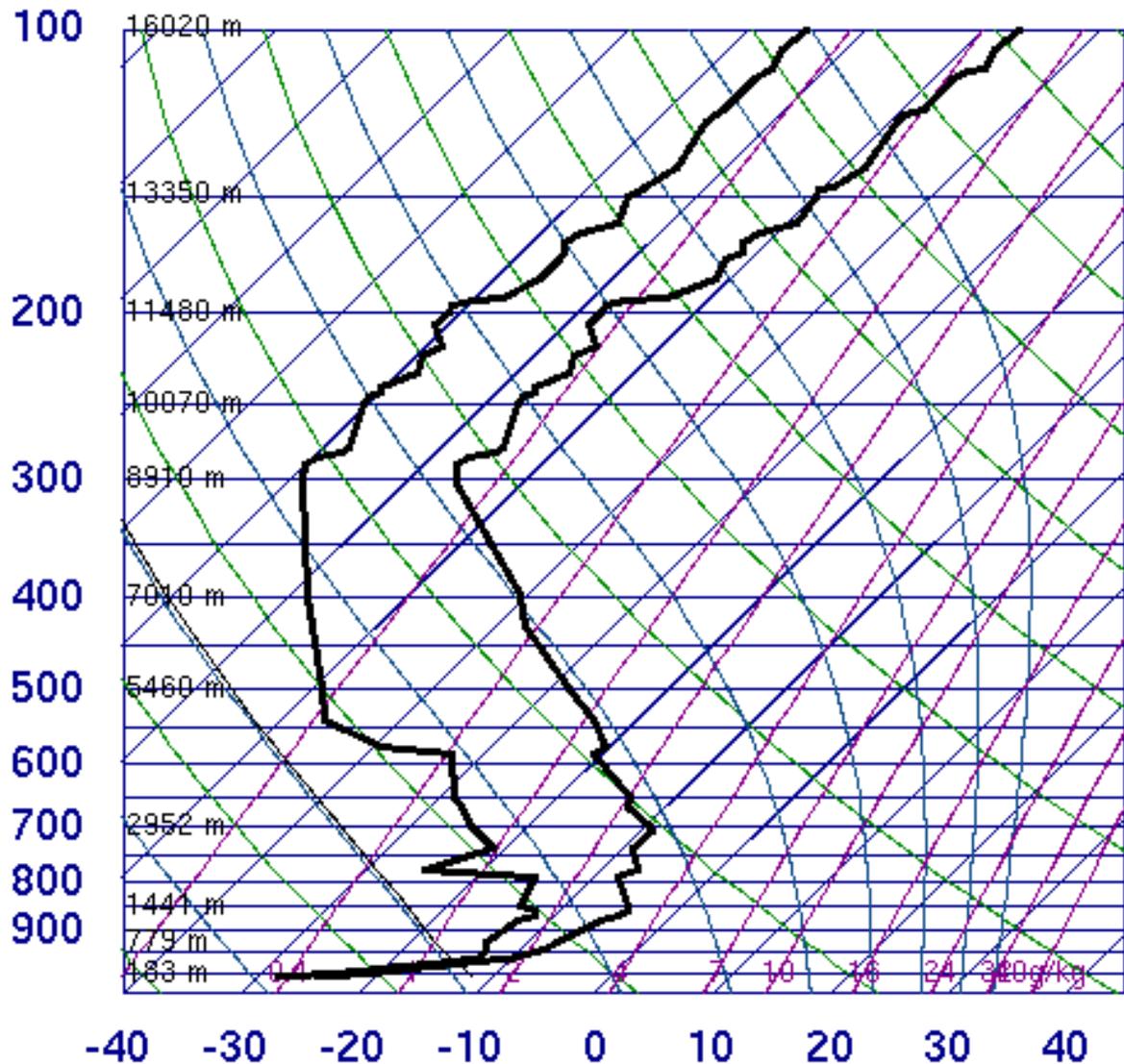


SLAT	64.81
SLON	-147.86
SELV	138.0
SHOW	9.35
LIFT	29.66
LFTV	29.67
SWET	52.00
KINX	8.90
CTOT	18.60
VTOT	24.60
TOTL	43.20
CAPE	0.00
CAPV	0.00
CINS	0.00
CINV	0.00
EQLV	-9999
EQTV	-9999
LFCT	-9999
LFCV	-9999
BRCH	0.00
BRCV	0.00
LCLT	251.5
LCLP	928.7
MLTH	256.9
MLMR	0.75
THCK	5203.
PWAT	5.90

12Z 23 Jan 2010

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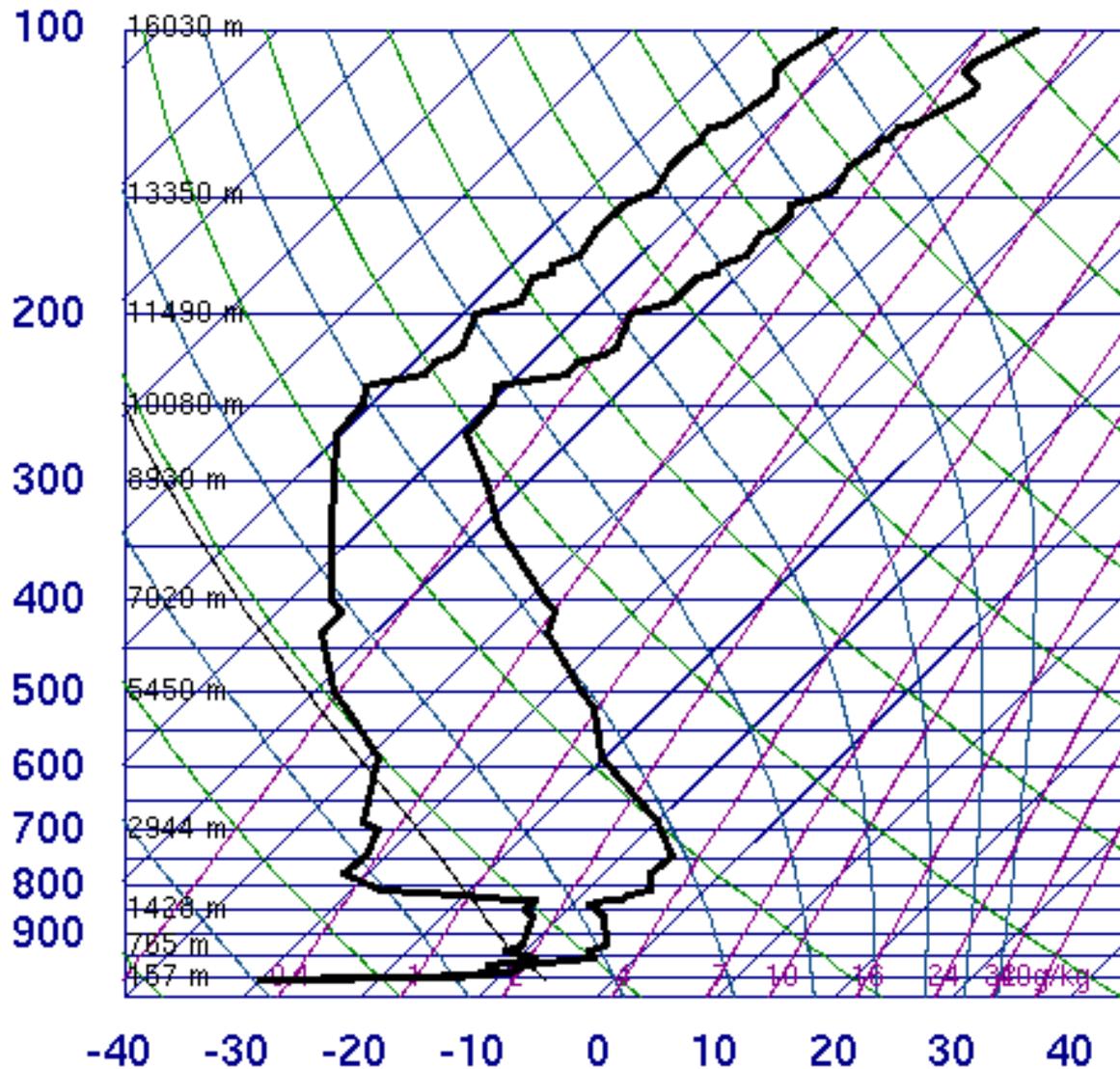


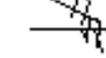
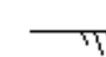
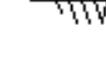
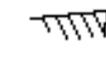
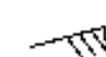
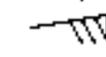
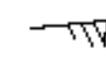
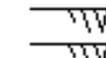
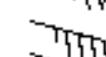
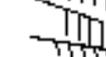
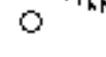
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	SLON	-147.86
	SELV	138.0
	SHOW	11.01
	LIFT	28.69
	LFTV	28.70
	SWET	93.98
	KINX	-5.10
	CTOT	14.60
	VTOT	23.60
	TOTL	38.20
	CAPE	0.00
	CAPV	0.00
	CINS	0.00
	CINV	0.00
	EQLV	-9999
	EQTV	-9999
	LFCT	-9999
	LFCV	-9999
	BRCH	0.00
	BRCV	0.00
	LCLT	255.2
	LCLP	927.9
	MLTH	260.8
	MLMR	1.08
	THCK	5277.
	PWAT	4.92

00Z 24 Jan 2010

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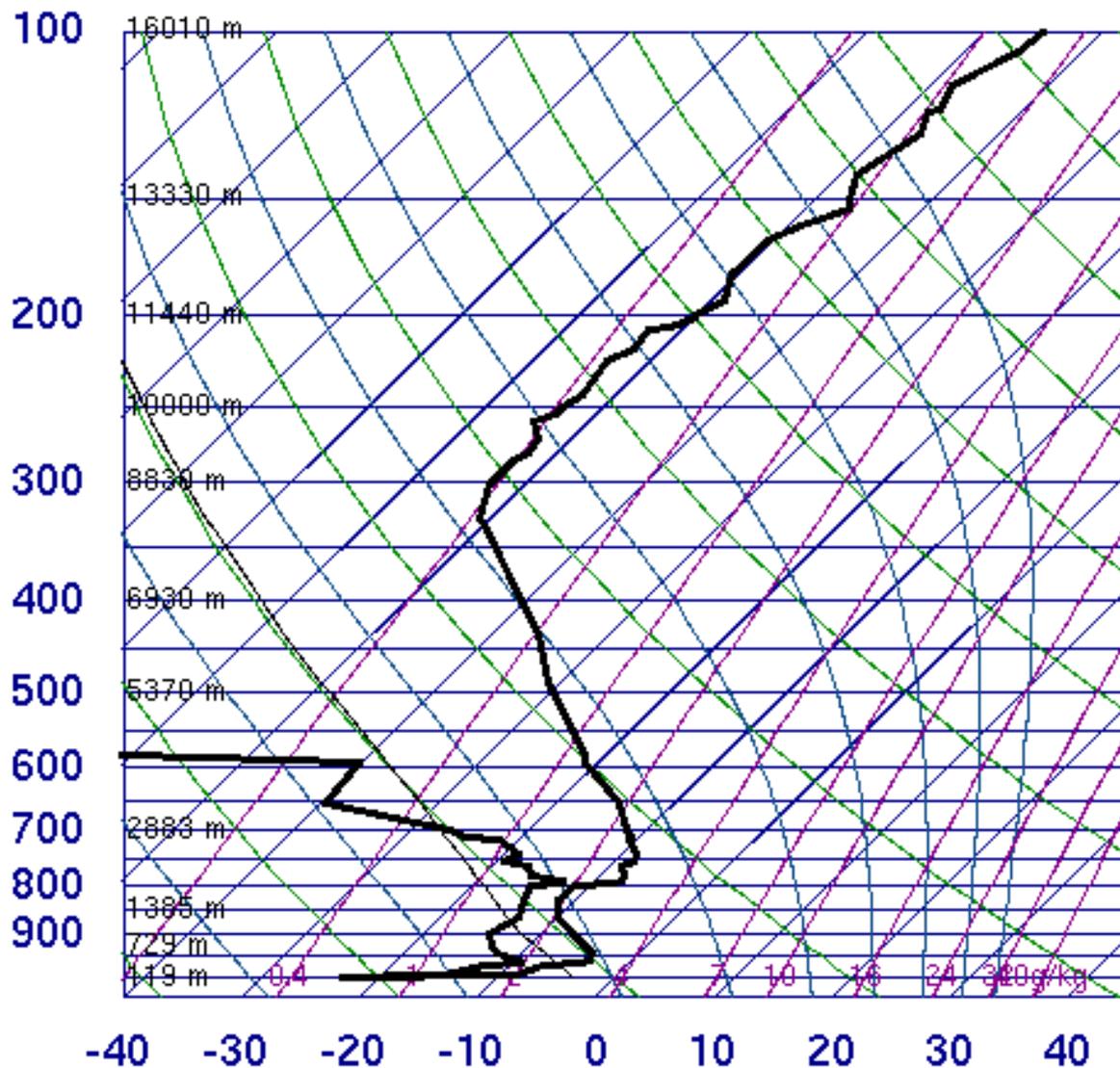


	SLAT	64.81
	SLON	-147.86
	SELV	138.0
	SHOW	14.06
	LIFT	23.27
	LFTV	23.27
	SWET	150.0
	KINX	-17.5
	CTOT	14.00
	VTOT	20.00
	TOTL	34.00
	CAPE	0.00
	CAPV	0.00
	CINS	0.00
	CINV	0.00
	EQLV	-9999
	EQTV	-9999
	LFCT	-9999
	LFCV	-9999
	BRCH	0.00
	BRCV	0.00
	LCLT	260.7
	LCLP	922.0
	MLTH	266.8
	MLMR	1.66
	THCK	5293.
	PWAT	4.48

12Z 24 Jan 2010

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SLAT	64.81
SLON	-147.86
SELV	138.0
SHOW	14.59
LIFT	18.98
LFTV	18.97
SWET	102.9
KINX	-9.70
CTOT	16.00
VTOT	19.00
TOTL	35.00
CAPE	0.00
CAPV	0.00
CINS	0.00
CINV	0.00
EQLV	-9999
EQTV	-9999
LFCT	-9999
LFCV	-9999
BRCH	0.00
BRCV	0.00
LCLT	259.6
LCLP	877.2
MLTH	269.5
MLMR	1.57
THCK	5251.
PWAT	4.63

00Z 25 Jan 2010

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The Forecast

- Initially the forecast appears to be fairly benign with the ridge of high pressure and no significant gradient to hang your hat on, forecasting light winds seems to be a no brainer.
- There is not even a mention of winds at higher elevations in any of the forecasts until the morning (12z) forecast on the 24th.

What was forecast?

AKZ222-231500-
MIDDLE TANANA VALLEY-
INCLUDING...FAIRBANKS...FORT WAINWRIGHT...EIELSON AFB...ESTER...
NORTH POLE...MOOSE CREEK...TWO RIVERS...FOX...CHATANIKA...CHENA
HOT SPRINGS...SOURDOUGH CAMP
253 PM AKST FRI JAN 22 2010

.TONIGHT...MOSTLY CLOUDY WITH A FEW FLURRIES IN THE EVENING...THEN
CLEARING AFTER MIDNIGHT. LOWS 15 BELOW TO 25 BELOW...EXCEPT
AROUND 5 BELOW IN THE HILLS. LIGHT WINDS.
.SATURDAY...MOSTLY CLEAR. HIGHS AROUND 10 BELOW...EXCEPT
AROUND 5 ABOVE IN THE HILLS. LIGHT WINDS.
.SATURDAY NIGHT...MOSTLY CLEAR. LOWS 20 BELOW TO 25 BELOW...EXCEPT
AROUND 5 ABOVE IN THE HILLS. LIGHT WINDS.
.SUNDAY...MOSTLY CLEAR. HIGHS 5 BELOW TO 10 BELOW...EXCEPT
AROUND 5 ABOVE IN THE HILLS. LIGHT WINDS.
.SUNDAY NIGHT...MOSTLY CLEAR. LOWS AROUND 20 BELOW...EXCEPT
AROUND ZERO IN THE HILLS. LIGHT WINDS.
.MONDAY...MOSTLY CLOUDY. HIGHS NEAR 10 BELOW.
.MONDAY NIGHT...PARTLY CLOUDY. LOWS NEAR 20 BELOW.
.TUESDAY...PARTLY CLOUDY. HIGHS NEAR ZERO.
.TUESDAY NIGHT...PARTLY CLOUDY. LOWS NEAR 20 BELOW.
.WEDNESDAY...PARTLY CLOUDY. HIGHS NEAR 5 BELOW.
.WEDNESDAY NIGHT...PARTLY CLOUDY. LOWS NEAR 20 BELOW.
.THURSDAY...MOSTLY CLOUDY. HIGHS NEAR 15 BELOW.
.THURSDAY NIGHT...MOSTLY CLOUDY. LOWS NEAR 20 BELOW.
.FRIDAY...PARTLY CLOUDY. HIGHS NEAR 15 BELOW.

&&

	TEMPERATURE				/	PRECIPITATION			
FAIRBANKS	-19	-10	-22	-8	/	0	0	0	0

AKZ222-240245-

MIDDLE TANANA VALLEY-

INCLUDING...FAIRBANKS...FORT WAINWRIGHT...EIELSON AFB...ESTER...
NORTH POLE...MOOSE CREEK...TWO RIVERS...FOX...CHATANIKA...CHENA
HOT SPRINGS...SOURDOUGH CAMP
245 AM AKST SAT JAN 23 2010

.TODAY...MOSTLY CLEAR. HIGHS 10 BELOW TO 10 ABOVE ZERO...WARMEST
IN THE HILLS. LIGHT WINDS.

.TONIGHT...CLEAR. LOWS 15 BELOW TO 20 BELOW ZERO...EXCEPT AROUND
5 ABOVE IN THE HILLS. LIGHT WINDS.

.SUNDAY...CLEAR. HIGHS 5 BELOW TO 10 ABOVE ZERO...WARMEST IN THE
HILLS. LIGHT WINDS.

.SUNDAY NIGHT...MOSTLY CLEAR. LOWS AROUND 20 BELOW ZERO...EXCEPT
AROUND ZERO IN THE HILLS. LIGHT WINDS.

.MONDAY...MOSTLY CLOUDY. HIGHS 5 BELOW TO ZERO. LIGHT WINDS.

.MONDAY NIGHT...PARTLY CLOUDY. LOWS NEAR 20 BELOW.

.TUESDAY...PARTLY CLOUDY. HIGHS NEAR ZERO.

.TUESDAY NIGHT...PARTLY CLOUDY. LOWS NEAR 20 BELOW.

.WEDNESDAY...PARTLY CLOUDY. HIGHS NEAR 5 BELOW.

.WEDNESDAY NIGHT...PARTLY CLOUDY. LOWS NEAR 20 BELOW.

.THURSDAY...MOSTLY CLOUDY. HIGHS NEAR 15 BELOW.

.THURSDAY NIGHT...MOSTLY CLOUDY. LOWS NEAR 20 BELOW.

.FRIDAY...PARTLY CLOUDY. HIGHS NEAR 15 BELOW.

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	TEMPERATURE	/	PRECIPITATION
FAIRBANKS	-5 -20 -4	/	0 0 0

AKZ222-241430-

MIDDLE TANANA VALLEY-

INCLUDING...FAIRBANKS...FORT WAINWRIGHT...EIELSON AFB...ESTER...

NORTH POLE...MOOSE CREEK...TWO RIVERS...FOX...CHATANIKA...CHENA

HOT SPRINGS...SOURDOUGH CAMP

224 PM AKST SAT JAN 23 2010

.TONIGHT...CLEAR. LOWS 15 BELOW TO 25 BELOW...EXCEPT AROUND
5 ABOVE IN THE HILLS. LIGHT WINDS.

.SUNDAY...CLEAR. HIGHS 5 BELOW TO 5 ABOVE...WARMEST IN THE
HILLS. LIGHT WINDS.

.SUNDAY NIGHT...MOSTLY CLEAR. LOWS AROUND 20 BELOW...EXCEPT
AROUND ZERO IN THE HILLS. LIGHT WINDS.

.MONDAY...MOSTLY CLOUDY. HIGHS 5 BELOW TO ZERO. EAST WINDS
10 TO 15 MPH.

.MONDAY NIGHT...PARTLY CLOUDY. LOWS 20 BELOW TO 25 BELOW.
LIGHT WINDS.

.TUESDAY...PARTLY CLOUDY. HIGHS NEAR 10 BELOW.

.TUESDAY NIGHT...PARTLY CLOUDY. LOWS NEAR 20 BELOW.

.WEDNESDAY...PARTLY CLOUDY. HIGHS NEAR 5 BELOW.

.WEDNESDAY NIGHT...PARTLY CLOUDY. LOWS NEAR 20 BELOW.

.THURSDAY...MOSTLY CLOUDY. HIGHS NEAR 15 BELOW.

.THURSDAY NIGHT...MOSTLY CLOUDY. LOWS NEAR 20 BELOW.

.FRIDAY...PARTLY CLOUDY. HIGHS NEAR 15 BELOW.

.FRIDAY NIGHT...PARTLY CLOUDY. LOWS NEAR 25 BELOW.

.SATURDAY...PARTLY CLOUDY. HIGHS NEAR 15 BELOW.

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	TEMPERATURE				/	PRECIPITATION			
FAIRBANKS	-21	-4	-19	-4	/	0	0	0	0

AKZ222-250300-

MIDDLE TANANA VALLEY-

INCLUDING...FAIRBANKS...FORT WAINWRIGHT...EIELSON AFB...ESTER...

NORTH POLE...MOOSE CREEK...TWO RIVERS...FOX...CHATANIKA...CHENA

HOT SPRINGS...SOURDOUGH CAMP

252 AM AKST SUN JAN 24 2010

.TODAY...CLEAR. HIGHS 5 BELOW TO 15 ABOVE ZERO...WARMEST IN THE HILLS. EAST WINDS 5 TO 15 MPH WITH GUSTS TO 25 MPH OVER THE HILLS.

.TONIGHT...PARTLY CLOUDY. LOWS 15 BELOW TO 20 BELOW ZERO...EXCEPT AROUND ZERO IN THE HILLS. LIGHT WINDS.

.MONDAY...PARTLY CLOUDY. HIGHS 5 BELOW TO 10 ABOVE...WARMEST IN THE HILLS. LIGHT WINDS.

.MONDAY NIGHT...PARTLY CLOUDY. LOWS 15 BELOW TO 25 BELOW ZERO. LIGHT WINDS.

.TUESDAY...MOSTLY CLEAR. HIGHS AROUND 5 BELOW. LIGHT WINDS.

.TUESDAY NIGHT...CLEAR. LOWS NEAR 15 BELOW.

.WEDNESDAY...PARTLY CLOUDY. HIGHS NEAR 5 BELOW.

.WEDNESDAY NIGHT...MOSTLY CLOUDY. LOWS NEAR 15 BELOW.

.THURSDAY...CLOUDY. HIGHS NEAR 10 BELOW.

.THURSDAY NIGHT...MOSTLY CLOUDY. LOWS NEAR 20 BELOW.

.FRIDAY...PARTLY CLOUDY. HIGHS NEAR 10 BELOW.

.FRIDAY NIGHT...MOSTLY CLOUDY. LOWS NEAR 20 BELOW.

.SATURDAY...PARTLY CLOUDY. HIGHS NEAR 5 BELOW.

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	TEMPERATURE	/	PRECIPITATION
FAIRBANKS	0 -19 -5	/	0 0 0

AKZ222-251415-

MIDDLE TANANA VALLEY-

INCLUDING...FAIRBANKS...FORT WAINWRIGHT...EIELSON AFB...ESTER...
NORTH POLE...MOOSE CREEK...TWO RIVERS...FOX...CHATANIKA...CHENA
HOT SPRINGS...SOURDOUGH CAMP
213 PM AKST SUN JAN 24 2010

.TONIGHT...MOSTLY CLEAR. LOWS 15 BELOW TO 20 BELOW...EXCEPT
AROUND 10 ABOVE IN THE HILLS. LIGHT WINDS.
.MONDAY...MOSTLY CLEAR. HIGHS 10 BELOW TO 15 ABOVE...WARMEST
IN THE HILLS. LIGHT WINDS.
.MONDAY NIGHT...PARTLY CLOUDY. LOWS 15 TO 25 BELOW IN VALLEYS
AND 5 TO 10 ABOVE IN THE HILLS. LIGHT WINDS.
.TUESDAY...MOSTLY CLEAR. HIGHS 10 BELOW TO 15 ABOVE...WARMEST IN
THE HILLS. NORTHEAST WINDS TO 15 MPH.
.TUESDAY NIGHT...MOSTLY CLEAR. LOWS 10 BELOW TO 25 BELOW.
NORTHEAST WINDS 10 TO 15 MPH.
.WEDNESDAY...PARTLY CLOUDY. HIGHS NEAR 5 BELOW.
.WEDNESDAY NIGHT...MOSTLY CLOUDY. LOWS NEAR 15 BELOW.
.THURSDAY...CLOUDY. HIGHS NEAR 10 BELOW.
.THURSDAY NIGHT...MOSTLY CLOUDY. LOWS NEAR 15 BELOW.
.FRIDAY...PARTLY CLOUDY. HIGHS NEAR 10 BELOW.
.FRIDAY NIGHT...MOSTLY CLOUDY. LOWS NEAR 20 BELOW.
.SATURDAY...PARTLY CLOUDY. HIGHS NEAR 5 BELOW.
.SATURDAY NIGHT...MOSTLY CLOUDY. LOWS NEAR 15 BELOW.
.SUNDAY...MOSTLY CLOUDY. HIGHS NEAR 5 BELOW.

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	TEMPERATURE				/	PRECIPITATION			
FAIRBANKS	-18	-7	-24	-9	/	0	0	0	0

Observed Conditions on Local ASOS's

- During the time frame (21-25 Jan) covered here, the following occurred at local sites:
 - Fairbanks high temperatures remained fairly steady from 0 to -10, lows were -15 to -26, with peak winds from the northeast to 7 mph.
 - Eielson AFB high temperatures remained steady from -18 to -23, lows were -25 to -30, peak winds were 6 mph or less.

Observed Conditions at COOP sites in the drainages

- Mile 42 Steese Highway observer at 8am on the 23rd reported -1 at observation time. The 8am report on the 24th shows a high for the 23rd of 26 above. It was also reported by the observer (in the local shift log) that the wind had come up quit strong (wind sock standing out) and gusting from the Northeast.
- Salcha observer reported at 9pm on the 23rd a temperature of -16. They then report a high on the 24th of 22 above with moderate winds. They also indicate the temperature rose rapidly in the evening with the wind.

The Forecast in Retrospect

- Light winds did prevail over the area, however, drainage winds were enhanced from the northeast down the Chatanika, Chena, and Salcha rivers.
- Winds in those areas were 10-15 mph higher than would usually be forecast, and gusty.
- Temperatures were also much warmer in the drainages than what was forecast for the remainder of the area. The difference can really be seen between the Salcha and Eielson AFB high temperatures reported on the 24th and 25th. Salcha reported 22 and 23 above respectively while Eielson AFB reported 19 below both days.

continued

- Using the generic “calm winds in the valleys and gusty winds in the hills” will not always cover the forecast area.
- The use of language implying stronger winds and warmer temperatures in the Chatanika river, upper Chena river, and Salcha river drainages would better convey what is occurring in the zone since few people live in the hills.

Verification Issues

- The biggest issue with verification in these situations is lack of ground truth.
- During the summer months there are RAWS sites on the Chena river at Angel Creek (AGLA2), the Salcha upriver from Richardson highway bridge (SLRA2), and near the Chatanika river there are 3 useful sites, downstream of the Elliot Highway (CHTA2) approximately 30 miles northwest of Fairbanks, 2 miles North of Chatanika (CHPA2) and 5 miles north of Chatanika at Caribou Peak (CPKA2) that can be used. Some indication of increased winds may also be seen on the Nome Creek RAWS (NOCA2).
- The best ground truth comes from our COOP observers in the area. The Lower Chatanika, Mile 42 Steese Highway, and Salcha observers can be very helpful in these situations. A quick call to them can verify the stronger than expected winds and during the winter the much warmer temperatures.

Observation Locations



Significance

- Warmer and windier conditions than forecast can be significant in the winter time as outdoor enthusiasts use our forecasts as a guide to recreational opportunities.
- It can also effect driving conditions around the area. Windy conditions down the drainages could bring poor driving conditions due to blowing or drifting snow, and poor road conditions as the temperatures rise.
- During the summer months, under forecasting the winds in these drainages can be especially significant during the fire weather season. Fires near the drainages can be enhanced by the higher than expected winds, and lower than expected humidity, allowing them to spread faster and farther.

What to look for?

- Watch for the ridge moving over and become quasi-stationary in the eastern Brooks Range.
- No significant gradient is required, but there should be a northeast to east flow.
- Strong inversion over the Fairbanks area as indicated on the Skew-T.
- Have the Public desk ask COOP observers for additional information (i.e. what does moderate breeze mean, etc...).
- If you think it may be occurring, have the Public desk call the COOP observers.