

# ASSESSMENT OF THE APRIL 20<sup>th</sup> 1997 TORNADO/GUSTNADO IN SOUTHEAST BOISE

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## INTRODUCTION

A small tornado, confirmed by NWS survey members, occurred in Southeast Boise on April 20<sup>th</sup>, 1997. This storm was associated with a fast moving surface cold front and low topped convective elements along the frontal surface. The developing squall line took on an accelerating Bow Echo appearance as the line progressed through Ada County to the Eastern end of the city of Boise. While no severe signatures were detected on radar, low level horizontal vorticity due to low level wind shear could allow the rapid spin-up and vorticity stretching causing a tornado or gustnado to occur. This would most likely form on the leading edge of the line near the gust front and area of maximum low level convergence. These conditions are favorable for the development of land spout Tornadoes, which develop under strong updrafts but are not necessarily associated with supercell thunderstorms. Another possibility is a Gustnado or Tornado without any connection to an updraft. These types of Tornadoes are not well understood.

## SYNOPTIC SETTING

A strong fast moving cold front was moving into the Treasure Valley between 9am and 11am MDT on April 20<sup>th</sup>, 1997. (attachment #1). The atmosphere in advance of the front was somewhat moist and conditionally unstable. Modified soundings using the **SHARP** workstation produced cape values of 300 J/KG for Boise and about 800 J/KG for the Twin Falls area with the assumption that temperatures would warm into the lower 60s. SR-helicity values of 207m<sup>2</sup>/s<sup>2</sup> were produced from the 12z Boise sounding. A powerful North Pacific jetstream was moving into the region from Central Oregon and was oriented nearly perpendicular to the cold frontal position. At least one 130kt isotach was associated with the jet axis and the Treasure Valley was located in the left front exit region of this strong wind core.

More impressive, as seen later on SRM four panel displays, was the strong rear inflow into the developing line along the front. These conditions allowed a segment of the front to bow ahead of the rest of the front, accelerating and assuming squall line characteristics. This pattern, although fairly uncommon in the Intermountain West, is a familiar regime in many other parts of the country. ( Figure #1). Velocity data showed a large area of 35-50 knot winds inbound to the radar, with isolated winds in excess of 50 knots being depicted. (Figure #2).

## **OBSERVATIONS AND STORM SPOTTER REPORTS**

As the line passed the observing sensors at Ontario, Caldwell and Boise, peak recorded wind gusts were around 36 knots or 42 mph. Spotter report estimates were mostly in the 35-45 mph range with estimates of 50 mph becoming more common as the line advanced through Ada County. Most **RAWS** station reports at lower elevations were consistent with these readings. Also, a spotter 6 miles north of Emmett measured 52 mph winds at an elevation of 800 feet above the valley floor. Lightning detection equipment did not record any lightning strikes in Idaho ( LA1 charts) during the event, although eyewitness accounts reported hearing thunder. (Most likely no CG strikes but CC strikes possible).

## **OFFICE ACTIONS AND DECISIONS MADE**

Based on no severe signatures seen on the WSR 88-D, combined with spotter reports and automated observations of 35-45 mph, the Forecasters decided to cover this event with strongly worded NOWCASTS. These short term forecasts included detail as to the timing and location of the line producing the strong winds. Meteorological thinking, interpretation of data, and Forecaster judgment allowed the Forecasters to decide between a Severe Thunderstorm Warning or a strongly worded NOWCAST. The nowcast was decided as the best product to issue. It was not an easy decision to make and could have gone either way. High Wind Warnings and Wind Advisories were not considered appropriate in this case because of the limited duration and location of stronger winds over a narrow corridor.

The first NOWCAST was issued at 925am MDT for the Western end of the Treasure Valley. By this time the Forecasters had received an observation of 30 knots at Ontario and 27 knots at Caldwell. Zone Forecasts were updated to include stronger winds and the mention of a thunderstorm. The Boise Airport tower was also notified of the approaching line of weather. At 957am MDT an updated NOWCAST was issued for winds of 35-45 mph and the inclusion of small hail and brief heavy rain. The line continued east across the city with a narrow swath of winds in the 35-50 mph range. As of the second nowcast issuance, there were still no reports of damage or of the small Tornado or Gustnado.

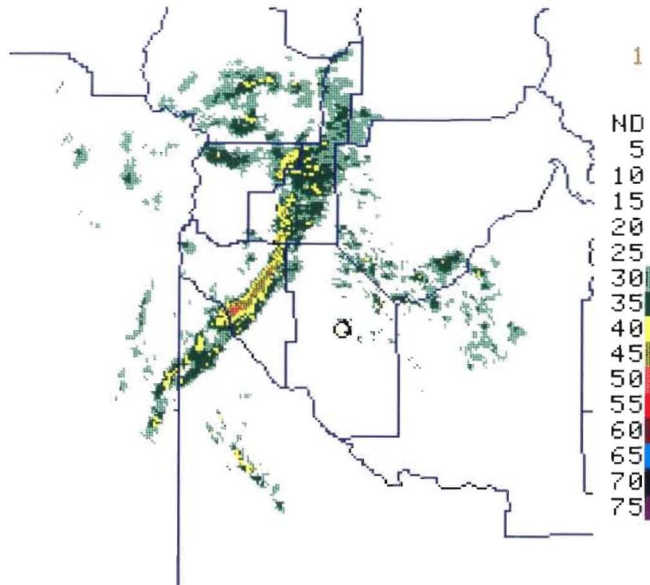
At about 10 am a call from Ada County Dispatch indicated some wind damage had occurred in the Five Mile and Overland area and also in Southeast Boise on Constitution Way. Along with this report were two unconfirmed sightings of funnel clouds/tornado in the above mentioned areas. At this time the squall line itself was moving out of the Boise area and into the Mountain Home Desert. At 1025 am a third nowcast was issued for winds 40-50 mph as the line approached the city of Mountain Home. When alerted to the possibility of the Tornado, the staff notified the WCM who conducted a damage survey in the aforementioned locations later in the day. A small tornado was confirmed by the WCM upon completing the damage survey. It should be noted that no other reports of damage were received except for the Tornado/Gustnado in Southeast Boise and some yard and roof damage in the Five Mile and Overland areas.

## COMMENTS

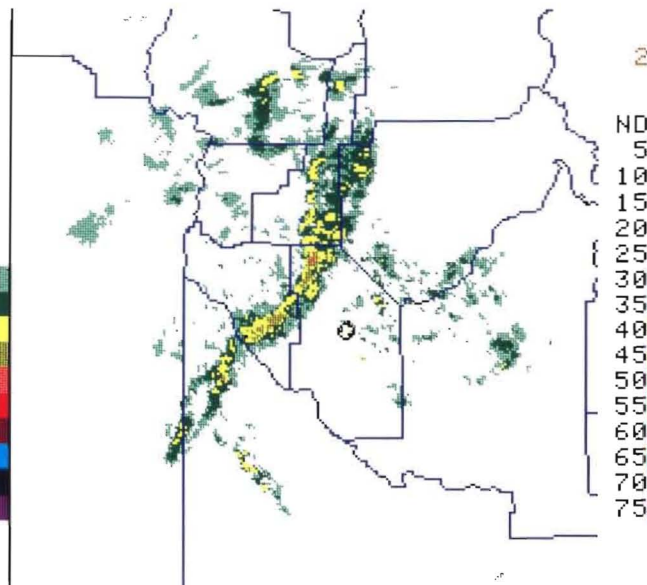
Radar exhibited no evidence of low level rotation and no rotating thunderstorms. Spotter reports showed nothing of significance at least initially. On other occasions small Tornadoes/Gustnadoes have occurred in the Boise CWA which were also not detected by radar. This is consistent with current thinking that these types of tornadoes are extremely difficult to detect with radar, due to their small size being below the resolution capability of the radar and the likelihood that the radar beam was overshooting the area in concern at close range. The WSR-88D did exhibit velocity signatures that were close to Severe Thunderstorm criteria, but it is common to see higher wind speeds on the radar than those that manifest themselves on the ground. All other spotter reports and observed wind gusts were below Severe Thunderstorm criteria, except for the Tornado report.

## CONCLUSIONS

1. The fact that no warning was issued and a Tornado occurred is a source of concern. However, the decision not to warn is often more difficult than the Decision to warn. Had the Tornado not occurred, then it is likely that no Severe weather would have been observed. Having a Severe Thunderstorm Warning out would have been preferable to not having any warning out, but It would not have necessarily been the right decision in this case.
2. The NOWCAST program can be a powerful forecast tool with accurately timed short term forecasts, such as was shown in this event. This was clearly a case that could have gone either way. (WARN vs. DON'T WARN). The nature of our warning tier of products, with NOWCASTS being used for everything that isn't severe, hampers our dissemination of significant events which may cause near severe conditions or greater.



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 04/20/97 15:41 CNTR 300DEG 10NM



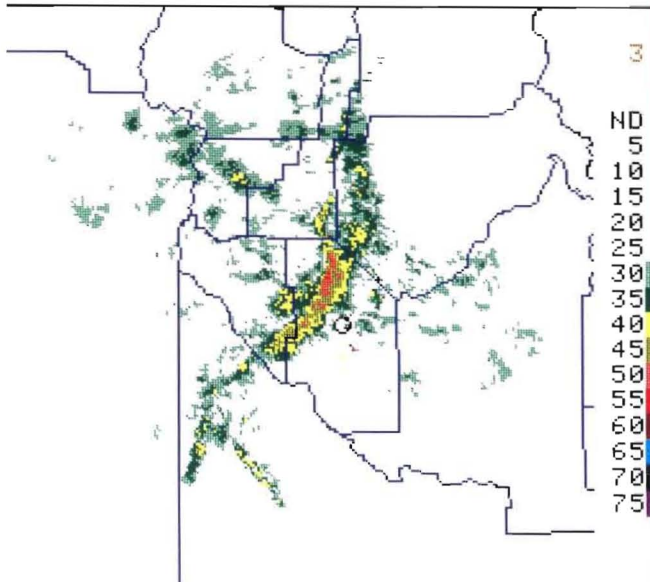
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 04/20/97 15:50 CNTR 300DEG 10NM

04/21/97 21:04

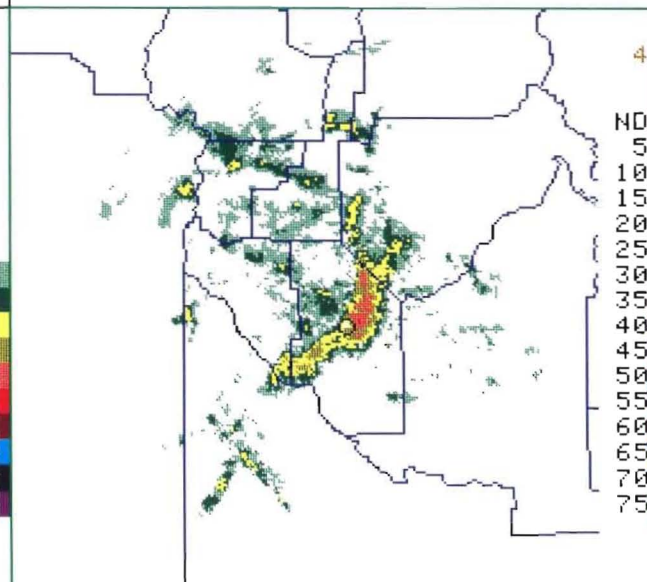
2 QUAD 1 MAG=2X  
 RDA:KCBX 43/29/27N  
 3142 FT 116/14/02W  
 MODE A / 11  
 MAX= 52 DBZ

QUAD 2 MAG=2X  
 RDA:KCBX 43/29/27N  
 3142 FT 116/14/02W  
 MODE A / 11  
 MAX= 51 DBZ

QUAD 3 MAG=2X  
 RDA:KCBX 43/29/27N  
 3142 FT 116/14/02W  
 MODE A / 11  
 MAX= 56 DBZ



CMP REF 37 CR 124 NM .54 NM RES  
 04/20/97 16:00 CNTR 300DEG 10NM



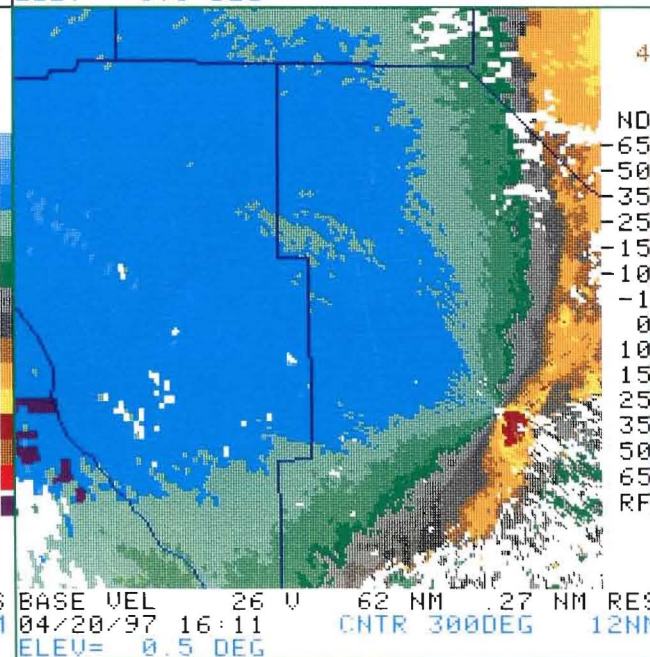
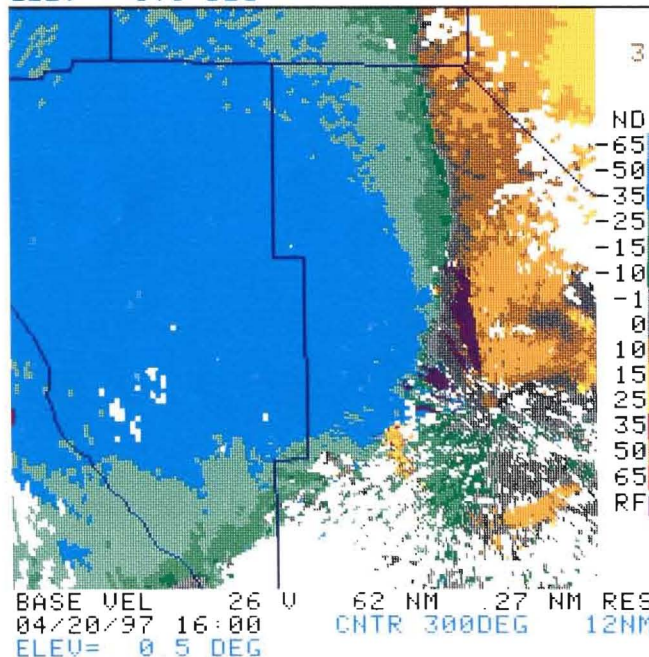
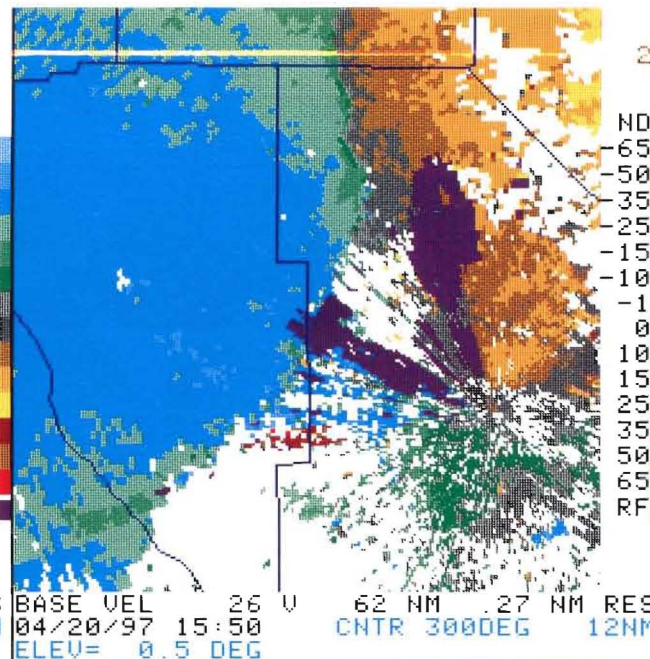
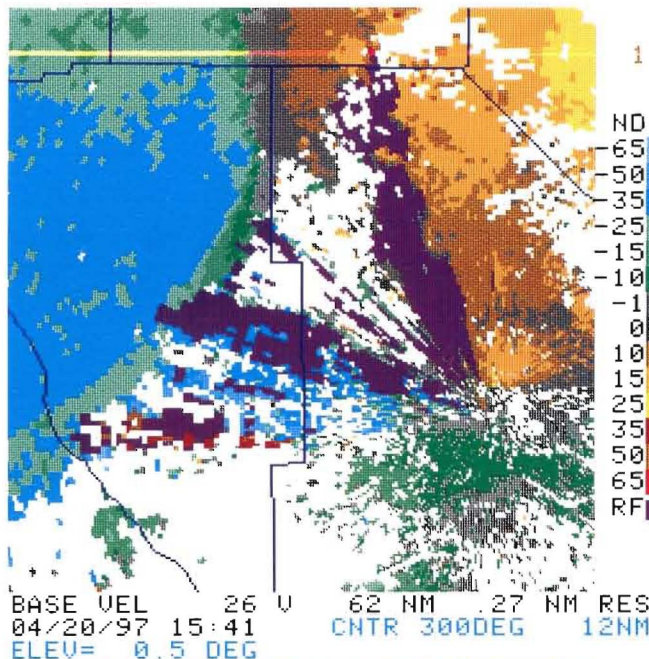
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 04/20/97 16:11 CNTR 300DEG 10NM

QUAD 4 MAG=2X  
 RDA:KCBX 43/29/27N  
 3142 FT 116/14/02W  
 MODE A / 11  
 MAX= 56 DBZ

Q15 WWP 2058 R  
 PROD RCUD: SRM RPS  
 KCBX 2103 1.5  
 21/2102 DELTA SYS  
 CAL = -0.50 DBZ  
 HARDCOPY

HARDCOPY OUT OF PAPER

FIGURE 1



04/21/97 20:02

QUAD 1 MAG=4X  
RDA:KCBX 43/29/27N  
3142 FT 116/14/02W  
MODE A / 11  
MAX= -86 KT 62 KT

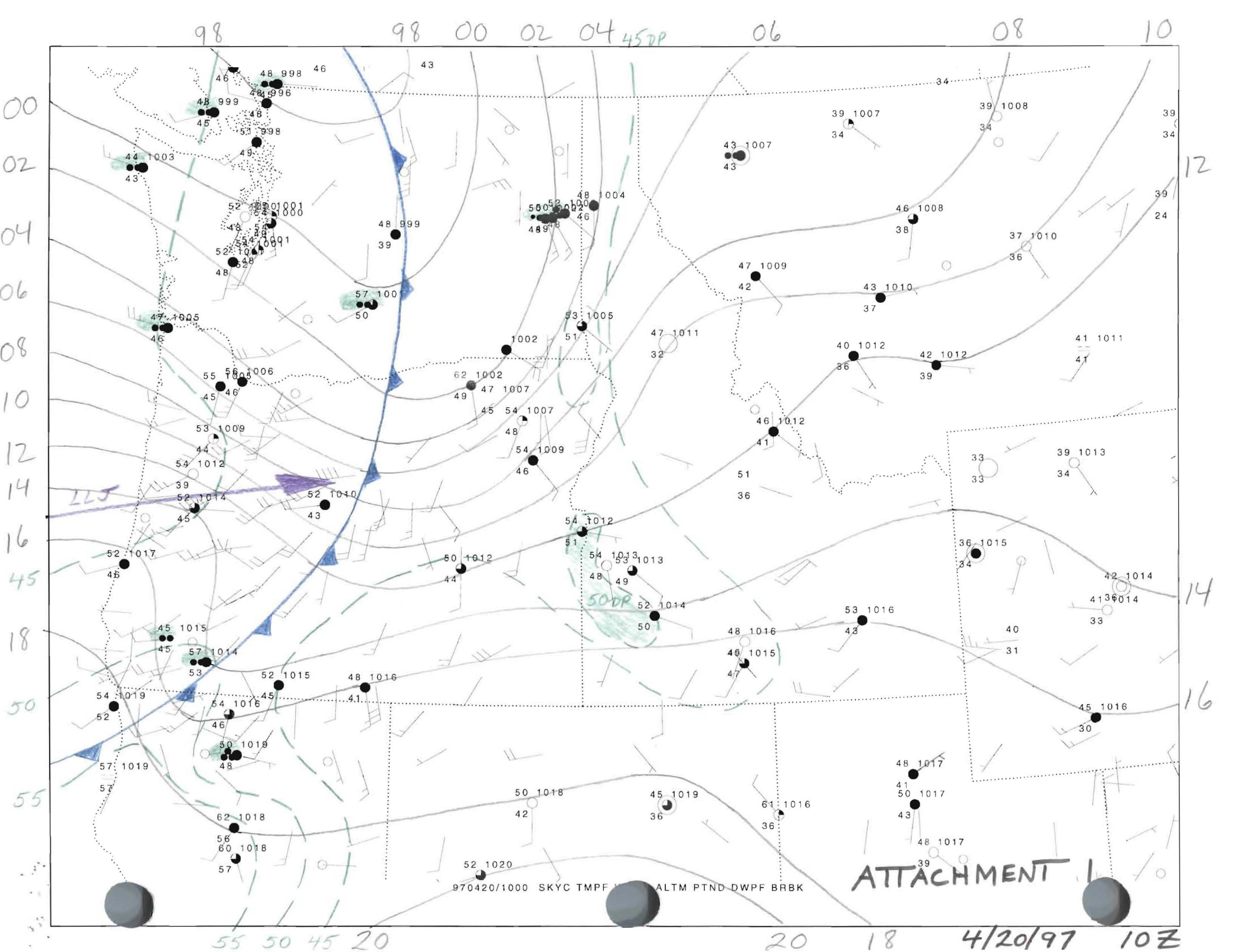
QUAD 2 MAG=4X  
RDA:KCBX 43/29/27N  
3142 FT 116/14/02W  
MODE A / 11  
MAX= -78 KT 86 KT

QUAD 3 MAG=4X  
RDA:KCBX 43/29/27N  
3142 FT 116/14/02W  
MODE A / 11  
MAX= -69 KT 53 KT

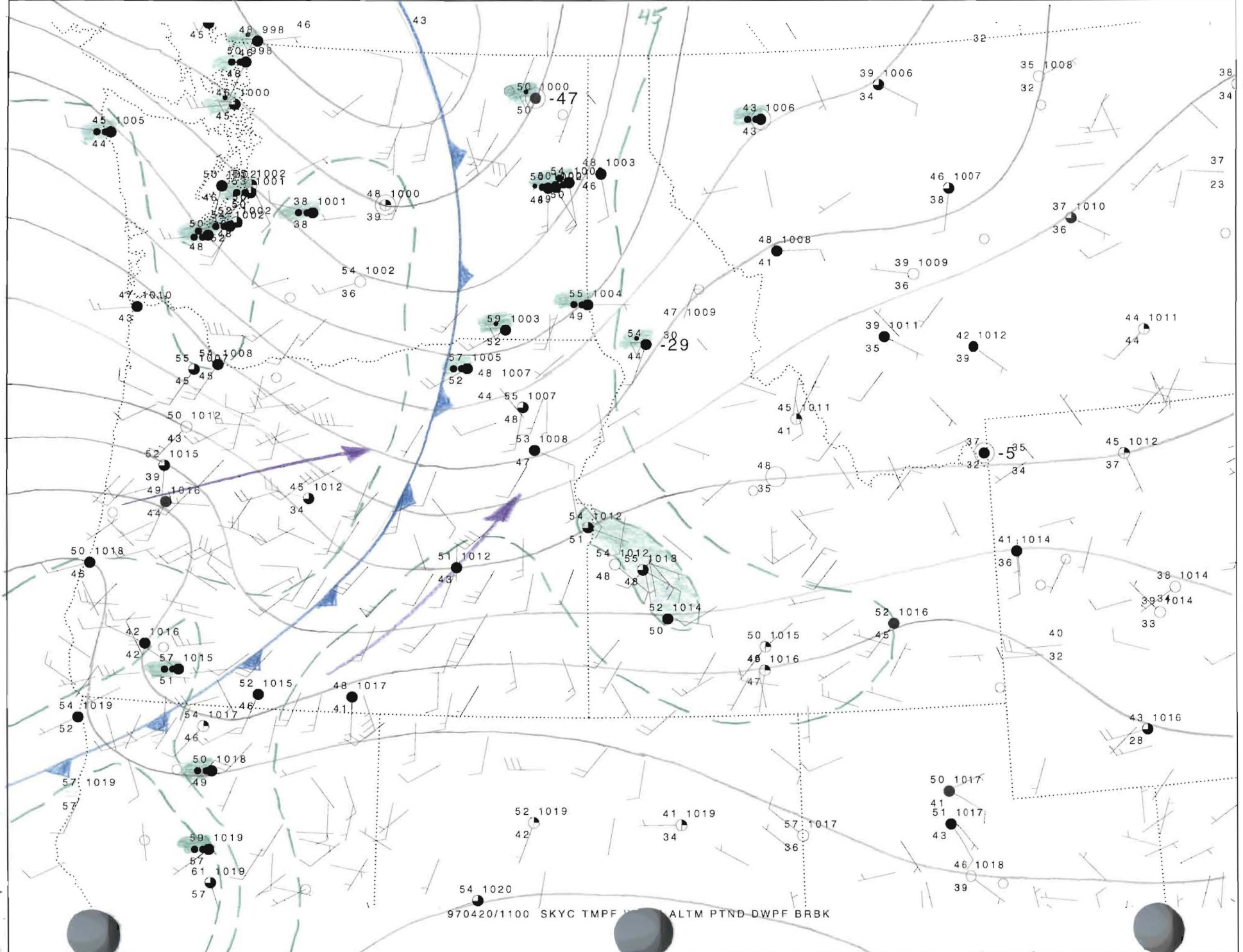
QUAD 4 MAG=4X  
RDA:KCBX 43/29/27N  
3142 FT 116/14/02W  
MODE A / 11  
MAX= -69 KT 62 KT

Q15 THP 1958 R  
PROD RCUD: SRM RPS  
KCBX 1958 14.0  
21/1957 DELTA SYS  
CAL = -0.50 DBZ  
HARDCOPY

FIGURE 2



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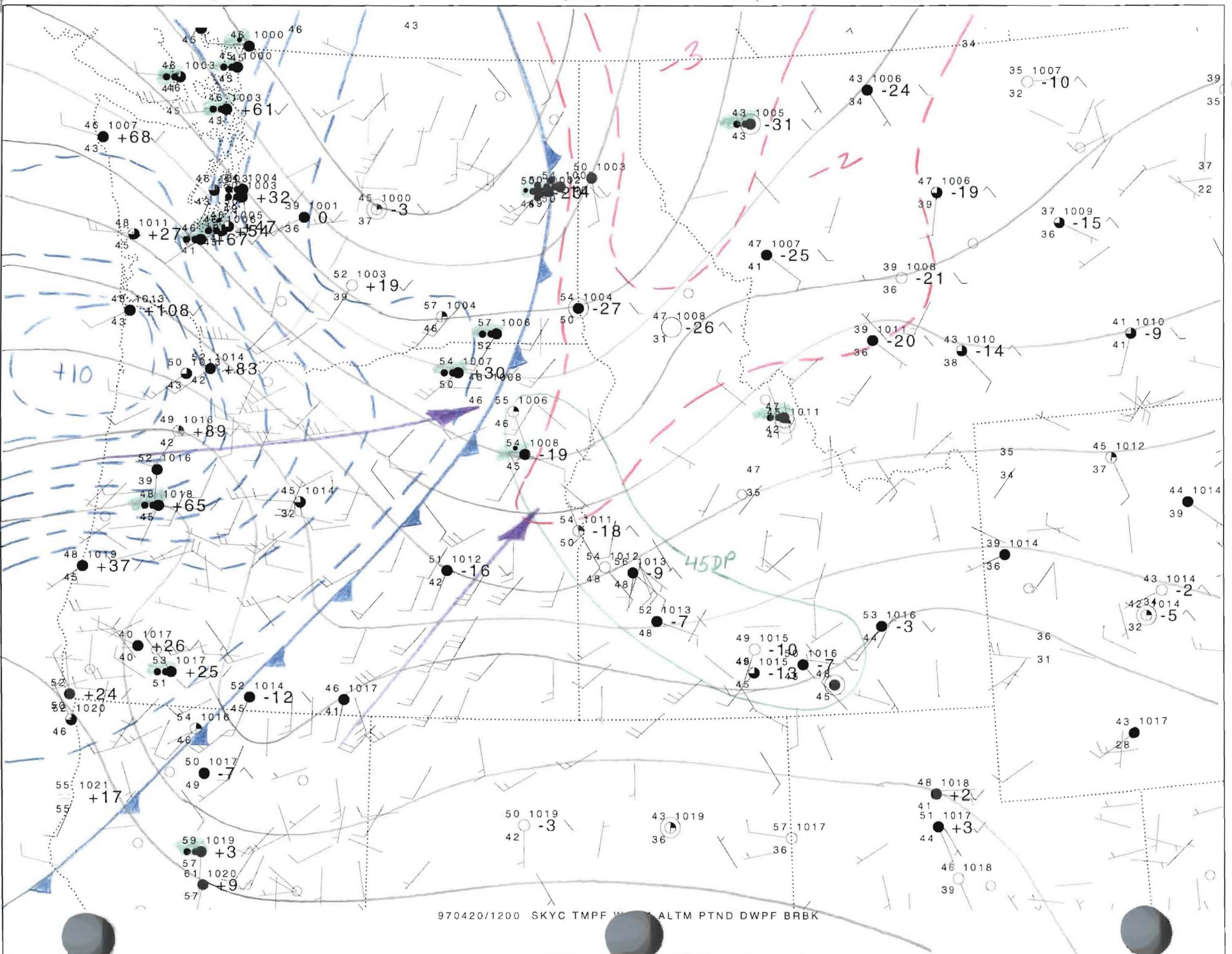
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970420/1100 SKYC TMPF ALT M PTND DWP F BRBK

5550 20 20 4/20/97 11Z

04 02 00 00 02 04 06

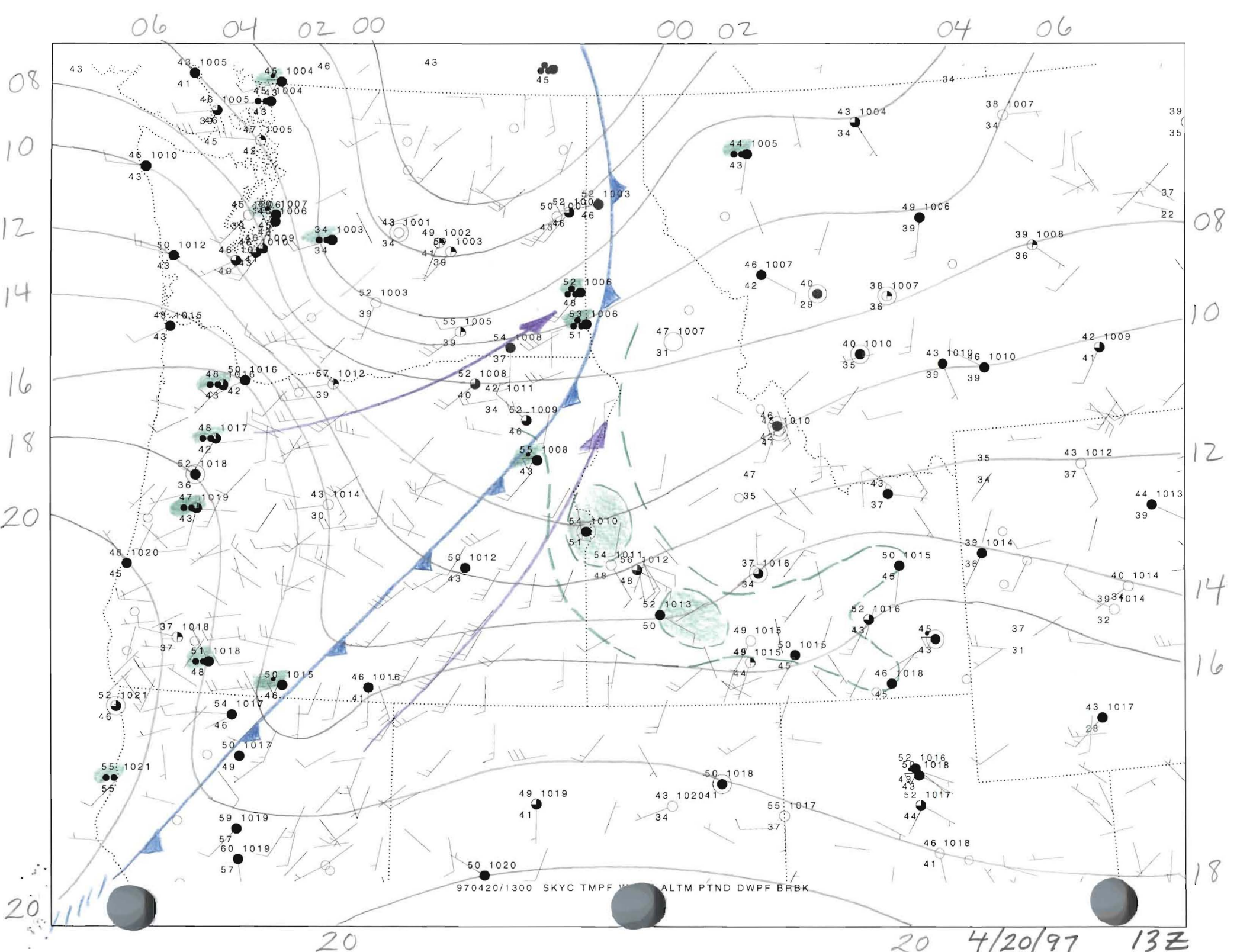
06 08 10 12 14 16 18 20



970420/1200 SKYC TMPF WIND ALTM PTND DWPF BRBK

4/20/97 12 Z 20 18





06 04 02 00 00 02 04 06

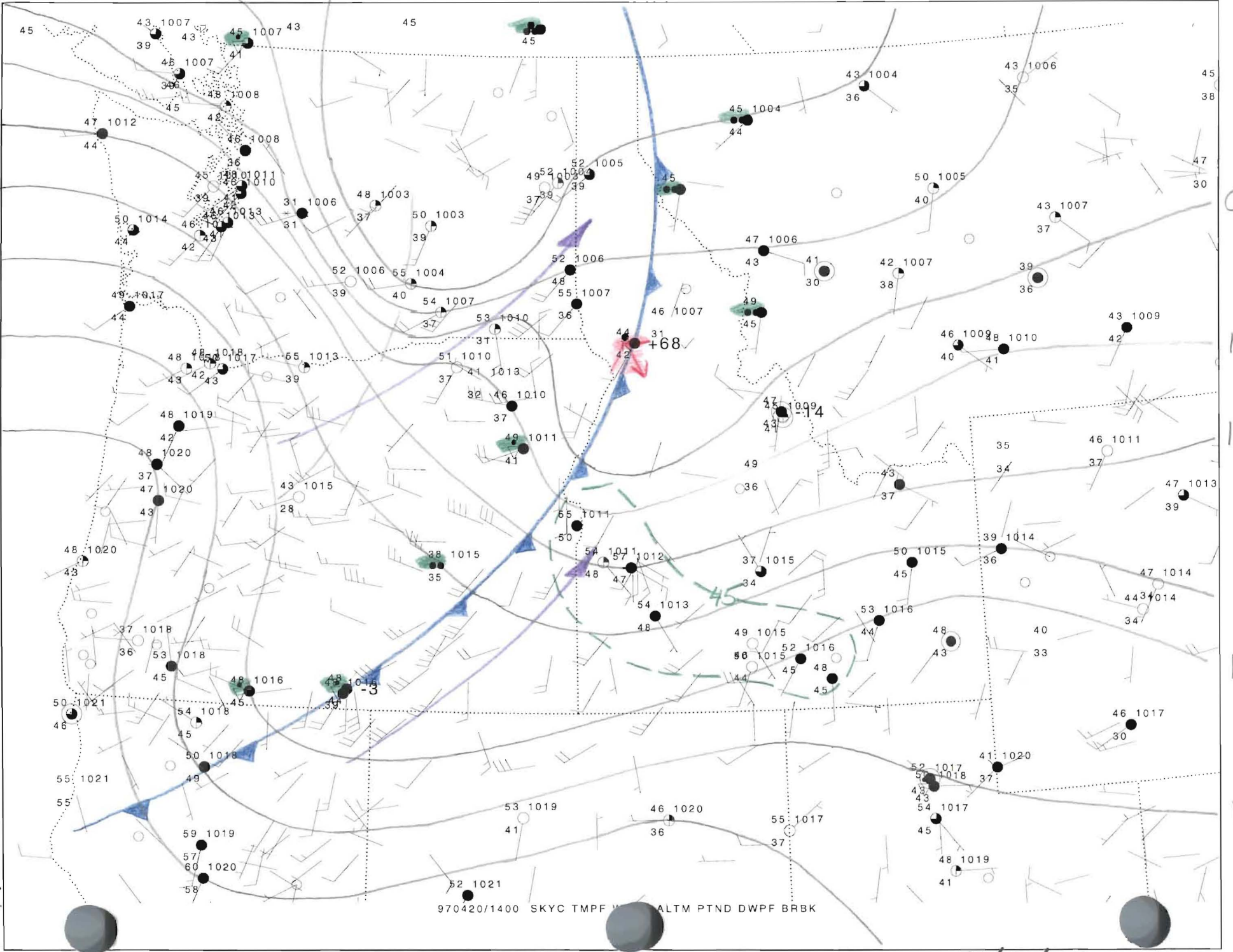
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970420/1300 SKYC TMPF W ALT M PTND DWPF BRBK

20 4/20/97 13Z

08 06 04 04 06



970420/1400 SKYC TMPF W ALT M PTND DWP F BRBK

20 4/20/97 14Z

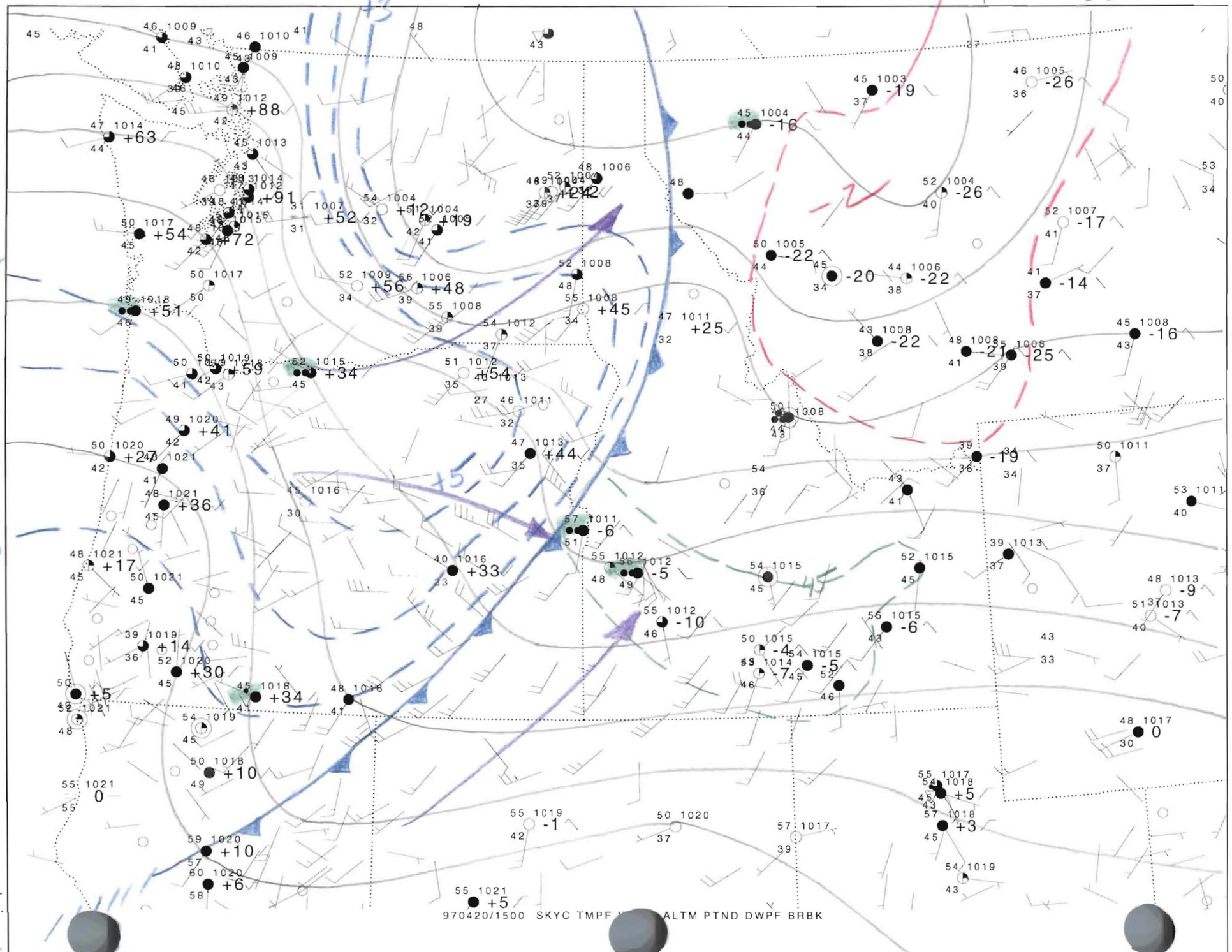
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+3

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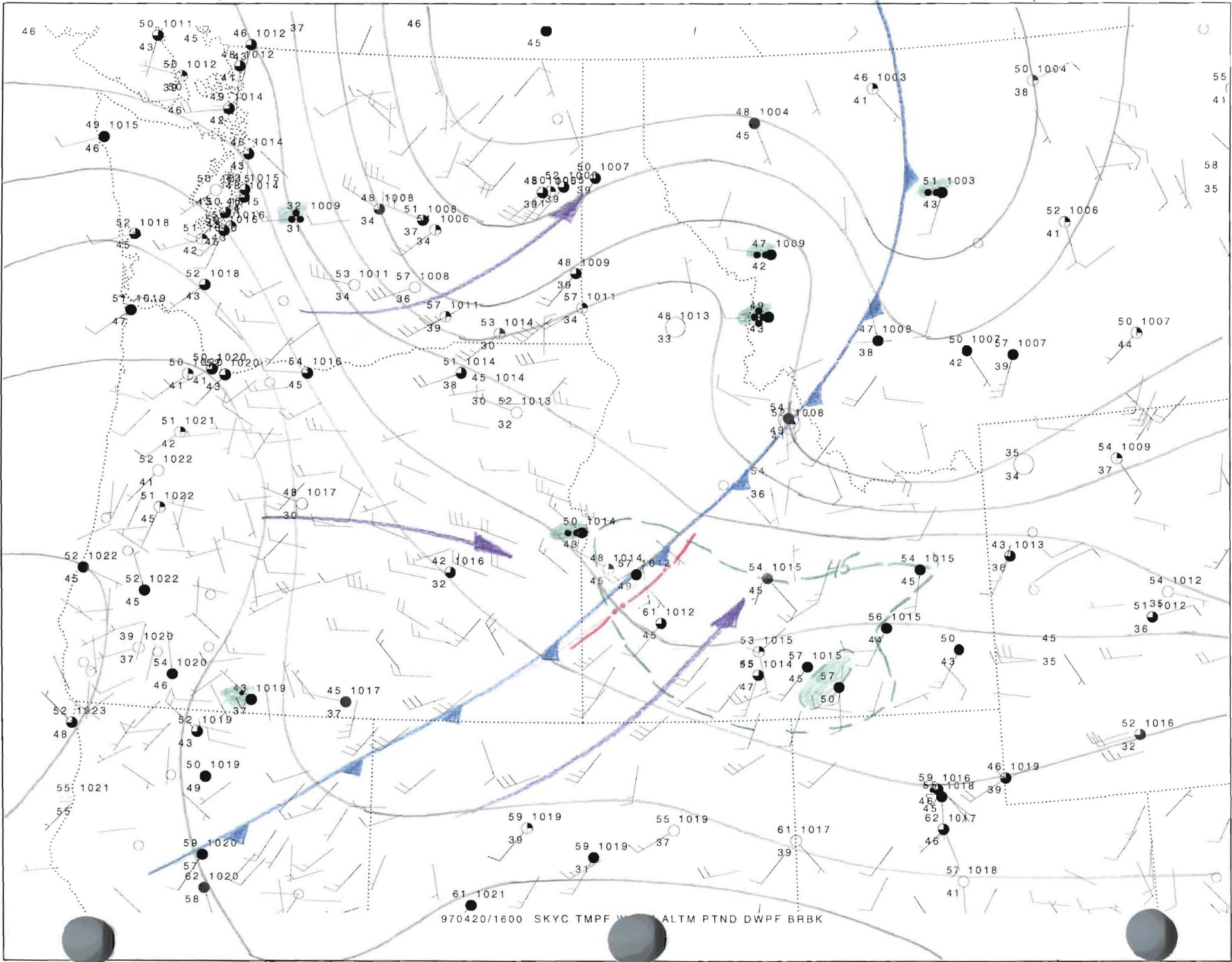


970420/1500 SKYC TMPF ALTM PTND DWPF BRBK

20 4/20/97 15Z

12 10 08 06 04

04 06



970420/1600 SKYC TMPF W... ALTM PTND DWPF BRBK

20 4/20/97 16Z

14 12 10 08 06 04

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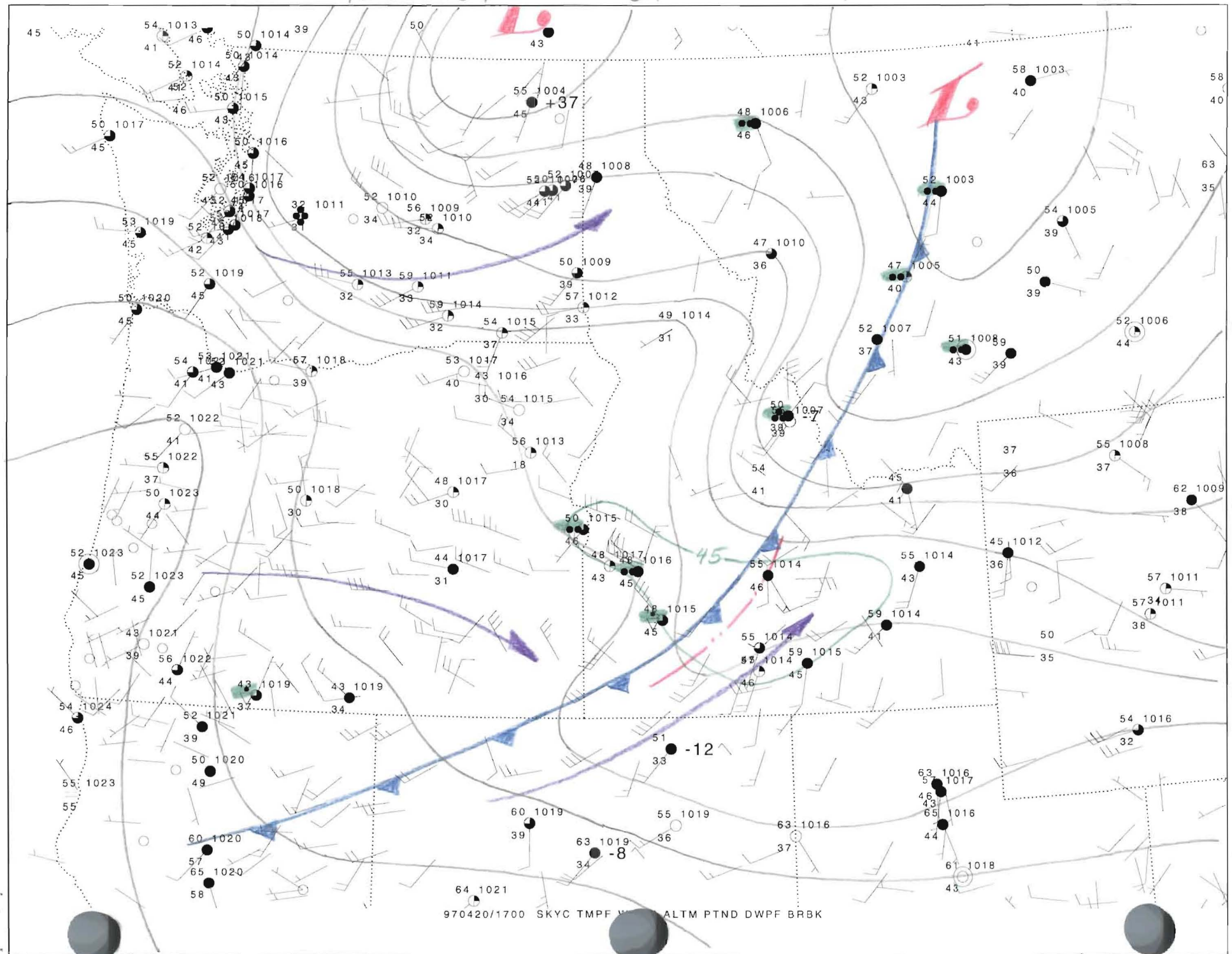
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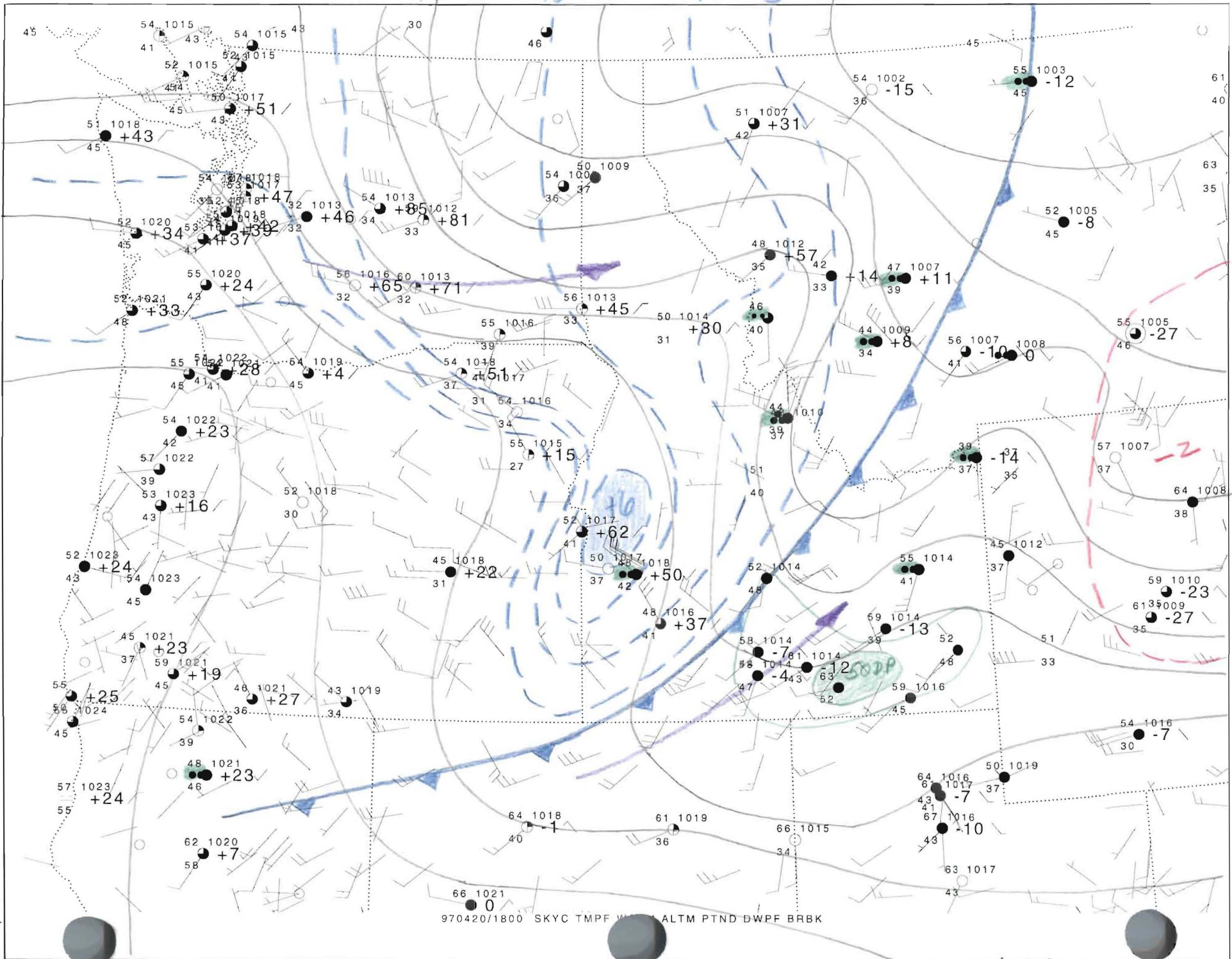
970420/1700 SKYC TMPF WIND ALTM PTND DWPFB BRBK

22

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4/20/97 17Z

14 12 10 08 15 06 14 13 04



970420/1800 SKYC TMPF WIND ALTM PTND DWPF BRBK

22

20 4/20/97 18Z

16 14 12 10 08 06 04

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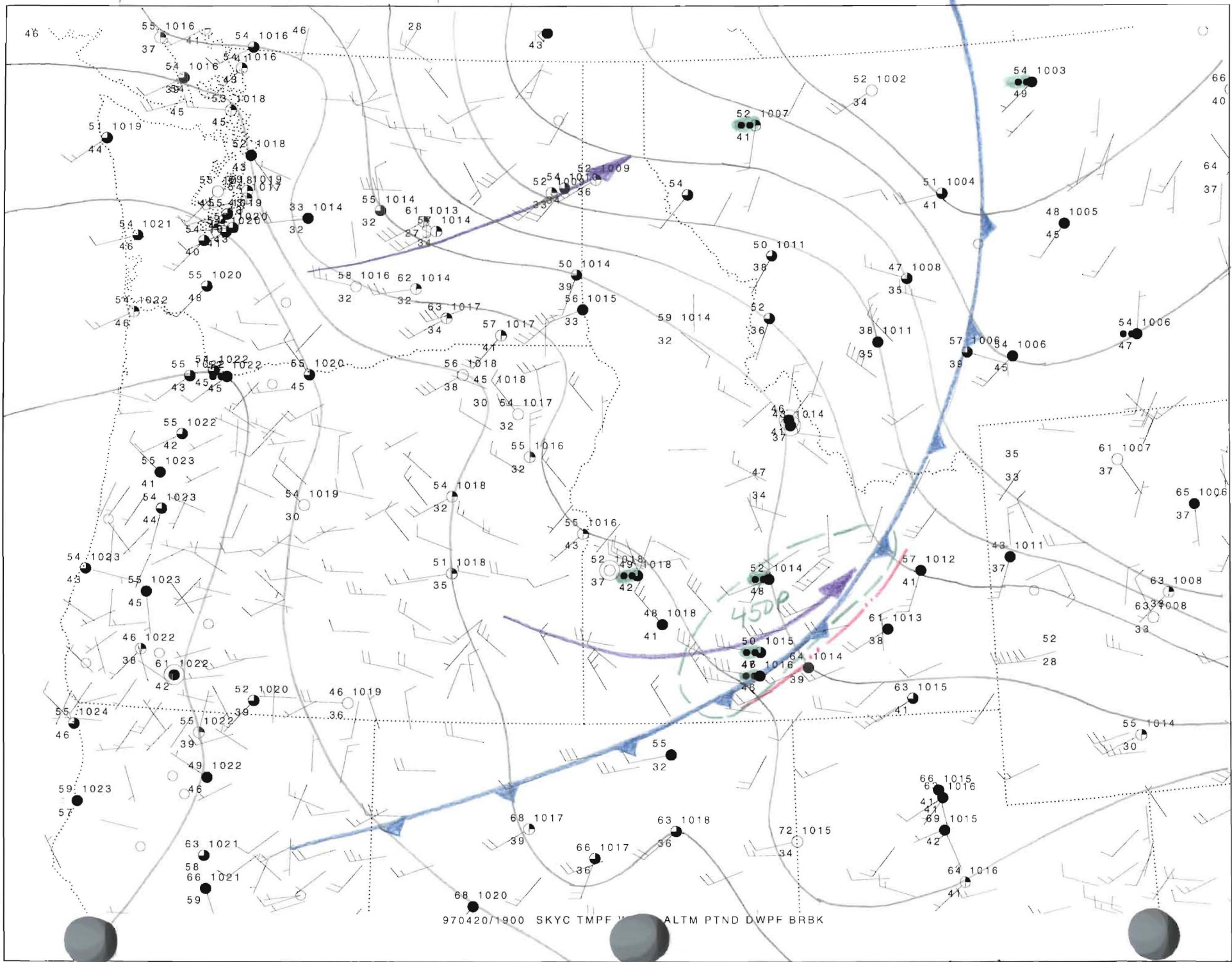
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970420/1900 SKYC TMPF V ALT M PTND D WPF BRB

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4/20/97

19Z

11 11 1977 001 APR 20 1977

15011018 201115  
BOISE MOUNTAINS-CANAS PRAIRIE-UPPER TREASURE VALLEY-  
SOUTHWEST HIGHWAYS REGIONAL MOUNTAIN VALLEY-  
112 AM PDT SUN APR 20 1977

UNCLAS  
AT 1100 AM PDT WEATHER SERVICE INDICATED A  
COLD FRONT MOVING THROUGH EASTERN CASPER COUNTY...THE WESTERN MOUNTAIN  
VALLEY AND THE CANAS PRAIRIE. HEAVY RAIN...DRIZZLE...AND SHOWERS  
BEHIND FRONT...THE AREA TO BEHIND DECREASED WITH THE FRONT AS IT MOVED  
THROUGH THE TREASURE VALLEY. WINDS WERE GUSTY...NEAR 50 MPH AT TOWN  
HALLS AT 1000 PM PDT. RAIN SHOWERS WILL CONTINUE AFTER THE FRONT  
PASSES AND WEST WINDS WILL CONTINUE IN THE 25 TO 35 MPH RANGE THIS  
AFTERNOON.

BT  
BRANCH TO BUREAU  
AT 1000 PM PDT 201115

STORM TERM FORECAST  
NATIONAL WEATHER SERVICE BOISE ID  
1120 AM PDT SUN APR 20 1977

15011011 201100-  
BOISE MOUNTAINS-CANAS PRAIRIE-UPPER TREASURE VALLEY-  
1100 AM PDT SUN APR 20 1977

UNCLAS  
AT 1000 AM PDT WEATHER SERVICE INDICATED AREAS OF SHOWERS OVER THE  
MOUNTAINS OF CLIFTON TANK. STORM SPOTTERS ARE REPORTING GUSTY  
WINDS WITH THESE SHOWERS...AS WELL AS HEAVY RAIN SHOWERS. SPOTTER  
REPORTS ALSO INDICATE THAT SOME MUDSLIDE ACTIVITY IS BEGINNING TO  
OCCUR IN BOISE COUNTY AND IN CASCADE SATURATED GROUND IS COMBINING  
WITH STRONG WINDS TO CAUSE TREES TO FALL OVER. GUSTY WINDS AND  
DRIZZLE TO HEAVY SHOWERS SHOULD CONTINUE OVER THE AREA UNTIL LATER  
THIS AFTERNOON.

BT  
BRANCH TO BUREAU  
AT 1000 AM PDT 201100

STORM TERM FORECAST  
NATIONAL WEATHER SERVICE BOISE ID  
1100 AM PDT SUN APR 20 1977

15011014 201100-  
WEST CENTRAL MOUNTAINS-LOWER TREASURE VALLEY-  
EASTERN HIGHWAYS PRAIRIE-UPPER TREASURE VALLEY-  
LOWER TREASURE VALLEY OREGON-  
1050 AM PDT SUN APR 20 1977

UNCLAS  
AT 1000 AM PDT A STRONG COLD FRONT WAS IN WESTERN ADA COUNTY MOVING  
THROUGH THE TREASURE VALLEY. WEATHER SPOTTERS WERE REPORTING WINDS  
OF 25 TO 40 MPH NEAR THE FRONT...SHALL HALL AND BRIEF HEAVY SHOWERS.  
THE FRONT WAS MOVING ABOUT 35 MPH AND SHOULD REACH THE MOUNTAIN HOME  
AREA ABOUT 1030 AM PDT.

BT  
BRANCH TO BUREAU  
AT 1000 AM PDT 201100

STORM TERM FORECAST  
NATIONAL WEATHER SERVICE BOISE ID  
1050 AM PDT SUN APR 20 1977

15011018 201100-  
WEST CENTRAL MOUNTAINS-LOWER TREASURE VALLEY-  
EASTERN HIGHWAYS PRAIRIE-UPPER TREASURE VALLEY-  
LOWER TREASURE VALLEY OREGON-  
1037 AM PDT SUN APR 20 1977

UNCLAS  
AT 1000 AM PDT A STRONG COLD FRONT WAS MOVING INTO WESTERN IDAHO.  
SURFACE OBSERVATIONS INDICATE THAT WINDS WILL BECOME WESTERLY 15 TO  
25 MPH WITH BRIEF GUSTS TO 35 MPH. ALSO STRONG SHOWERS AND ISOLATED  
THUNDERSTORMS ARE POSSIBLE AS THIS SYSTEM MOVES THROUGH THE AREA.  
THE FRONT SHOULD REACH THE BOISE AREA AROUND 10 AM AND THE MOUNTAIN  
HOME AREA AROUND 1030 AM.

BT



MMNN>WCA  
<ZCZC BOIPNSBOI  
ETTAAOO KBOI 201942

PUBLIC INFORMATION STATEMENT  
NATIONAL WEATHER SERVICE BOISE ID  
137 PM PDT SUN APR 20 1997

...TORNADO DAMAGE CONFIRMED IN SOUTHEAST BOISE...

BOISE NATIONAL WEATHER SERVICE PERSONNEL CONCLUDED A SMALL TORNADO TOUCHED DOWN IN SOUTHEAST BOISE THIS MORNING AT AROUND 10:15 AM.

THE AFFECTED AREA OF DAMAGE WAS APPROXIMATELY 400 YARDS LONG AND UP TO 30 YARDS WIDE. SIX HOUSES SUFFERED ROOF DAMAGE AS SHINGLES AND TILING WERE TORN AWAY. EXTENSIVE FENCE DAMAGE ALSO OCCURRED WITH NUMEROUS POSTS SNAPPED OFF AT GROUND LEVEL. ONE TRAMPOLINE WAS PICKED UP TO 300 FEET IN THE AIR AND DEPOSITED 5 BLOCKS AWAY IN A LOCAL PARK. NEIGHBORHOODS AFFECTED BY THE TORNADO WERE LOCATED EAST OF APPLE STREET WITHIN A QUARTER MILE OF THE BERGUSCH/APPLE STREET INTERSECTION.

THE TORNADO ACCOMPANIED THE PASSAGE OF A STRONG COLD FRONT IN THE BOISE AREA BETWEEN 10:00 AND 10:30 AM THIS MORNING. HEAVY RAIN AND SMALL HAIL PRECEDED THE SMALL TORNADO.

WSFO BOISE/DEVOIR