



# **PACIFIC REGION TECHNICAL NOTES**

80-025

August 20, 1980

## A CASE OF TEN THOUSAND CLOUD TO GROUND LIGHTNING STRIKES

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### INTRODUCTION

On July 22, 1980, at approximately 10:15 a.m., a surprise massive lightning outbreak began in the Kamloops Forest Region. By the time it has moved out of the range of the B.C.F.S. Lightning Locator System (L.L.S.) (Ref. Pacific Region Technical Note by R.O. Duffy, **80-024**), over 10,000 cloud to ground lightning strikes had been recorded. (See fig. 1, a plotting of 9,400 of the strikes). This report is a description of events on the 22nd.

### WEATHER SYNOPSIS

#### Fig. 2 - 221200 Surface Weather Analysis

A weak surface trough lay over Vancouver Island ahead of a cold front lying along 137W. Scattered altocumulus lay over the Southern Interior with a more organized mass of mid and low level cloud over North coastal areas spreading into the Central Interior.

#### Fig. 3 - 221200Z Analysis 700mb

Mid level moisture had spread into Northern B.C. but arced back around the upper low into the Gulf of Alaska.

#### Fig. 3A- 221200Z Analysis 500mb

With a ridge aloft over Eastern B.C. and a trough offshore, B.C. was in a southwesterly flow aloft.

#### Fig. 5 - Fire Weather Forecast

The 1345Z forecast indicated sunny and hot conditions for the day but deteriorating for Wednesday the 23rd, as the offshore trough aloft was forecast to move inland.

#### Fig. 4 - 221200Z Tephigram for Vernon

The Tephigram indicated quite unstable air with enough moisture aloft to give a Showalter Index of -1.2 and a K - Index of 34.7. Although the Sly Index did not indicate thunderstorm, it has not been proving as effective as the K - Index so far this year. The Tephigram induced me to add at least a chance of thunderstorms to the forecast broadcast to the Kamloops Forest Region.

By 1400Z, the AC had developed into scattered ACC in southern sections. A thunderstorm at Burns Lake (WP Z) did not arouse too much concern as it was in the much more moist airmass over Central B.C. (Fig. 6).

The 1645Z Satellite Imagery discussion (Fig. 6) indicated much the same as AES reports with patchy ACC noted over southern areas. Cloud movement was noted at 30-40 knots to the East-Northeast. The quality of the imagery was noted, indicating poor detail on convective cloud in central areas.

At approximately 1715Z (10:15 PDT) the excitement began with almost simultaneous reportings of CB activity and lightning cloud to cloud south of the Kamloops tower (Fig. 6) and the B.C. Forest Service Lightning Locator System recording of lightning cloud to ground to the southwest of Kamloops and in the western portion of Wells Grey Park (Fig. 7). By 1730Z the thunderstorm had moved over Kamloops (Fig. 6) and cloud to ground lightning was being madly plotted on the L.L.S. (Fig. 7). Note that no CB's were reported from the AES network at 1700Z (Fig. 8).

By 1800Z, an amended Fire Weather Forecast was received indicating that the thunderstorms should be widely scattered (Fig. 5).

As the day progressed, the L.L.S. never ceased its mad plotting of cloud to ground lightning. An attempt to judge the speed of the cells obtained a speed of 35 knots from the southwest, similar to speeds mentioned earlier on the satellite discussion (Figs. 6 & 7). I began telephoning reports of this L.L.S. recording to the Kamloops Weather Office at 1730Z for transmission to the AES network and to Cariboo and Nelson Forest Regions (Fig. 10) and continued until the AES network indicated just how extensive the activity was.

By 16:47 local time, 4593 lightning reports had been recorded on the L.L.S (Fig. 9) and in the morning by the end of the outbreak, 10,204 strikes had been recorded (Fig. 1).

By 2100Z winds at Lytton picked up to 38 knots from the South and the temperature jumped 4°C, a factor that was to spread through most areas in the following few hours.

#### CONCLUSION

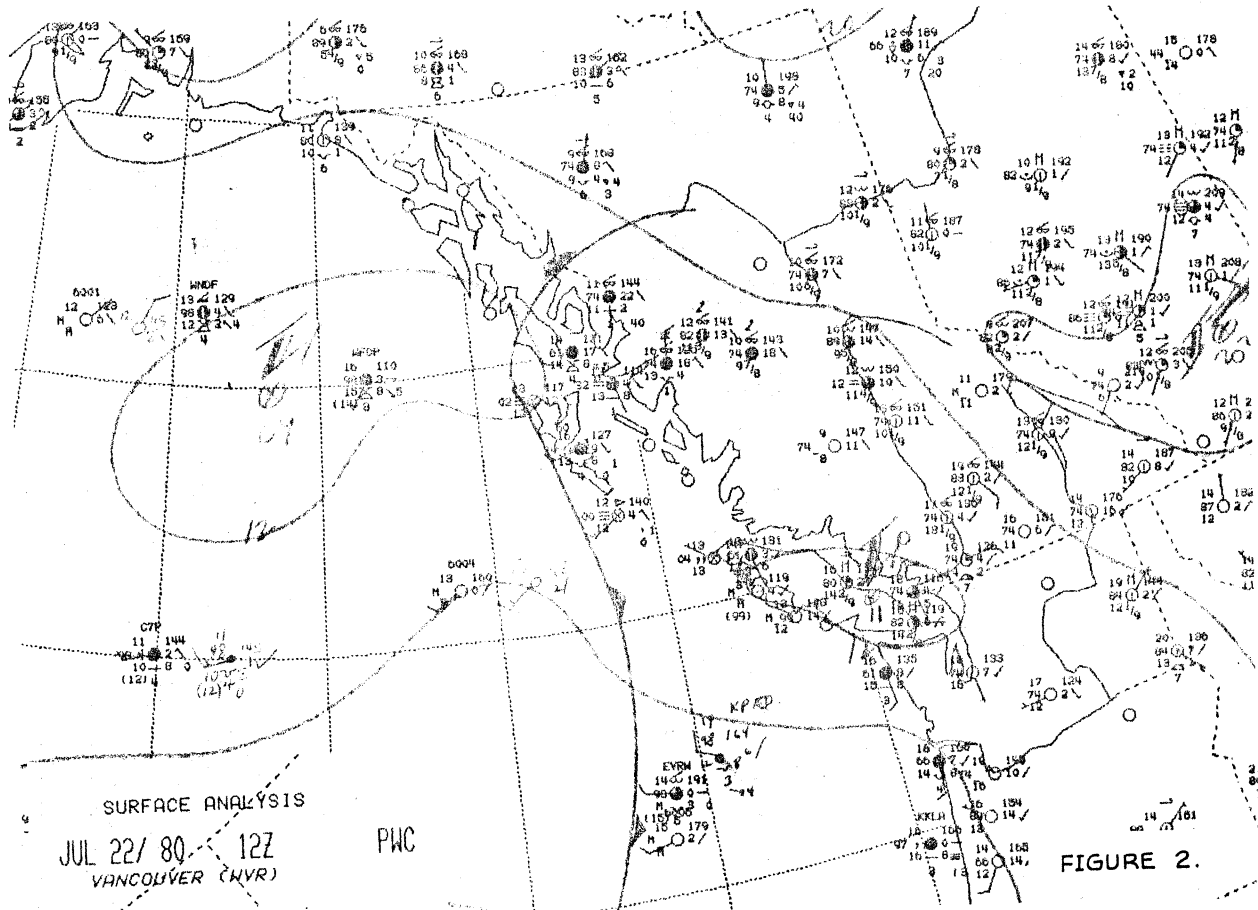
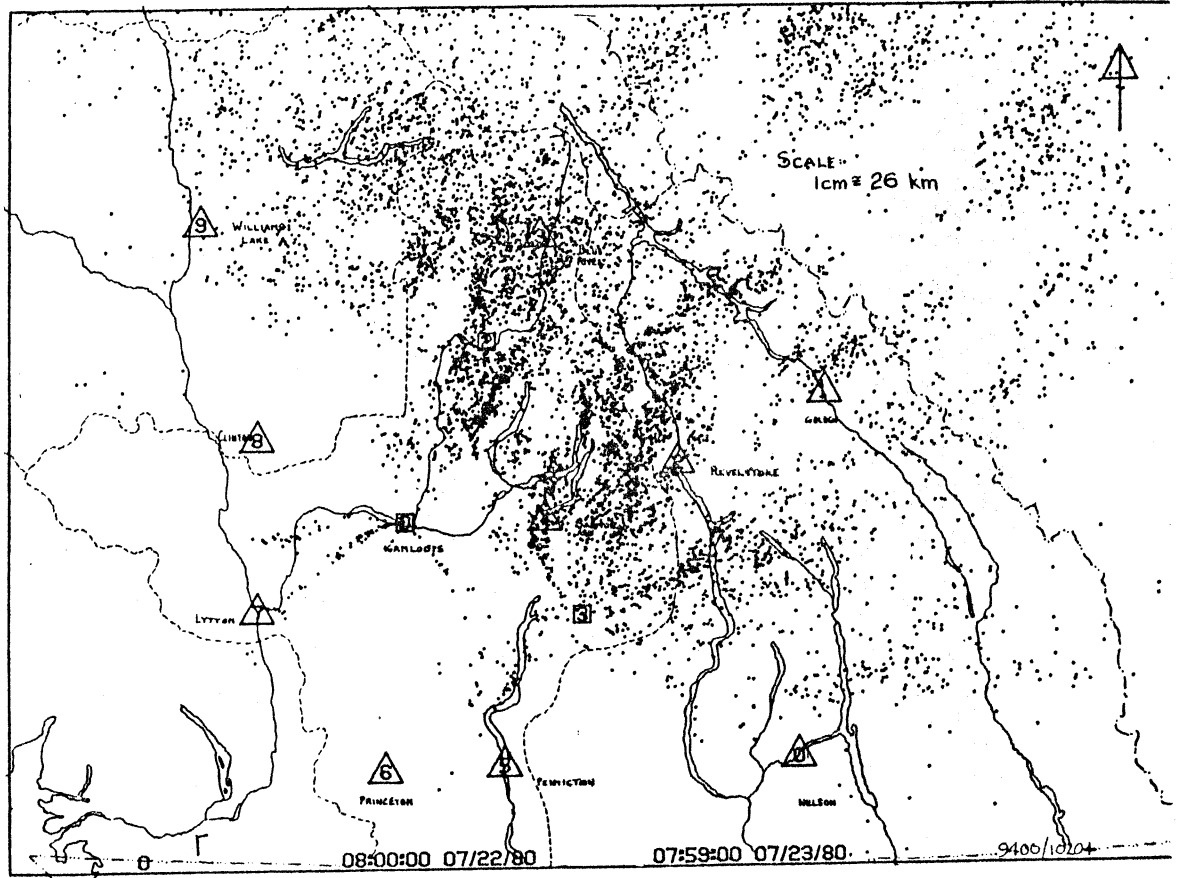
- (1) A later discussion with H. Raynor, Fire Weather Forecaster, gave a possible explanation as to what had happened.

Unstable and moist tropical air had spread into the Interior in the warm sector ahead of the cold front, to heat and destabilize the Interior, causing the massive outbreak of lightning as well as being responsible for the wind and temperature increases that followed.

- (2) a. The morning tephigram proved the most useful tool that morning for indicating the possibility of lightning and for forewarning the Forest Region of that possibility.
- b. The early Fire Weather Forecast is done without the aid of the morning tephigram, due to time restrictions, and therefore cannot be overly faulted for not forecasting the lightning, but can be shown to have a large weakness as a result.
- c. The satellite imagery was apparently not detailed enough to delineate convective development in B.C. A more detailed photo could possibly have given some forewarning as to the extent of the thunderstorm activity to follow.
- d. The B.C. Forest Service showed some worth in giving timing, track and speed of the cloud to ground lightning activity. Many examples of general concurrence occurred during the day between the L.L.S. and the AES Weather Network showing a possible future benefit.

To date, however, the L.L.S. is unable to guarantee the precise location of the lightning events due to both inherent problems and topographical distortion. These problems are being analyzed and hopefully a solution can be found.

FIGURE 1.



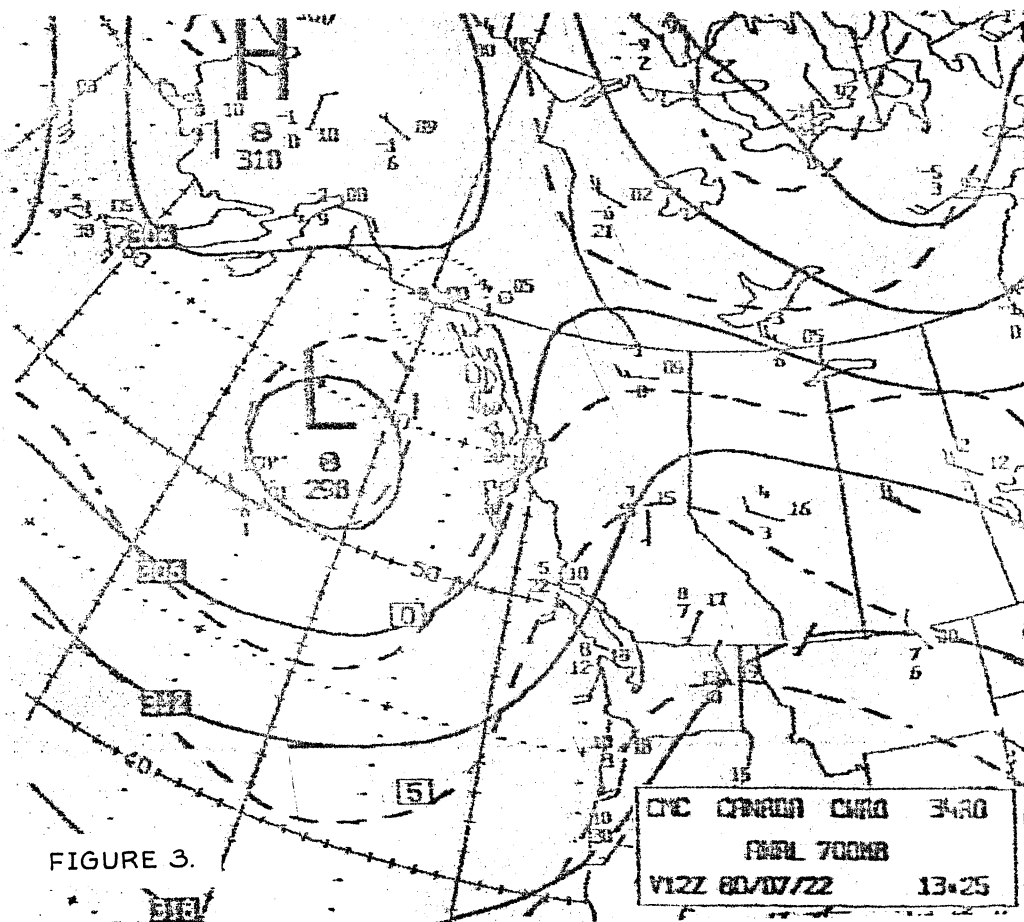
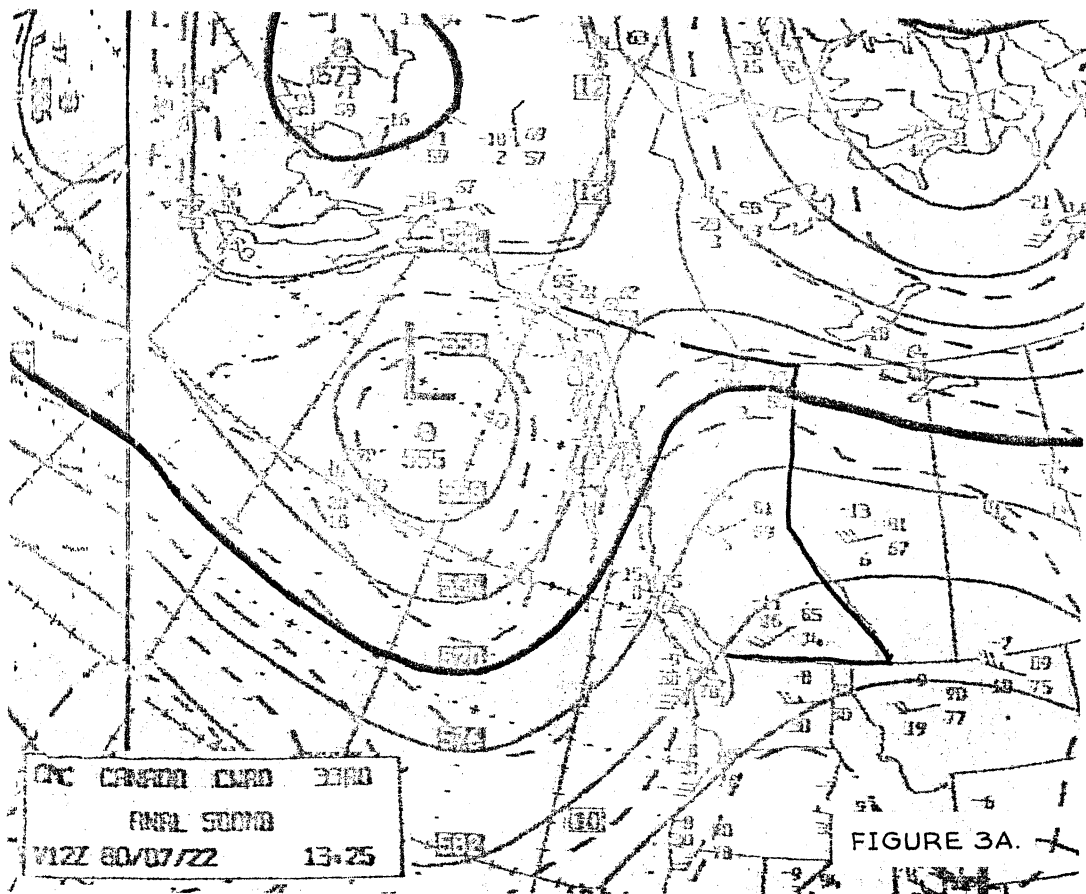


FIGURE 4.

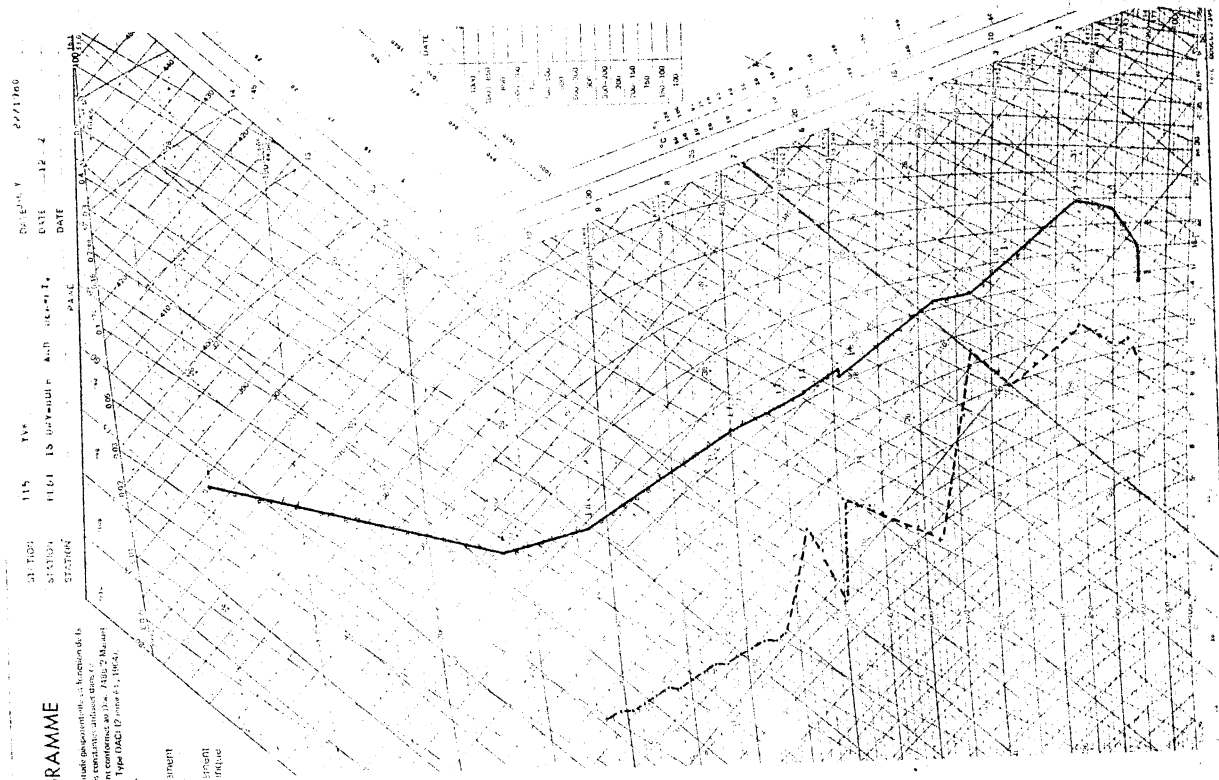


FIGURE 5.

FXCN6 CWVR 221645  
FIRE WEATHER FORECAST FOR SOUTH INTERIOR  
FOR TUESDAY JULY 22 1980  
WEATHER ZONES 20 21  
AIR MASS REMAINING DRY TODAY WITH UPPER FLOW SOUTHWESTERLY.  
SUNNY AND HOT TODAY. LOW HUMIDITIES. LIGHT WINDS. OUTLOOK  
WEDNESDAY TO SATURDAY...COOLER WITH CLOUDY PERIODS ON WEDNESDAY.  
A FEW AFTERNOON AND EVENING SHOWERS AND THUNDERSTORMS THURSDAY  
TO SATURDAY.  
1PM FCST TMP RH WIND ZCHNC RN  
HAMILTON LO 25 39 SW13 10  
PEMBERTON RS 30 45 SW14 10  
KAMLOOPS RS 31 40 E 14 5  
KELOWNA AP 32 34 N 11 5  
END

FXCN3 6 CWVR 221800 AND  
AMENDED FIRE WEATHER FORECAST FOR SOUTH INTERIOR  
FOR TUESDAY JULY 22 1980  
WEATHER ZONES 20 21

INC REASING MOISTURE AND INSTABILITY IN AIR MASS OVER DISTRICT.  
UPPER FLOW REMAINING SOUTHWESTERLY. SUNNY WITH A FEW CLOUDY  
PERIODS TODAY. WIDELY SCATTERED SHOWERS AND THUNDERSTORMS.  
CONTINUING HOT. LOW HUMIDITIES. WINDS SOUTHEAST 25 EXCEPT  
STRONGER NEAR THUNDERSTORMS. OUTLOOK WEDNESDAY TO  
SATURDAY...COOLER. CLOUDY PERIODS AND A FEW AFTERNOON AND  
EVENING SHOWERS AND THUNDERSTORMS.

1PM FCST TMP RH WIND ZCHNC RN  
HAMILTON LO 25 39 SW13 25  
PEMBERTON RS 30 45 SW14 20  
KAMLOOPS RS 31 40 E 14 25  
KELOWNA AP 32 34 SE11 15  
END

FIGURE 6.

FXCN6 CWVR 221645  
DISCUSSION OF SATELLITE IMAGERY PERTAINING TO FIRE WEATHER  
CONDITIONS OVER BRITISH COLUMBIA  
COLD LO AND TROF OVER NERN PAC WITH BKN TO OVC MID AND HI LVL CLDS  
XTND ENDS ACRS NRN HALF RC. CVCTV CLDS EMBOD BUT SA PHOTOS LACK  
DETAIL. WK FNIL MID AND HI CLD BAND XTND S FM MAIN CLOUD AREA  
TO 27N. BACK EDGE ALG 127W MOVG ENE 30-40KTS AND OVRNG LO CLDS.  
LEADING EDGE DIFFUSE ALG 125W. PTCHY ACC IN ADVANCE OVR SRN BC.  
BKN MID CLDS ALG WRN RCKYS ARV 50N.

FIGURE 7.

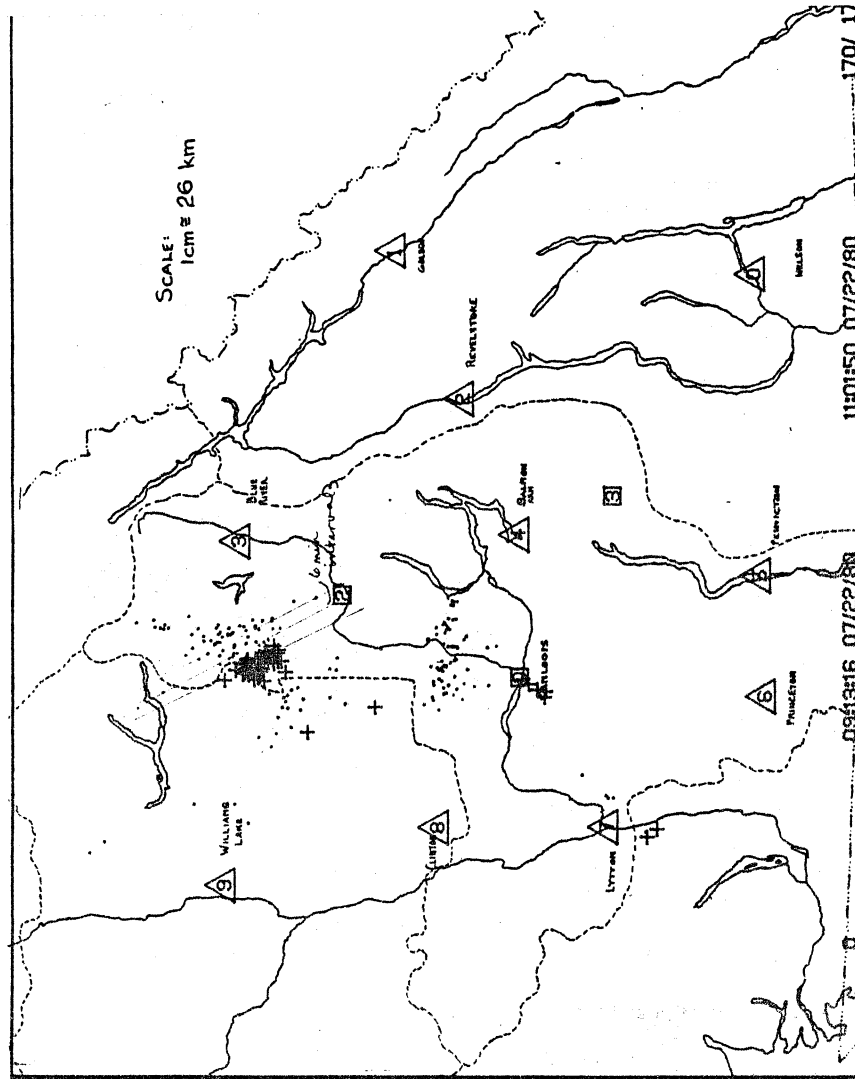


FIGURE 8.

SACN1 CYVR 221700  
 YVR SA 1700 70 SCT E100 BKN 15 131/23/15/1213/992/AC2ACC5 =  
 WIC SA 1700 70 SCT E100 BKN 15+ 132/21/17/300/992/AC4ACC3 =  
 WAE SA 1700 80 SCT E120 BKN 13 135/18/12/2000/997/ACC3ACC6 =  
 WLY SA 1700 70 SCT 85 SCT 15 117/24/14/2000/989/CUIAC2 ACC ASOCTD =  
 WCL 0301/9.+ 68/ 54/1807/997/2000=  
 YKA SA 1700 80 SCT 140 SCT 30 124/25/14/1509/991/AC4AC1 TCU ENBDD =  
 YRV SA 1700 130 SCT 15+ 167/20/14/1302/203/AC1 =  
 WGE SA 1700 80 SCT 15+ 21/14/1401/AC1 =  
 YWL SA 1700 130 SCT E140 OVC 15 120/22/13/1506/993/ACC3ACC7 =  
 WPU \* 9.+ MMW/ 17/ 10/2000/991// 719 =  
 Y07 SA 1700 E120 BKN 230 BKN 15 116/19/14/1305/987/AC7C1 =  
 YX5 SA 1700 40 SCT 150 SCT 250 -BKN 45 114/19/14/2003/986/CUIAC2C11 =  
 YAY SA 1700 50 SCT E100 OVC 15+ 134/17/12/2000/992/SCIAC9 AS ASOCTD  
 1700 30 SCT E120 BKN 220 BKN 270 OVC 15+ 119/16/12/2333/983/  
 CUIAS0S3CC SHWRS N-WE =  
 YYD SA 1700 60 SCT 90 SCT E200 BKN 25 112/18/13/2003/986/CBIAC20C3 =  
 YXI SA 1700 20 SCT 75 SCT 120 -SCT 300 -BKN 15 101/23/14/3506/982/  
 CFIACCIAC11 CB DSHI W =  
 ZST SA 1700 2 SCT E50 BKN 80 BKN 15 116/12/12/2000/987/SF2SC4AC4 SHI  
 F BANK OVR CANAL =  
 YPR RS 1700 W0 X 3F 116/14/14/2000/987/F10 WRO SHS =  
 YJM SA 1700 W0 BKN 85 BKN 250 OVC 15 117/17/12/3002/987/CB0AC1C1  
 SHWRS SW, LTGG =  
 YCP SA 1700 65 SCT 140 SCT 15+ 149/23/13/20502/998 CUIAC1 TR ACC =  
 SACN1 CYVJ 221700  
 YYJ SA 1700 80 SCT 120 -BKN 25 131/18/14/1307/992/ACCI AC4 FLOCCUS =  
 WVG \*\*\*\*\*/ 63/ 55/3534/\*\*\*\*/0302=  
 WIR SA 1700 20 SCT 20 SCIAC2 KCCY H =  
 WEZ \* 121/ 19/2305/989// 211 =  
 YCD SA 1700 580 BKN 30 124/25/15/1303/990/AC6 =  
 WPI \* 142/ 13/3210/995// 816 =  
 YXX SA 1700 80 SCT E120 BKN 15 136/24/19/2507/994/ACC4AC2 98147 =  
 YHE SA 1700 70 SCT 15+ 123/24/17/2000/991/CUI =  
 WKV SA 1700 120 SCT 10 25/15/3208/AC1 8711=  
 YDC SA 1700 CLR 15+ 132/24/12/2003/998/ =  
 YYF SA 1700 110 SCT 300 -SCT 15+ 133/25/14/2035/994/AC1C1 ACC ASOCTD  
 S =  
 YLW SA 1700 85 SCT 350 -SCT 20 133/25/15/1501/995/AC1C1 ACC ASOCTD =  
 YCG SA 1700 70 SCT 15+ 158/23/14/3404/002/TCUI K' IN VLY =

FIGURE 9.

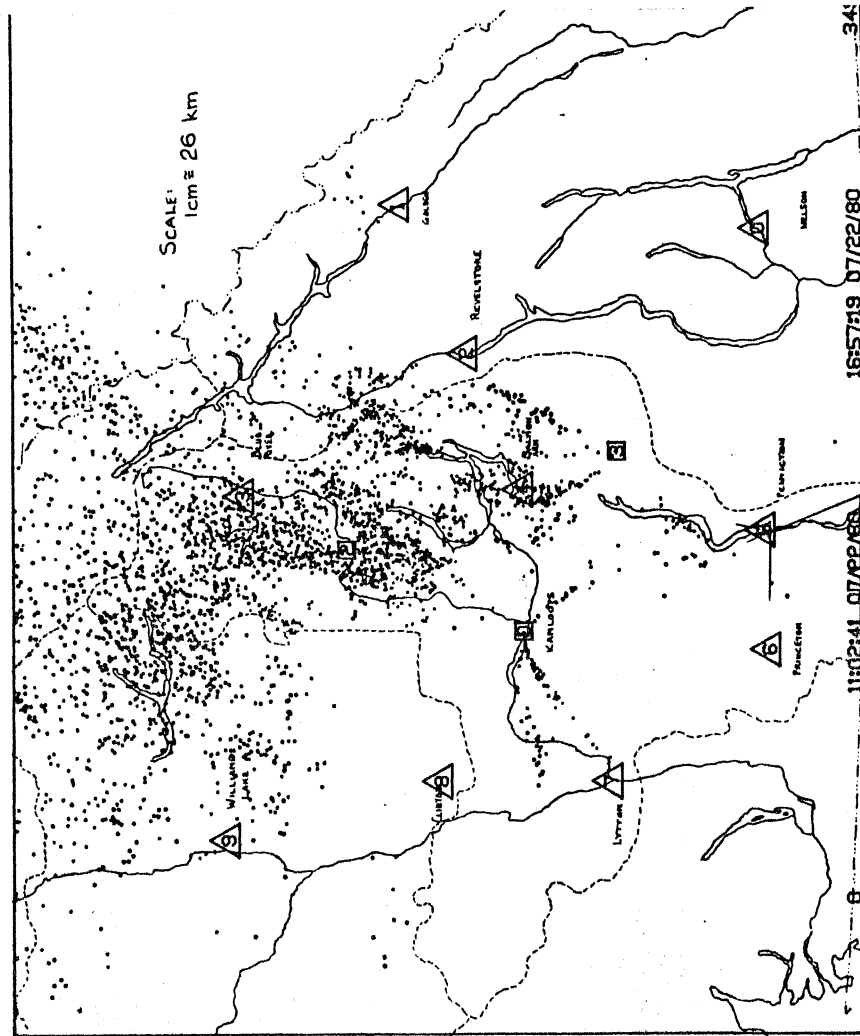


FIGURE 10.

MS  
120 121 122  
KAMLOOPS BCFS LTNG LOCATOR REPORTS 221700-1733  
KAMLOOPS AREA OF STRIKES ESTMD 40-50 353-003 DEGREES 70-80M VCNTY BRIDGE  
LAKE AREA  
ANOTHER SMALLER AREA OF STRIKE 207-215 DEGREES FM 1 TO 10M VCNTY YKA  
ABOUT 10 STRIKES.  
KAMLOOPS W04

MS  
120 121 122  
YKA BCFS LTNG LOCATOR REPORTS 221740-1745  
342-350/11-25 343-350/20 5 STRIKES  
350/70 1 STRIKE  
002--012/00-90 11 STRIKES  
024-20-30 3 STRIKES. ALL CELLS MOVG NE AT 35K  
KAMLOOPS W04

MS  
120 121 122  
B.C.F.S. LGNG LOCATOR RPTS 1805-1810Z.

ISOLTD STRIKES  
353 DEG 133 KM  
004 DEG 114 KM  
008 DEG 185 & 231 KM  
023 DEG 130 KM  
256 DEG 63 & 77 KM  
009 DEG 166 & 167 KM

NUMEROUS STRIKES  
002-045 DEG 51-68 KM 17 STRIKES.  
YKA KAMLOOPS FORESTRY WEATHER BRIEFER 221828

MS  
120 121 130  
KAMLOOPS B.C. FOREST SERVICE LIGHTNING LOCATION 222000-2100  
ATTN FIRE WEATHER CARIBOO  
AZMUTH OFF KAMLOOPS TANKER BASE DF  
020-024 AT 140-15 8 STRIKE  
339-3-48 AT 132-140 KM 3 STRIKES  
333-017 AT 150-200 KM 6 STRIKES  
340-020 AT 208-225 KM 4 STRIKES

ISOLTD STRIKES AT  
011 DEGREES 323 KM  
336 DEGREES AT 263 KM

HEAVIEST ACTIVITY ON A LINE FROM BARRIERE-NORTH END OF ADAMS LAKE  
END