NOAA Technical Memorandum ERL ESG-30

THE OKLAHOMA-KANSAS PRELIMINARY REGIONAL EXPERIMENT FOR STORM-CENTRAL (O-K PRE-STORM)

VOLUME III. AIRCRAFT MISSION SUMMARY

José G. Meitín, Jr.

Environmental Sciences Group
Boulder, Colorado
February 1988

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UNITED STATES
DEPARTMENT OF COMMERCE
C.William Verity
Secretary

NATIONAL OCEANIC AND
ATMOSPHERIC ADMINISTRATION

Environmental Research
Laboratories

Vernon E. Derr,
Director

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The Oklahoma-Kansas Preliminary Regional Experiment for STORM[1]-Central Volume III. Aircraft Mission Summary

José G. Meitín, Jr.

Abstract

The aircraft missions during the PRE-STORM experiment are summarized. Flight tracks and related radar charts for the NOAA aircraft are presented. Tables of data collected by NOAA aircraft instrumentation are included.

1. Introduction.

The purpose of this document is to provide researchers with a synopsis of the flights taken during May and June of 1985 as part of the Oklahoma-Kansas Preliminary Regional Experiment for STORM-Central (PRE-STORM). This technical memorandum is the final publication in the series which describes the activities and catalogs the data collected during the field phase of the PRE-STORM project. Weather conditions and an overview of operations can be found in Volume I, Daily Operations Summary (Meitín and Cunning, 1985). A description of the radar subprogram and the radar data collected is published in Volume II, Radar Data Summary (Meitín, 1987). Scientific goals and objectives for PRE-STORM are discussed in an article by Cunning (1986).

2. Aircraft Subprogram.

The principal goals of the aircraft subprogram were to (1) gather aircraft data in the vicinity of developing and mature convective systems in order to better define their structure, evolution, and physical processes, and (2) develop and test observational strategies for optimal use of long-range research aircraft in the mesoscale convective system (MCS) environment in order to help define measurement techniques, for example, the use of airborne Doppler radar in coordination with ground-based Doppler radars.

1 Stormscale Operational and Research Meteorology

The aircraft program for PRE-STORM consisted of two NOAA WP-3 research aircraft and the University of Wyoming King Air research airplane. One aircraft (NOAA-43) flew missions during May and June of 1985. The University of Wyoming King Air aircraft participated in PRE-STORM during May 1985. The second P-3 (NOAA-42) was available only during June. The two P-3 aircraft flew a total of 195 hours during the project. The missions are summarized in Appendix A. The King Air flew nine missions; these are summarized in Appendix B. The highest priority missions for the NOAA planes were to operate within the densely instrumented network. On a few occasions, weather systems traveled through the network and the aircraft continued monitoring them outside of the PRE-STORM observational network. The primary goals of the Wyoming King Air were to investigate the inflow structure into MCSs and the development of the nocturnal low-level jet. Both NOAA planes were similarly instrumented (see Table 1) with the exception of the tail Doppler radar onboard NOAA-43. Characteristics of the NOAA airborne radars are listed in Table 2.

A separate research program sponsored by the Department of Energy was conducted during June in conjunction with PRE-STORM. The program, termed PRECP (Processing of Emissions by Clouds and Precipitation), used three aircraft to measure certain chemical constituents of the inflow and outflow air of an MCS. Aircraft from Brookhaven Laboratory, the National Center for Atmospheric Research (NCAR), and the National Oceanic and Atmospheric Administration's (NOAA) Air Quality Division participated in the PRECP program sharing the operations base with PRE-STORM. A brief summary of the PRECP flights is given in Appendix C. A description of the goals and objectives of the PRECP program during PRE-STORM can be found in Appendix B of the PRE-STORM Design and Operations plan. Dates and times that PRE-STORM aircraft flew missions during May and June, 1985 are summarized in Figures 1 and 2.

Table 1 Characteristics of P-3 Instrumentation

Parameter	Instrument	Manufacturer	Accuracy	Resolution
Positioning	Inertial Navigation Equip.	Northrop/Delco	1.5 km	8.3×10^{-8} °
Temperature	Platinum resistance	Rosemount	0.2°C	0.03°C
Dewpoint	Cooled Mirror	General Eastern	0.5°C	0.03°C
Static Pressure	Transducer	Garrett	0.2 mb	0.1 mb
Dynamic Pressure	Transducer	Garrett, Rosemount	0.1 mb	0.1 mb
Attack Pressure	Transducer	Rosemount	0.15%	0.1 mb
Sideslip Pressure	Transducer	Rosemount	0.15%	0.1 mb
Absolute Altitude	Radar Altimeter	APN-59	0.01%	1 meter
Cloud Water Meter	Hot-Wire	Johnson-Williams	0.2%	0.1 g m^{-3}
Cloud Temperature	CO_2 radiometer	Barnes/OAO	0.2°C	0.1°C
Sea Sfc Temp	CO_2 radiometer	Barnes	0.2°C	0.1°C
Ground Speed	INE accelerometers	Northrop/Delco	0.5 ms^{-1}	0.06 m s^{-1}
Track Angle	INE accelerometers	Northrop/Delco	0.2°	0.005°
Heading Angle	INE accelerometers	Northrop/Delco	0.1°	0.005°
Pitch Angle	INE accelerometers	Northrop/Delco	0.06°	0.005°
Roll Angle	INE accelerometers	Northrop/Delco	0.06°	0.005°
Hydrometer Size	Optical Spectrometer	Knollenberg		50 microns

Table 2 Characteristics of P-3 Airborne Radars

Parameter	LF Radar	TA Radar
Transmitter Frequency	5370 ±6.7 MHz	9315 ±11.6 MHz
Transmitter Wavelength	5.59 cm	3.22 cm
Transmitter Pulse Width	1800 m	150 m
Pulse Repetition Frequency	200 s^{-1}	1600 s^{-1}
Peak Transmitter Power	70 kW	60 kW
Receiver Dynamic Range	80 dB	80 dB
Gain, Main Beam	37.5 dB	40 dB
Gain, Sidelobe	23 dB down	23 dB down
Horizontal Beam Width	1.1°	1.35°
Vertical Beam Width	4.1°	1.9°
Antenna Stabilization	±10° pitch and roll	±25° pitch and drift
Maximum Range	371 km	93 km
Nyquist Velocity	N/A	12.89 m s^{-1}
Antenna Rotation Rate	4 RPM	8 RPM

MAY 1985

SUN	MON	TUE	WED	THU	FRI	SAT
			1 121	2 122	3 123	4 124
5 N43 2156-0552 125	6 126	7 127	8 128	9 129	10 130	11 N43 0300-1015 131
12 132	13 N43 0307-1225 UWa 0105-0415 UWb 0645-0920 133	14 134	15 135	16 136	17 137	18 138
19 139	20 UW 1935-2230 140	21 N43 0404-0918 UW 0420-0545 141	22 142	23 143	24 144	25 145
26 146	27 N43 0155-1014 147	28 148	29 N43 0813-1754 UW 1740-2030 149	30 150	31 151	

Figure 1. PRE-STORM aircraft missions during May 1985.

JUNE 1985

SUN	MON	TUE	WED	THU	FRI	SAT
						1 152
2 153	3 N43 0225-0621 154	4 N43 0044-0944 N42 0334-1220 155	5 N43 0109-0923 QA 1424-1651 SL 1803-2058 156	6 QA 2133-0000 KA 2140-2340 157	7 KA 2009-2100 158	8 QA 1745-1959 KA 1745-2024 SL 1757-1850 159
9 160	10 N43 2210-0750 QA 2059-2358 SLa 1723-1955 SLb 2108-2328 161	11 N42 0230-1031 162	12 163	13 QA 2000-2151 SL 1705-1943 164	14 165	15 N43 2205-0717 N42 0540-1046 QA 1029-1405 SL 1107-1312 166
16 QA 2017-2348 KA 2040-0039 SL 2056-2347 167	17 N43 0020-0733 QA 1227-1530 KA 2035-2330 SLa 1256-1540 SLb 2200-0030 168	18 SL 1750-2018 169	19 170	20 SL 2005-2243 171	21 172	22 N43 0400-1300 N42 0604-1350 QA 1020-1224 KA 0452-0756 Sla 1715-1955 Slb 2207-0015 173
23 174	24 N43 0555-1430 N42 0740-1600 175	25 QA 2220-0000 KA 2306-0244 SL 2300-0000 176	26 N43 2128-0730 QA 2012-2200 KA 2042-2311 SL 1954-2229 177	27 N42 0108-1021 QA 0004-0110 KA 0042-0336 SLa 0006-0210 SLb 1949-2208 178	28 179	29 180

Figure 2. PRE-STORM aircraft missions during June 1985.

3. Data Archives.

All P-3 magnetic tapes, flight logs and mission summaries are archived at NOAA's Weather Research Program in Boulder, Colo. A computer workstation is available at WRP for researchers wishing to analyze aircraft data. Duplication and distribution of data is performed at cost to interested scientists. Inquiries about the P-3 data archives and use of the workstation should be addressed to the PRE-STORM data coordinator.

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The University of Wyoming aircraft data collected during PRE-STORM is available from the principal investigator.

Prof. John Marwitz
Dept. of Atmospheric Science
University of Wyoming
Laramie, WY 82071

For inquiries about PRECP aircraft data availability, contact:

Data Manager
PRECP Project
Battelle P.N.L.
Richland, WA 99352

4. Acknowledgments.

The airborne scientists are commended for the comprehensive summaries, excellent note-taking and detailed logs without which this document could not have been compiled. The aircraft subprogram was a success, in part, due to the personnel and flight crews from the Office of Aircraft Operations, NOAA; their contribution is gratefully acknowledged. Equally, the contribution of the aircrews for the PRECP program are duly noted. The Wyoming King Air mission summaries were provided courtesy of Professor John Marwitz. The summaries for the PRECP aircraft were provided by Dr. Joe Boatman (NOAA/Air Quality Division), Dr. Russ

Dickerson (University of Maryland), and Tom Kelly (Brookhaven Labs). The instrumentation logs were transcribed by Sandie Chandler and Aileen Cárdenas. The final document was expertly prepared by Wanda Gilmer.

5. References.

Cunning, J.B., 1986: The Oklahoma-Kansas preliminary regional experiment for STORM-Central. Bull. Amer. Meteor. Soc., **67**, 1478-1486.

Meitín, J.G. and J.B. Cunning, 1985: The Oklahoma-Kansas preliminary regional experiment for STORM-Central (O-K PRE-STORM) Volume I. Daily Operations Summary. NOAA Tech Memo. ERL ESG-20, 313 pp.

Meitín, J.G., 1987: The Oklahoma-Kansas preliminary regional experiment for STORM-Central (O-K PRE-STORM) Volume II. Radar Data Summary. NOAA Tech Memo. ERL ESG-26, 84 pp.

Appendix A

NOAA AIRCRAFT MISSION SUMMARY

NOAA Mission Summaries.

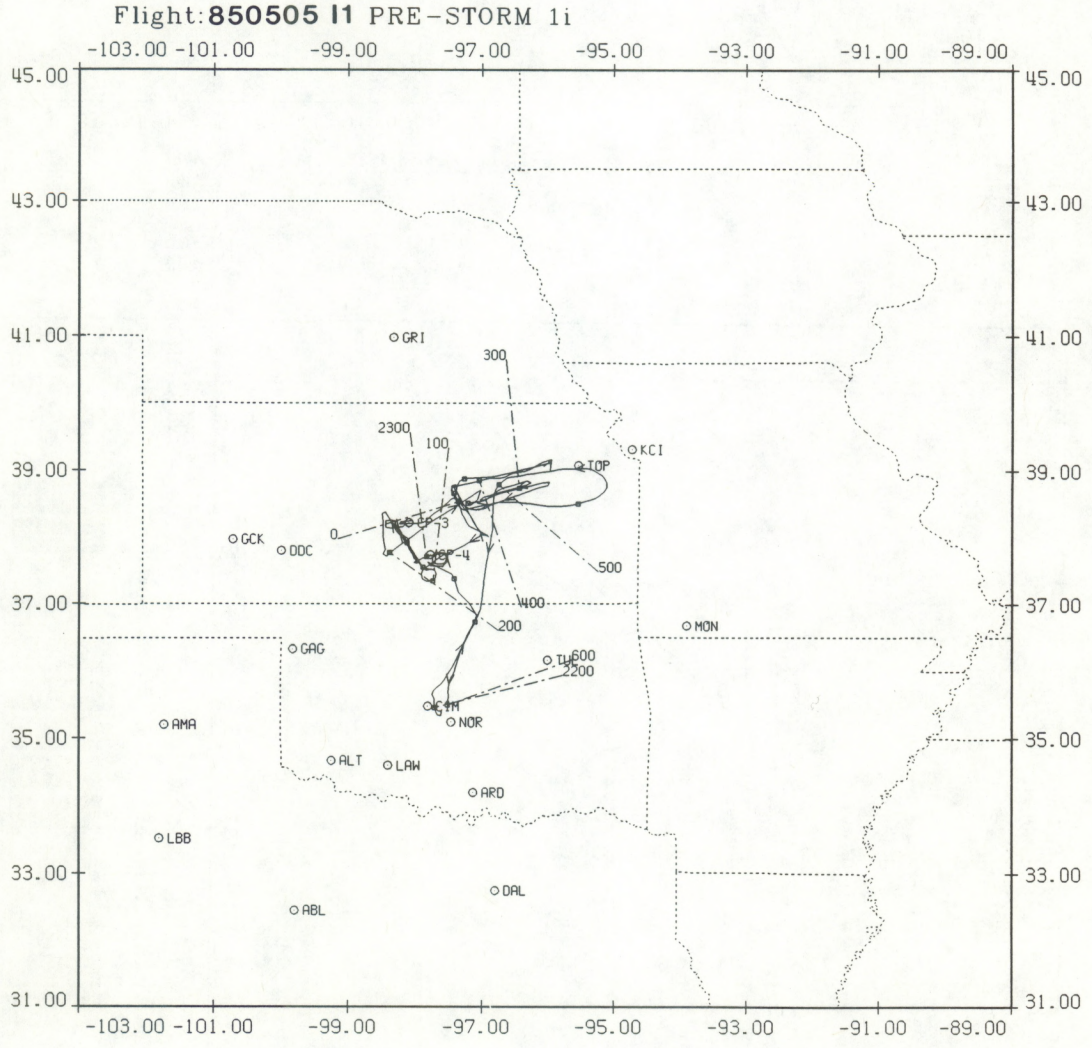
Fifteen mission days had aircraft flights by the NOAA P-3s during the PRE-STORM experiment. Table 3 list the dates and flight times for these missions. Each summary contains a brief description of the flight, a plot of the flight track, a time series of the different flight levels used during the mission, sections of flight tracks overlayed on ground-based radar plan position indicator (PPI) scans, and a data log of the archived tapes.

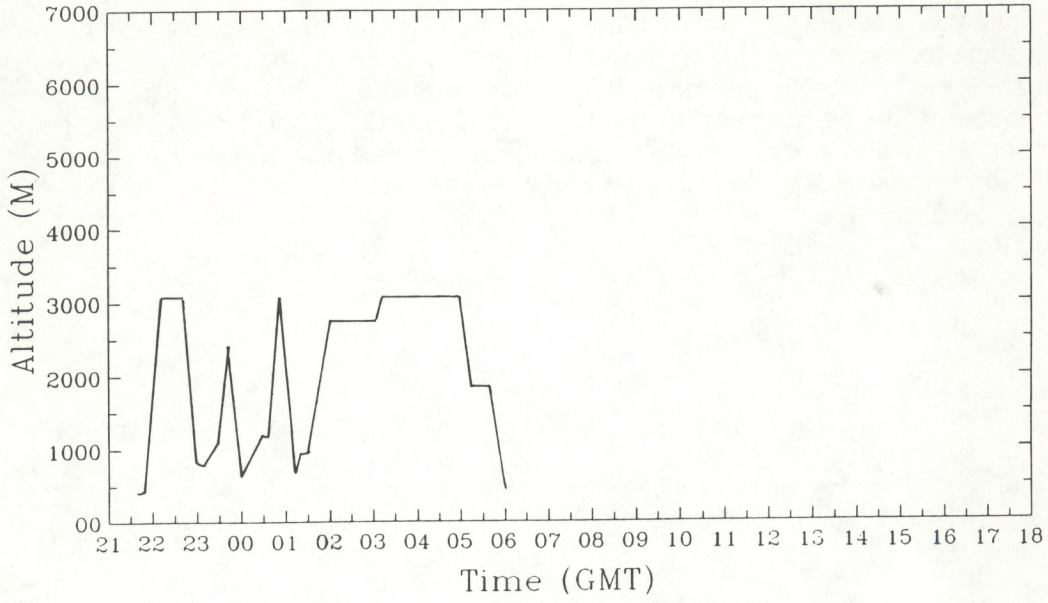
Table 3. OKLAHOMA-KANSAS PRE-STORM PROGRAM NOAA P-3 FLIGHT SUMMARY

Date	Flight Number	A/C ID	Take Off (Time in GMT)	Return (Time in GMT)
5-6 May	1	N43	2156	0552
10-11 May	2	N43	0300	1015
12-13 May	3	N43	0307	1225
20-21 May	4	N43	0404	0918
26-27 May	5	N43	0155	1014
28-29 May	6	N43	0813	1754
2-3 June	7	N43	0225	0621
3-4 June	8	N43	0044	0944
		N42	0334	1220
4-5 June	9	N43	0109	0923
10-11 June	10	N43	2210	0750
		N42	0230	1031
14-15 June	11	N43	2205	0717
		N42	0540	1046
16-17 June	12	N43	0020	0733
21-22 June	13	N43	0400	1300
		N42	0604	1350
23-24 June	14	N43	0555	1430
		N42	0740	1600
26-27 June	15	N43	2128	0730
		N42	0108	1021

Mission # 1 NOAA-43
5-6 May 1985 (2156-0552 GMT)

Primary interest of the mission was to monitor the pre-convective environment near a surface convergence zone, and then continue to study the convective organization as storms developed. Flight pattern was coordinated with the Kansas Doppler radars in order to maintain the aircraft within radar range of CP-3 and CP-4. The region produced a number of active areas but it was difficult to monitor the complete evolution since convection dissipated quickly and refired elsewhere.

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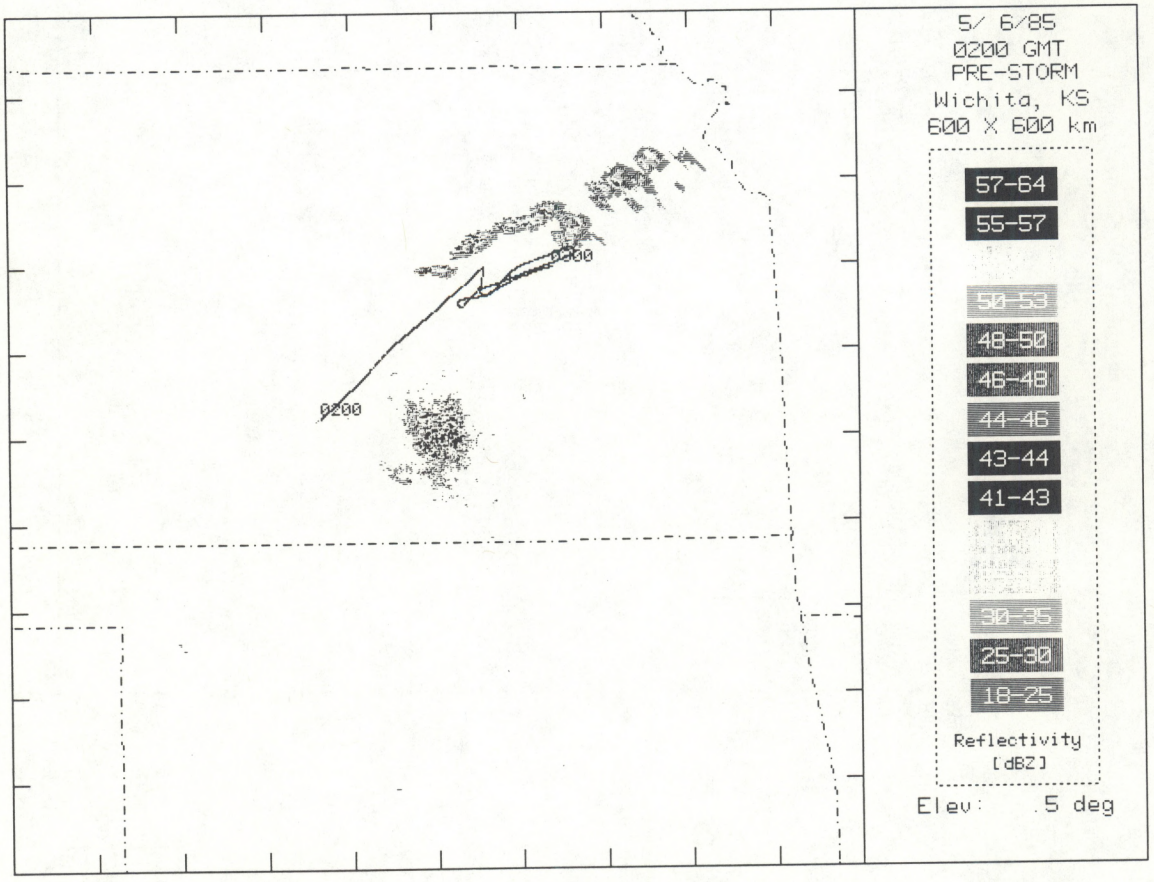
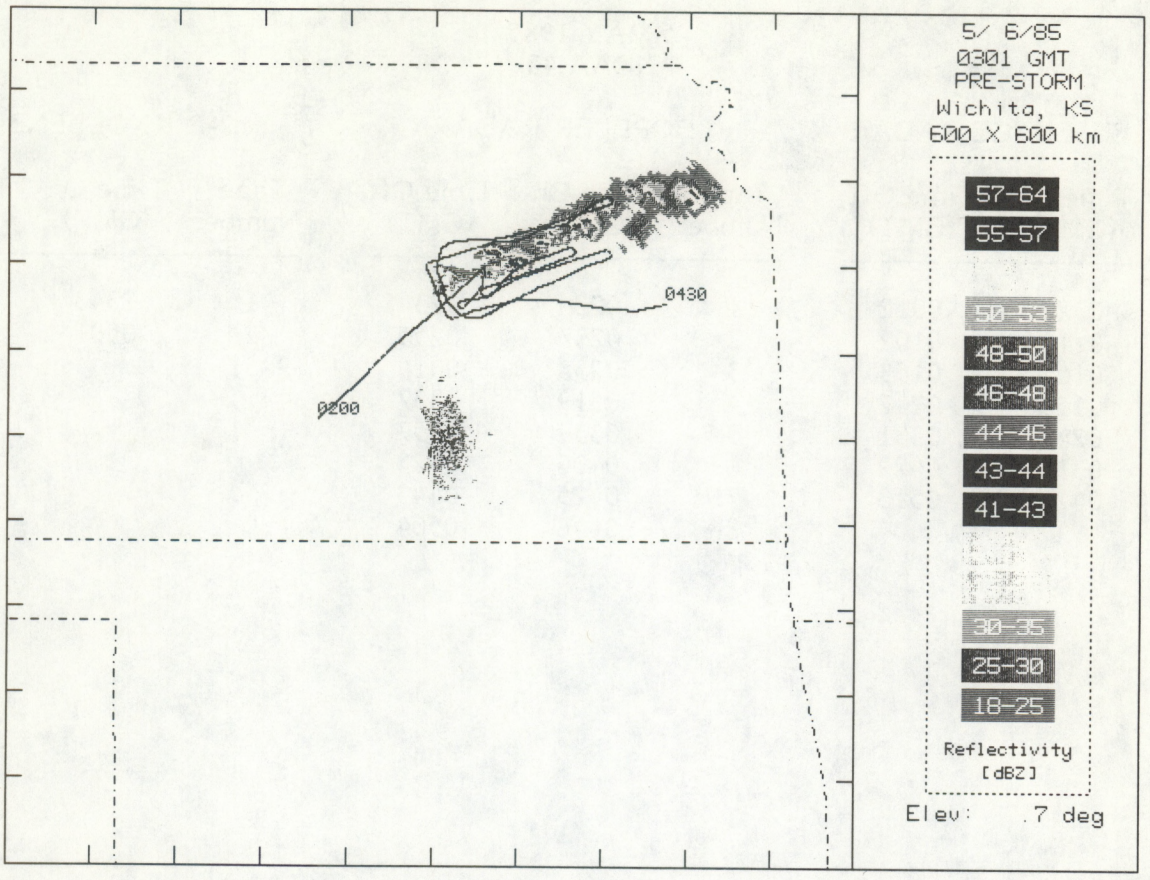

5/ 6/85
0200 GMT
PRE-STORM
Wichita, KS
600 X 600 km
57-64
55-57
50-53
48-50
46-48
44-46
43-44
41-43
30-35
25-30
18-25
Reflectivity
[dBZ]
Elev: .5 deg
0200
0200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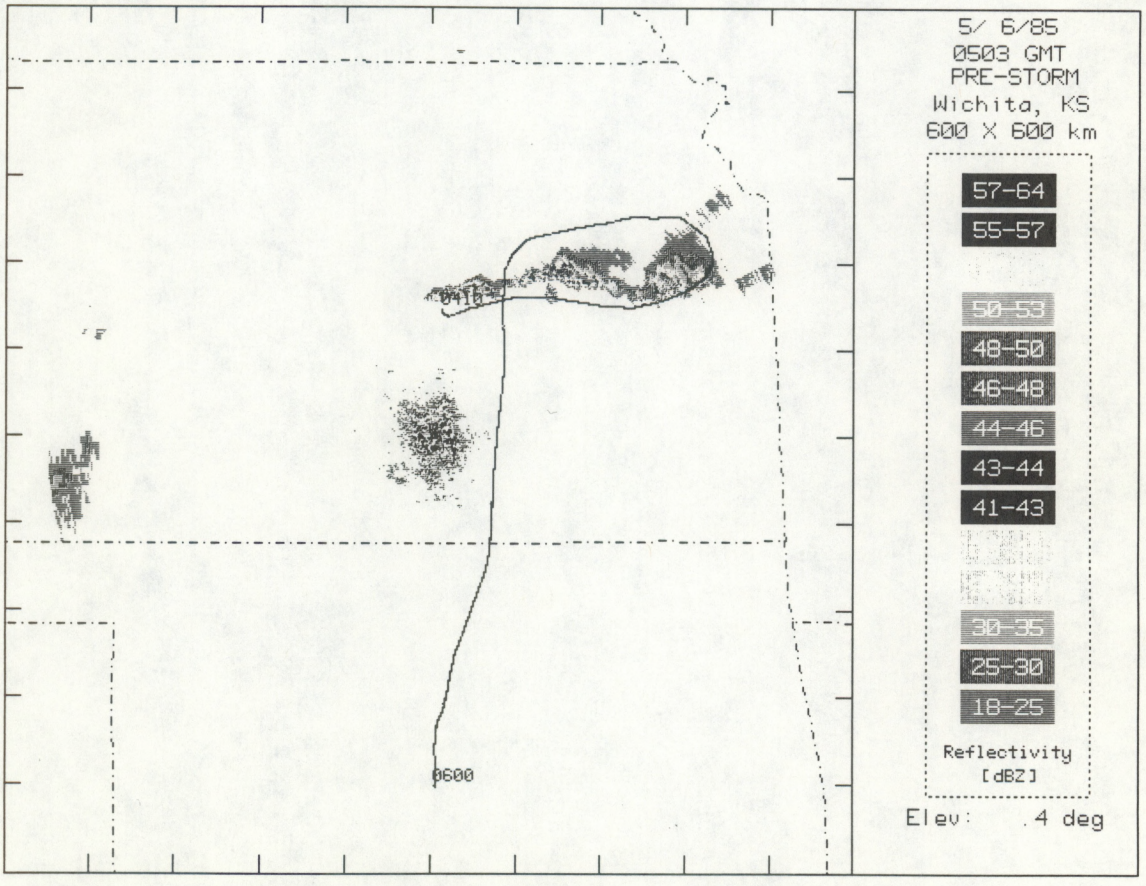
PRE-STORM
Wichita, KS
600 X 600 km
57-64
55-57
50-53
48-50
46-48
44-46
43-44
41-43
30-35
25-30
18-25
Reflectivity
[dBZ]
Elev: .7 deg
0200
0430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PRE-STORM
Wichita, KS
600 X 600 km
57-64
55-57
50-53
48-50
46-48
44-46
43-44
41-43
30-35
25-30
18-25
Reflectivity
[dBZ]
Elev: .4 deg
0600

5 MAY 1985
NOAA 43

LOWER FUSELAGE RADAR

Tape Number	Time On (GMT)	Time Off (GMT)
1	2322	0012
2	0112	0102
3	0102	0153
4	0153	0242
5	0242	0331
6	0331	0422
7	0422	0513

DOPPLER RADAR

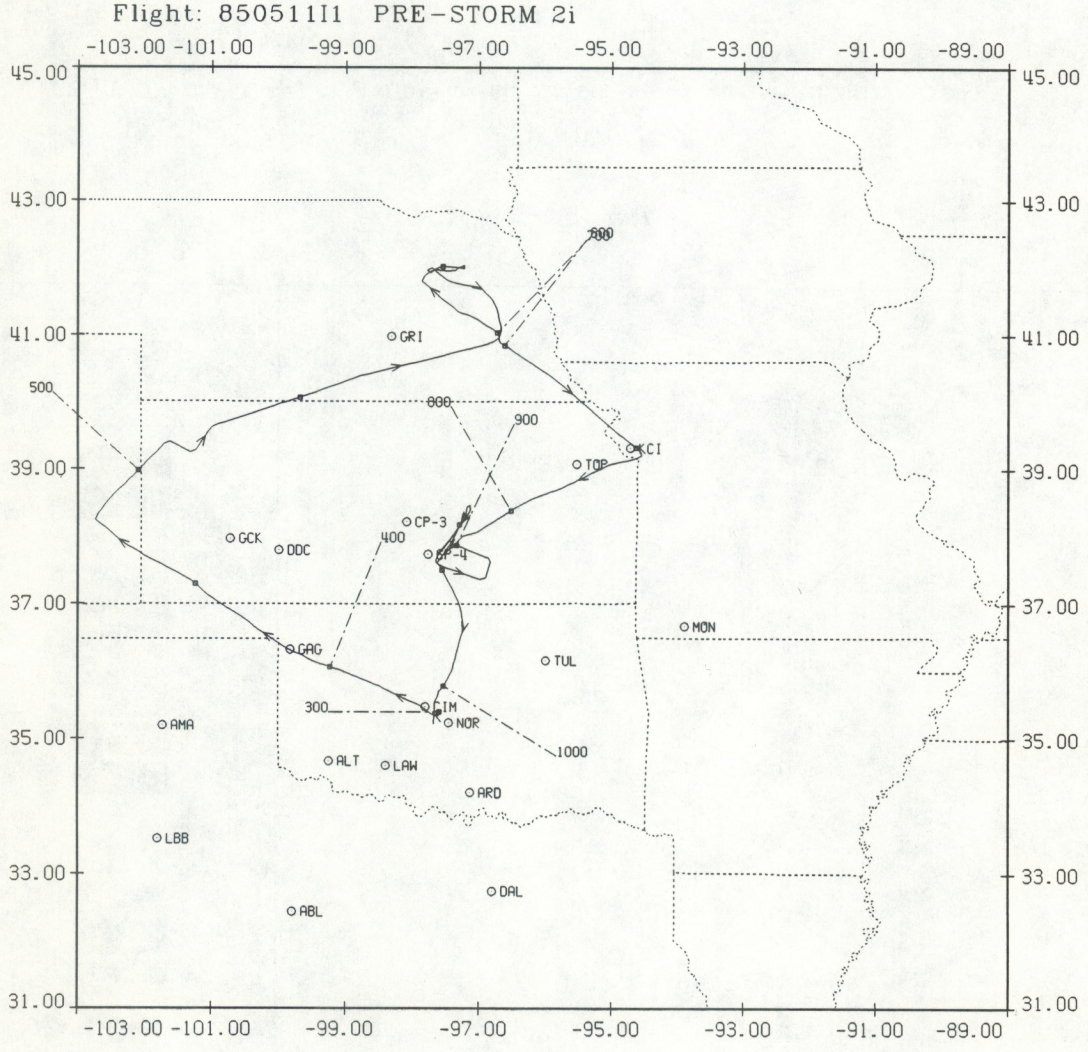
Tape Number	Time On (GMT)	Time Off (GMT)
1	0220	0234
2	0237	0255
3	0258	0316
4	0319	0337
5	0339	0357
6	0406	0423
7	0425	0443
8	0446	0504

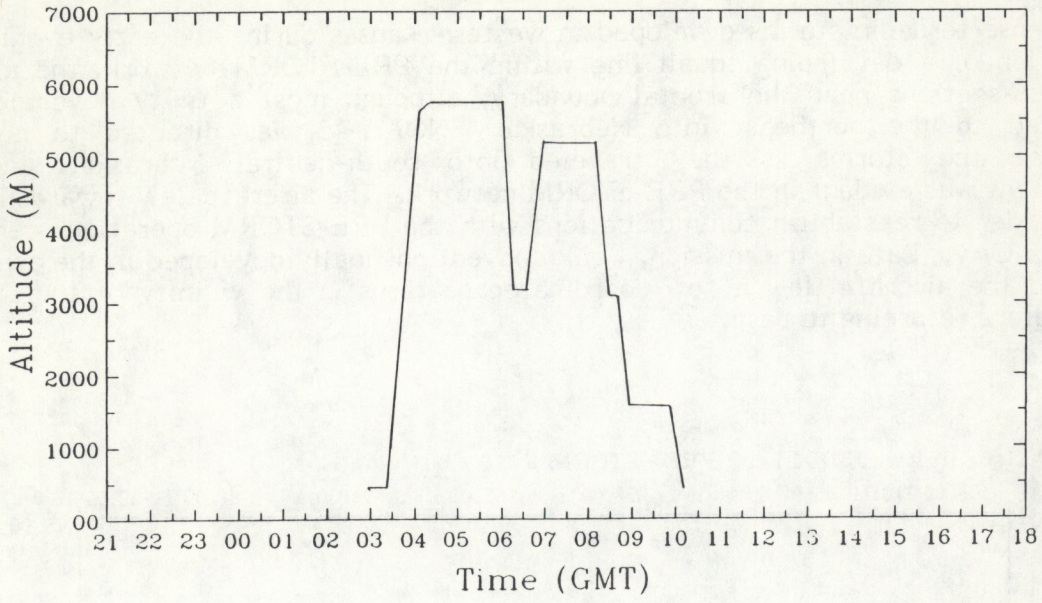
2-D KNOLLENBERG

Tape Number	Time On (GMT)	Time Off (GMT)
1	2343	0501
2	0501	0511

Mission # 2 NOAA-43
11 May 1985 (0300-1015 GMT)

Intense tornadic storms developed in western Kansas during the early evening. In anticipation of a developing squall line within the PRE-STORM network, the aircraft flew cross-sections near the frontal boundary, although most activity developed and propagated to the northeast into Nebraska. NOAA-43 was directed to continue monitoring the storms as they traveled into south-central Nebraska, since no development was evident in the PRE-STORM network. The aircraft flew towards Kansas City in order to reestablish communications with the PRE-STORM operations center in Oklahoma City. Late in the mission, weak convection finally developed in the area near CP-4 and the aircraft flew a few coordinated patterns in the vicinity of the Doppler radars before returning to base.

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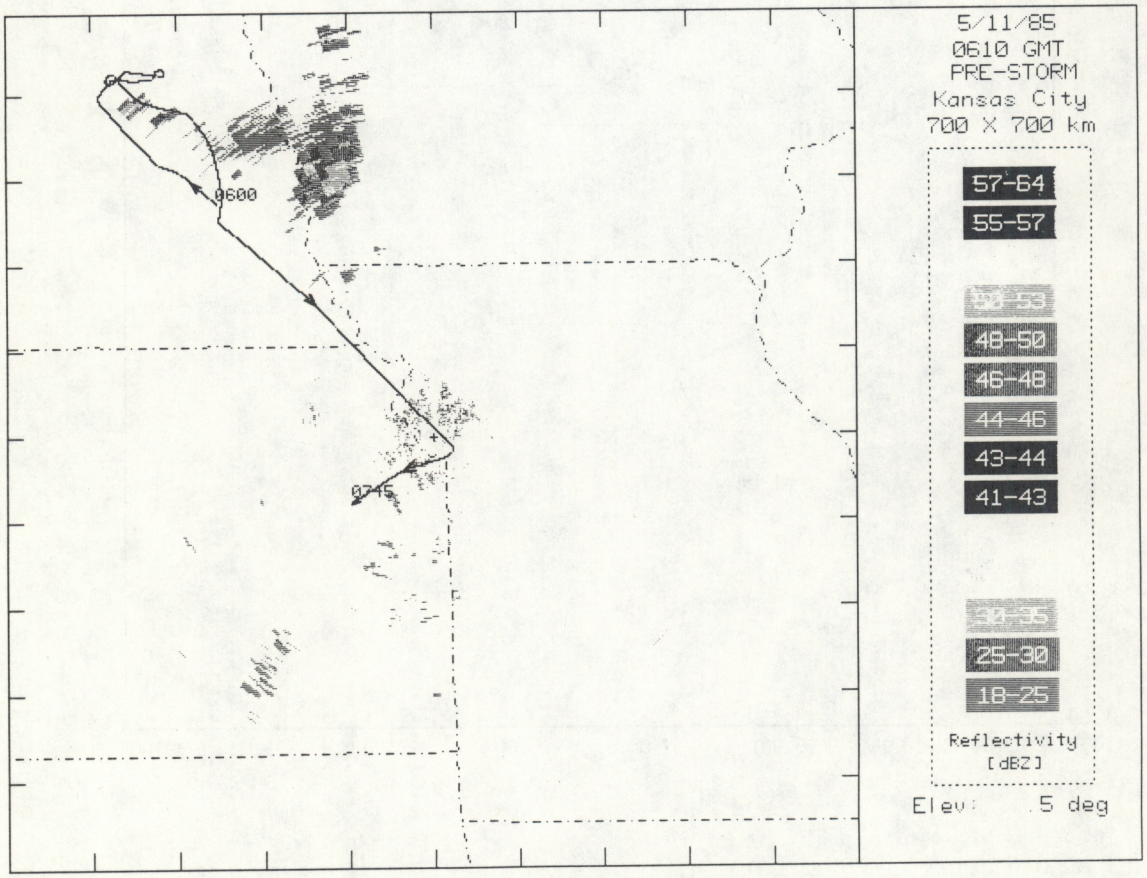

0600
0745
5/11/85
0610 GMT
PRE-STORM
Kansas City
700 X 700 km
57-64
55-57
48-50
46-48
44-46
43-44
41-43
25-30
18-25
Reflectivity
[dBZ]
Elev: .5 deg

11 MAY 1985
NOAA 43

LOWER FUSELAGE RADAR

Tape Number	Time On (GMT)	Time Off (GMT)
1	0547	0637
2	0637	0727
3	0727	0817
4	0817	0906
5	0906	0930

DOPPLER RADAR

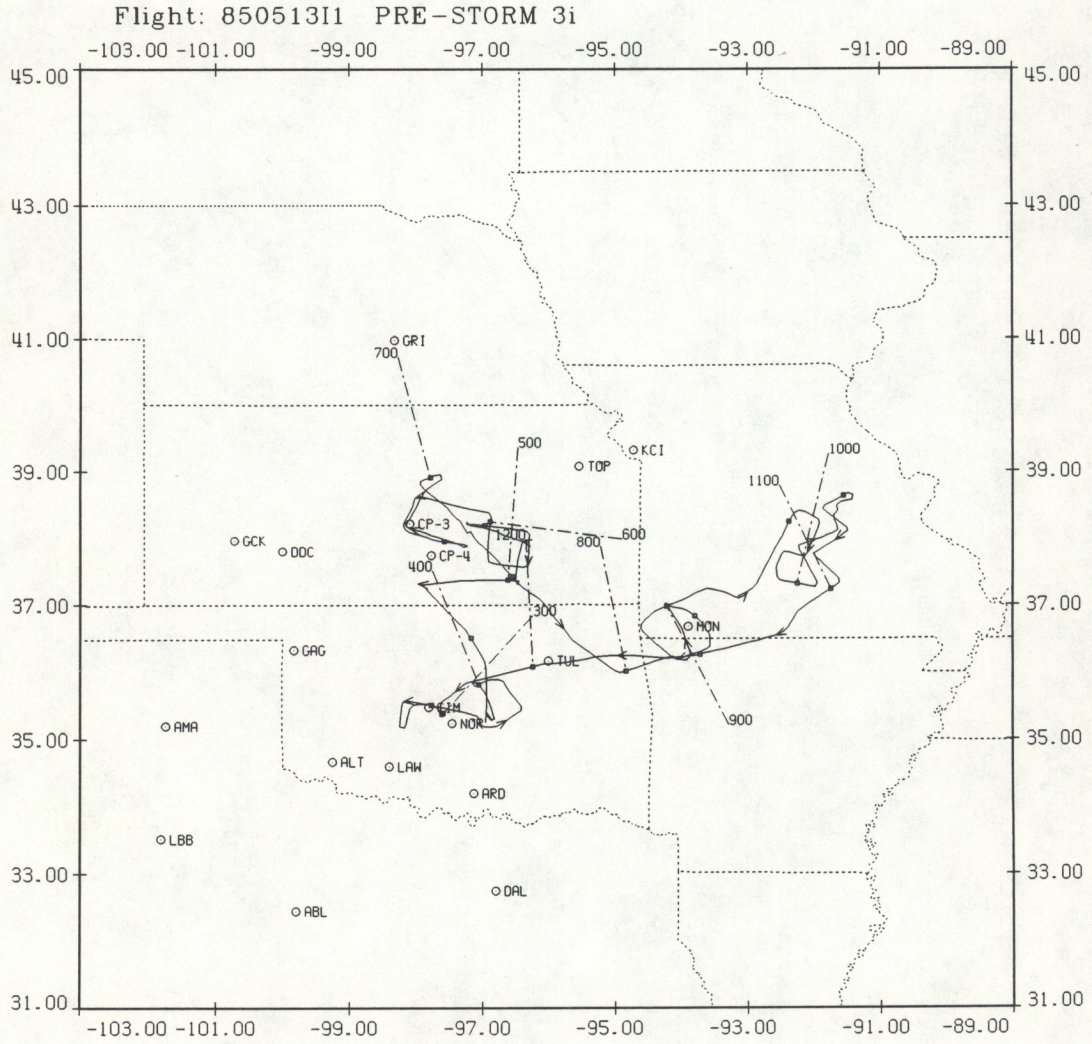
Tape Number	Time On (GMT)	Time Off (GMT)
1	0610	0630
2	0636	0645
3	0827	0846
4	0854	0909

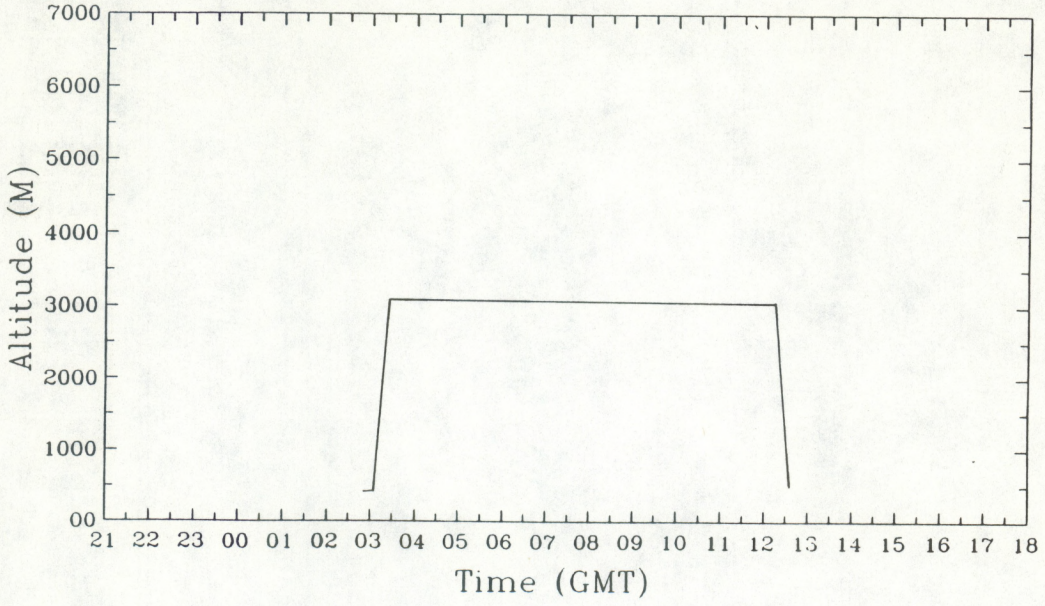
2-D KNOLLENBERG

Tape Number	Time On (GMT)	Time Off (GMT)
1	0626	0714
2	0714	0724
3	0724	0732
4	0732	0738
5	0738	0746
6	0746	0754
7	0754	0810
8	0810	0857

Mission # 3 NOAA-43
13 May 1985 (0307-1225 GMT)

Takeoff was delayed by 2 hours due to intense thunderstorms in the Oklahoma City area. The first portion of the mission was coordinated with the NSSL Doppler radar network in the study of convective cells to the south and southeast of Oklahoma City. Of primary interest was the stratiform precipitation dynamics with secondary emphasis on storm-scale cells and interactions. With this in mind, the flight pattern was changed to east-west legs through the stratiform region which had developed from southwest Missouri to south-central Kansas. Several mesoscale "hook echoes" were noted on aircraft radar.

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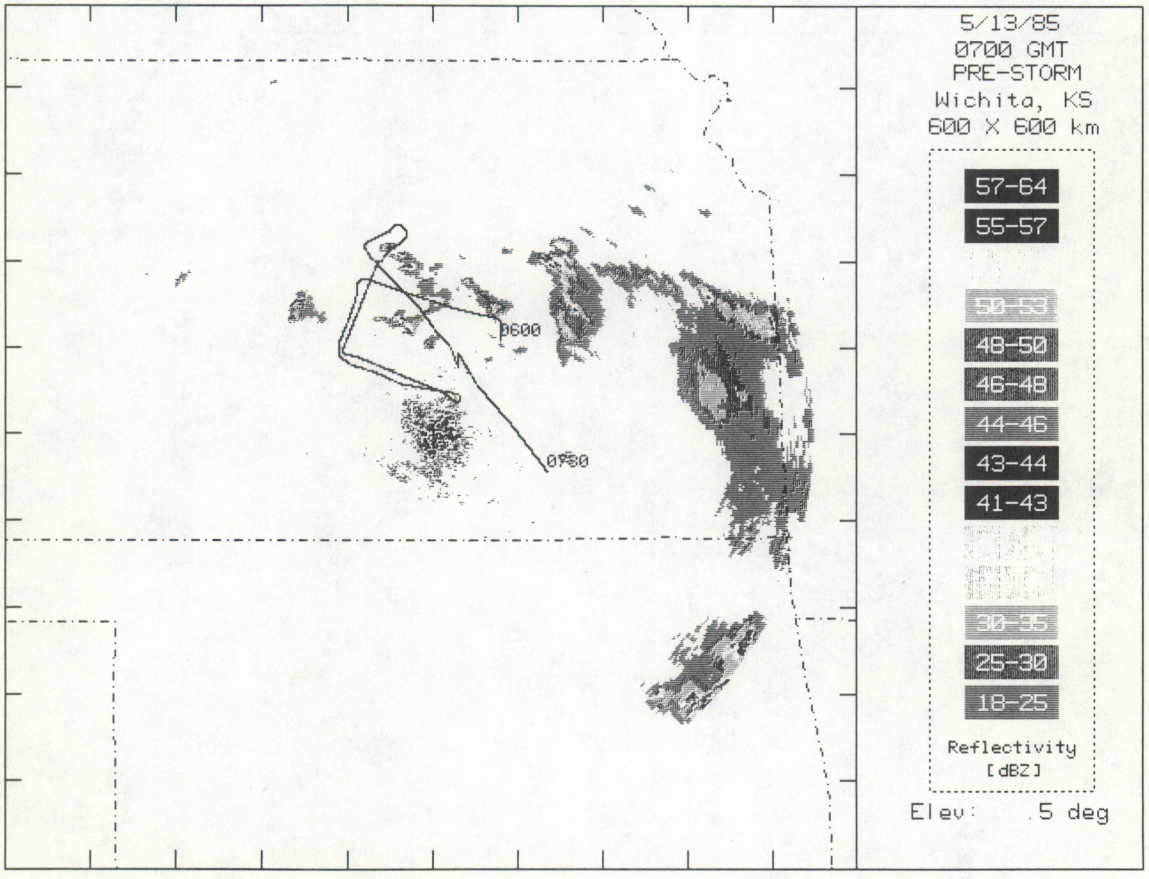
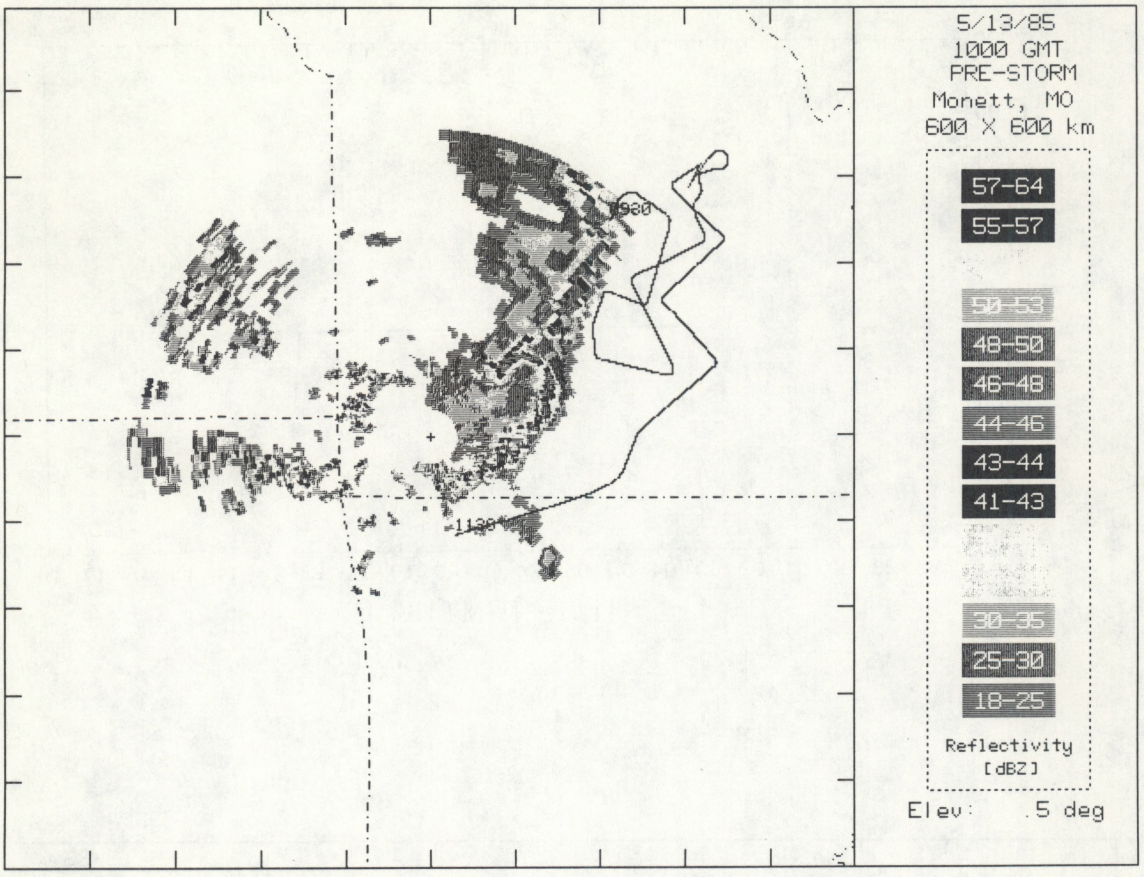

0600
0700
5/13/85
0700 GMT
PRE-STORM
Wichita, KS
600 X 600 km
57-64
55-57
50-53
48-50
46-48
44-46
43-44
41-43
30-35
25-30
18-25
Reflectivity
[dBZ]
Elev: .5 deg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PRE-STORM
Monett, MO
600 X 600 km
57-64
55-57
50-53
48-50
46-48
44-46
43-44
41-43
30-35
25-30
18-25
Reflectivity
[dBZ]
Elev: .5 deg

13 MAY 1985
NOAA 43

LOWER FUSELAGE RADAR

Tape Number	Time On (GMT)	Time Off (GMT)
1	0314	0404
2	0404	0454
3	0454	0544
4	0544	0634
5	0634	0725
6	0725	0815
7	0815	0905
8	0905	0956
9	0956	1047
10	1047	1145

DOPPLER RADAR

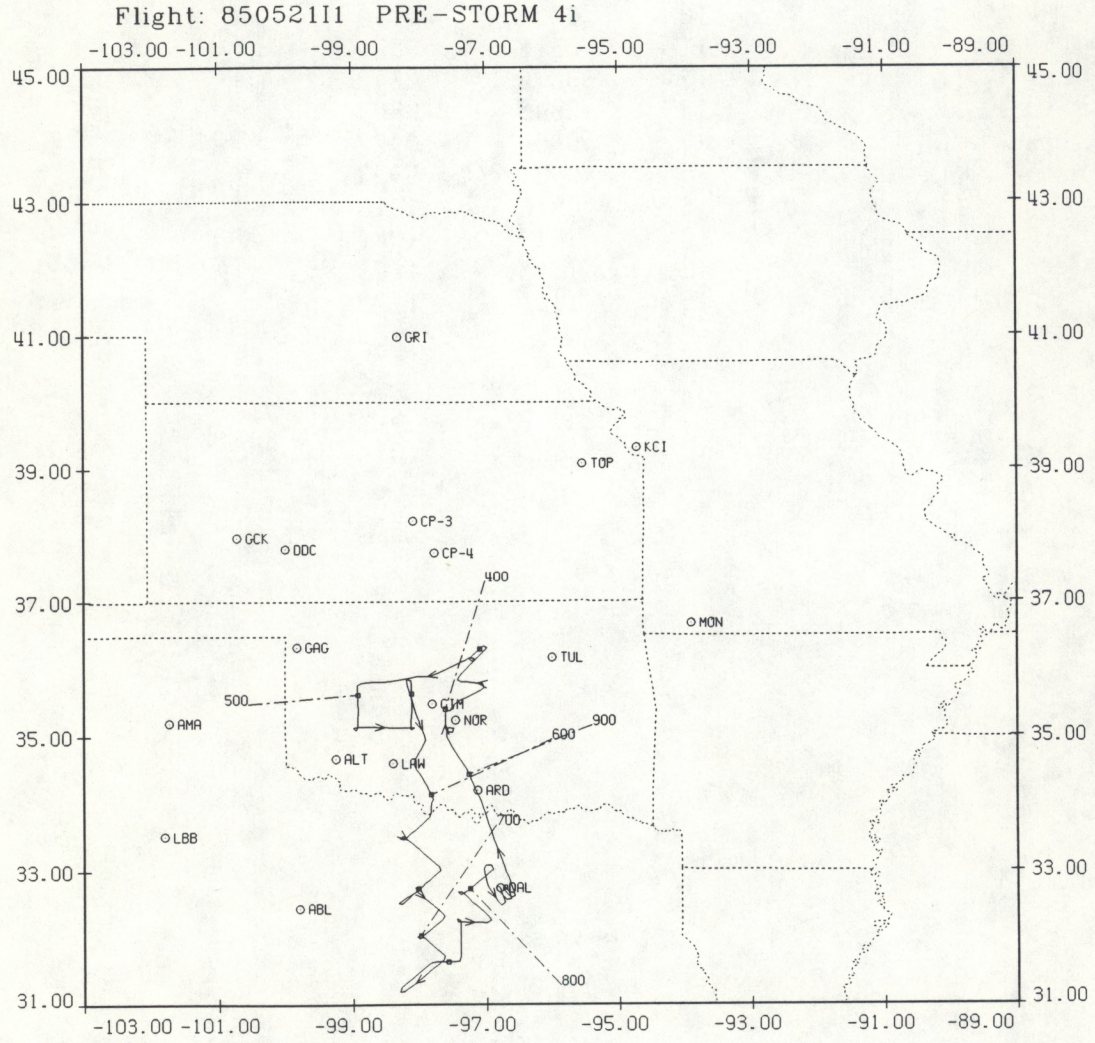
Tape Number	Time On (GMT)	Time Off (GMT)
1	0338	0356
2	0405	0412
3	0446	0502
4	0504	0524
5	0528	0544
6	0547	0604
7	0607	0625
8	0628	0645
9	0648	0702
10	0751	0810
11	0812	0821
12	0824	0842
13	0845	0903
14	0906	0923
15	0935	0953
16	0956	1016
17	1019	1041
18	1043	1103
19	1105	1122

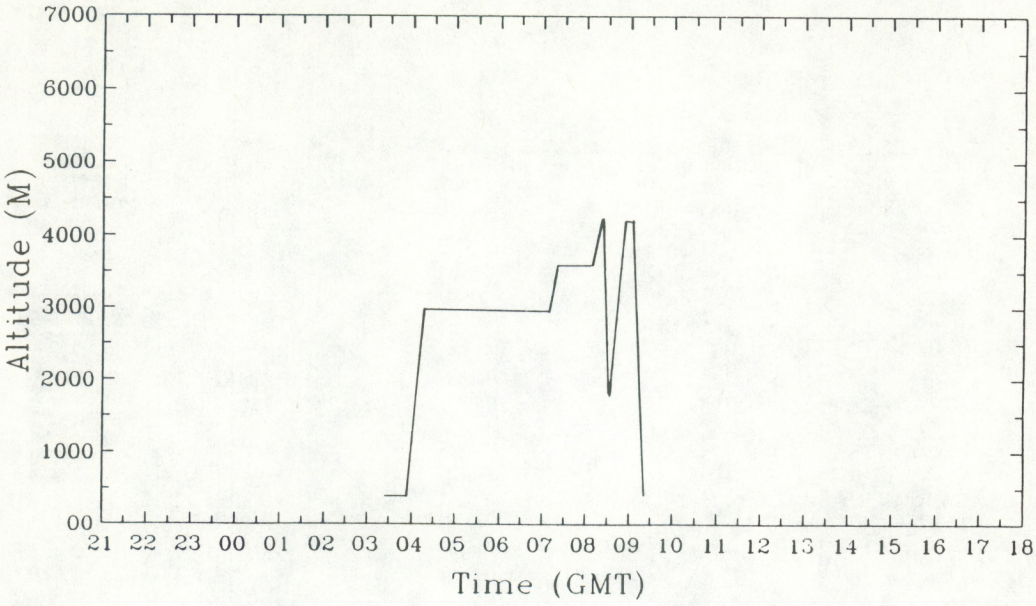
2-D KNOLLENBERG

Tape Number	Time On (GMT)	Time Off (GMT)
1	0313	0459
2	0459	0628
3	0628	0849
4	0849	0914
5	0914	1142

Mission # 4 NOAA-43
21 May 1985 (0404-0918 GMT)

Although convective activity was present in Kansas early on 20 May, the flight mission was to conduct microphysical experiment in conjunction with the NSSL Doppler radars. As the activity in Oklahoma weakened, there remained a mesoscale system in northern Texas, near Dallas. The remainder of the flight was spent monitoring stratiform precipitation and transition zone microphysics in that region.

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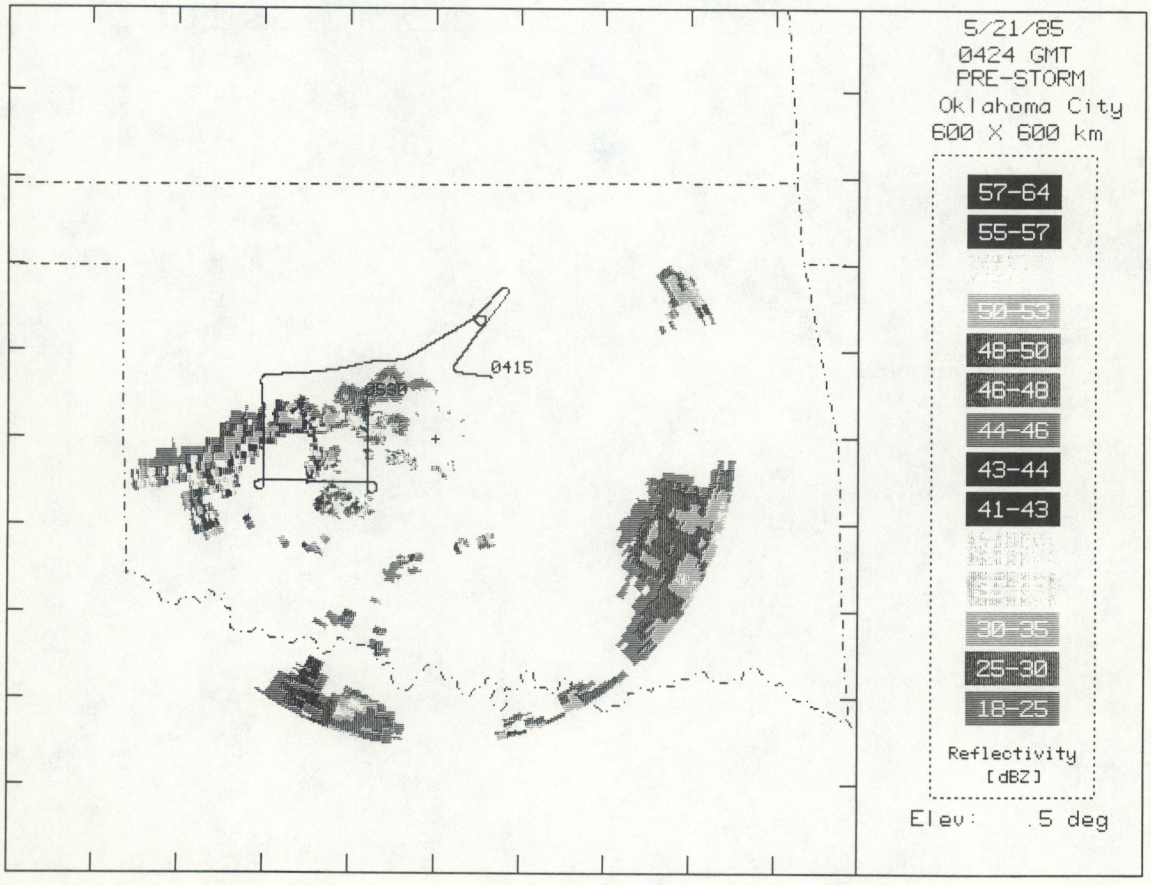
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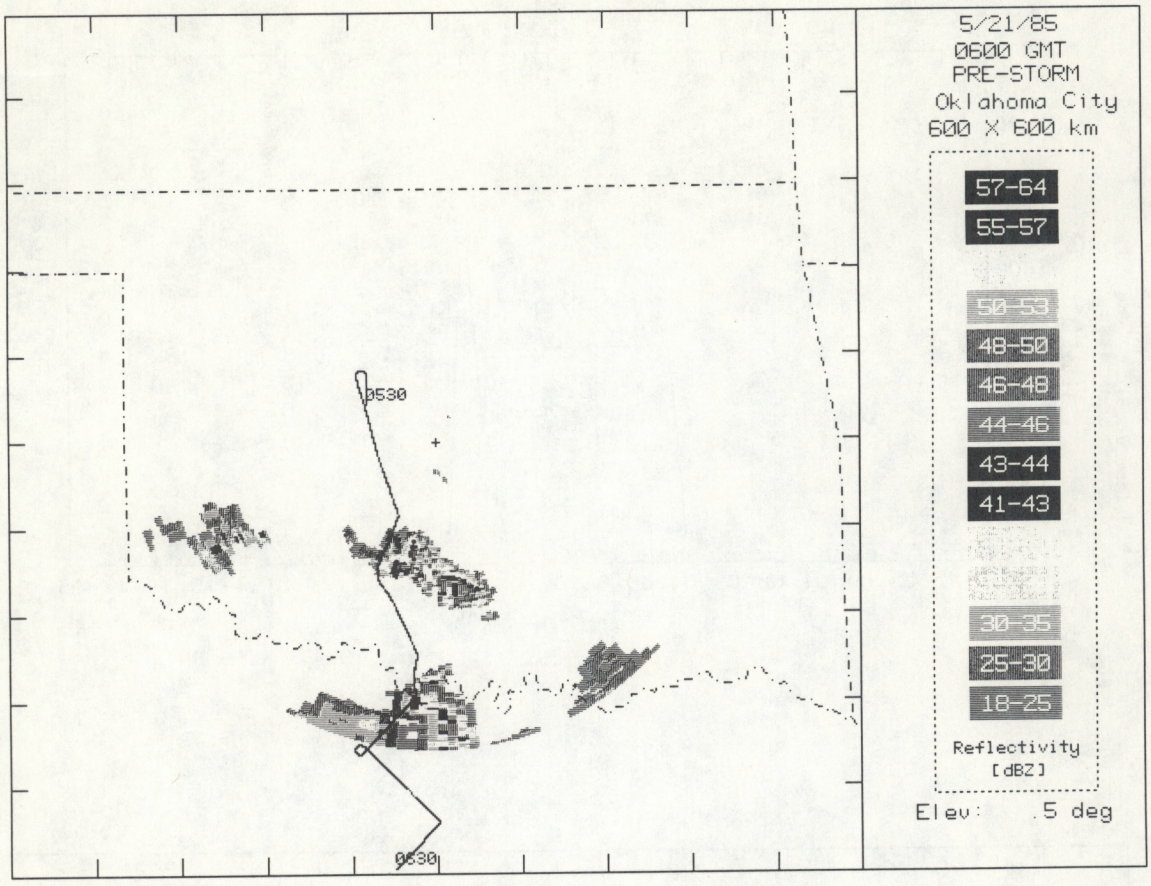
0500
5/21/85
0424 GMT
PRE-STORM
Oklahoma City
600 X 600 km
57-64
55-57
50-53
48-50
46-48
44-46
43-44
41-43
30-35
25-30
18-25
Reflectivity
[dBZ]
Elev: .5 deg


5/21/85
0600 GMT
PRE-STORM
Oklahoma City
600 X 600 km
57-64
55-57
50-53
48-50
46-48
44-46
43-44
41-43
30-35
25-30
18-25
Reflectivity
[dBZ]
Elev: .5 deg
0530
0630

21 MAY 1985
NOAA 43

LOWER FUSELAGE RADAR

Tape Number	Time On (GMT)	Time Off (GMT)
1	0426	0517
2	0517	0608
3	0608	0636
4	0656	0742
5	0742	0830
6	0830	0906

DOPPLER RADAR

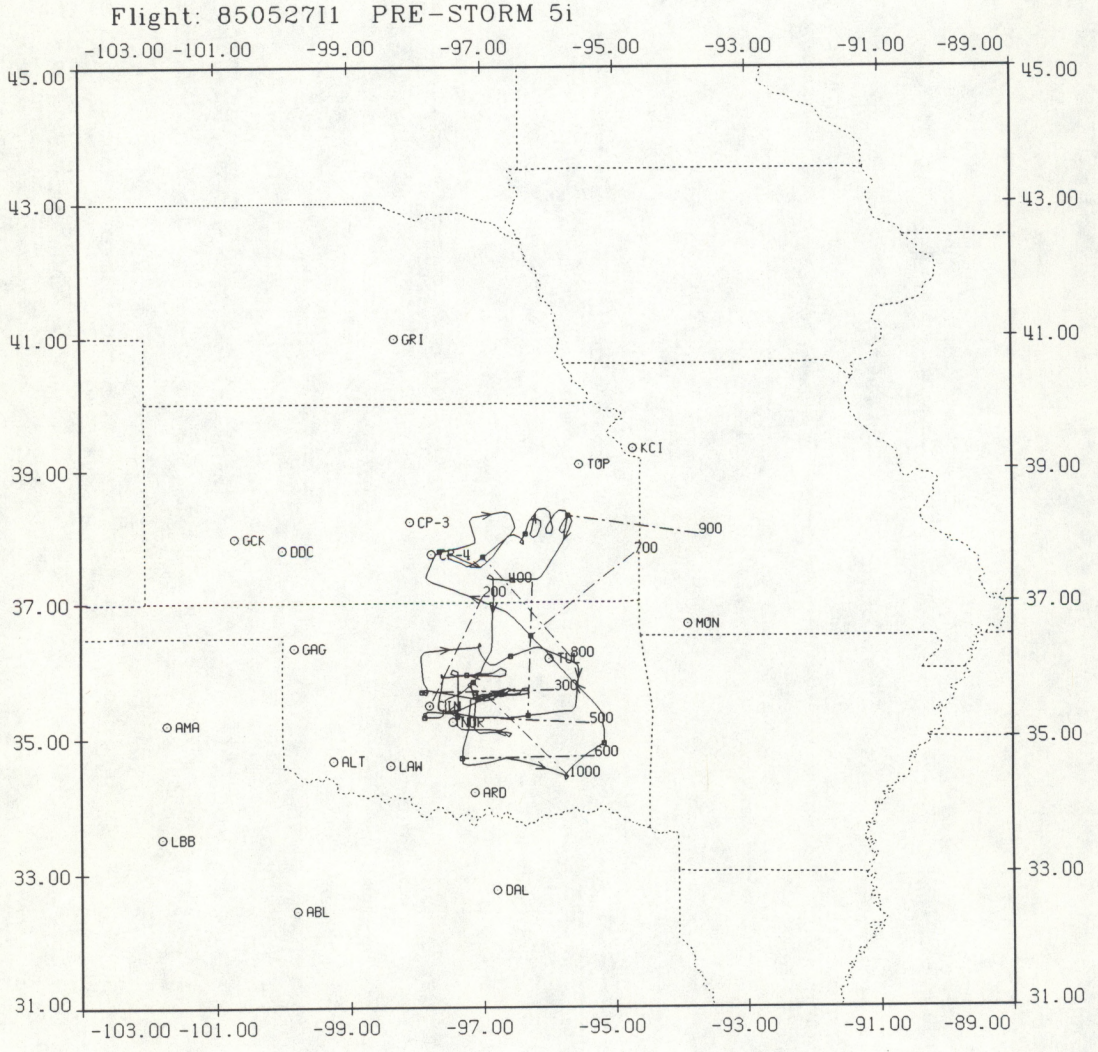
Tape Number	Time On (GMT)	Time Off (GMT)
1	0458	0518
2	0522	0549
3	0557	0612
4	0615	0632
5	0642	0657
6	0700	0714
7	0720	0740
8	0742	0756
9	0759	0819
10	0822	0840

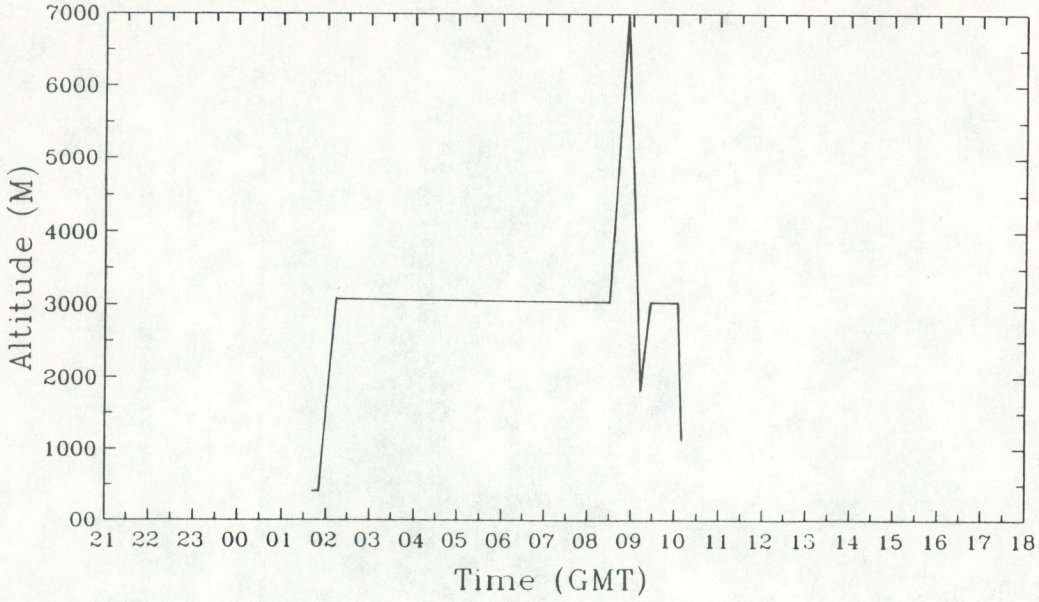
2-D KNOLLENBERG

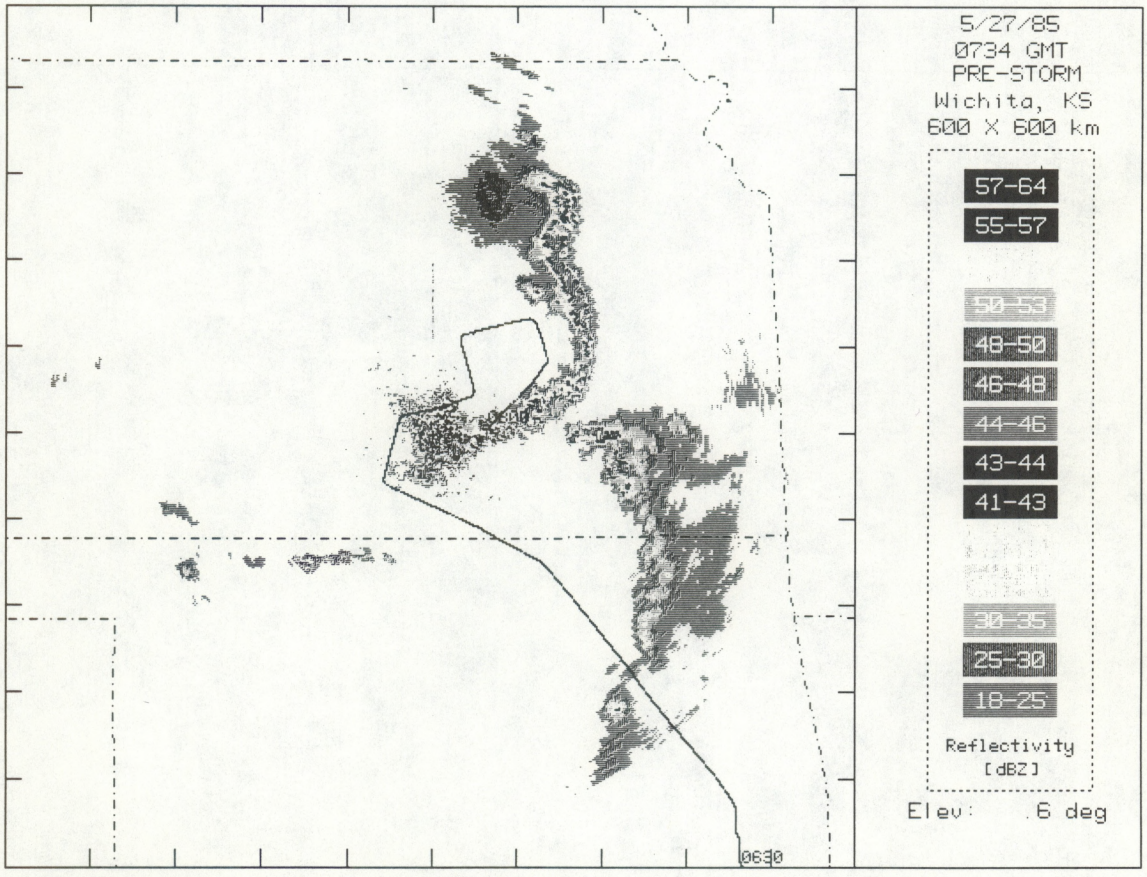
Tape Number	Time On (GMT)	Time Off (GMT)
1	0406	0606
2	0606	0620
3	0620	0628
4	0628	0637
5	0637	0644
6	0644	0649
7	0649	0656
8	0656	0704
9	0704	0716
10	0716	0722
11	0722	0728
12	0728	0733
13	0733	0739
14	0739	0744
15	0744	0750
16	0750	0754
17	0754	0759
18	0759	0804
19	0804	0809
20	0809	0814
21	0814	0819
22	0819	0823
23	0823	0835
24	0835	0842
25	0842	0847
26	0847	0852
27	0852	0857
28	0857	0903
29	0903	0909

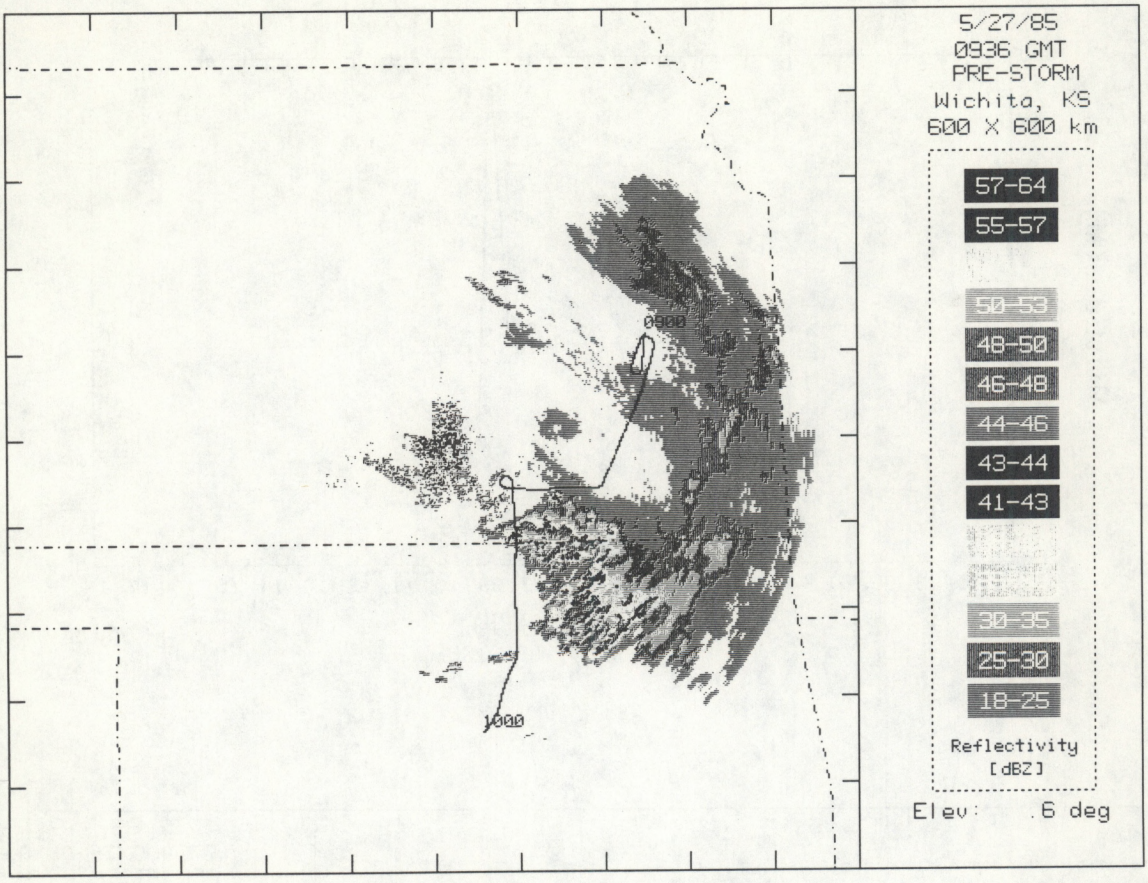
Mission # 5 NOAA-43
27 May 1985 (0155-1014 GMT)

With areas of convection evident over Kansas and Oklahoma, the mission began studying the system in the vicinity of Oklahoma City in coordination with the NSSL radars. As this activity weakened and moved out of radar range (0630 GMT), the flight was redirected to the Kansas radars where a squall line had moved into the area. Before concluding the mission, the aircraft followed the Kansas MCS eastward, out of the PRE-STORM network.




7000
6000
5000
4000
3000
2000
1000
00
Altitude (M)
21 22 23 00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18
Time (GMT)


5/27/85
0734 GMT
PRE-STORM
Wichita, KS
600 X 600 km
57-64
55-57
50-53
48-50
46-48
44-46
43-44
41-43
30-35
25-30
18-25
Reflectivity
[dBZ]
Elev: .6 deg
0630


5/27/85
0936 GMT
PRE-STORM
Wichita, KS
600 X 600 km
57-64
55-57
50-53
48-50
46-48
44-46
43-44
41-43
30-35
25-30
18-25
Reflectivity
[dBZ]
Elev: .6 deg
0900
1000

27 MAY 1985
NOAA 43

LOWER FUSELAGE RADAR

Tape Number	Time On (GMT)	Time Off (GMT)
1	0205	0236
2	0236	0306
3	0313	0344
4	0344	0415
5	0415	0445
6	0445	0515
7	0515	0545
8	0545	0615
9	0615	0646
10	0646	0716
11	0716	0747
12	0747	9817
13	0817	0848
14	0848	0918
15	0918	0948
16	0948	0958

DOPPLER RADAR

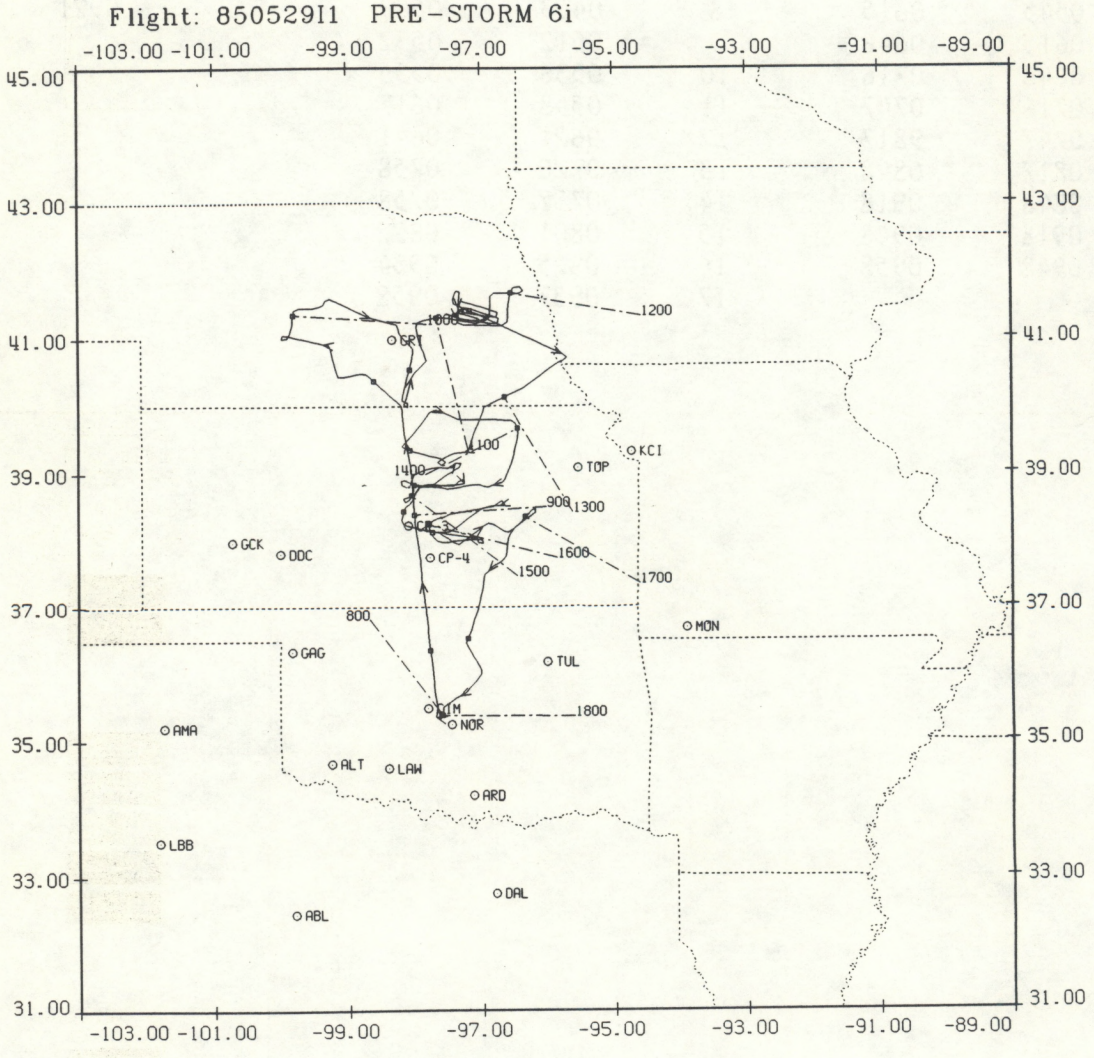
Tape Number	Time On (GMT)	Time Off (GMT)
1	0210	0231
2	0234	0259
3	0302	0319
4	0322	0340
5	0334	0402
6	0405	0423
7	0426	0448
8	0453	0509
9	0512	0532
10	0536	0555
11	0558	0617
12	0621	0641
13	0720	0758
14	0737	0758
15	0801	0822
16	0825	0934
17	0937	0952

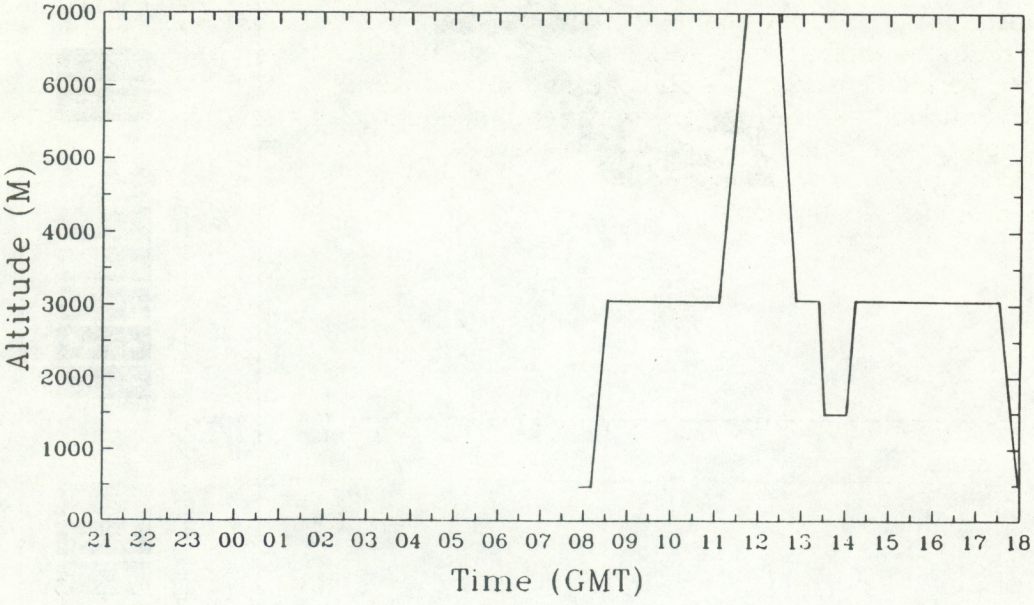
2-D KNOLLENBERG

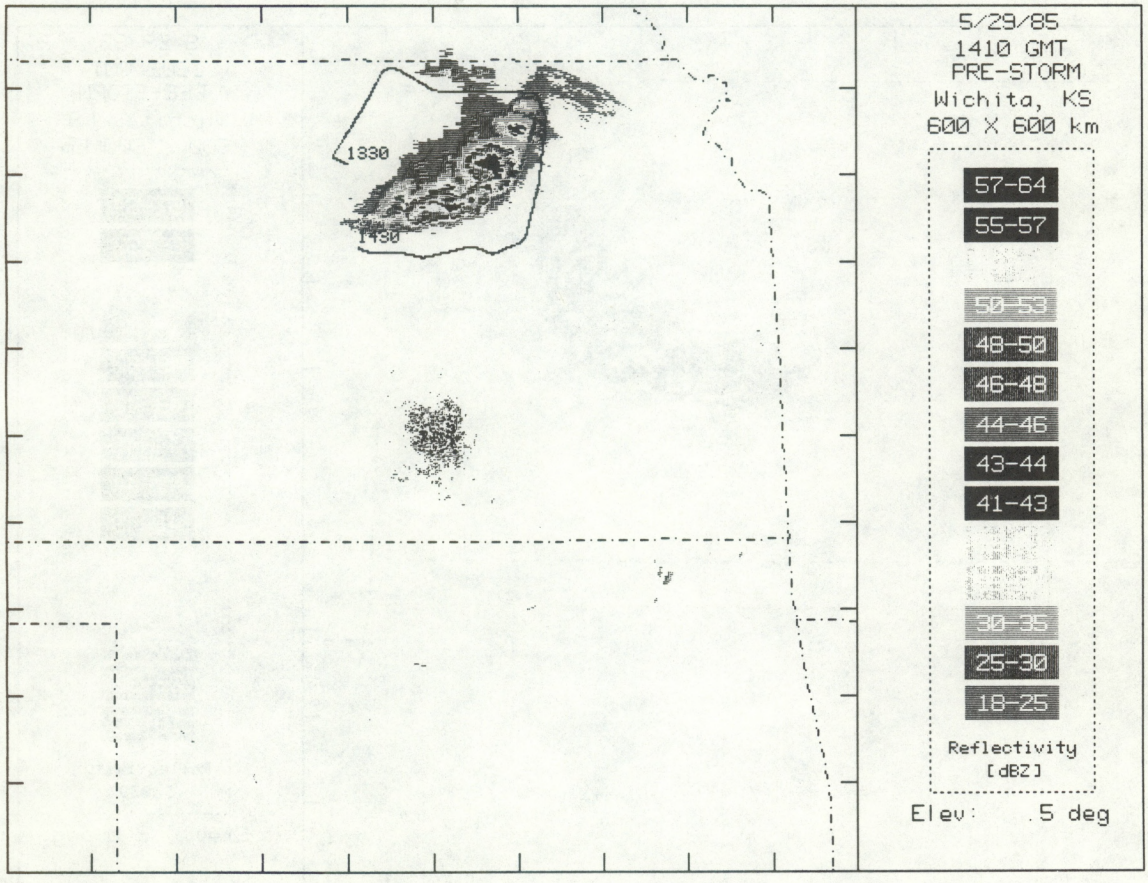
Tape Number	Time On (GMT)	Time Off (GMT)
1	0157	0610
2	0610	0636
3	0636	0842
4	0842	0847
5	0847	0852
6	0852	0857
7	0857	0921
8	0921	0953

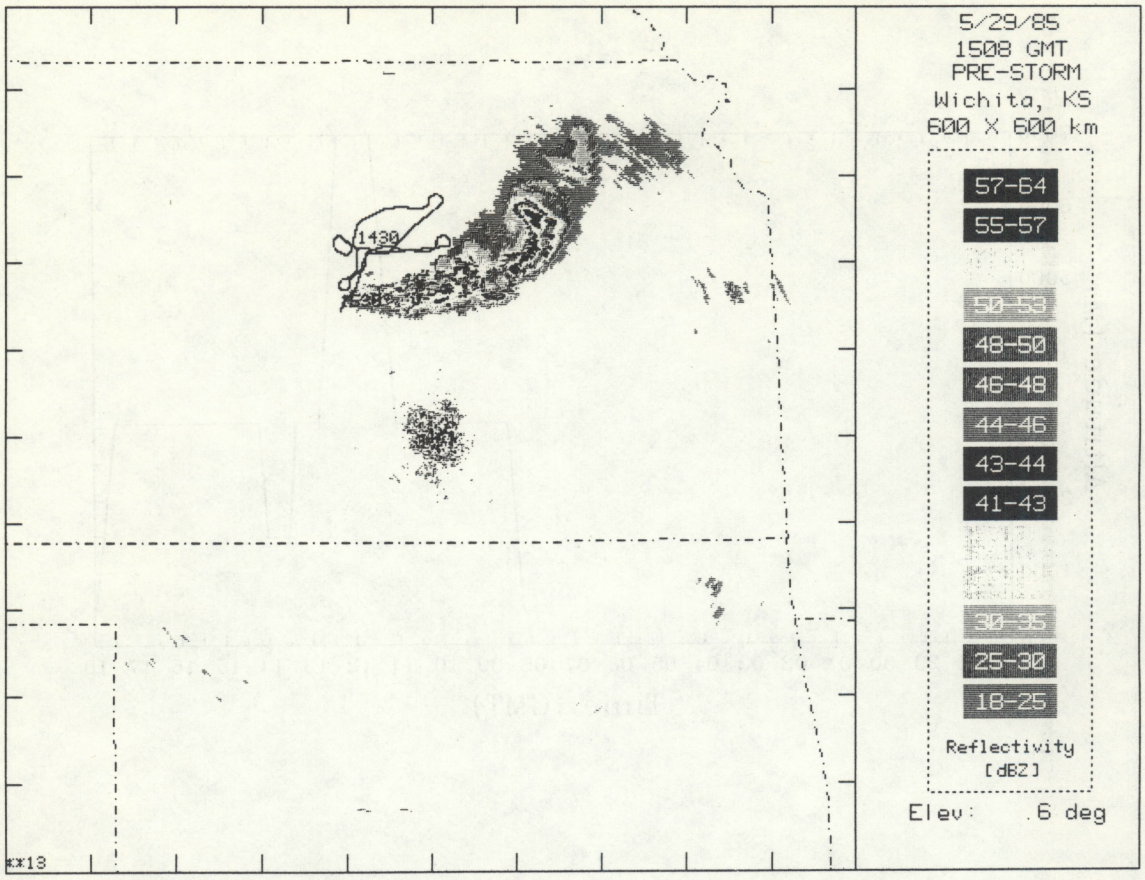
Mission # 6 NOAA-43
29 May 1985 (0813-1754 GMT)

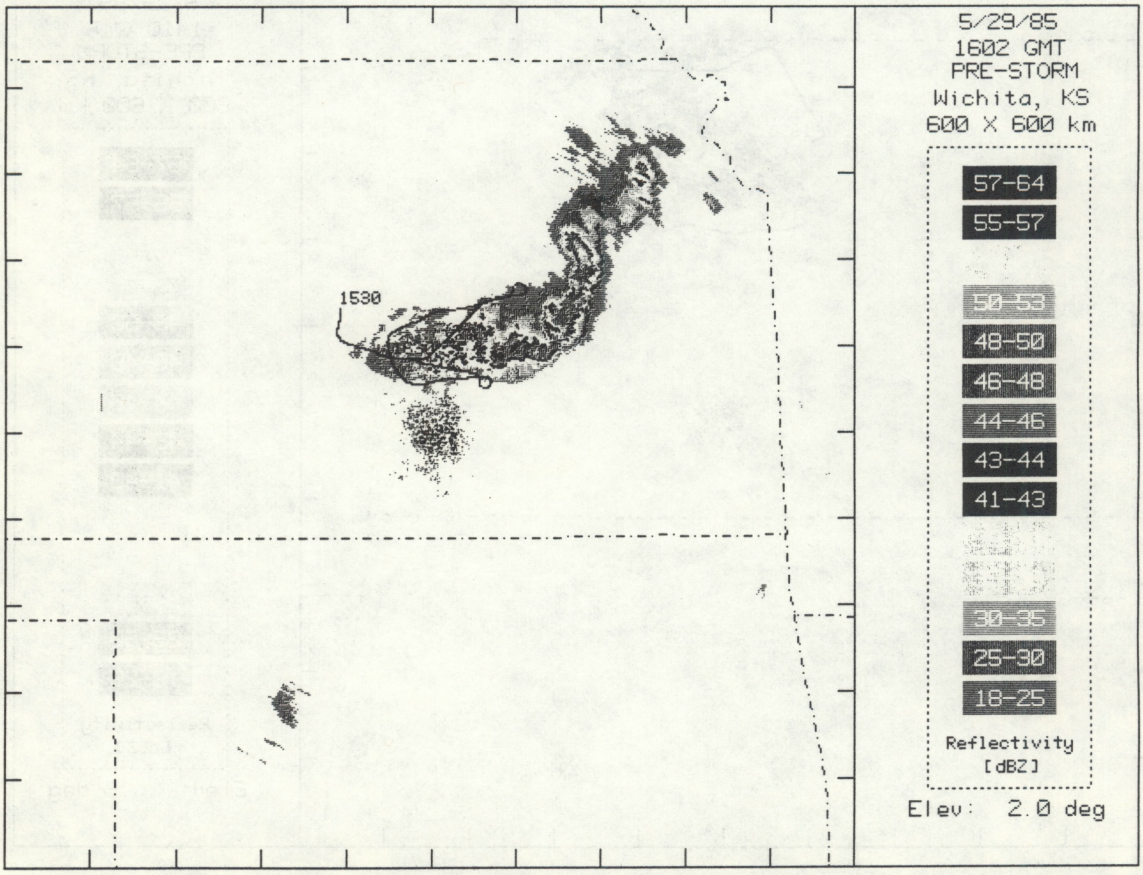
In anticipation of developing conditions over the northern section of the PRE-STORM region, the aircraft take-off was delayed. In route to the planned research area, a squall line formed in central Nebraska and moved rapidly east-northeast; this became the primary mission as the system matured. While returning to base, once near the Kansas Doppler radars, the mission was operated in coordination with the ground-based radars in order to study the dynamics of the transition zone between the convective and stratiform precipitation areas.

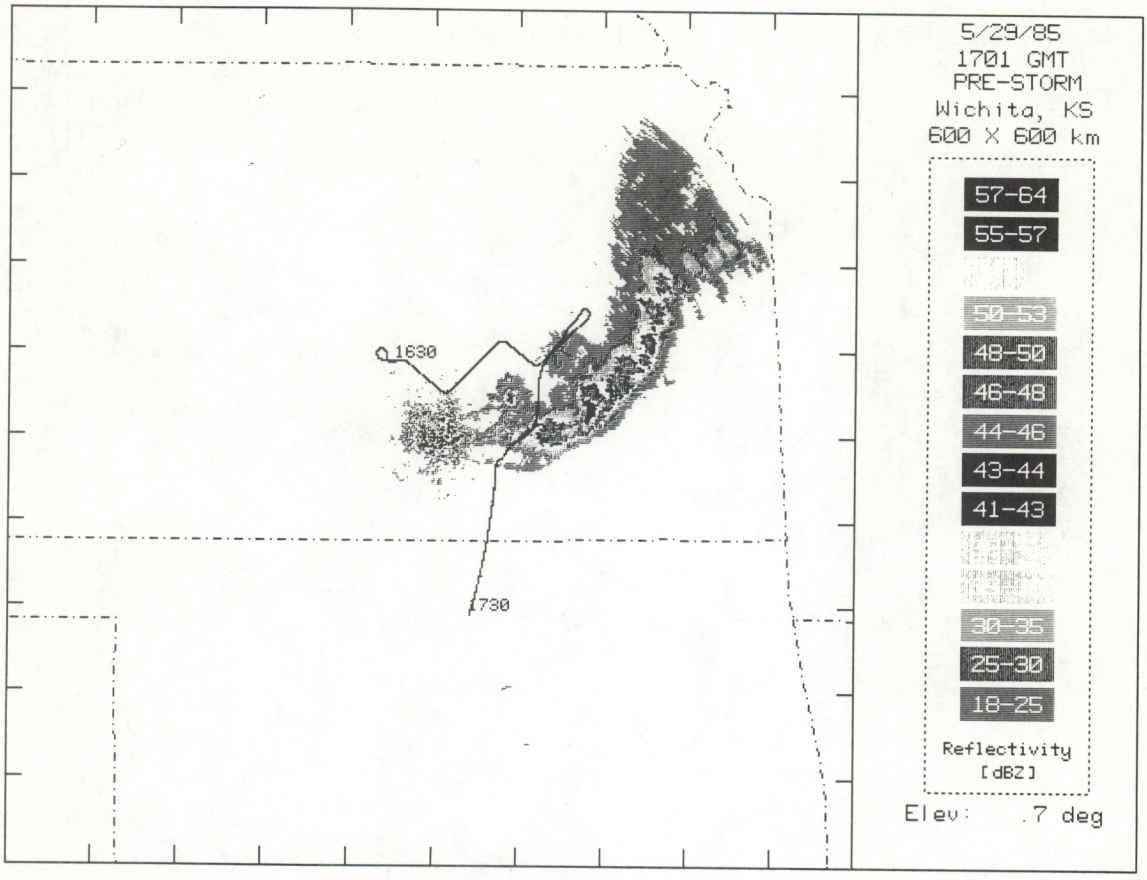



7000
6000
5000
4000
3000
2000
1000
00
Altitude (M)
21 22 23 00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18
Time (GMT)


1330
1430
5/29/85
1410 GMT
PRE-STORM
Wichita, KS
600 X 600 km
57-64
55-57
50-53
48-50
46-48
44-46
43-44
41-43
30-35
25-30
18-25
Reflectivity
[dBZ]
Elev: .5 deg


5/29/85
1508 GMT
PRE-STORM
Wichita, KS
600 X 600 km
57-64
55-57
50-53
48-50
46-48
44-46
43-44
41-43
30-35
25-30
18-25
Reflectivity
[dBZ]
Elev: .6 deg
1430
xx13


5/29/85
1602 GMT
PRE-STORM
Wichita, KS
600 X 600 km
57-64
55-57
50-53
48-50
46-48
44-46
43-44
41-43
30-35
25-30
18-25
Reflectivity
[dBZ]
Elev: 2.0 deg
1530


5/29/85
1701 GMT
PRE-STORM
Wichita, KS
600 X 600 km
57-64
55-57
50-53
48-50
46-48
44-46
43-44
41-43
30-35
25-30
18-25
Reflectivity
[dBZ]
Elev: .7 deg
1630
1730

29 MAY 1985
NOAA 43

LOWER FUSELAGE RADAR

Tape Number	Time On (GMT)	Time Off (GMT)
1	0919	0948
2	0948	1019
3	1019	1050
4	1050	1120
5	1120	1150
6	1150	1220
7	1220	1250
8	1250	1321
9	1321	1351
10	1351	1421
11	1421	1452
12	1452	1522
13	1522	1552
14	1552	1622
15	1622	1652
16	1652	1722

DOPPLER RADAR

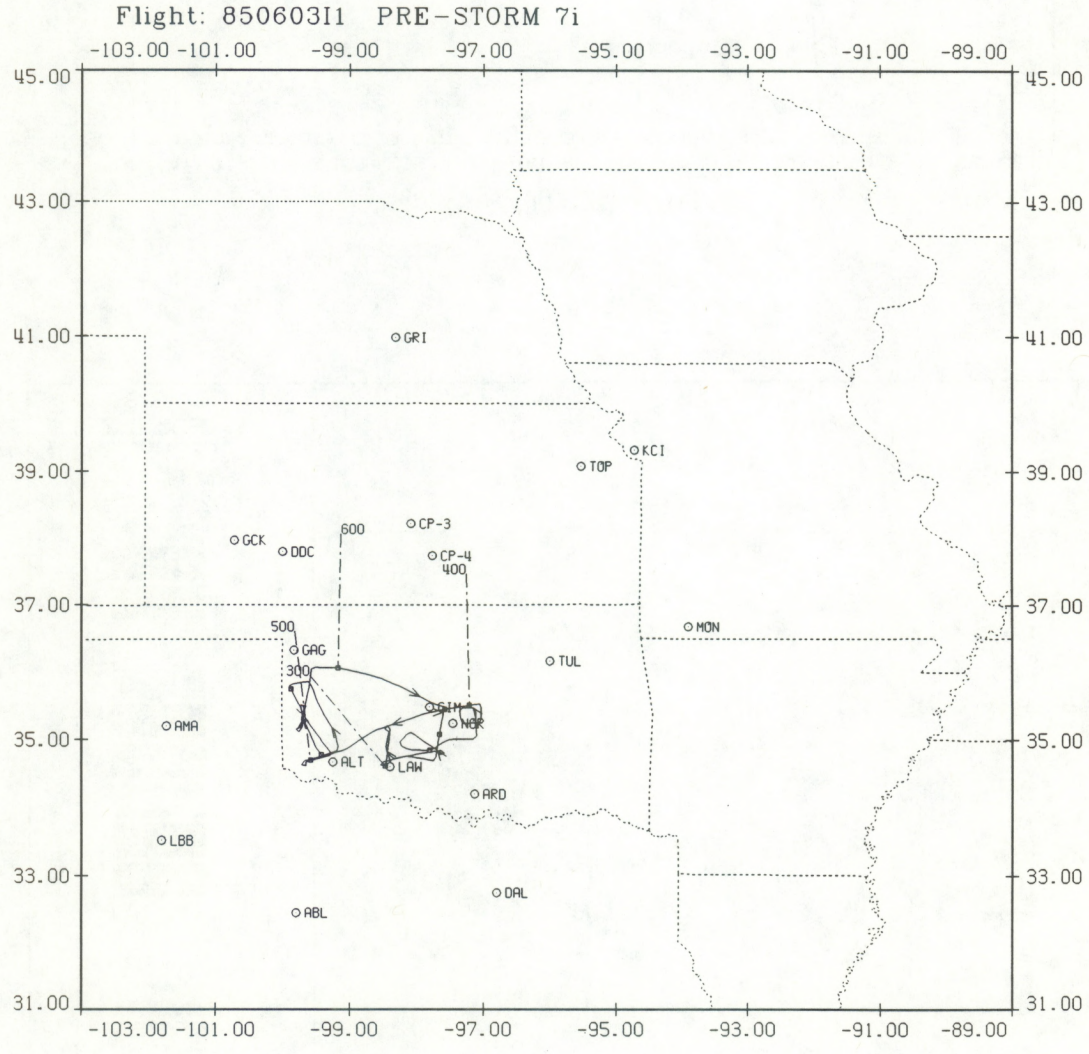
Tape Number	Time On (GMT)	Time Off (GMT)
1	0932	0952
2	0956	1016
3	1019	1036
4	1040	1058
5	1101	1124
6	1127	1140
7	1143	1200
8	1204	1223
9	1227	1245
10	1307	1320
11	1323	1341
12	1344	1358
13	1400	1418
14	1422	1443
15	1447	1505
16	1507	1529
17	1533	1544
18	1548	1606
19	1609	1627
20	1634	1649
21	1652	1710
22	1712	1721

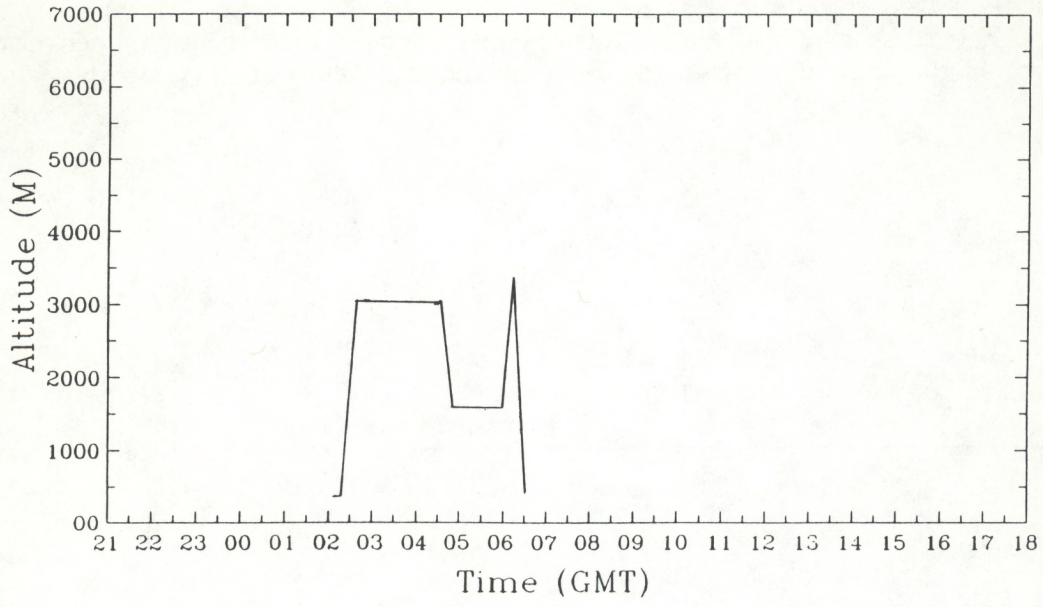
2-D KNOLLENBERG

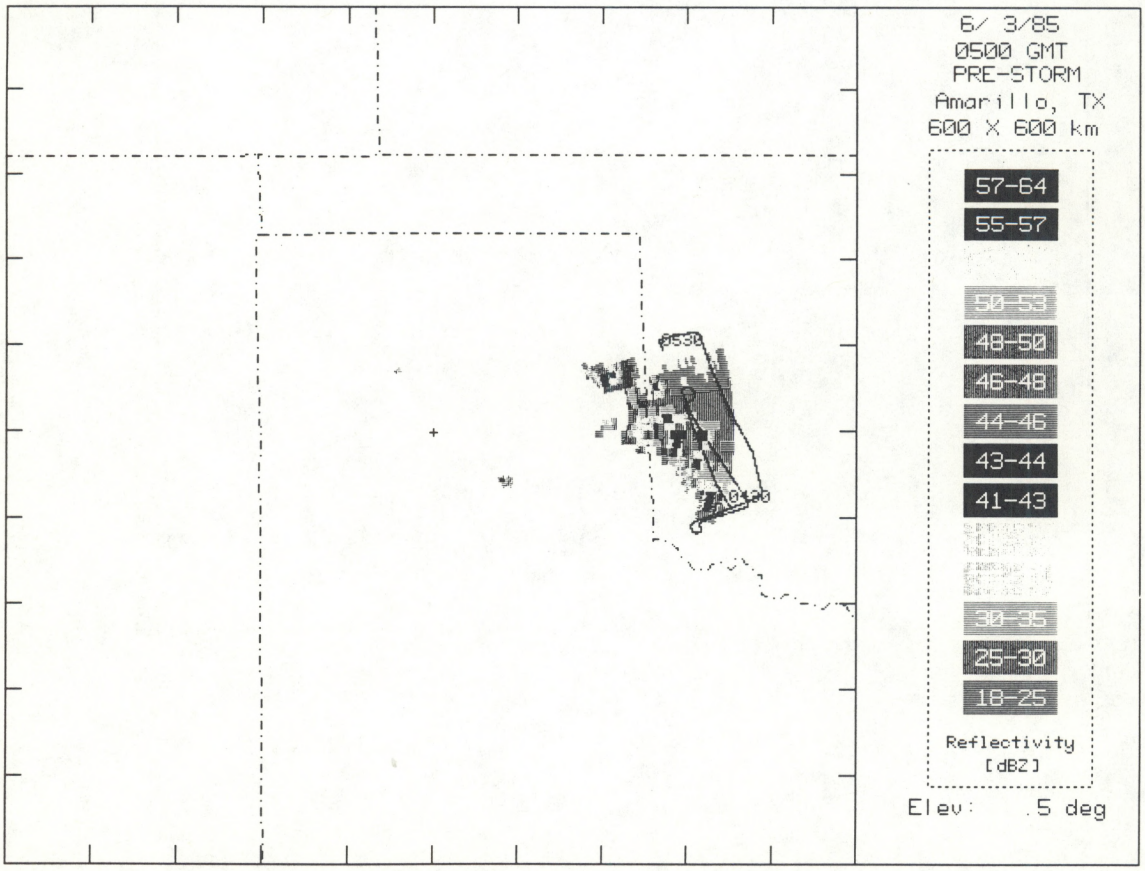
Tape Number	Time On (GMT)	Time Off (GMT)
1	0850	1022
2	1022	1056
3	1056	1105
4	1105	1110
5	1110	1115
6	1115	1119
7	1119	1124
8	1124	1128
9	1128	1134
10	1134	1138
11	1138	1143
12	1143	1148
13	1148	1153
14	1153	1157
15	1157	1203
16	1203	1207
17	1207	1212
18	1212	1217
19	1217	1220
20	1220	1223
21	1223	1228
22	1228	1233
23	1233	1238
24	1238	1323
25	1323	1330
26	1330	1420
27	1420	1505
28	1505	1615
29	1615	1640
	1651	1721

Mission # 7 NOAA-43
3 June 1985 (0225-0621 GMT)

The mission was designed for short duration (6h fuel) since storms had developed and quickly dissipated throughtout the day over western Oklahoma. The aircraft flew patterns designed to study the area of storm genesis near an intense line of convection. The region of origin seemed to be in the Texas panhandle where storms had split earlier in the day.




7000
6000
5000
4000
3000
2000
1000
00
Altitude (M)
21 22 23 00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18
Time (GMT)


6/ 3/85
0500 GMT
PRE-STORM
Amarillo, TX
600 X 600 km
57-64
55-57
50-53
48-50
46-48
44-46
43-44
41-43
30-35
25-30
18-25
Reflectivity
[dBZ]
Elev: .5 deg

3 JUNE 1985
NOAA 43

LOWER FUSELAGE RADAR

Tape Number	Time On (GMT)	Time Off (GMT)
1	0234	0304
2	0304	0334
3	0334	0404
4	0409	0440
5	0440	0510
6	0510	0540
7	0540	0610

DOPPLER RADAR

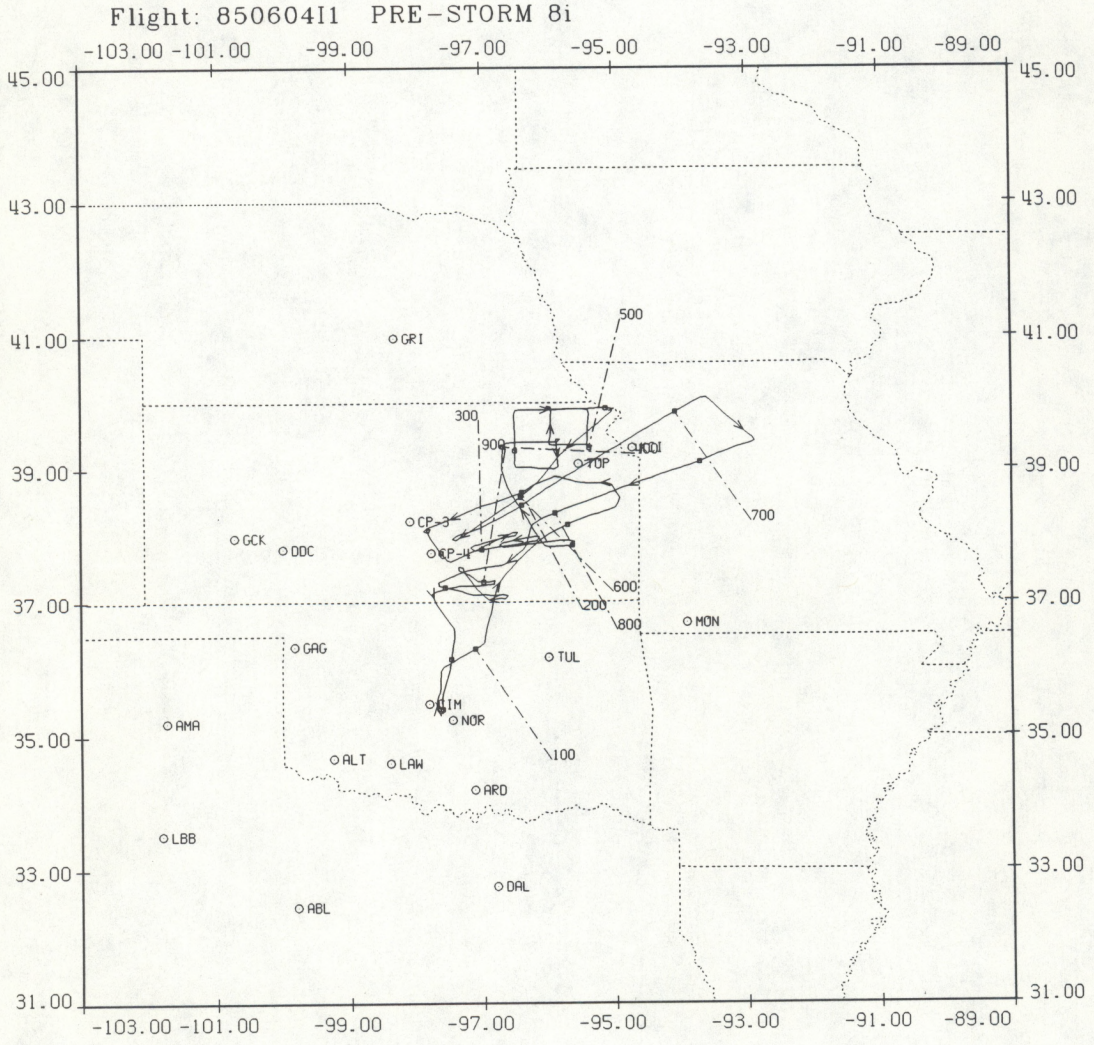
Tape Number	Time On (GMT)	Time Off (GMT)
1	0233	0257
2	0305	0334
3	0336	0357
4	0430	0439
5	0443	0455
6	0457	0520
7	0522	0538
8	0542	0600

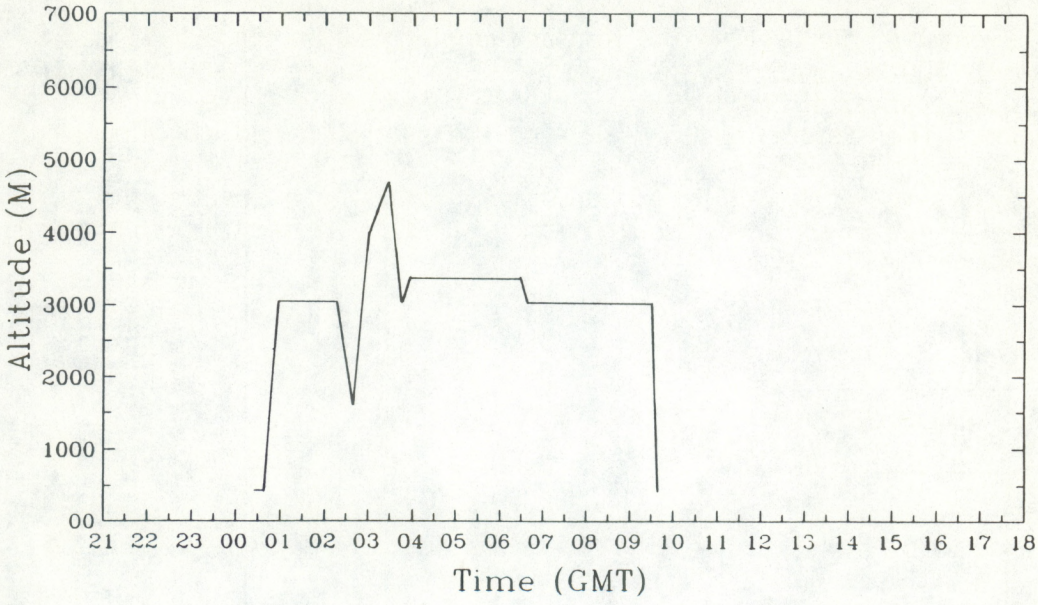
2-D KNOLLENBERG

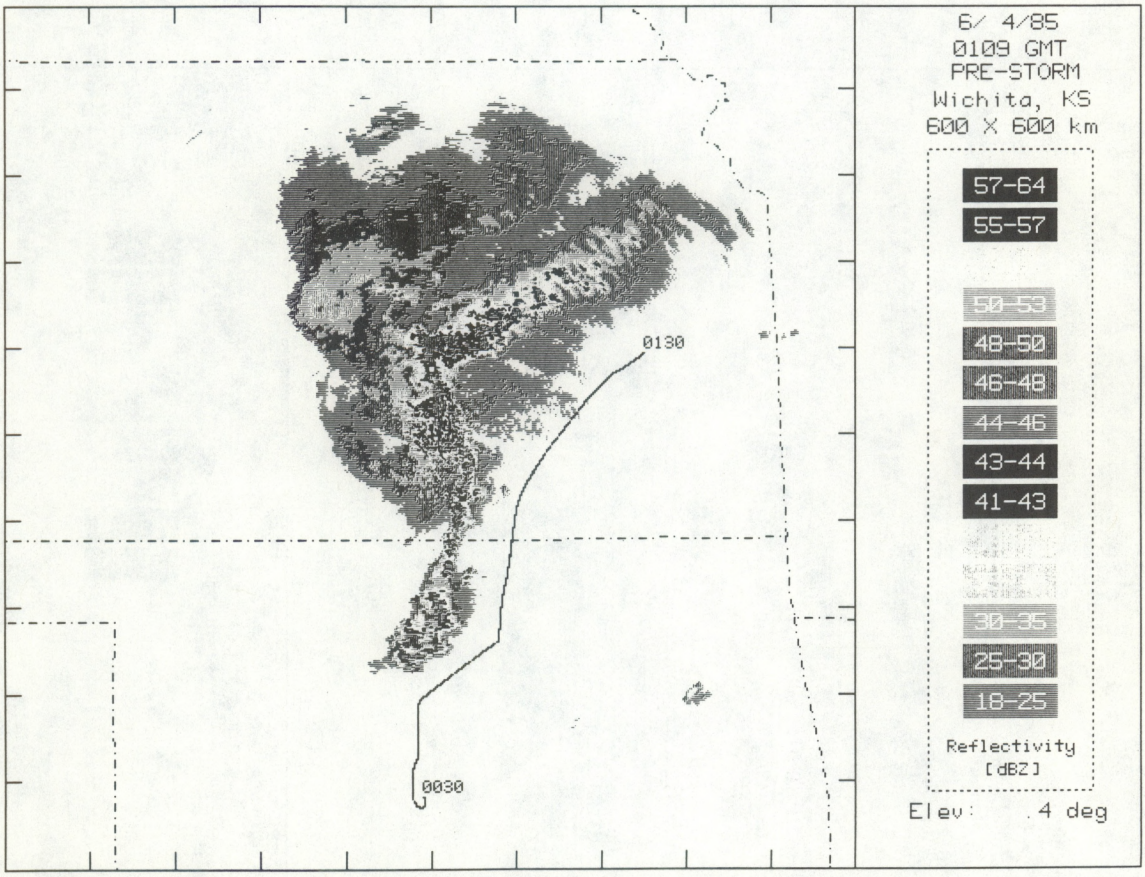
Tape Number	Time On (GMT)	Time Off (GMT)
1	0231	0531
2	0531	0623

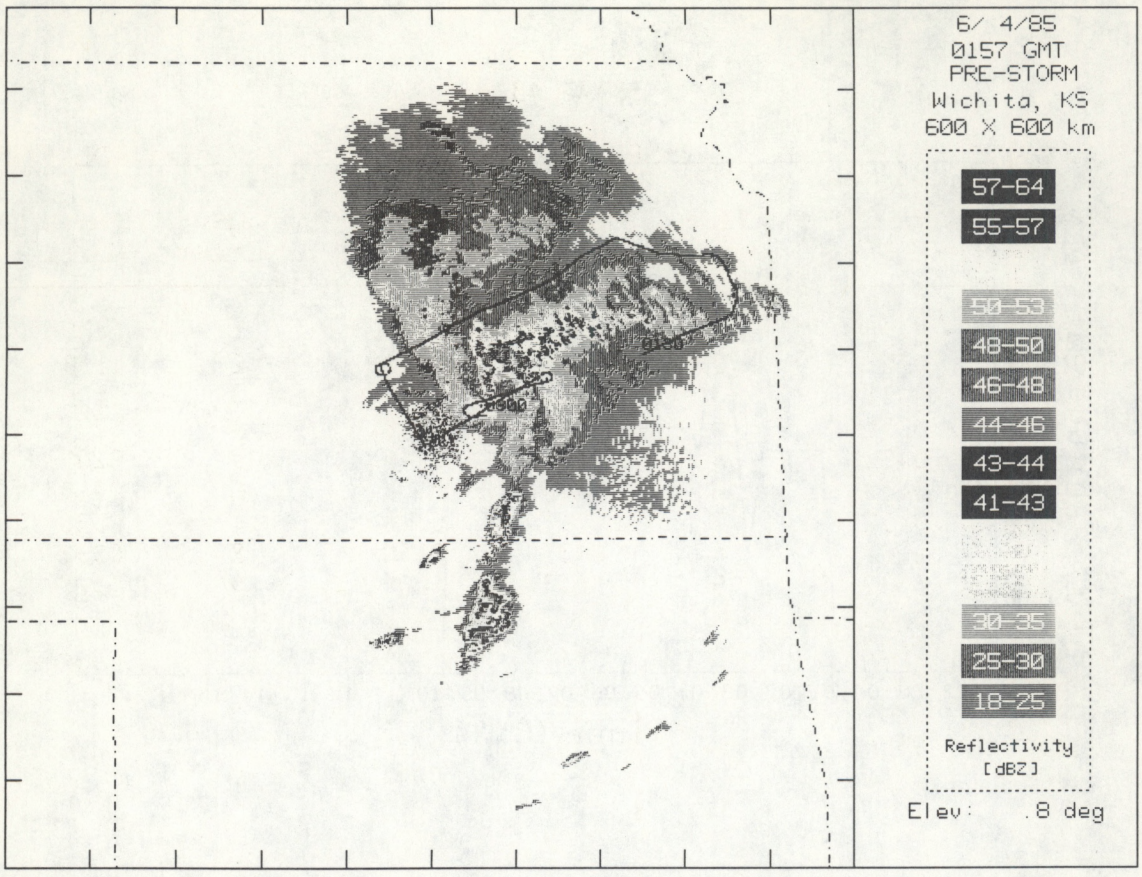
Mission # 8 NOAA-43
4 June 1985 (0044-0944 GMT)

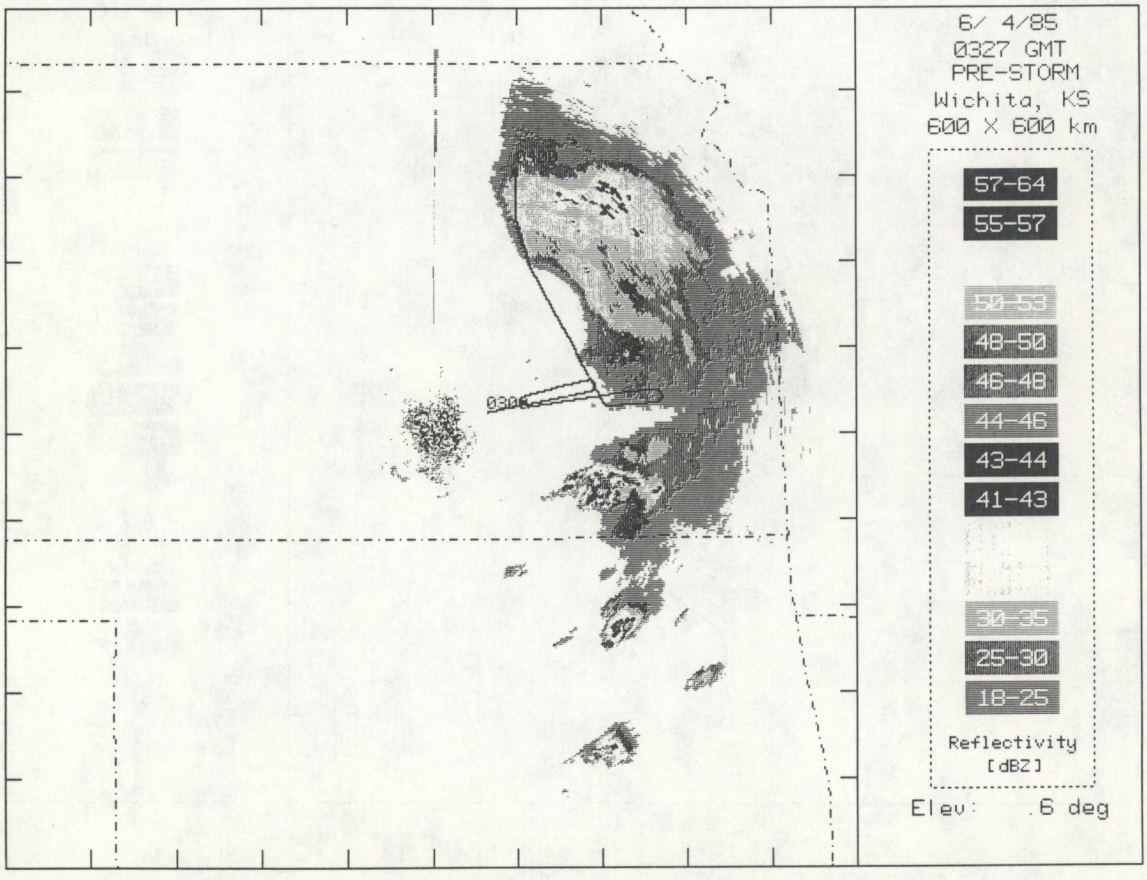
The first aircraft of a two-aircraft mission began monitoring an MCS (second of a series of events) in the area of the Kansas Doppler radars. NOAA-43 had to deviate approximately 200 km to circumvent an intense line of convection. Once behind the line, it began microphysical experiments in the trailing portion of the stratiform precipitation. The system moved rapidly to the northeast and the aircraft followed. NOAA-42 joined the mission over northeast Kansas. The pattern was modified over Missouri into a large-scale butterfly to study circulations in the decaying system. As the third system began in southwest Kansas, the aircraft were recalled to the area of the Kansas radar network.




7000
6000
5000
4000
3000
2000
1000
00
Altitude (M)
21 22 23 00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18
Time (GMT)


6/ 4/85
0109 GMT
PRE-STORM
Wichita, KS
600 X 600 km
57-64
55-57
50-53
48-50
46-48
44-46
43-44
41-43
30-35
25-30
18-25
Reflectivity
[dBZ]
Elev: .4 deg
0130
0030


6/ 4/85
0157 GMT
PRE-STORM
Wichita, KS
600 X 600 km
57-64
55-57
50-53
48-50
46-48
44-46
43-44
41-43
30-35
25-30
18-25
Reflectivity
[dBZ]
Elev: .8 deg


6/ 4/85
0327 GMT
PRE-STORM
Wichita, KS
600 X 600 km
57-64
55-57
50-53
48-50
46-48
44-46
43-44
41-43
30-35
25-30
18-25
Reflectivity
[dBZ]
Elev: .6 deg

4 JUNE 1985
NOAA 43

LOWER FUSELAGE RADAR

Tape Number	Time On (GMT)	Time Off (GMT)
1	0048	0120
2	0130	0201
3	0201	0231
4	0301	0331
5	0331	0402
6	0402	0432
7	0402	0432
8	0432	0502
9	0502	0532
10	0532	0602
11	0602	0632
12	0632	0802
13	0807	0837
14	0837	0906
15	0906	0936

DOPPLER RADAR

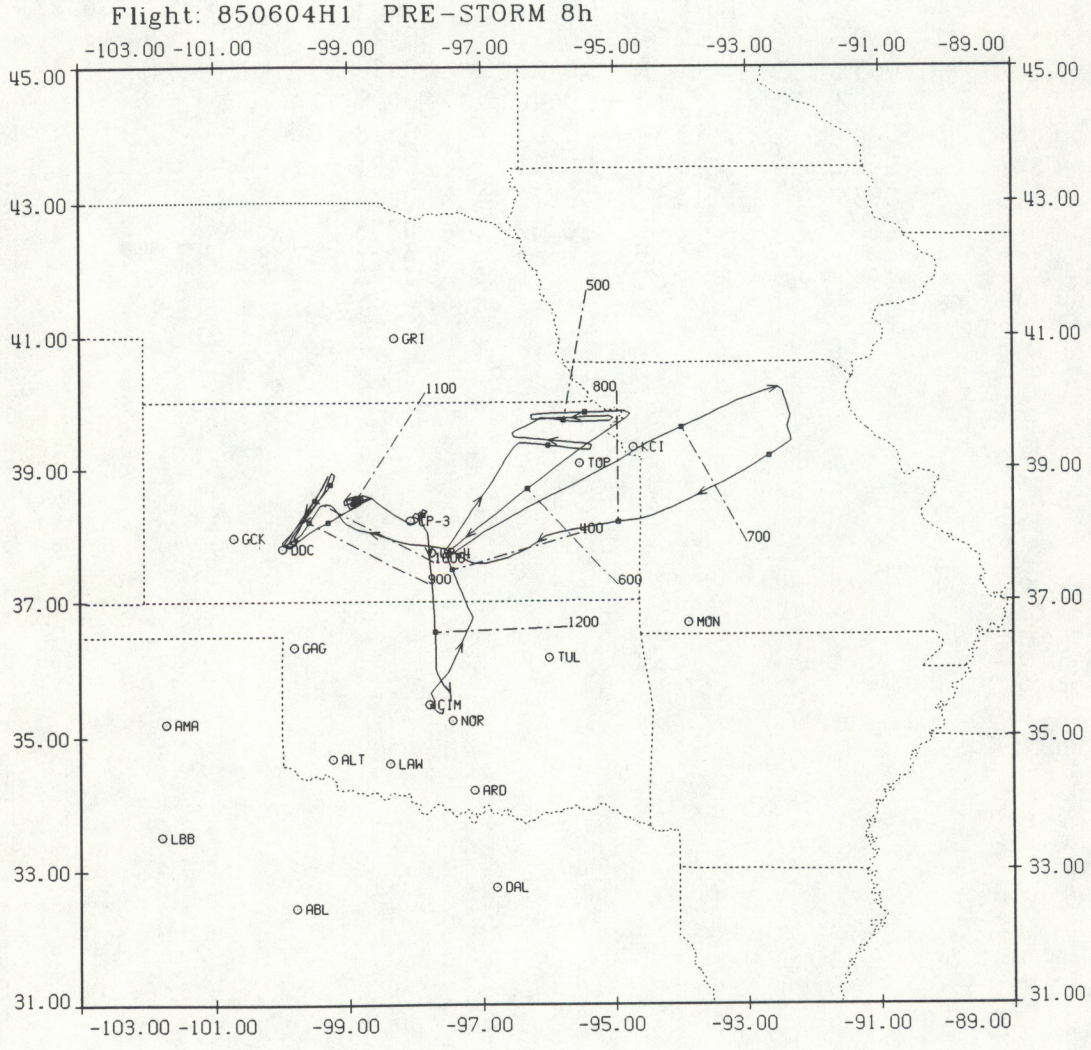
Tape Number	Time On (GMT)	Time Off (GMT)
1	0054	0112
2	0114	0132
3	0141	0200
4	0203	0218
5	0229	0246
6	0246	0308
7	0310	0328
8	0331	0350
9	0353	0409
10	0411	0425
11	0428	0438
12	0440	0459
13	0501	0518
14	0521	0535
15	0814	0834
16	0837	0858
17	0903	0922

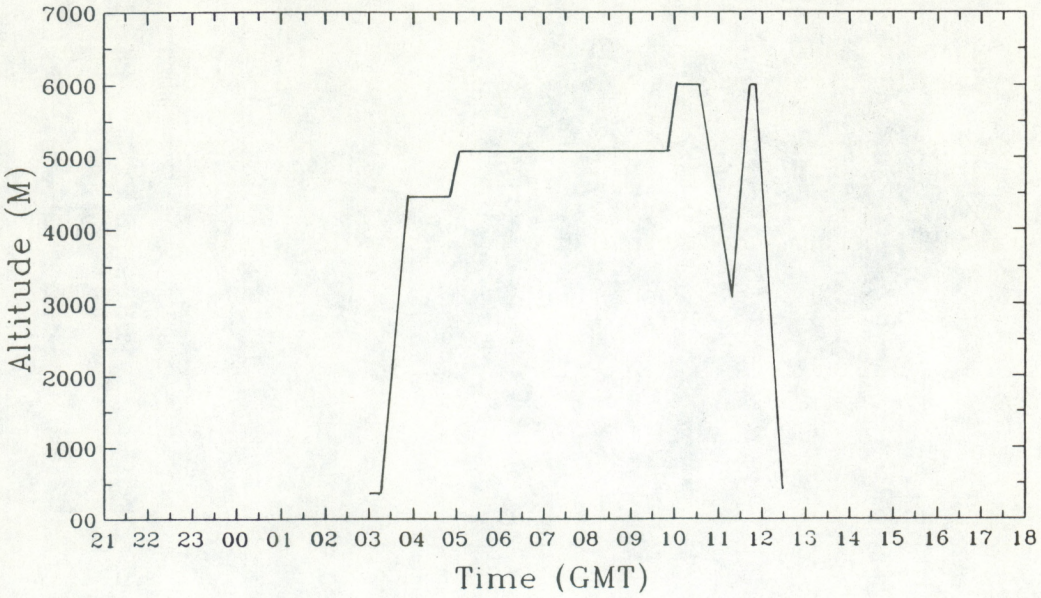
2-D KNOLLENBERG

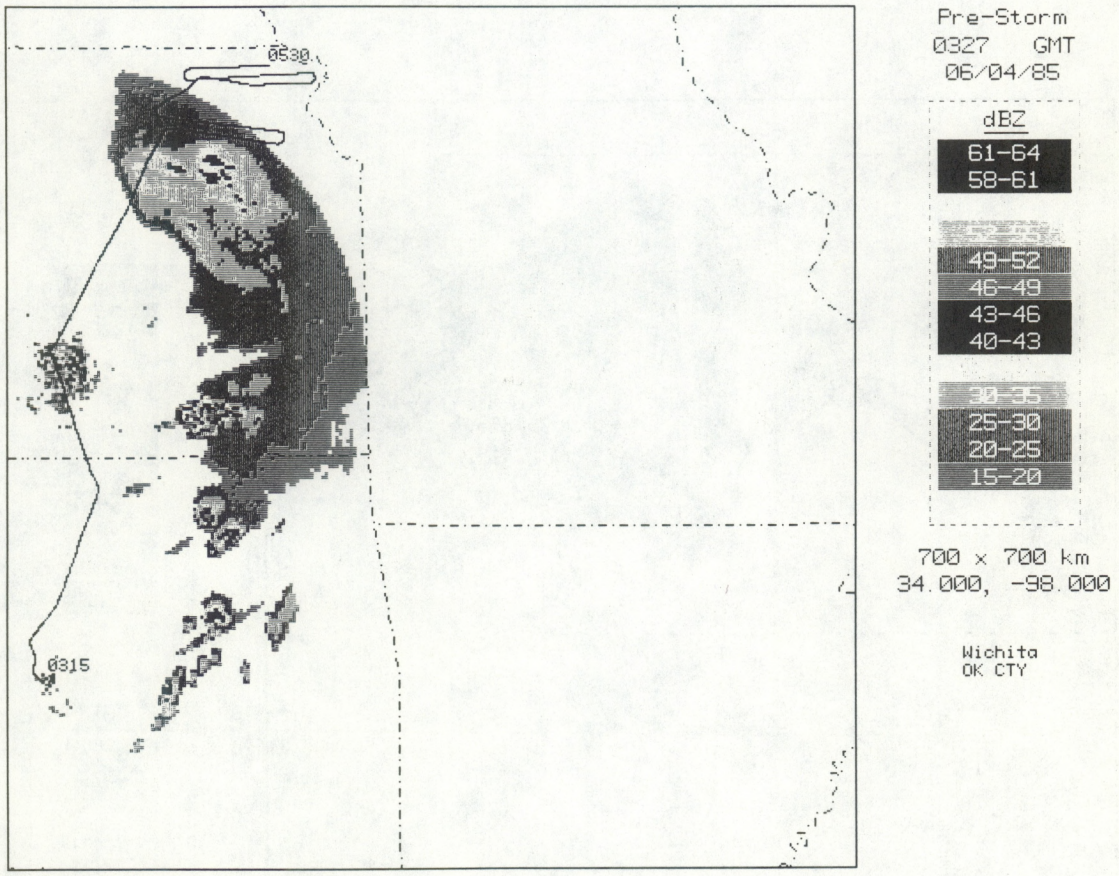
Tape Number	Time On (GMT)	Time Off (GMT)
1	0109	0153
2	0153	0156
3	0156	0201
4	0201	0203
5	0205	0213
6	0213	0326
7	0326	0332
8	0332	0407
9	0527	0932

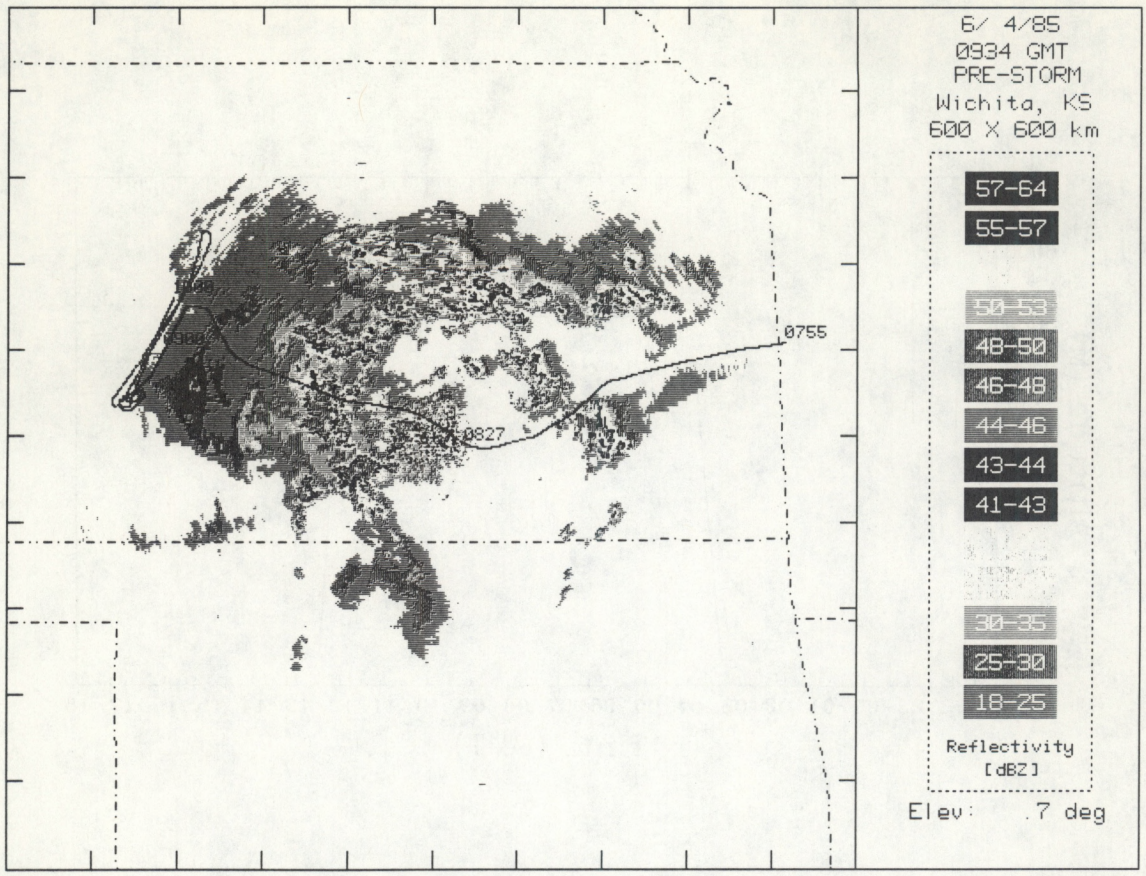
Mission # 8 NOAA-42
4 June 1985 (0334-1220 GMT)

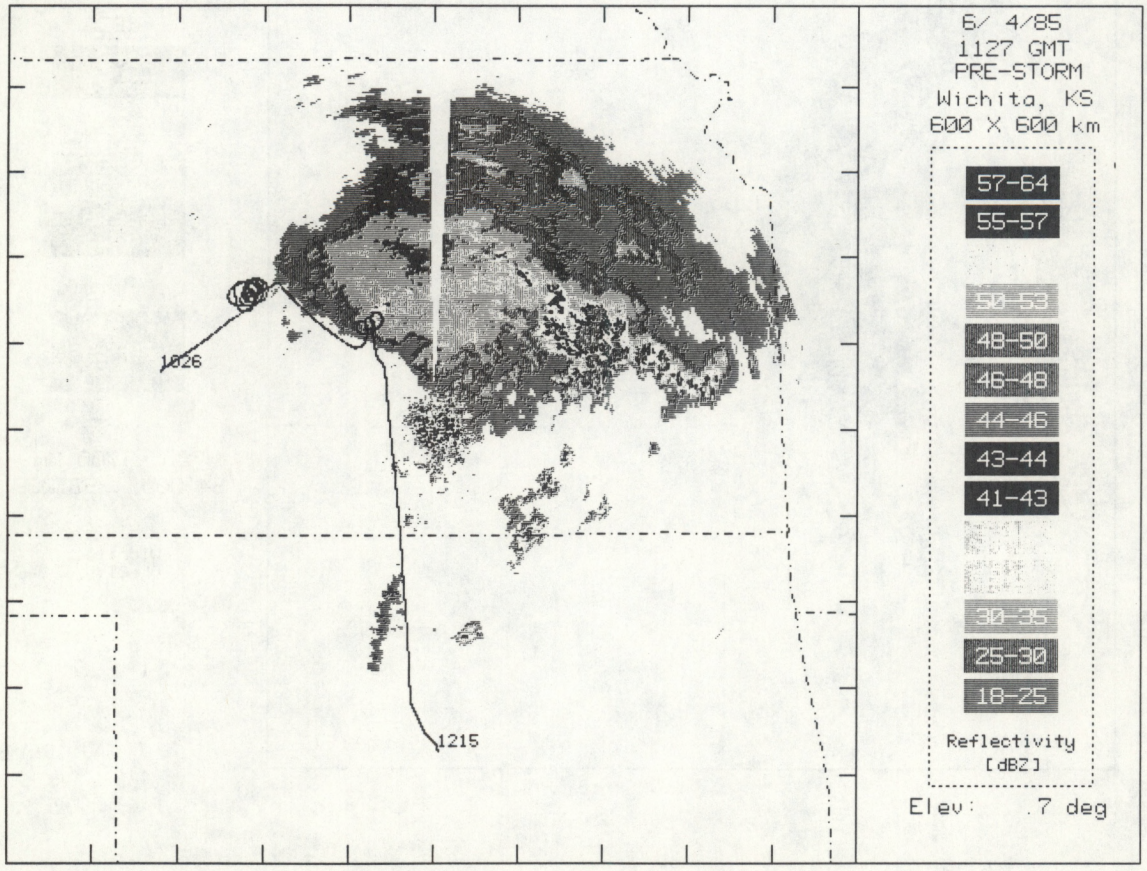
Early in the mission, the aircraft joined NOAA-43 over northeast Kansas to study a dissipating stratiform rain area. NOAA-42 did microphysical studies at 15,000 and 18,000 feet. As the MCS continued to decay, the flight pattern was enlarged into a butterfly pattern centered over north-central Missouri. New convection was active in the region within the PRE-STORM observational network, therefore the aircraft returned to the vicinity of the Kansas Doppler radars. NOAA-42 worked under the direction of the CP-4 radar, gathering microphysical data in the stratiform region present to the west of the radars.




7000
6000
5000
4000
3000
2000
1000
00
Altitude (M)
21 22 23 00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18
Time (GMT)


0530
0315
Pre-Storm
0327 GMT
06/04/85
dBZ
61-64
58-61
49-52
46-49
43-46
40-43
30-35
25-30
20-25
15-20
700 x 700 km
34.000, -98.000
Wichita
OK CTY


6/ 4/85
0934 GMT
PRE-STORM
Wichita, KS
600 X 600 km
57-64
55-57
50-53
48-50
46-48
44-46
43-44
41-43
30-35
25-30
18-25
Reflectivity
[dBZ]
Elev: .7 deg
0755
0827


6/ 4/85
1127 GMT
PRE-STORM
Wichita, KS
600 X 600 km
57-64
55-57
50-53
48-50
46-48
44-46
43-44
41-43
30-35
25-30
18-25
Reflectivity
[dBZ]
Elev: .7 deg
1026
1215

4 JUNE 1985
NOAA 42

LOWER FUSELAGE RADAR

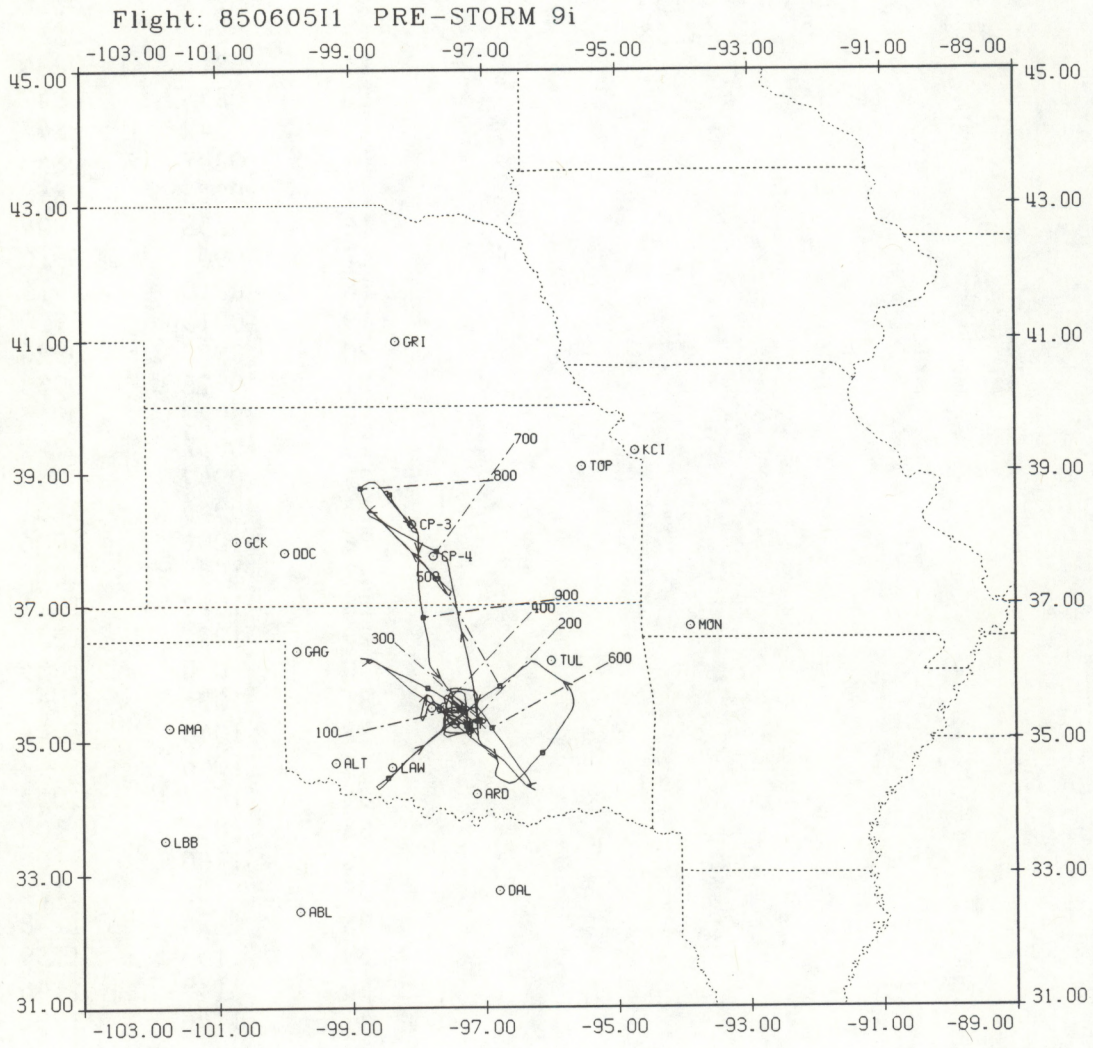
Tape Number	Time On (GMT)	Time Off (GMT)
1	0337	0454
2	0454	0548
3	0548	0636
4	0636	0726
5	0726	0813
6	0813	0902
7	0902	0950
8	0950	1040
9	1040	1130
10	1130	1158

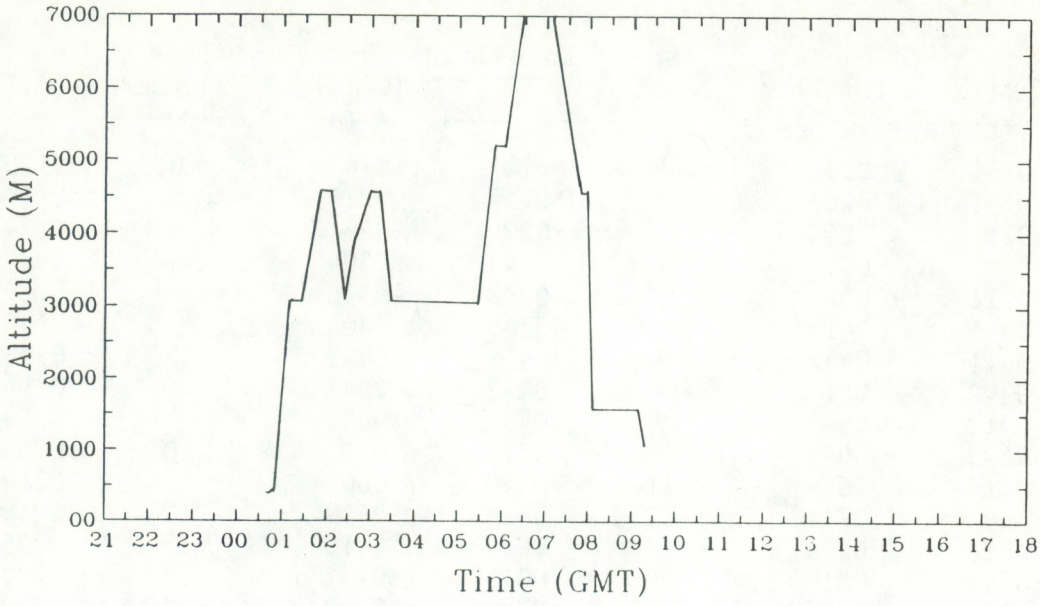
2-D KNOLLENBERG

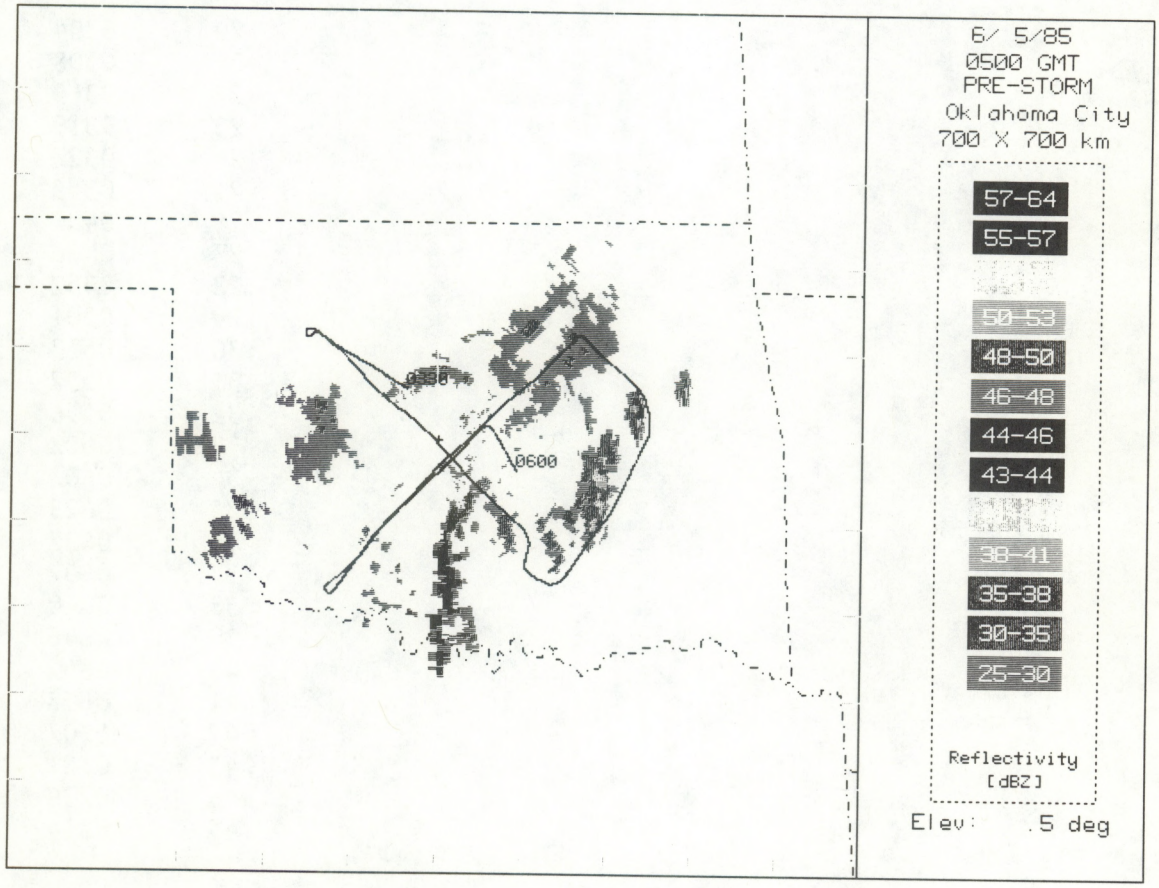
Tape Number	Time On (GMT)	Time Off (GMT)
1	0354	0354
2	0354	0432
3	0432	0438
4	0438	0445
5	0445	0507
6	0507	0531
7	0531	0707
8	0707	0718
9	0718	0810
10	0810	0817
11	0817	0834
12	0834	0842
13	0842	0847
14	0847	0853
15	0853	0858
16	0858	0904
17	0904	0910
18	0910	0915
19	0915	0920
20	0920	0926
21	0926	0933
22	0933	0937
23	0937	0942
24	0942	0955
25	0955	1001
26	1001	1006
27	1006	1012
28	1012	1021
29	1021	1030
30	1030	1035
31	1035	1040
32	1040	1046
33	1046	1047
34	1047	1055
68	1055	1100
36	1100	1105
37	1105	1124
38	1124	1133
39	1133	1139
40	1139	1146
41	1156	1202

Mission # 9 NOAA-43
5 June 1985 (0109-0923 GMT)

As the weather continued unsettled, the aircraft began a series of patterns coordinated with the NSSL Doppler radars. Microphysical experiments were conducted in an area of optimum dual-doppler coverage. The stratiform rain region was quite extensive, therefore the flight pattern was enlarged. Monitoring continued until out of range of the ground-based radars. A new flight plan was set up to monitor heavy rains falling in a area of weak convergence near Wichita, Kans.




7000
6000
5000
4000
3000
2000
1000
00
Altitude (M)
21 22 23 00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18
Time (GMT)


6/ 5/85
0500 GMT
PRE-STORM
Oklahoma City
700 X 700 km
57-64
55-57
50-53
48-50
46-48
44-46
43-44
38-41
35-38
30-35
25-30
Reflectivity
[dBZ]
Elev: .5 deg
0600

5 JUNE 1985
NOAA 43

LOWER FUSELAGE RADAR

Tape Number	Time On (GMT)	Time Off (GMT)
1	0101	0131
2	0131	0201
3	0211	0240
4	0240	0311
5	0311	0341
6	0341	0411
7	0411	0442
8	0442	0512
9	0512	0543
10	0543	0614
11	0614	0644
12	0644	0714
13	0714	0745
14	0745	0816
15	0816	0846

DOPPLER RADAR

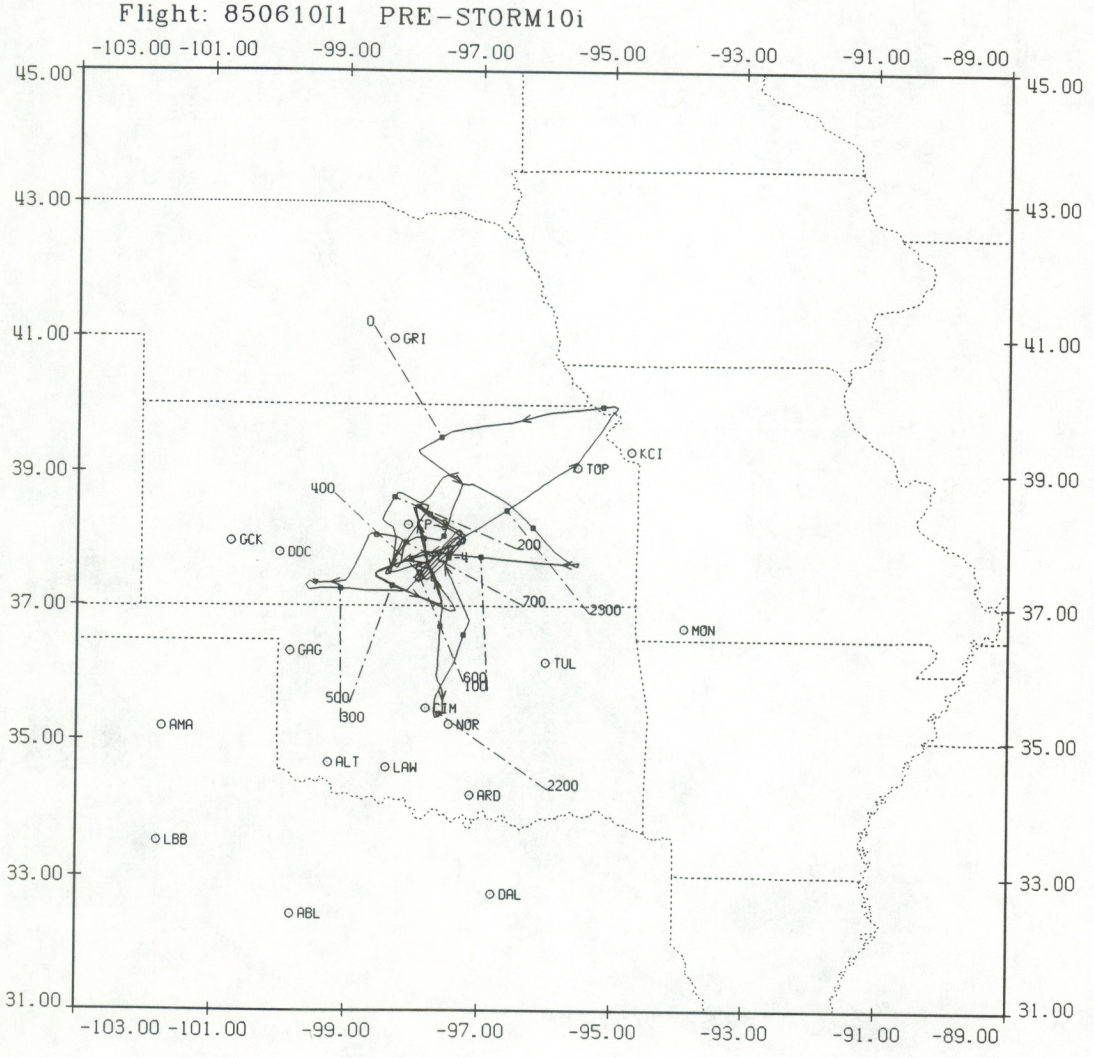
Tape Number	Time On (GMT)	Time Off (GMT)
1	0121	0145
2	0152	0212
3	0224	0241
4	0244	0304
5	0308	0336
6	0345	0404
7	0408	0429
8	0432	0447
9	0452	0509
10	0511	0525
11	0550	0608
12	0621	0638
13	0653	0710
14	0716	0733
15	0736	0753
16	0810	0826
17	0831	0840

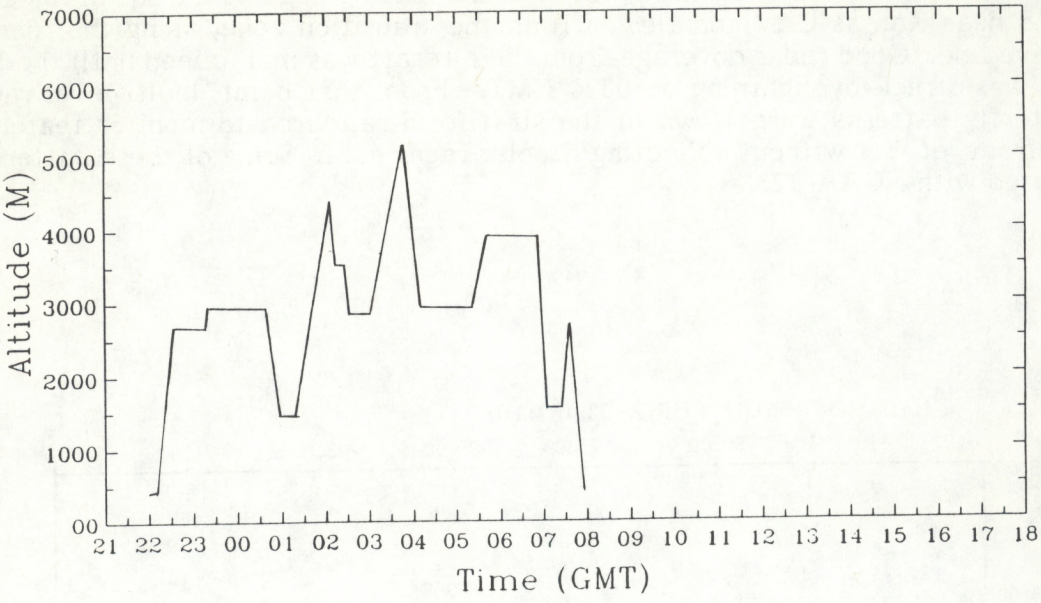
2-D KNOLLENBERG

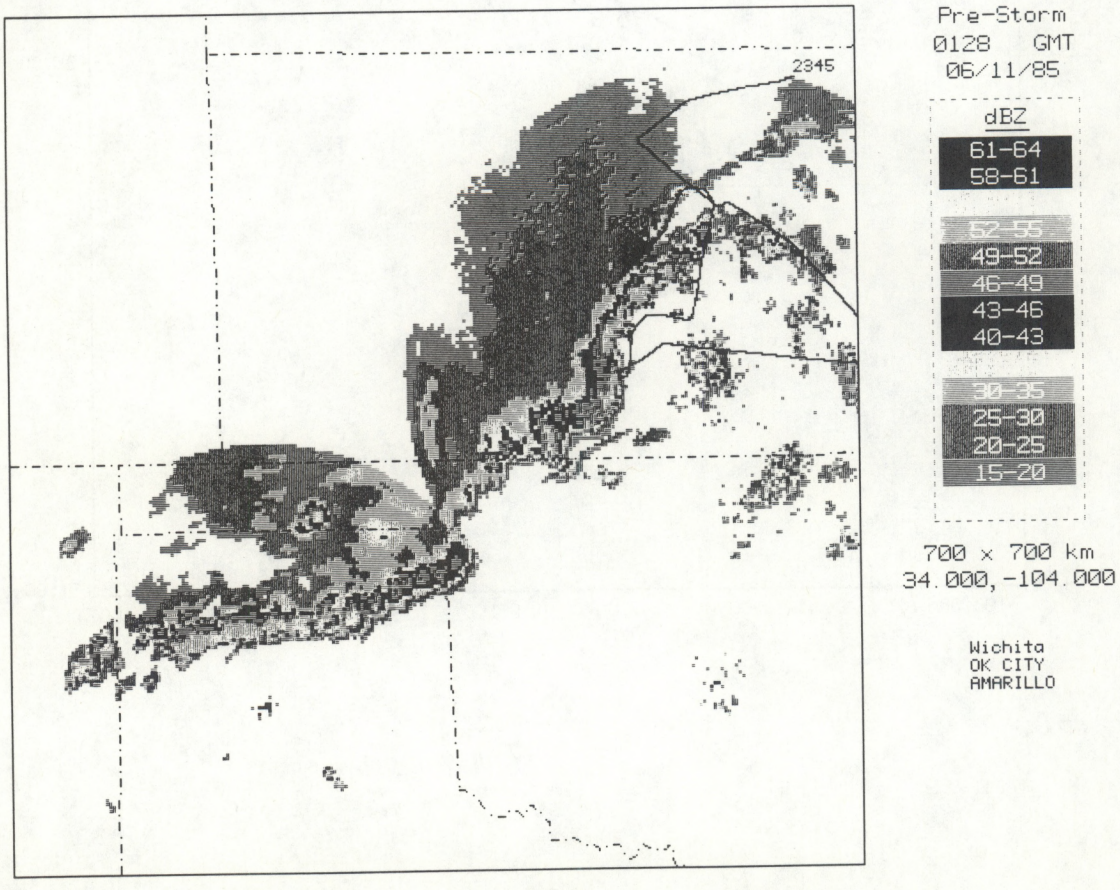
Tape Number	Time On (GMT)	Time Off (GMT)
1	0100	0112
2	0113	0124
3	0124	0130
4	0130	0139
5	0139	0145
6	0145	0151
7	0151	0156
8	0156	0202
9	0204	0209
10	0209	0214
11	0214	0219
12	0219	0225
13	0225	0234
14	0234	0239
15	0239	0245
16	0245	0249
17	0249	0254
18	0254	0258
19	0258	0304
20	0304	0308
21	0308	0313
22	0313	0319
23	0319	0324
24	0327	0353
25	0353	0407
26	0407	0426
27	0426	0452
28	0452	0501
29	0501	0513
30	0513	0552
31	0552	0556
32	0556	0602
33	0602	0607
34	0607	0623
35	0623	0627
36	0627	0632
37	0632	0640
38	0640	0646
39	0646	0652
40	0652	0656
41	0658	0704
42	0707	0721
43	0721	0736
44	0736	0815
45	0815	0839

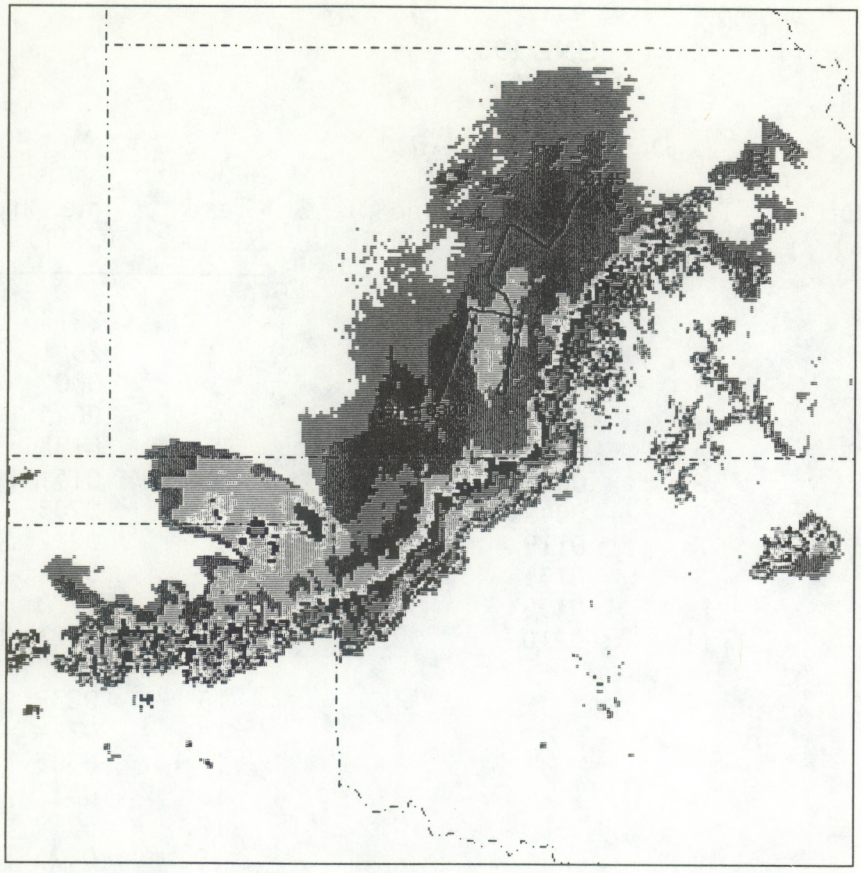
Mission # 10 NOAA-43
10-11 June 1985 (2210-0750 GMT)

NOAA-43 flew northeastward parallel to the leading edge of the squall line, crossed westward near Kansas City and flew, within the transition zone, along the rear of the convective line. Good radar coverage from the aircraft was maintained until the Doppler antenna was struck by lightning at 0330 GMT. From that point, multi-level racetrack and butterfly patterns were flown in the stratiform rain area to monitor features of a rear-to-front jet, but without collecting doppler radar data. Some of these patterns were coordinated with NOAA-42.




Altitude (M)
7000
6000
5000
4000
3000
2000
1000
00
21 22 23 00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18
Time (GMT)


2345
Pre-Storm
0128 GMT
06/11/85
dBZ
61-64
58-61
52-55
49-52
46-49
43-46
40-43
30-35
25-30
20-25
15-20
700 x 700 km
34.000,-104.000
Wichita
OK CITY
AMARILLO



Pre-Storm
0228 GMT
06/11/85

dBZ
61-64
58-61
52-55
49-52
46-49
43-46
40-43
30-35
25-30
20-25
15-20

700 x 700 km
34.000,-103.000

Wichita
OK CITY
AMARILLO

Pre-Storm
0351 GMT
06/11/85

dBZ
61-64
58-61
52-55
49-52
46-49
43-46
40-43
30-35
25-30
20-25
15-20

700 x 700 km
34.000,-102.000

Wichita
OK CITY

10 JUNE 1985
NOAA 43

LOWER FUSELAGE RADAR

Tape Number	Time On (GMT)	Time Off (GMT)
1	2221	2352
2	2352	0022
3	0022	0052
4	0052	0122
5	0122	0153
6	0153	0225
7	0225	0437
8	0445	0729

DOPPLER RADAR

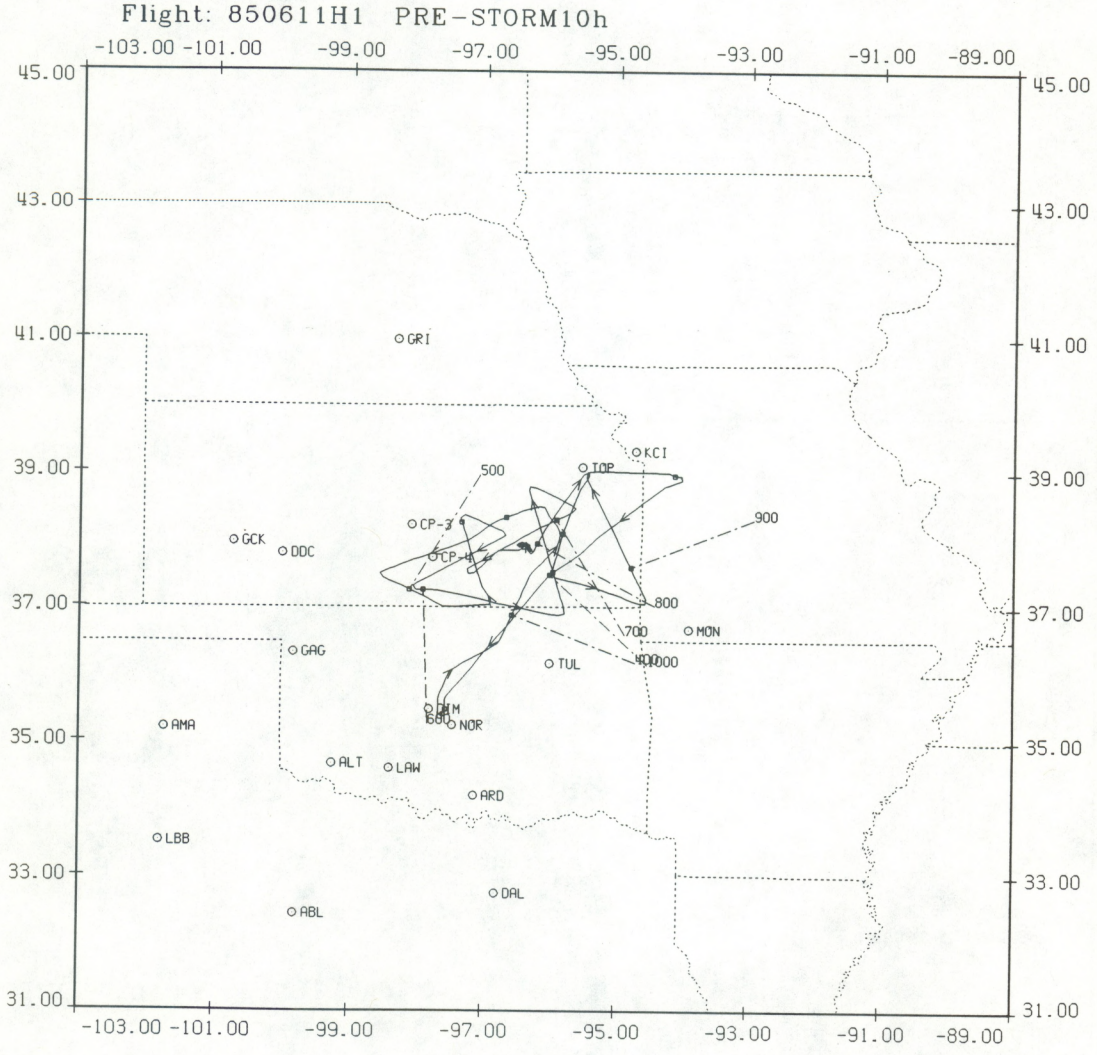
Tape Number	Time On (GMT)	Time Off (GMT)
1	2249	2257
2	2343	2352
3	2355	0005
4	0016	0017
5	0018	0023
6	0039	0040
7	0042	0043
8	0119	0128
9	0131	0136
10	0150	0207
11	0210	0223

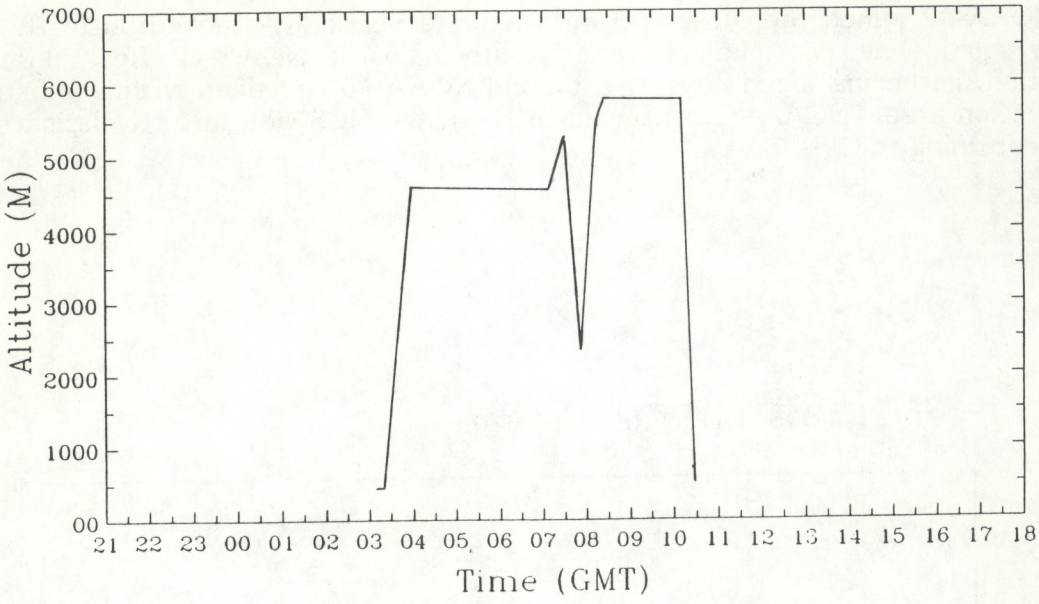
2-D KNOLLENBERG

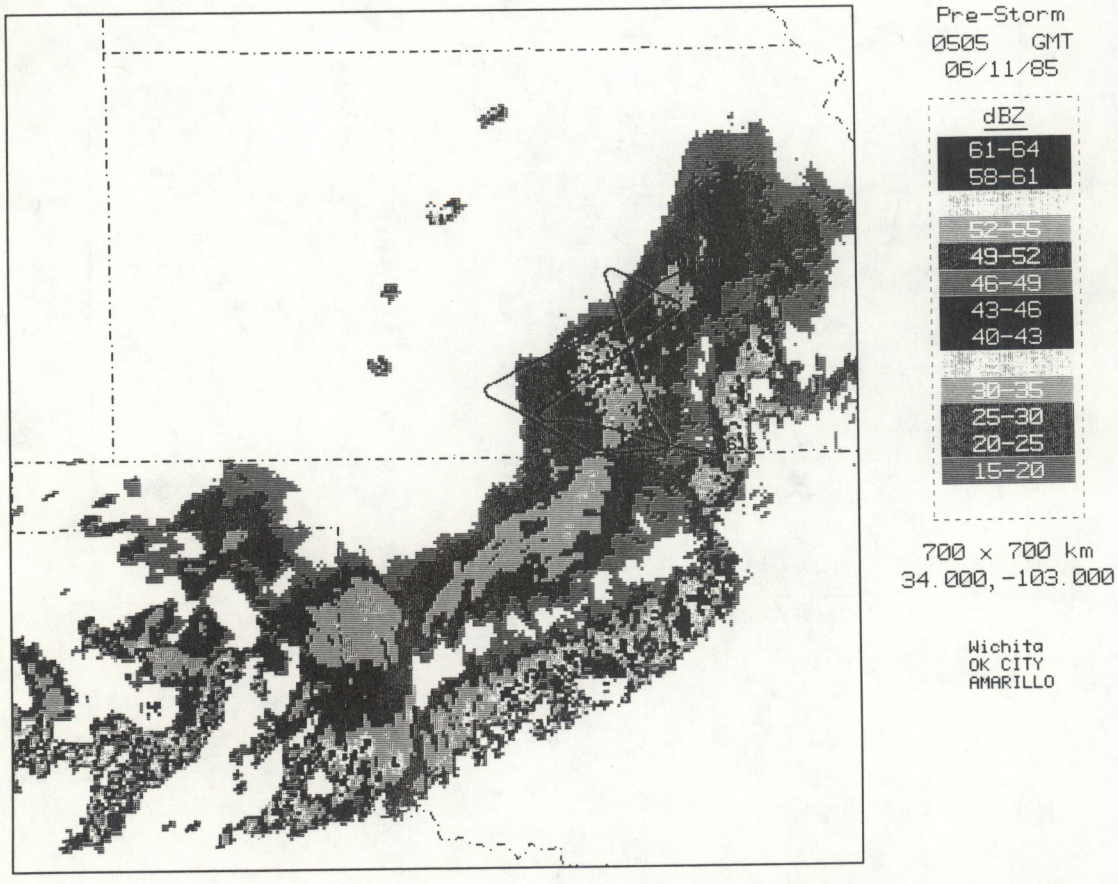
Tape Number	Time On (GMT)	Time Off (GMT)
1	2213	2351
2	2351	0002
3	0002	0045
4	0045	0138
5	0138	0151
6	0151	0203
7	0203	0210
8	0212	0218
9	0218	0223
10	0223	0228
11	0228	0233
12	0233	0239
13	0239	0244
14	0244	0305
15	0305	0312
16	0312	0319
17	0319	0325
18	0325	0331
19	0331	0336
20	0336	0341
21	0341	0346
22	0347	0352
23	0352	0357
24	0357	0402
25	0402	0407
26	0407	0412
27	0412	0420
28	0420	0438
29	0438	0448
30	0448	0507
31	0507	0518
32	0518	0527
33	0527	0546
34	0546	0551
35	0551	0556
36	0556	0624
37	0624	0739

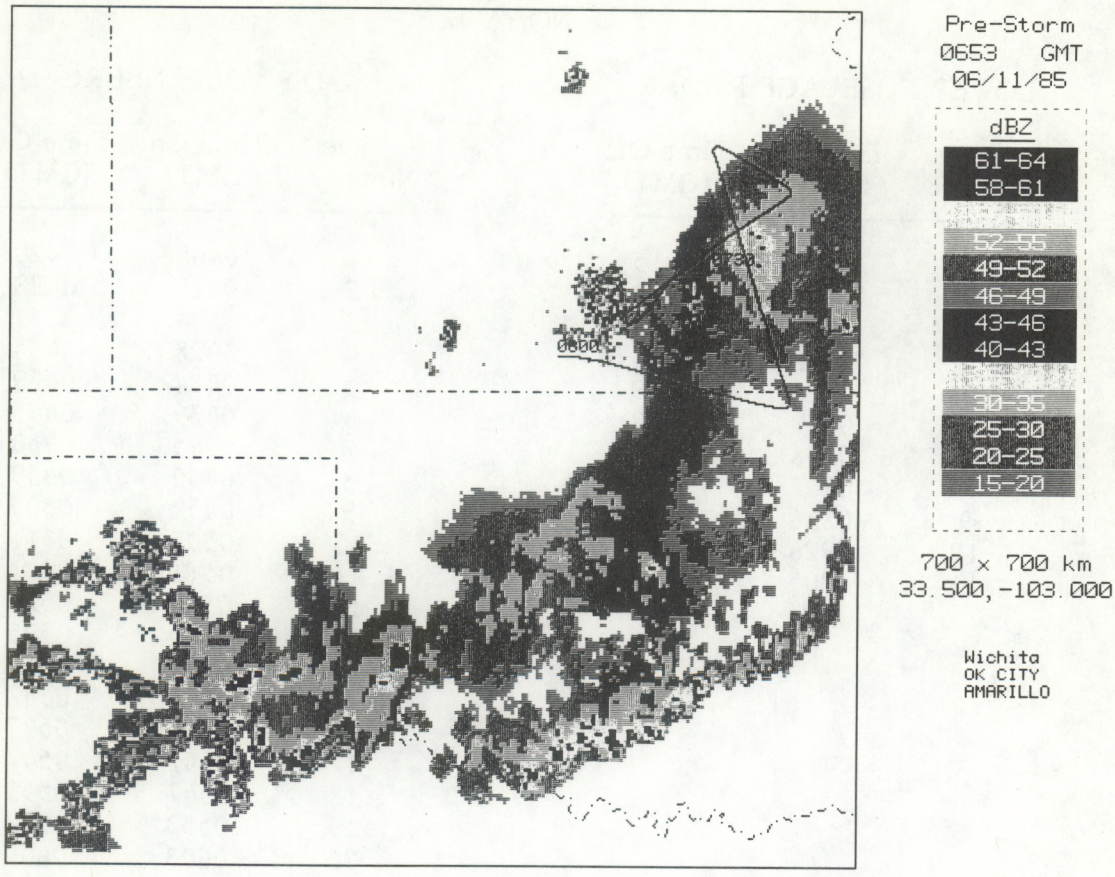
Mission # 10 NOAA-42
11 June 1985 (0230-1031 GMT)

NOAA-42 joined the other P-3 aircraft in a vertically-stacked butterfly pattern. As the squall line continued to drift southeastward, NOAA-42 flew close to the convection, gathering cloud physics data, and NOAA-43 remained within the stratiform precipitation area. NOAA-42 continued to fly in the MCS well into its dissipation stage before returning to Oklahoma City.




7000
6000
5000
4000
3000
2000
1000
00
Altitude (M)
21 22 23 00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18
Time (GMT)


Pre-Storm
0505 GMT
06/11/85
dBZ
61-64
58-61
52-55
49-52
46-49
43-46
40-43
30-35
25-30
20-25
15-20
700 x 700 km
34.000,-103.000
Wichita
OK CITY
AMARILLO


Pre-Storm
0653 GMT
06/11/85
dBZ
61-64
58-61
52-55
49-52
46-49
43-46
40-43
30-35
25-30
20-25
15-20
700 x 700 km
33.500, -103.000
Wichita
OK CITY
AMARILLO

11 JUNE 1985
NOAA 42

LOWER FUSELAGE RADAR

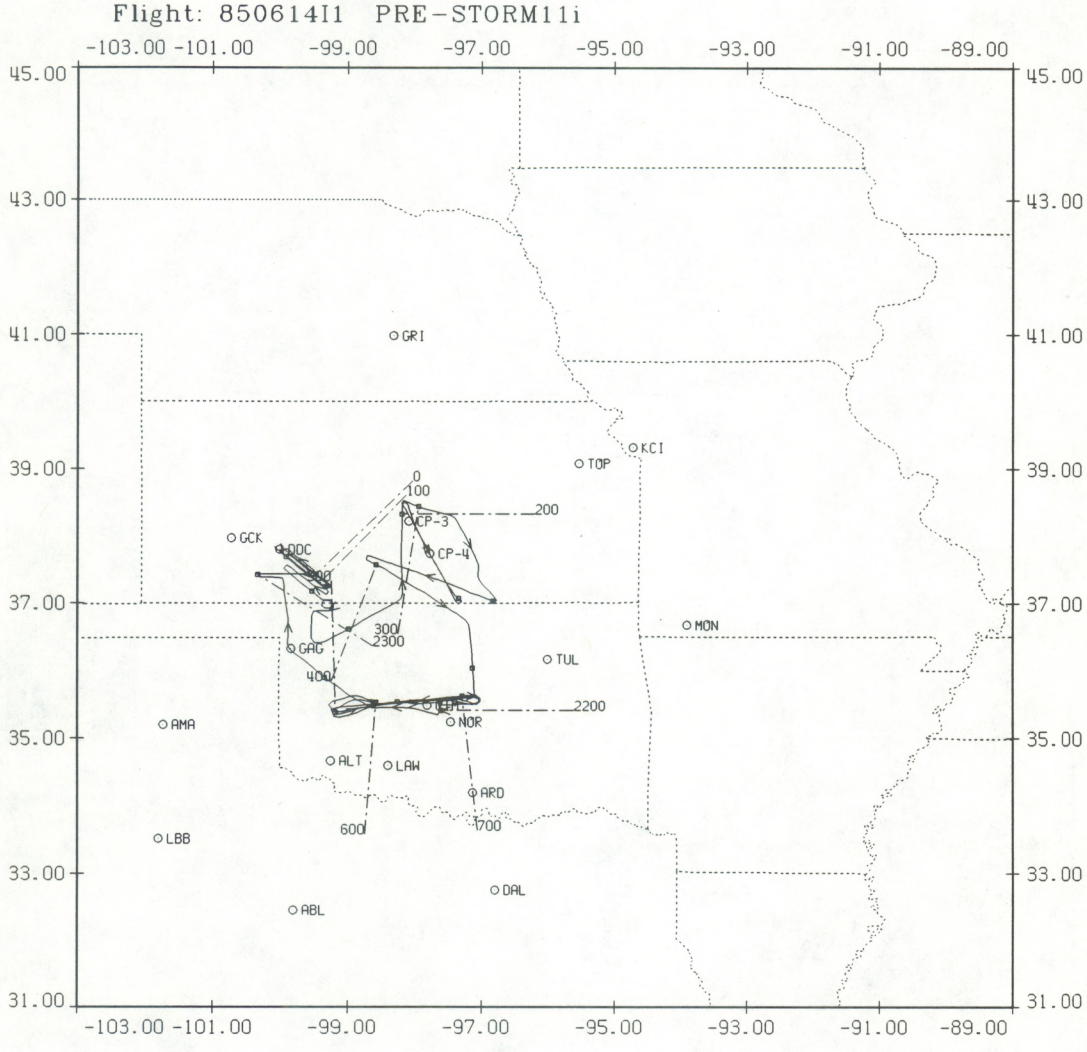
Tape Number	Time On (GMT)	Time Off (GMT)
1	0336	0415
2	0415	0452
3	0452	0532
4	0532	0610
5	0610	0649
6	0649	0728
7	0728	0807
8	0807	0846
9	0846	0926
10	0926	1005
11	1005	1019

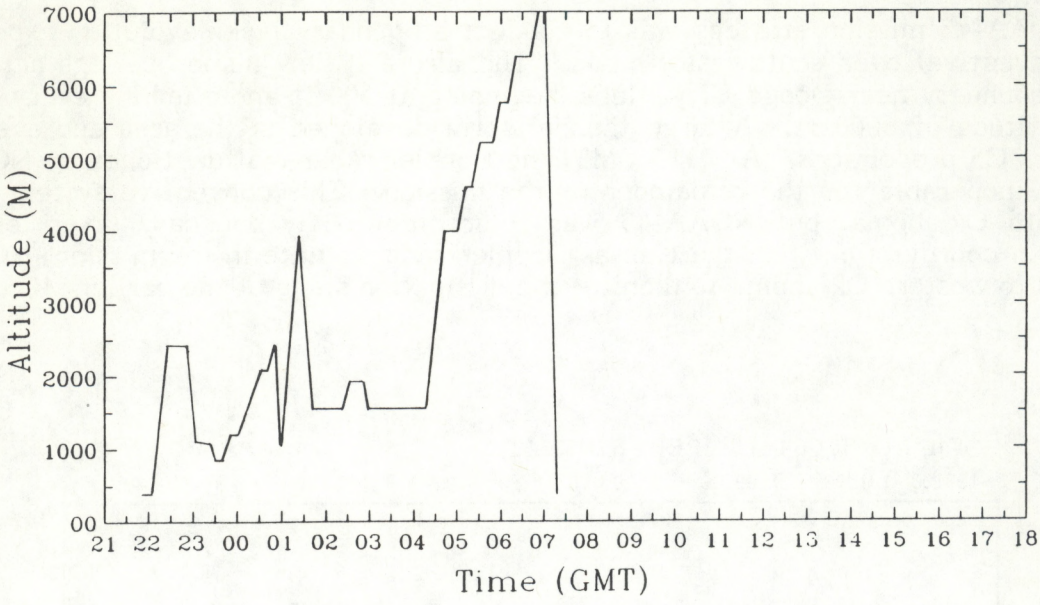
2-D KNOLLENBERG

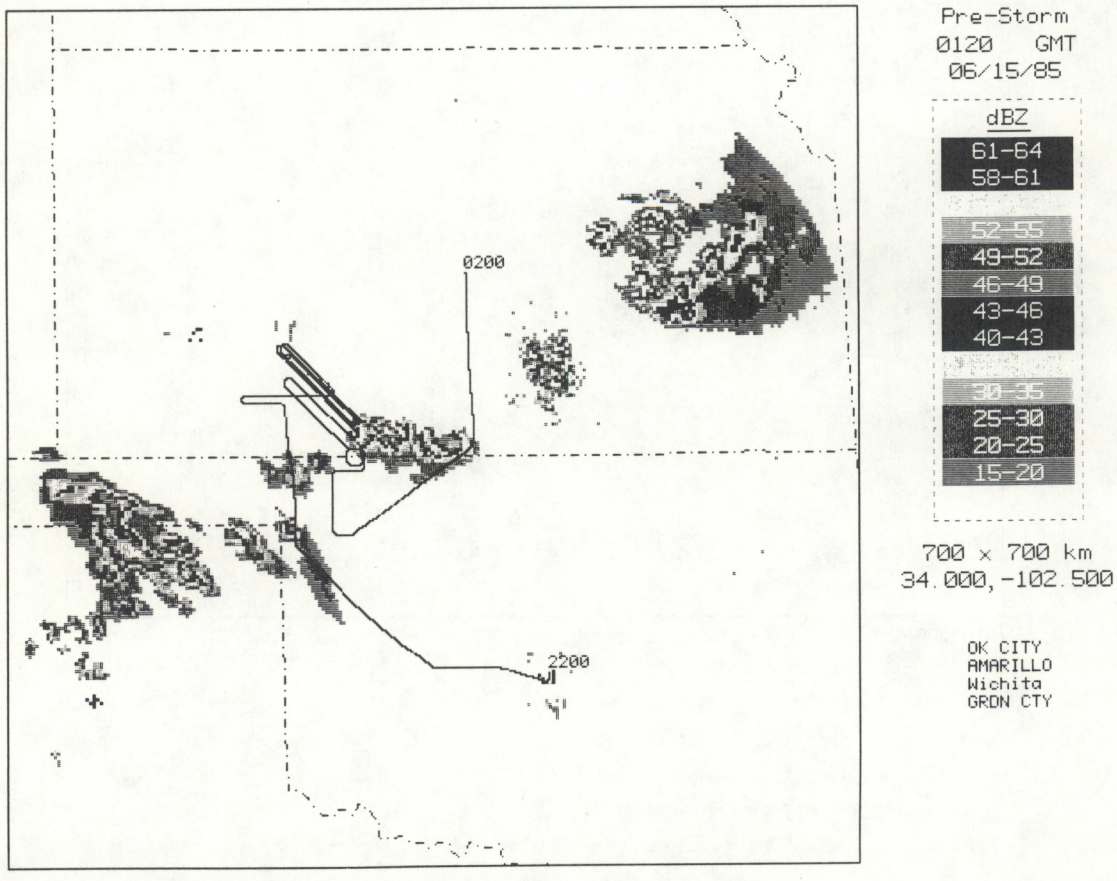
Tape Number	Time On (GMT)	Time Off (GMT)
1	0408	0420
2	0420	0428
3		
4	0428	0434
5	0434	0439
6	0439	0445
7	0445	0450
8	0450	0459
9	0459	0505
10	0505	0511
11	0511	0515
12	0515	0520
13	0520	0525
14	0525	0531
15	0531	0537
16	0537	0542
17	0542	0547
18	0547	0553
19	0553	0603
20	0603	0608
21	0608	0613
22	0613	0619
23	0619	0628
24	0628	0633
25	0633	0638
26	0638	0644
27	0644	0649
28	0649	0655
29	0655	0659
30	0659	0706
31	0706	0712
32	0712	0726
33	0726	0732
34	0732	0738
35	0738	0743
36	0743	0802
37	0802	0808
38	0808	0815
39	0815	0848
40	0848	0921
41	0921	1000

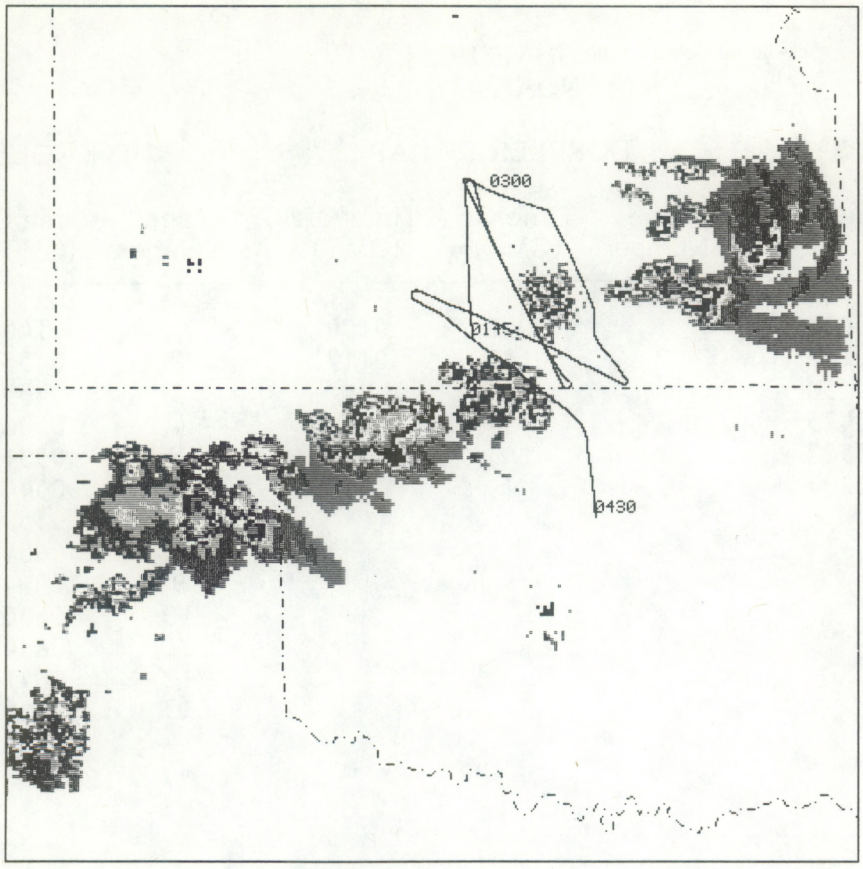
Mission # 11 NOAA-43
14-15 June 1985 (2205-0717 GMT)

NOAA-43 mission strategy was to conduct a boundary layer evolution experiment (Pre-Convective) over southwest Kansas. The aircraft flew numerous legs across the frontal boundary near Dodge City, Kans, beginning at 500 ft and climbing every 1000 ft to an altitude of 6000 ft. A large thunderstorm developed in the area and eventually grew to MCS proportions. At 0115 GMT, the Doppler radar malfunctioned on NOAA-43 and was inoperable for the remainder of the mission. This convective system drifted south into Oklahoma, but NOAA-43 was redirected to fly boundary layer legs near Wichita in coordination with the Kansas Doppler radars. Late in the mission, NOAA-43 returned to western Oklahoma to monitor the dissipation stage of the earlier MCS.




Altitude (M)
7000
6000
5000
4000
3000
2000
1000
00
21 22 23 00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18
Time (GMT)


0200
2200
Pre-Storm
0120 GMT
06/15/85
dBZ
61-64
58-61
52-55
49-52
46-49
43-46
40-43
30-35
25-30
20-25
15-20
700 x 700 km
34.000,-102.500
OK CITY
AMARILLO
Wichita
GRDN CTY

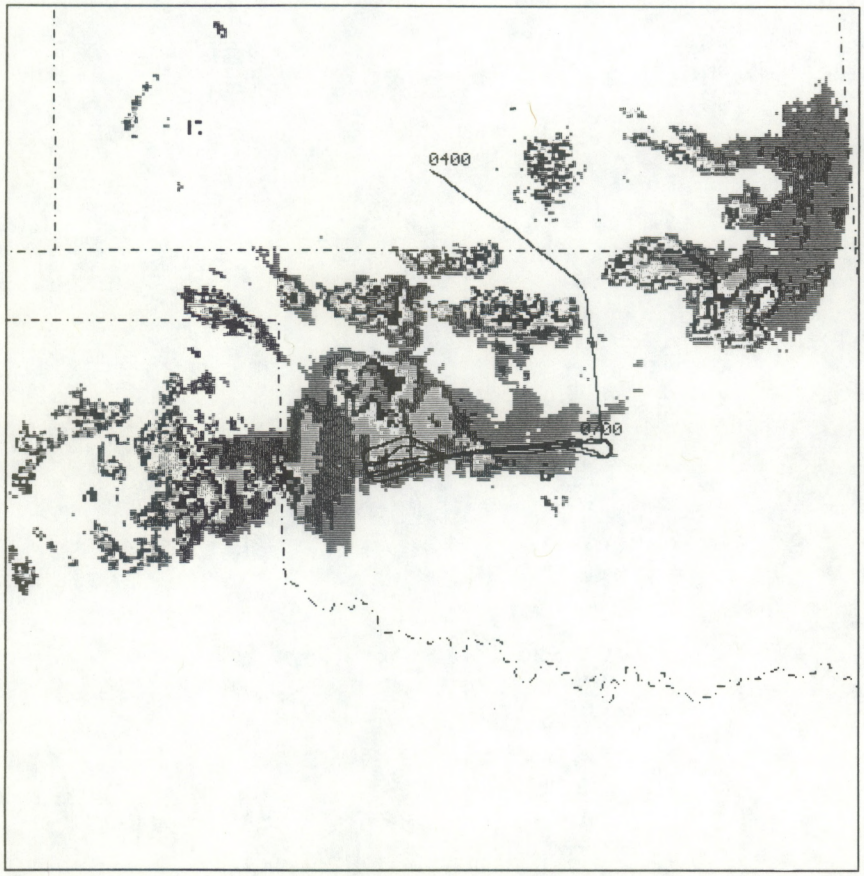


Pre-Storm
0229 GMT
06/15/85

dBZ
61-64
58-61
52-55
49-52
46-49
43-46
40-43
30-35
25-30
20-25
15-20

700 x 700 km
33.500, -102.500

OK CITY
AMARILLO
Wichita
GRDN CTY



Pre-Storm
0430 GMT
06/15/85

dBZ
61-64
58-61
52-55
49-52
46-49
43-46
40-43
30-35
25-30
20-25
15-20

700 x 700 km
32.500, -102.500

OK CITY
AMARILLO
Wichita
GRDN CTY

14 JUNE 1985
NOAA 43

LOWER FUSELAGE RADAR

Tape Number	Time On (GMT)	Time Off (GMT)
1	2247	0030
2	0030	0102
3	0102	0150
4	0150	0425
5	0425	0502
6	0520	0704

DOPPLER RADAR

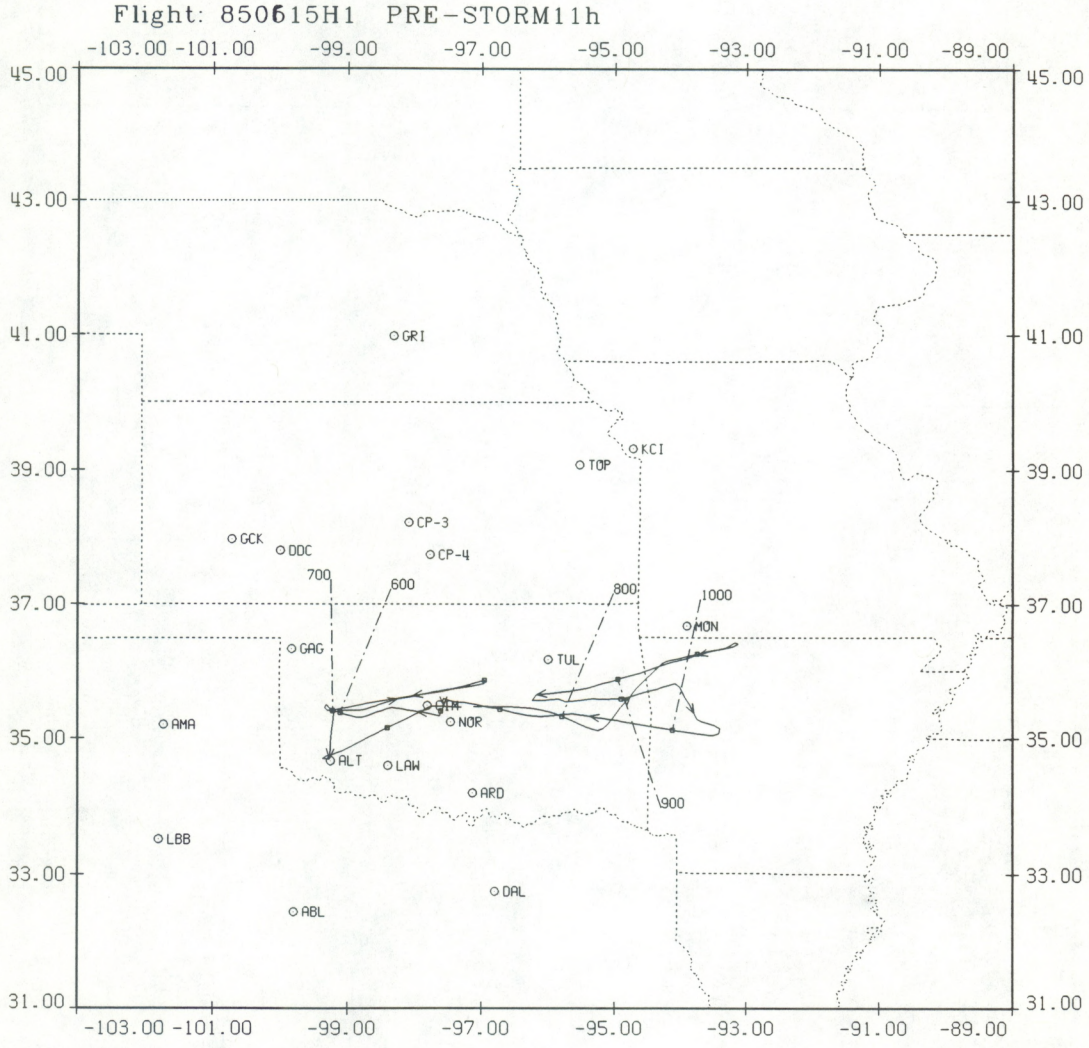
Tape Number	Time On (GMT)	Time Off (GMT)
1	0042	0104
2	0111	0117

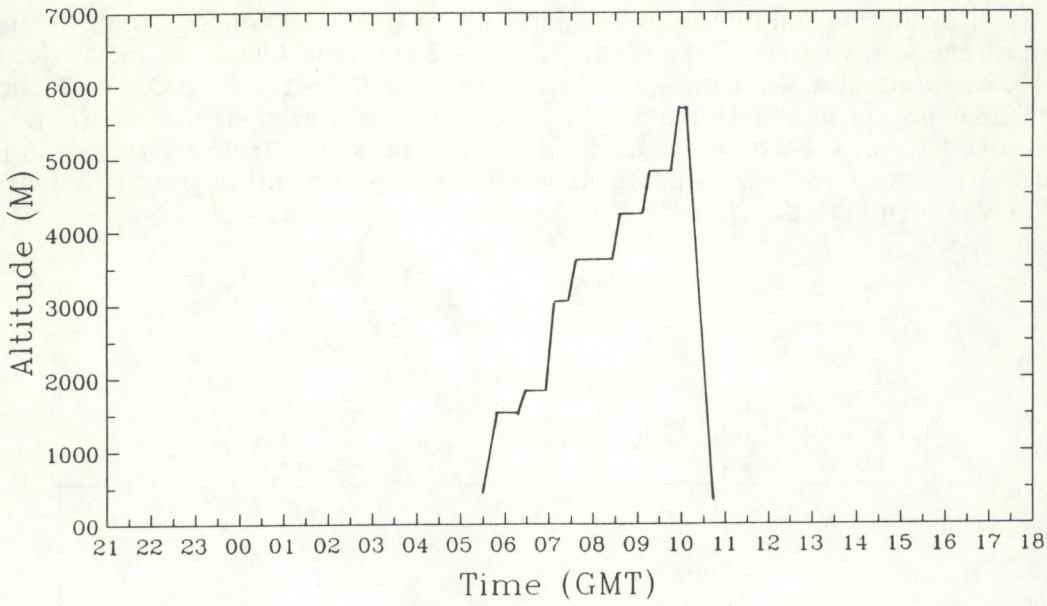
2-D KNOLLENBERG

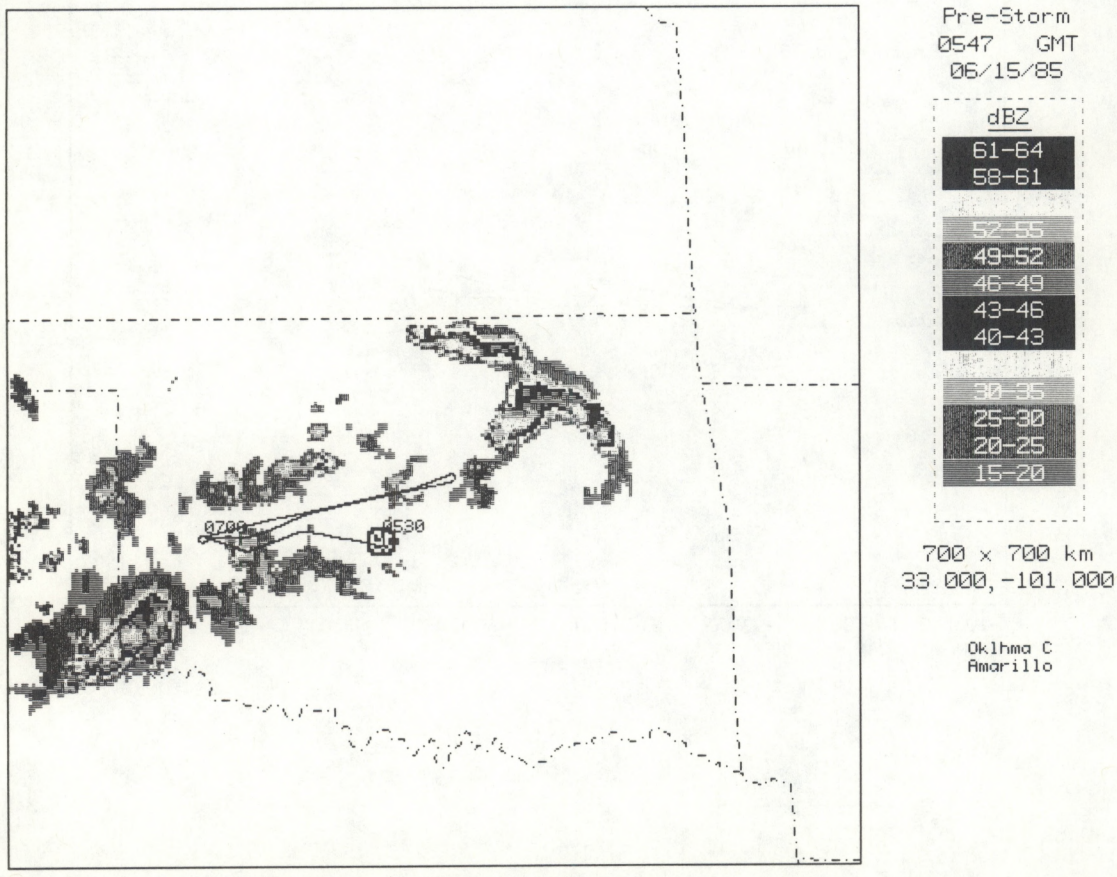
Tape Number	Time On (GMT)	Time Off (GMT)
1	0140	0453
2	0453	0459
3	0459	0506
4	0506	0531
5	0531	0544
6	0544	0559
7	0559	0604
8	0604	0624
9	0624	0630
10	0630	0630
11	0634	0640
12	0641	0645
13	0646	0651
14	0651	0706

Mission # 11 NOAA-42
15 June 1985 (0540-1046 GMT)

An anvil dynamics and microphysics experiment (mature to dissipating) was planned using both aircraft in western Oklahoma. NOAA-42 flew the low-level inflow legs, with NOAA-43 overflying the same area at 13,000 to 23,000 feet. As NOAA-43 ended its mission, NOAA-42 continued flying in the stratiform rain area at 10,000 feet. Flight plan was moved to an area of stratiform rain which persisted from northeast Oklahoma to western Arkansas. Numerous patterns were flown before all activity dissipated and the mission was terminated.




7000
6000
5000
4000
3000
2000
1000
00
Altitude (M)
21 22 23 00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18
Time (GMT)


0700
0530
Pre-Storm
0547 GMT
06/15/85
dBZ
61-64
58-61
52-55
49-52
46-49
43-46
40-43
30-35
25-30
20-25
15-20
700 x 700 km
33.000,-101.000
Oklhma C
Amarillo

15 JUNE 1985
NOAA 42

LOWER FUSELAGE RADAR

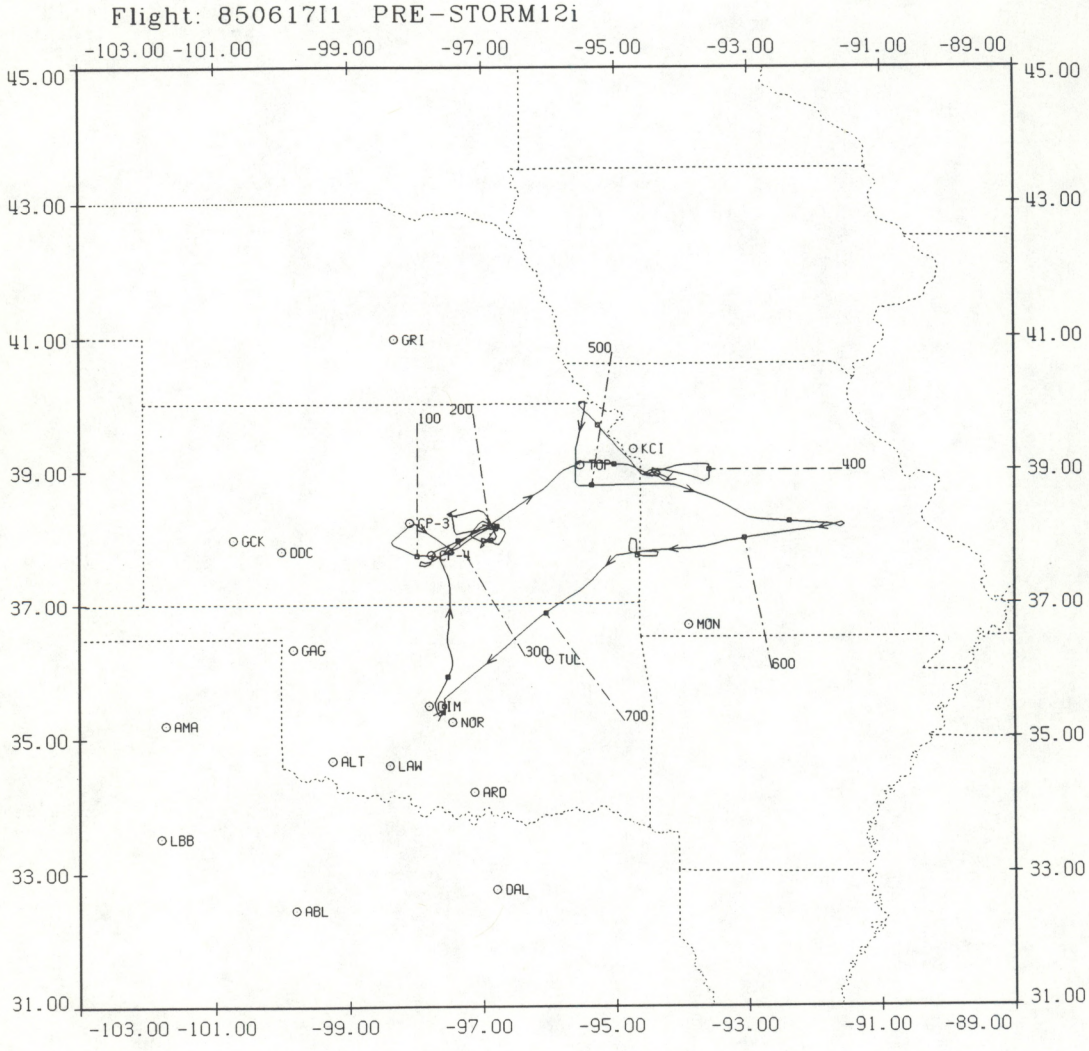
Tape Number	Time On (GMT)	Time Off (GMT)
1	0545	0624
2	0624	0702
3	0702	0741
4	0741	0821
5	0821	0859
6	0859	0937
7	0937	1016
8	1016	1038

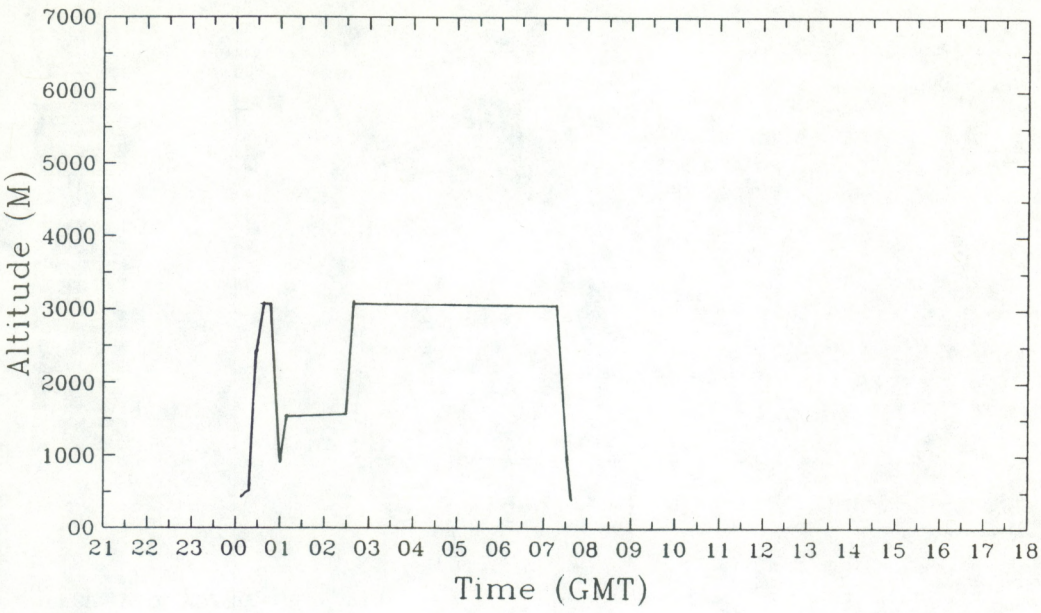
2-D KNOLLENBERG

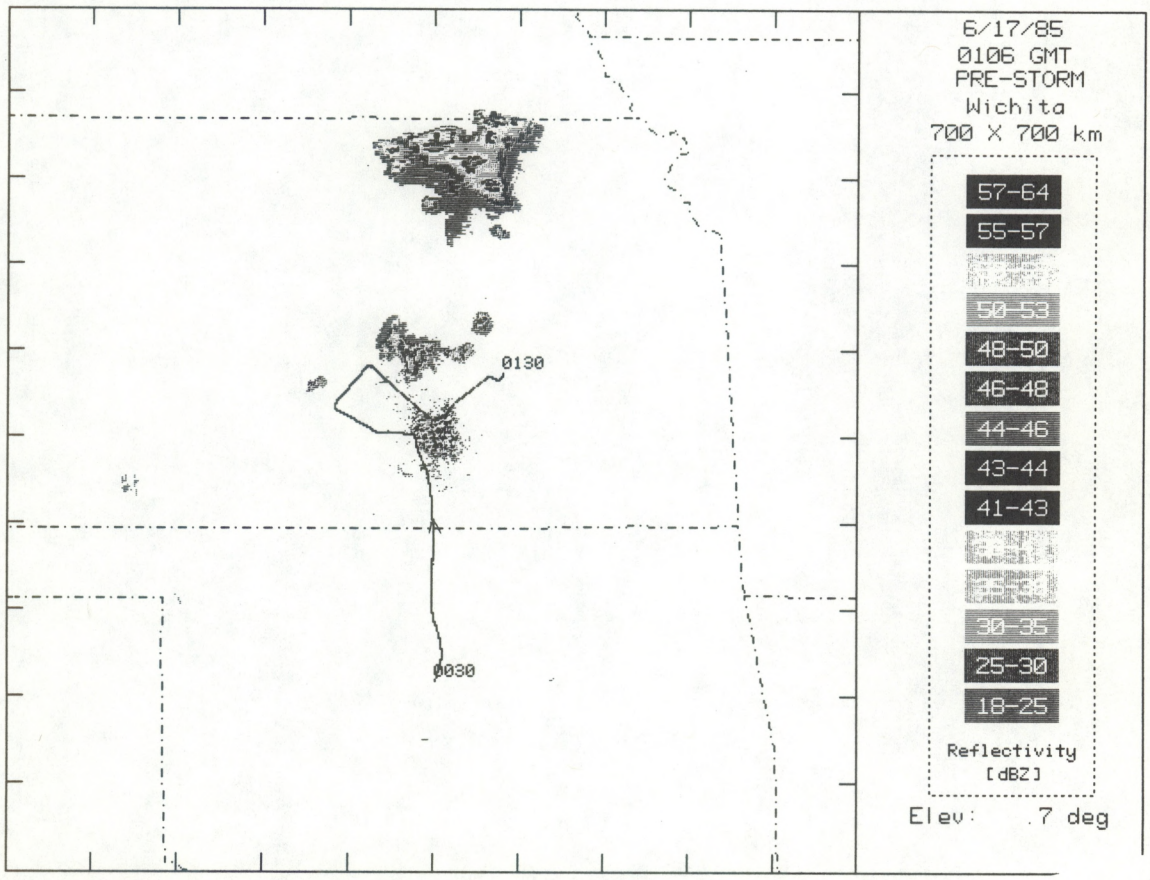
Tape Number	Time On (GMT)	Time Off (GMT)
1	0720	0811
2	0811	0817
3	0817	0855
4	0855	0933
5	0933	0943
6	0943	0948
7	0948	0953
8	0953	0958
9	0958	1004
10	1004	1023

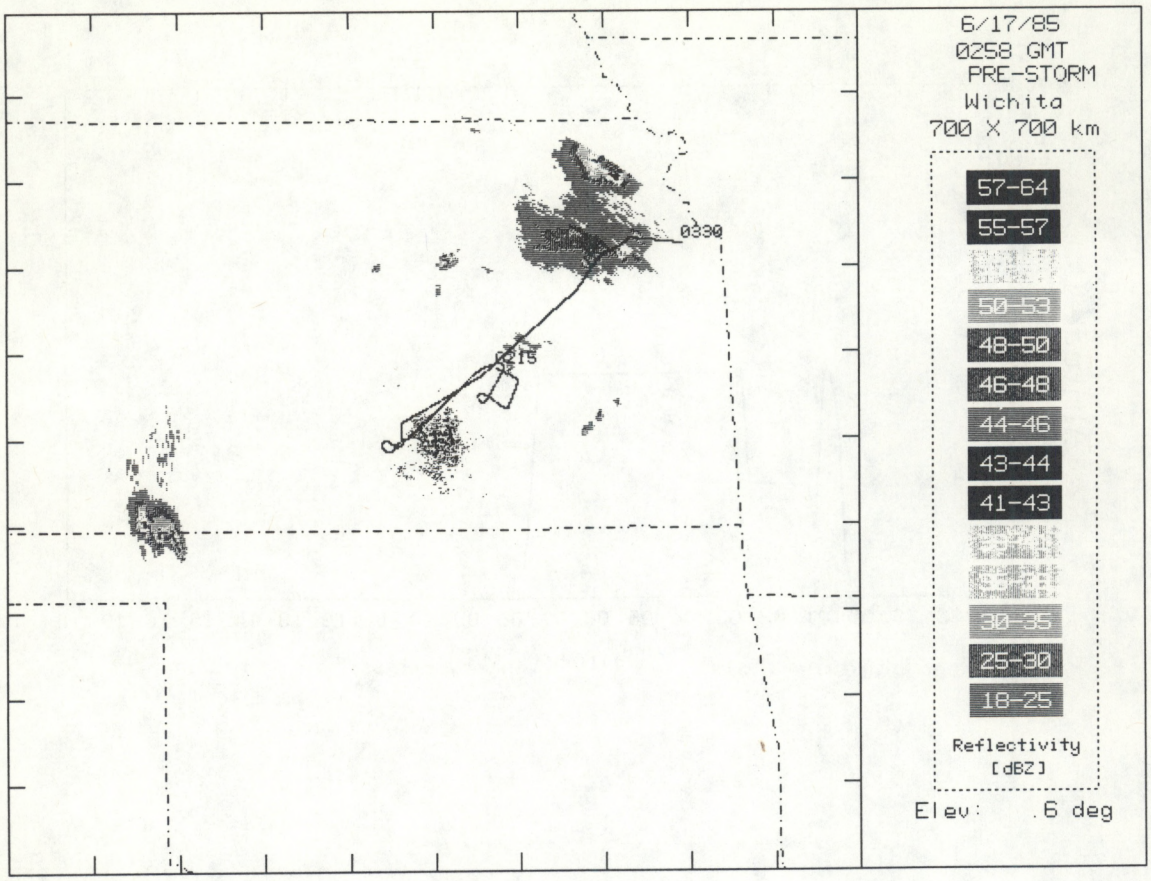
Mission # 12 NOAA-43
17 June 1985 (0020-0733 GMT)

With a mission of gathering low-level inflow/outflow data before sunset, NOAA-43 flew legs coordinated with the CP-4 radar in an area of weak, multi-cellular thunderstorms, north of Wichita. This activity dissipated further, but other activity existed in northeast Kansas. The aircraft was directed to fly large-scale box patterns around this loosely organized, but intense convection. NOAA-43 followed this meso-alpha scale system into Missouri, out of the PRE-STORM region. The convection did not organize as expected and the mission had no other supporting data systems, therefore the aircraft returned to Oklahoma City.




7000
6000
5000
4000
3000
2000
1000
00
Altitude (M)
21 22 23 00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18
Time (GMT)


6/17/85
0106 GMT
PRE-STORM
Wichita
700 X 700 km
57-64
55-57
50-53
48-50
46-48
44-46
43-44
41-43
30-35
25-30
18-25
Reflectivity
[dBZ]
Elev: .7 deg
0130
0030


6/17/85
0258 GMT
PRE-STORM
Wichita
700 X 700 km
57-64
55-57
50-53
48-50
46-48
44-46
43-44
41-43
30-35
25-30
18-25
Reflectivity
[dBZ]
Elev: .6 deg
0330
0215

17 JUNE 1985
NOAA 43

LOWER FUSELAGE RADAR

Tape Number	Time On (GMT)	Time Off (GMT)
1	0051	0122
2	0122	0152
3	0152	0223
4	0223	0254
5	0254	0402
6	0402	0432
7	0432	0526
8	0526	0630

DOPPLER RADAR

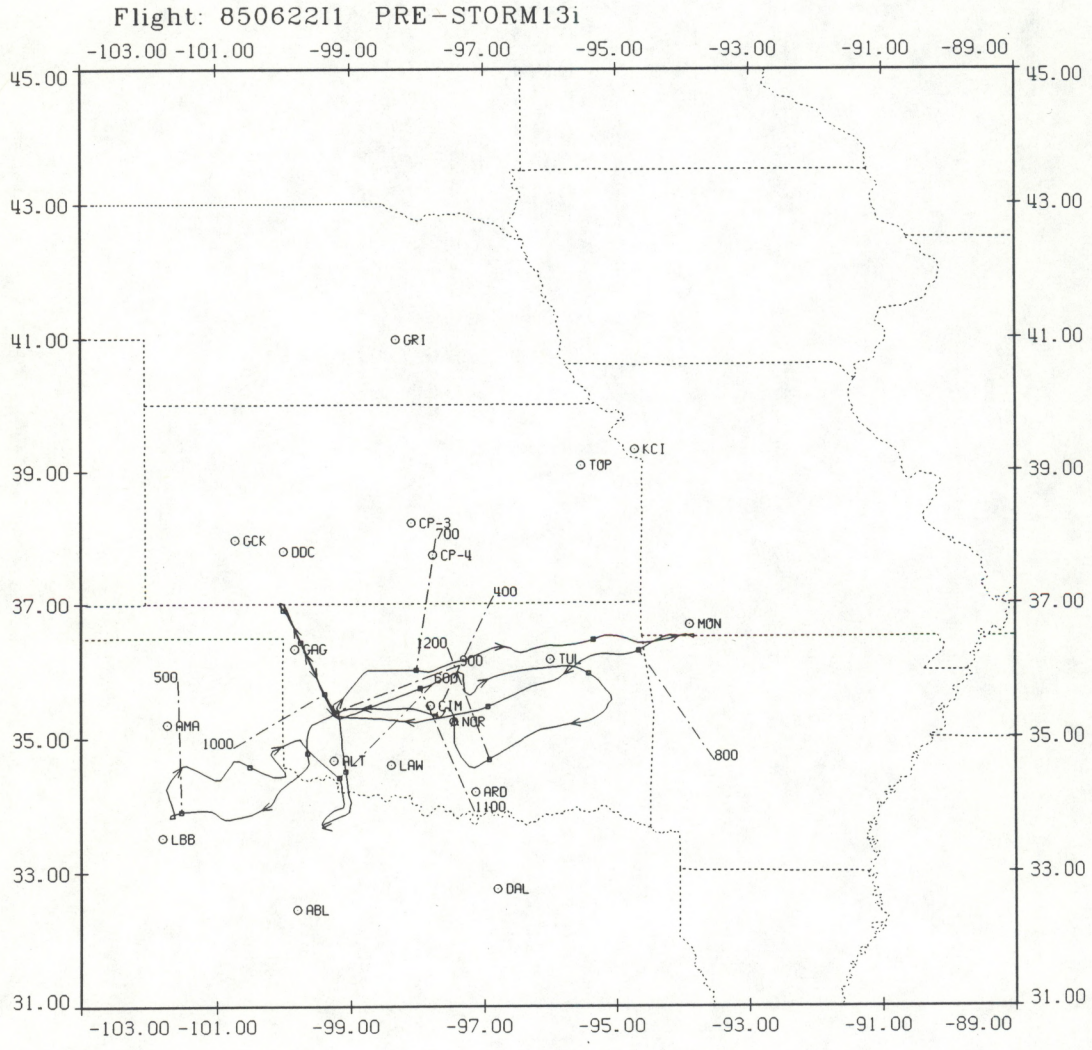
Tape Number	Time On (GMT)	Time Off (GMT)
1	0056	0106
2	0112	0119
3	0122	0127
4	0131	0143
5	0146	0202
6	0209	0221
7	0221	0224
8	0227	0245
9	0247	0255
10	0305	0308
11	0349	0356
12	0359	0416
13	0418	0435
14	0438	0443
15	0517	0530

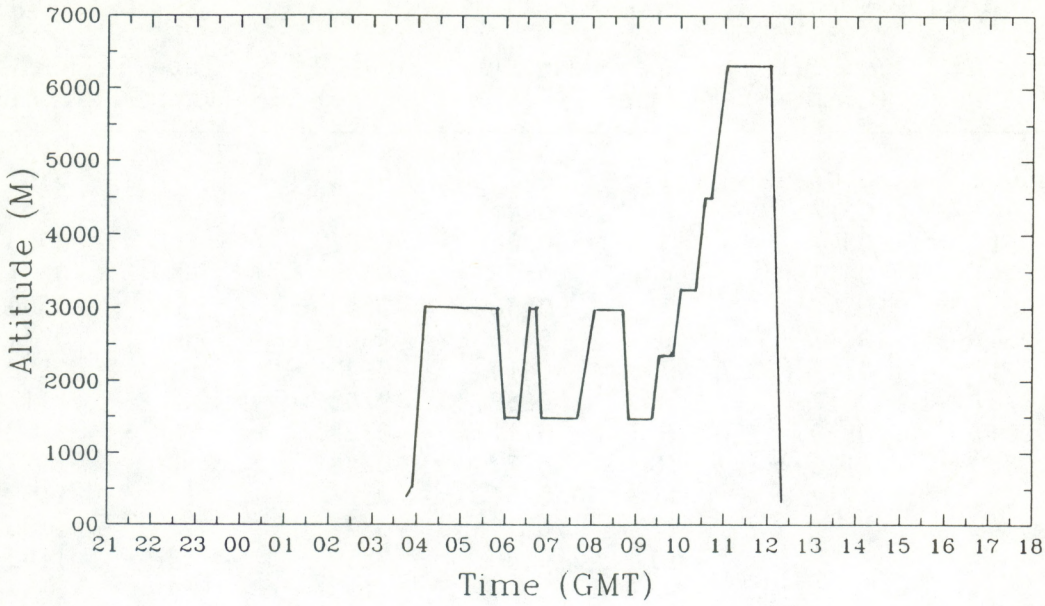
2-D KNOLLENBERG

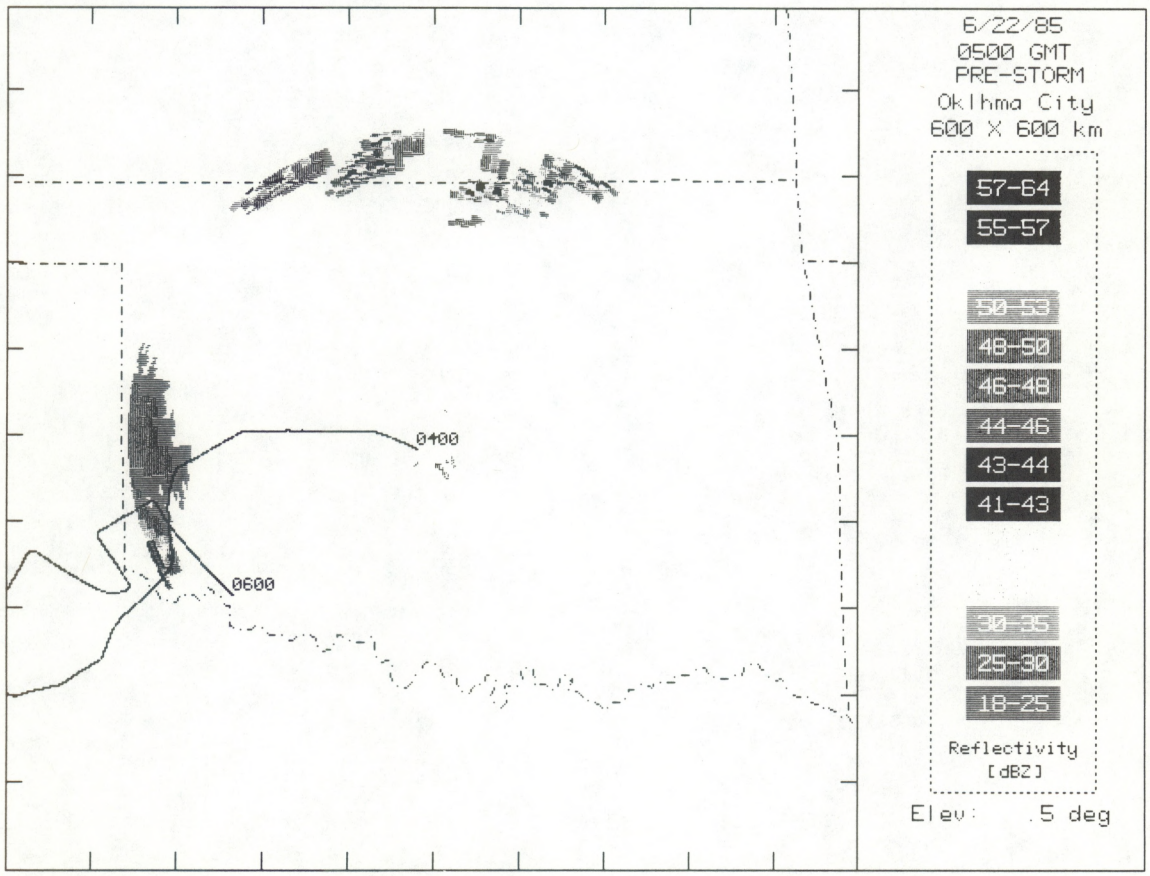
Tape Number	Time On (GMT)	Time Off (GMT)
1	0112	0510
2	0510	0613

Mission # 13 NOAA-43
22 June 1985 (0400-1300 GMT)

The first two hours of the flight were spent monitoring a convective system in the Texas panhandle. Good aircraft radar coverage was maintained along the convective and stratiform rain regions. Later, a line of thunderstorms developed along the Kansas-Oklahoma border and NOAA-43's flight plan was moved to study the inflow region on the south flank of this activity. The aircraft continued to monitor the southern flank of the system from central Oklahoma to western Arkansas.




7000
6000
5000
4000
3000
2000
1000
00
Altitude (M)
21 22 23 00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18
Time (GMT)


6/22/85
0500 GMT
PRE-STORM
Oklhma City
600 X 600 km
57-64
55-57
50-53
48-50
46-48
44-46
43-44
41-43
30-35
25-30
18-25
Reflectivity
[dBZ]
Elev: .5 deg
0400
0600

22 JUNE 1985
NOAA 43

LOWER FUSELAGE RADAR

Tape Number	Time On (GMT)	Time Off (GMT)
1	0402	0447
2	0447	0517
3	0517	0547
4	0547	0617
5	0617	0647
6	0647	0717
7	0717	0747
8	0747	0817
9	0817	0850
10	0850	1126
11	1126	1214

DOPPLER RADAR

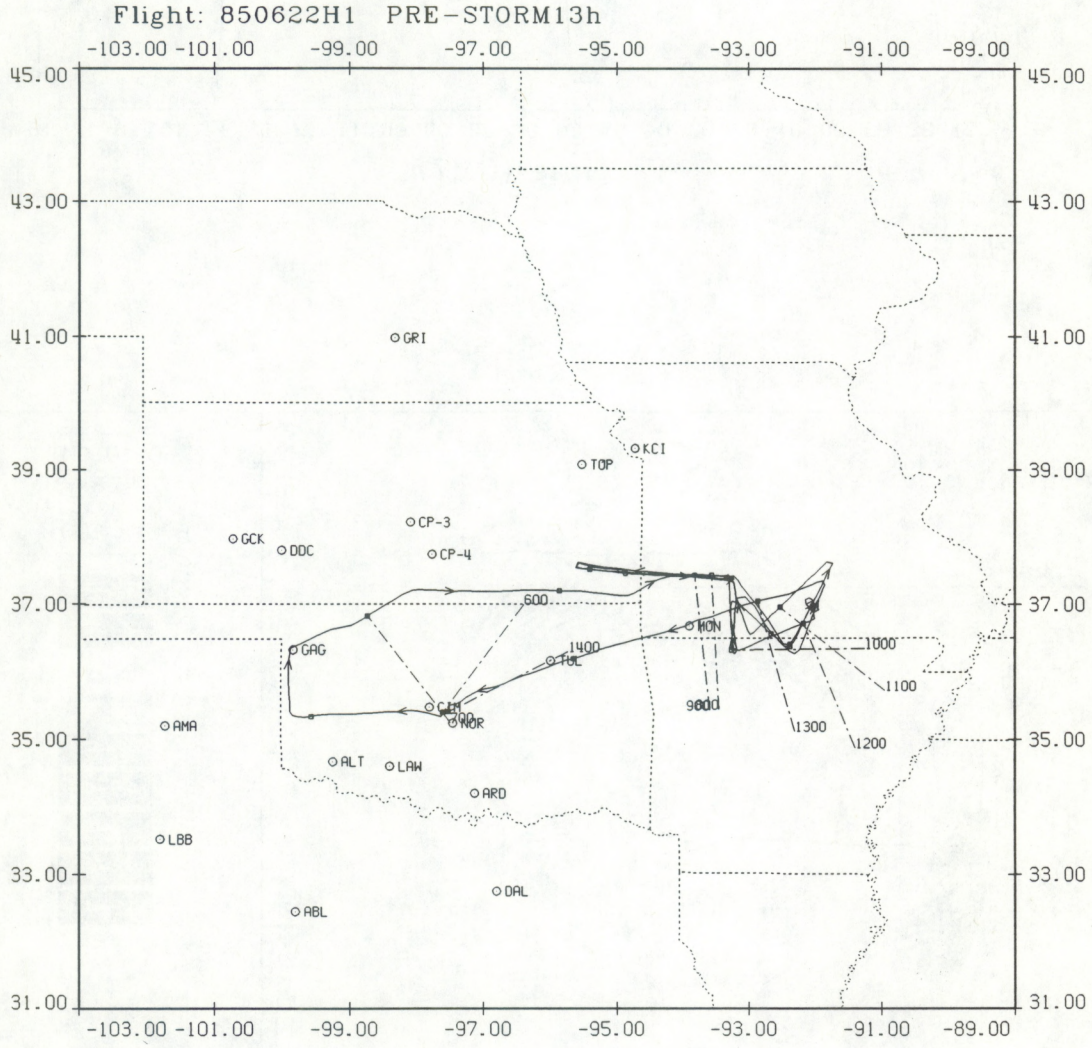
Tape Number	Time On (GMT)	Time Off (GMT)
1	0425	0442
2	0445	0501
3	0504	0521
4	0523	0534
5	0536	0553
6	0556	0606
7	0615	0632
8	0652	0708
9	0711	0728
10	0732	0748
11	0751	0808
12	0810	0827
13	0830	0839

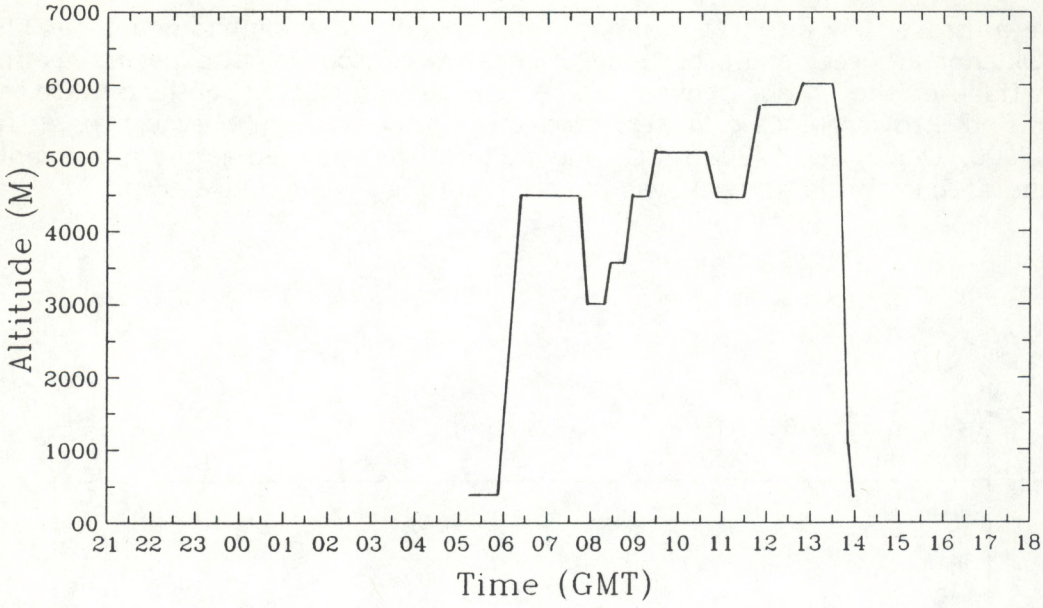
2-D KNOLLENBERG

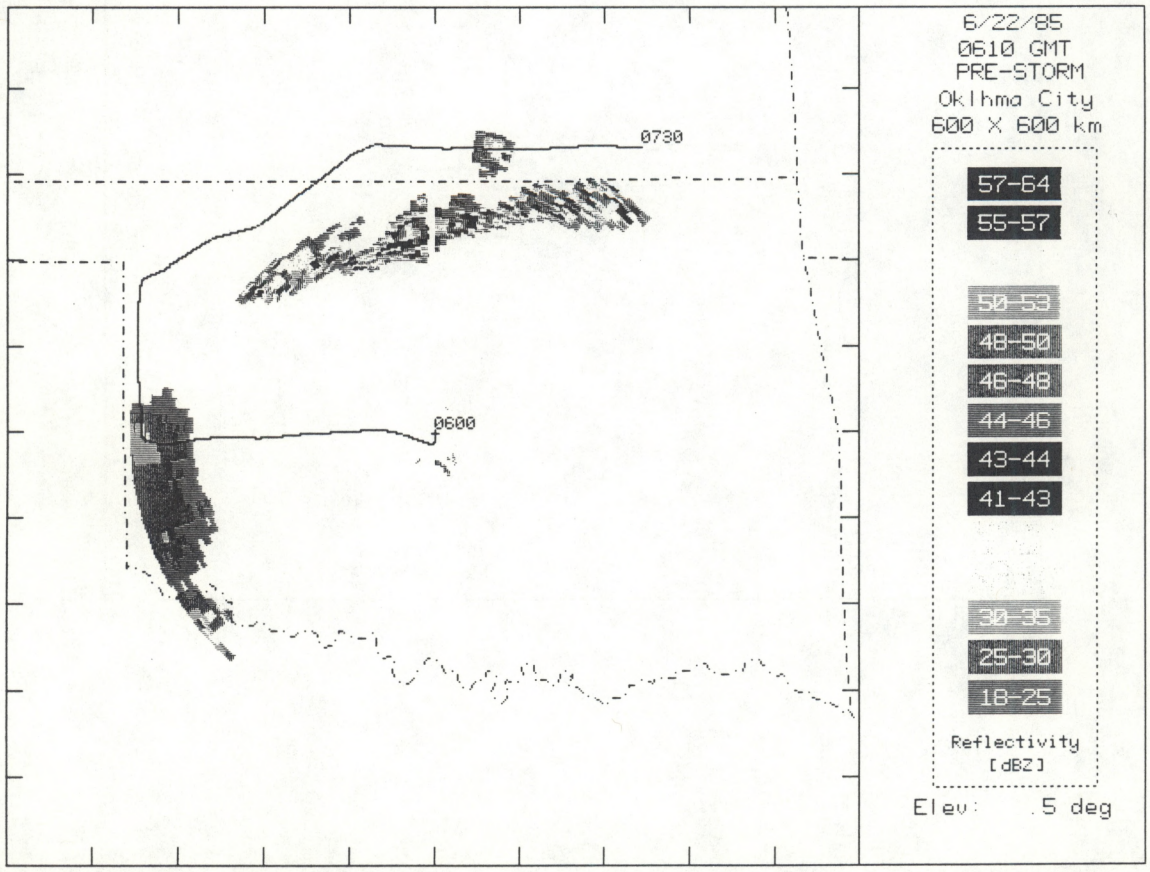
Tape Number	Time On (GMT)	Time Off (GMT)
1	0437	0456
2	0457	0523
3	0523	0532
4	0531	0544
5	0544	0640
6	0754	0820
7	0820	1117
8	1117	1122
9	1122	1127
10	1127	1132
11	1132	1136
12	1136	1143
13	1143	1147
14	1147	1153

Mission # 13 NOAA-42
22 June 1985 (0604-1350 GMT)

The aircraft flew directly to an area of convection which had developed along the Kansas-Oklahoma border and proceeded to perform microphysical experiments along the northern flank of the line of convection. As the system drifted southeastward, the plan was modified into large-scale butterfly patterns into southern Missouri at altitudes of 10000, 12000, 15000, and 17000 feet. The pattern was adjusted as the movement of the system dictated until the activity was too far from the PRE-STORM area.




7000
6000
5000
4000
3000
2000
1000
00
Altitude (M)
21 22 23 00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18
Time (GMT)


0730
0600
6/22/85
0610 GMT
PRE-STORM
Oklhma City
600 X 600 km
57-64
55-57
50-53
48-50
46-48
44-46
43-44
41-43
30-35
25-30
18-25
Reflectivity
[dBZ]
Elev: .5 deg

22 JUNE 1985
NOAA 42

LOWER FUSELAGE RADAR

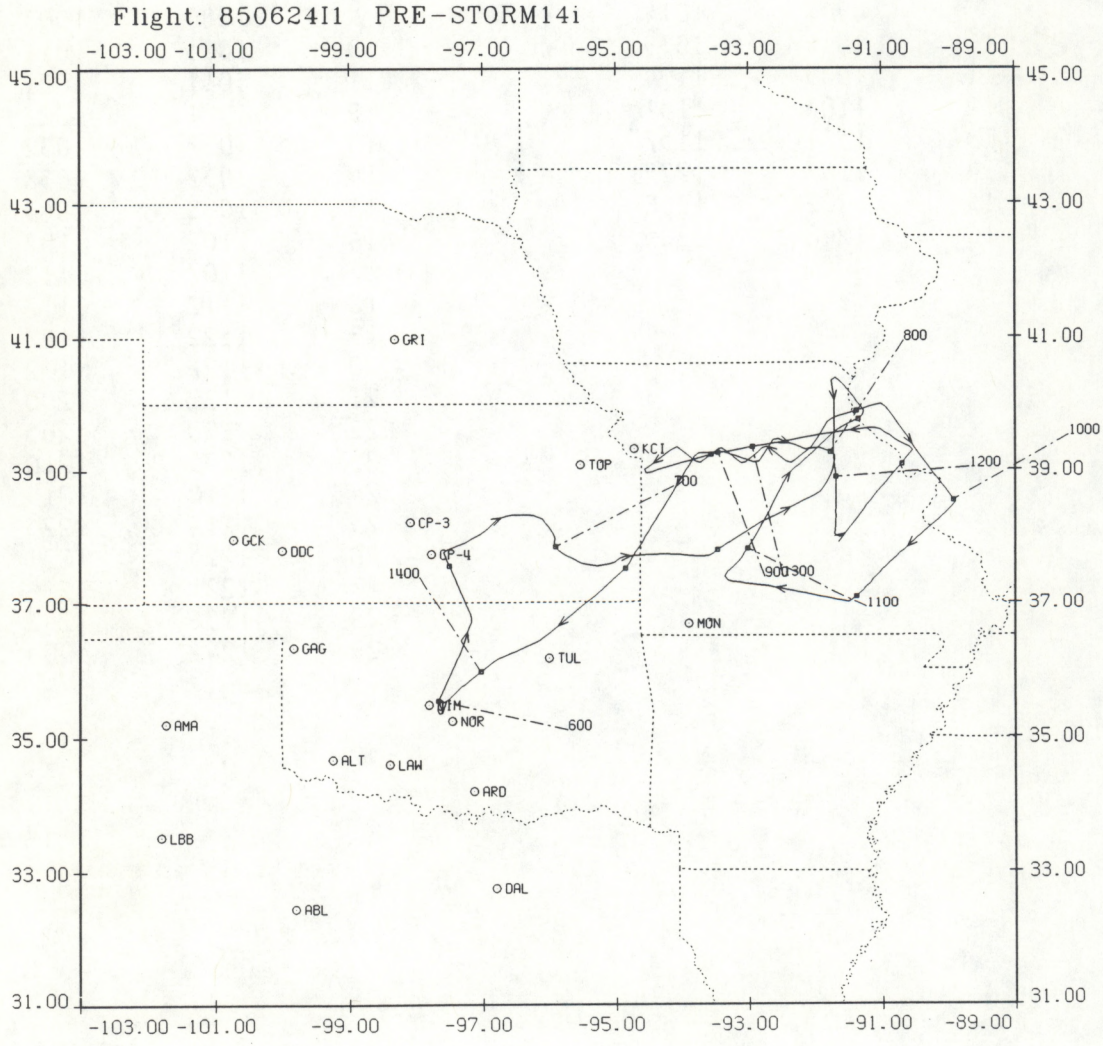
Tape Number	Time On (GMT)	Time Off (GMT)
1	0622	0648
2	0648	0712
3	0712	0740
4	0740	0806
5	0806	0831
6	0831	0857
7	0857	0922
8	0922	0948
9	0948	1014
10	1014	1039
11	1039	1104
12	1104	1131
13	1131	1157
14	1157	1222
15	1222	1248
16	1248	1305

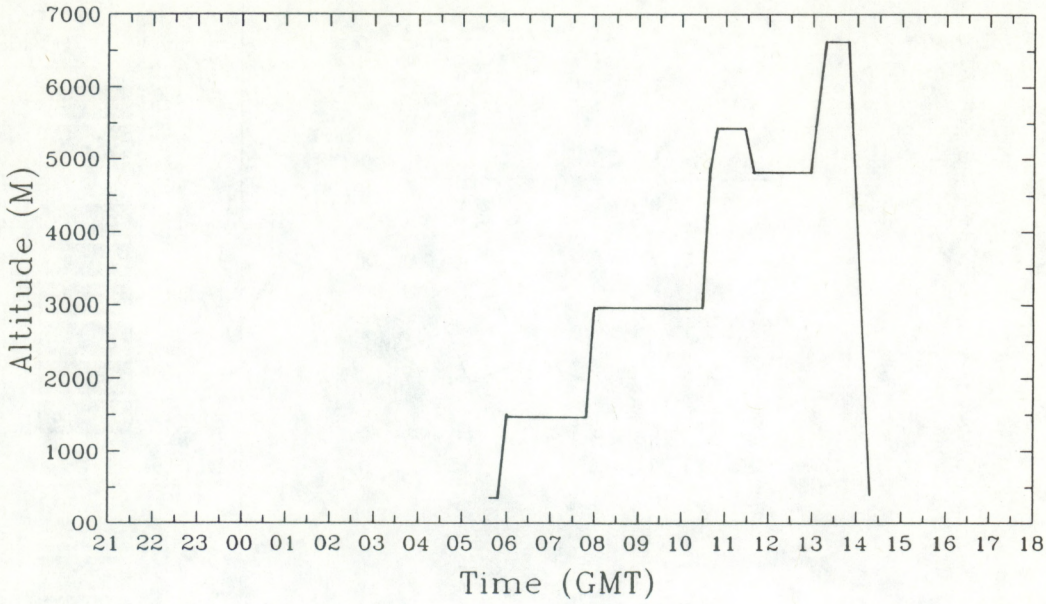
2-D KNOLLENBERG

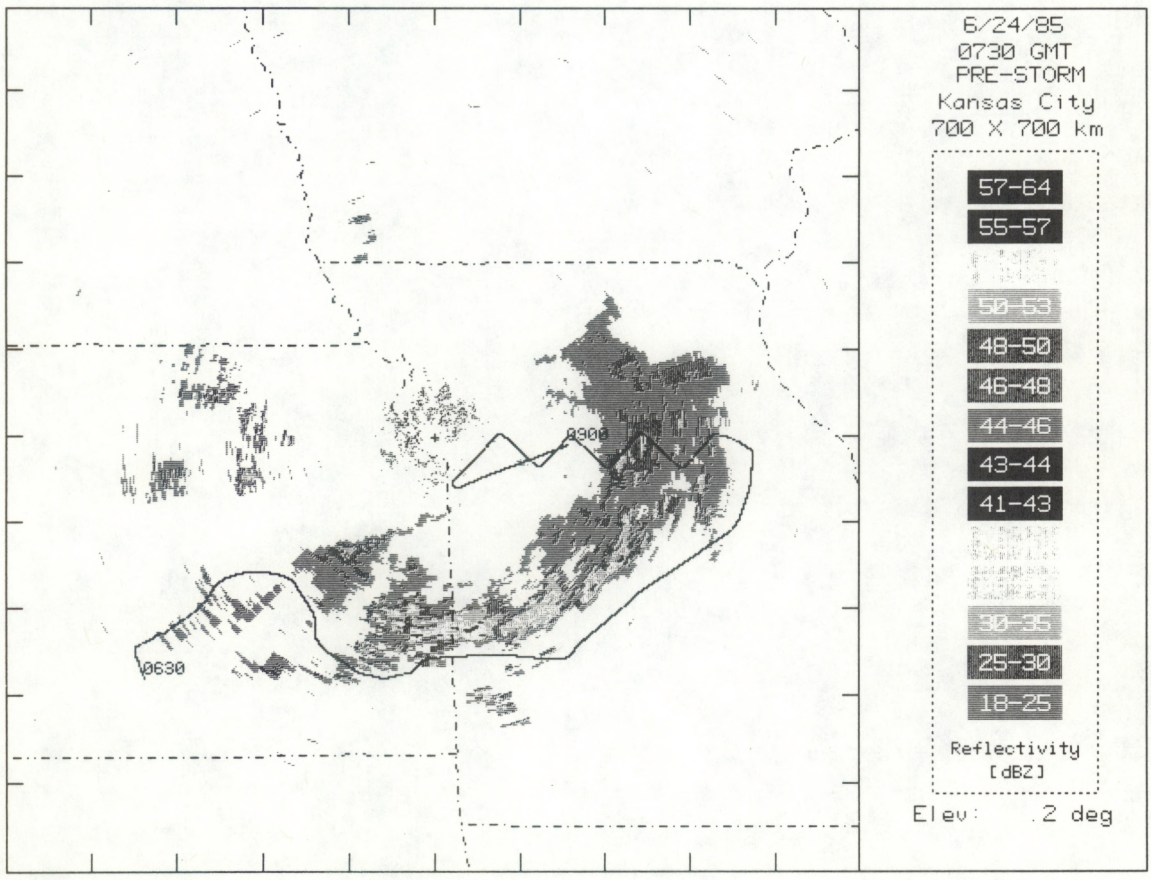
Tape Number	Time On (GMT)	Time Off (GMT)
1	0627	0634
2	0634	0715
3	0715	0721
4	0734	0753
5	0753	0817
6	0817	0927
7	0947	0954
8	0954	1000
9	1000	1005
10	1005	1011
11	1011	1021
12	1021	1027
13	1027	1032
14	1032	1038
15	1038	1043
16	1102	1107
17	1107	1112
18	1112	1117
19	1122	1127
20	1127	1132
21	1132	1200
22	1200	1205
23	1205	1210
24	1210	1215
25	1215	1225
26	1225	1231
27	1231	1236
28	1236	1242
29	1242	1305

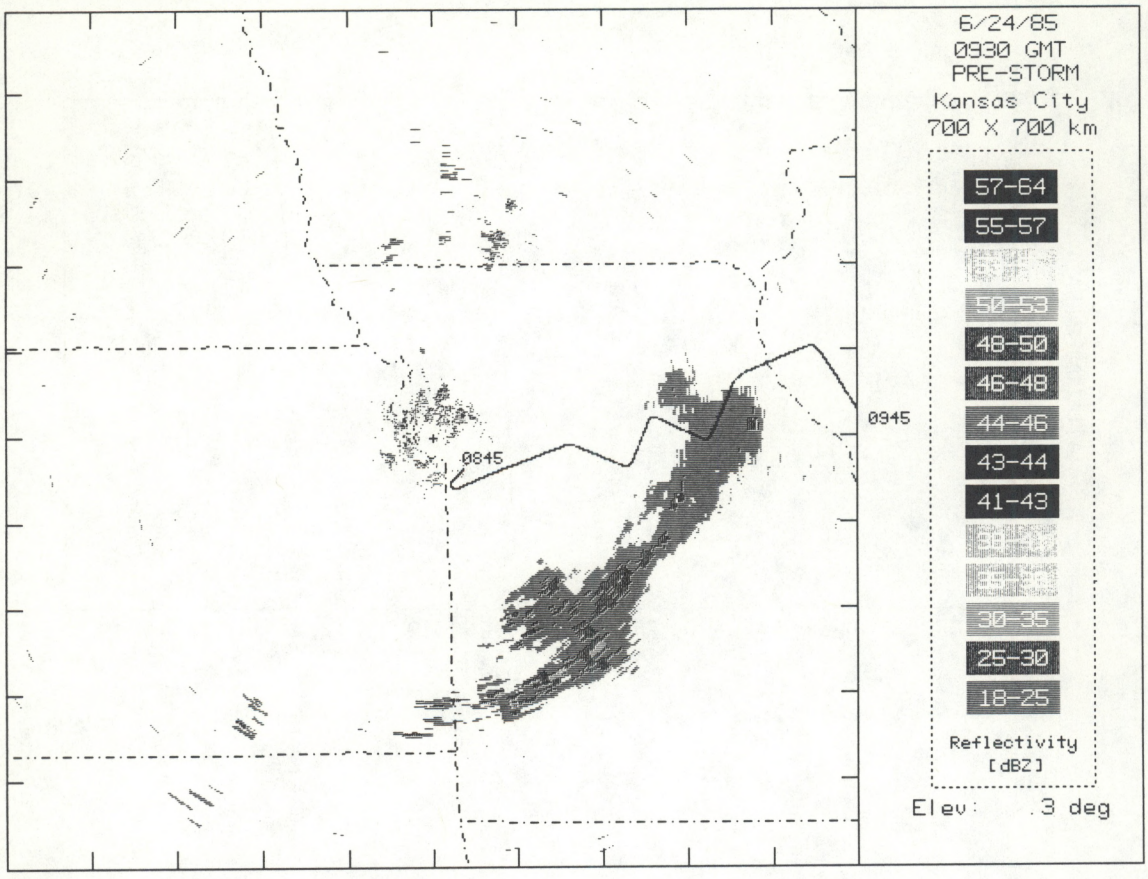
Mission # 14 NOAA-43
24 June 1985 (0555-1430 GMT)

The primary mission was the long-term monitoring of a decaying system which originated in Nebraska. Enroute from Oklahoma City, NOAA-43 flew a low-level inflow experiment at 5000 ft (850 mb), across southeast Kansas to central Missouri, where the aircraft climbed to 10000 ft and began saw-tooth pattern circumnavegating the stratiform rain region. The flight plan was modified to a butterfly pattern at 16000 and 19000 ft before returning to base.




7000
6000
5000
4000
3000
2000
1000
00
Altitude (M)
21 22 23 00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18
Time (GMT)


6/24/85
0730 GMT
PRE-STORM
Kansas City
700 X 700 km
57-64
55-57
50-53
48-50
46-48
44-46
43-44
41-43
30-35
25-30
18-25
Reflectivity
[dBZ]
Elev: .2 deg
0900
0630


6/24/85
0930 GMT
PRE-STORM
Kansas City
700 X 700 km
57-64
55-57
50-53
48-50
46-48
44-46
43-44
41-43
30-35
25-30
18-25
Reflectivity
[dBZ]
Elev: .3 deg
0845
0945

24 JUNE 1985
NOAA 43

LOWER FUSELAGE RADAR

Tape Number	Time On (GMT)	Time Off (GMT)
1	0610	0639
2	0639	0709
3	0709	0729
4	0739	0809
5	0809	0840
6	0840	0910
7	0910	0940
8	0940	1011
9	1011	1041
10	1041	1111
11	1111	1142
12	1142	1213
13	1213	1243
14	1243	1313
15	1313	1344

DOPPLER RADAR

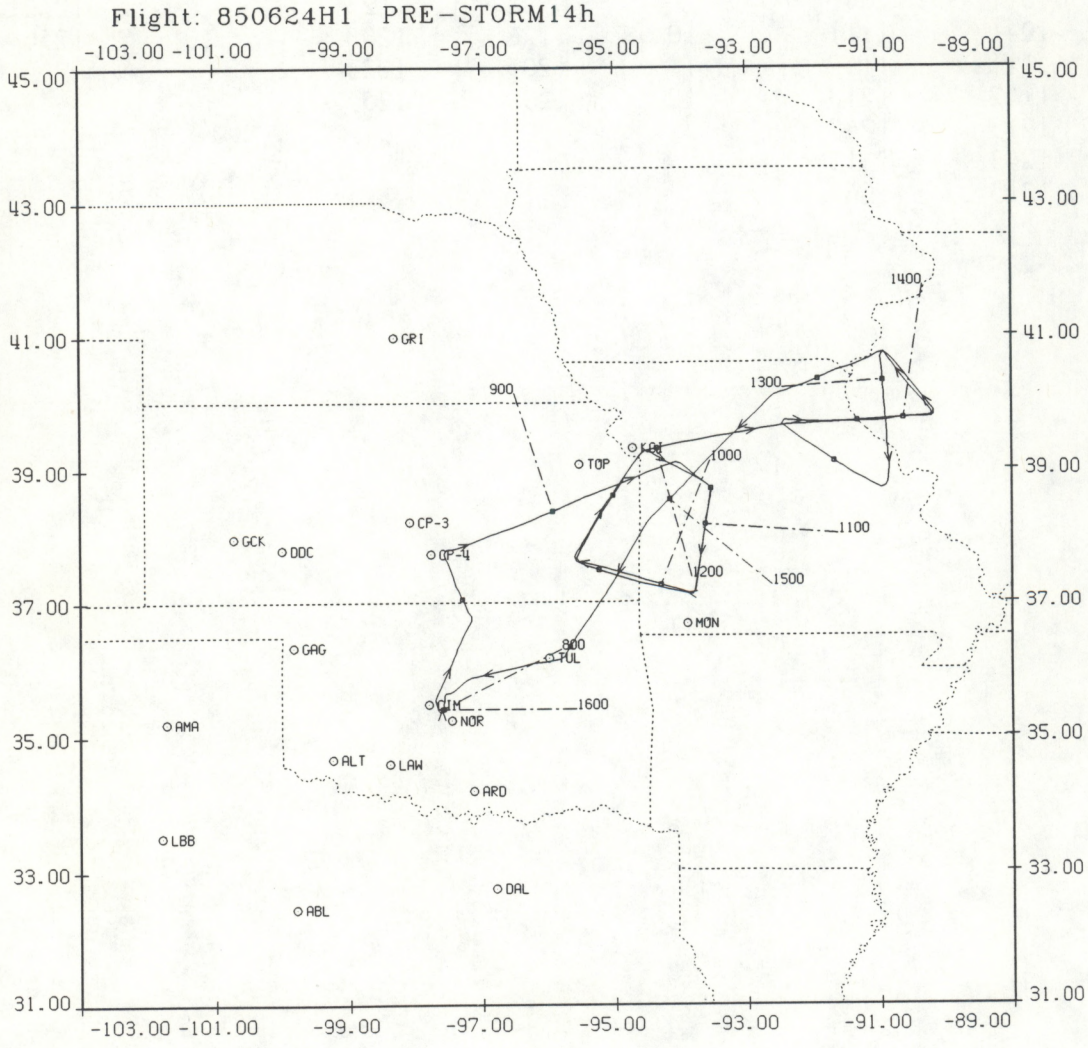
Tape Number	Time On (GMT)	Time Off (GMT)
1	0641	0658
2	0700	0717
3	0720	0737
4	0739	0757
5	0759	0814
6	0817	0833
7	0835	0906
8	0908	0925
9	0928	1123
10	1126	1203
11	1205	1223
12	1238	1255

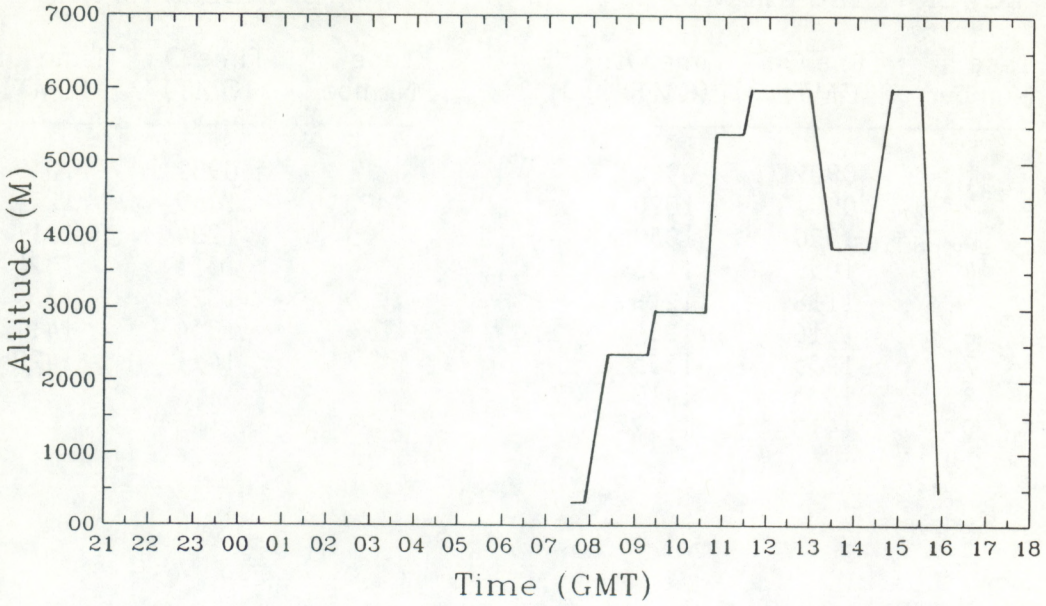
2-D KNOLLENBERG

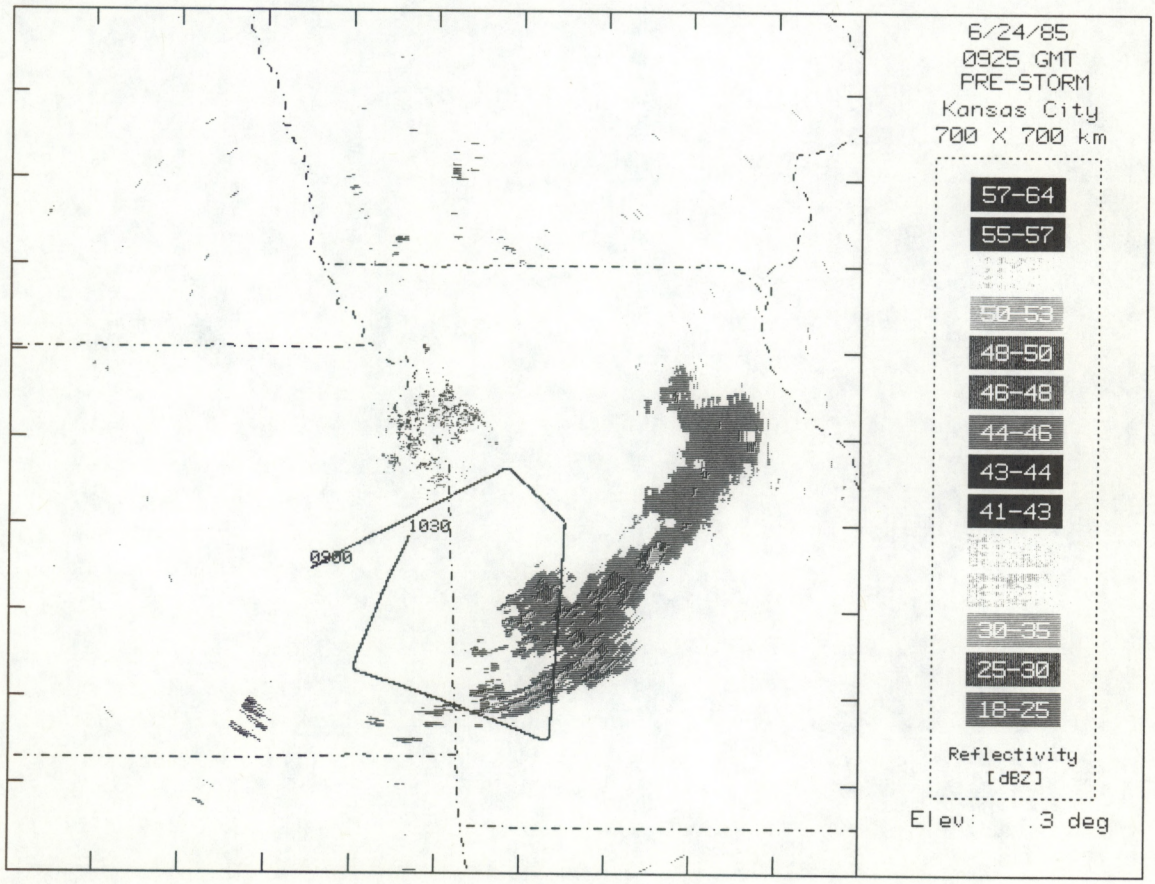
Tape Number	Time On (GMT)	Time Off (GMT)
1	0636	0740
2	0740	0815
3	0815	0923
4	0923	1109
5	1109	1122
6	1122	1155
7	1155	1203
8	1203	1210
9	1210	1254
10	1254	1332

Mission # 14 NOAA-42
24 June 1985 (0740-1600 GMT)

The aircraft flew to the vicinity of Kansas City and began a box pattern at 10000 ft, effectively monitoring the system west of 93°. The size of the box was modified and NOAA-42 ascended to 15000 ft. After NOAA-43 left the research area, NOAA-42 took over the eastern region of the MCS, flying butterfly patterns starting at 20000 ft and descending to 15000 ft on subsequent legs.




7000
6000
5000
4000
3000
2000
1000
00
Altitude (M)
21 22 23 00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18
Time (GMT)


6/24/85
0925 GMT
PRE-STORM
Kansas City
700 X 700 km
57-64
55-57
50-53
48-50
46-48
44-46
43-44
41-43
30-35
25-30
18-25
Reflectivity
[dBZ]
Elev: .3 deg
1030
0900

24 JUNE 1985
NOAA 42

LOWER FUSELAGE RADAR

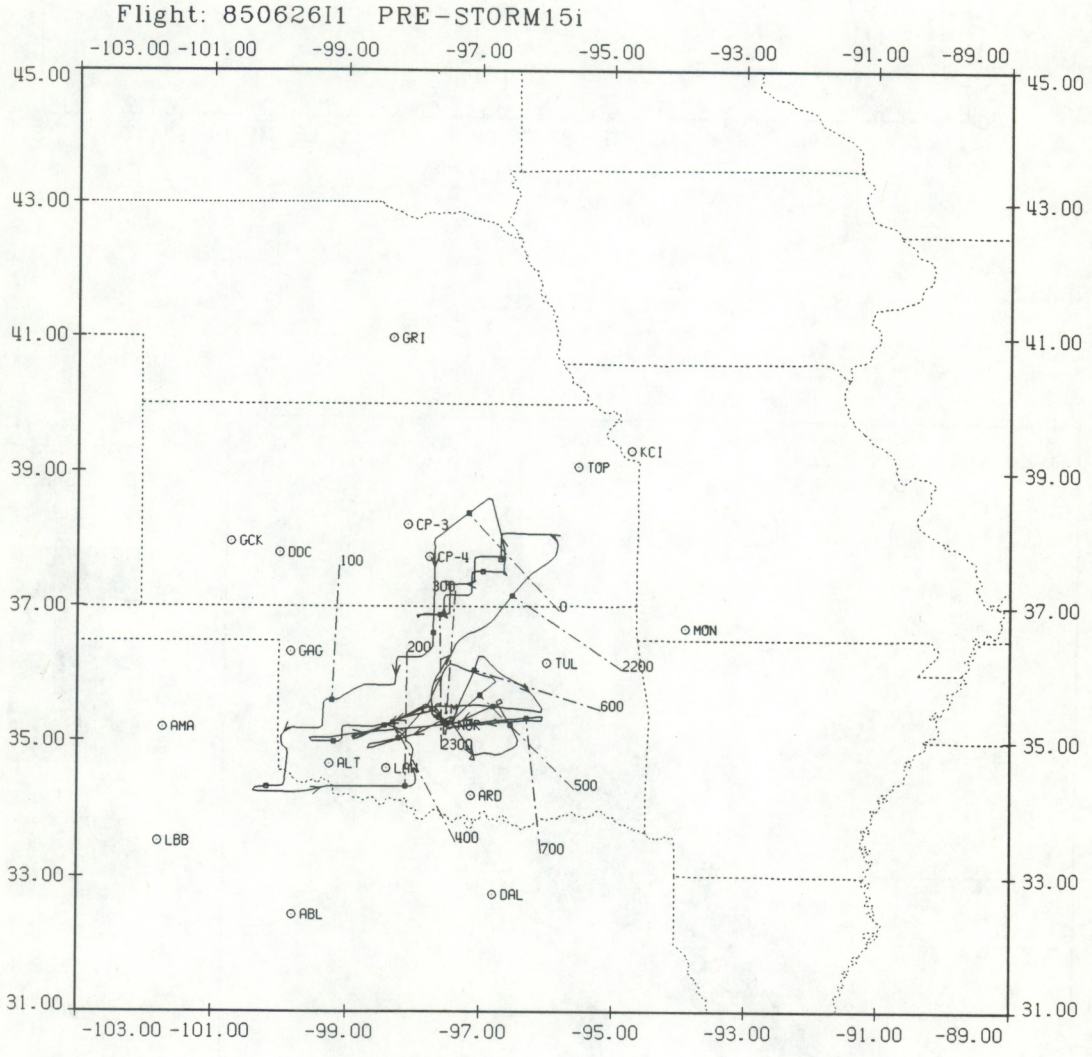
Tape Number	Time On (GMT)	Time Off (GMT)
1	0902	0941
2	0941	1020
3	1020	1059
4	1059	1138
5	1138	1216
6	1216	1255
7	1255	1335
8	1335	1413
9	1413	1452

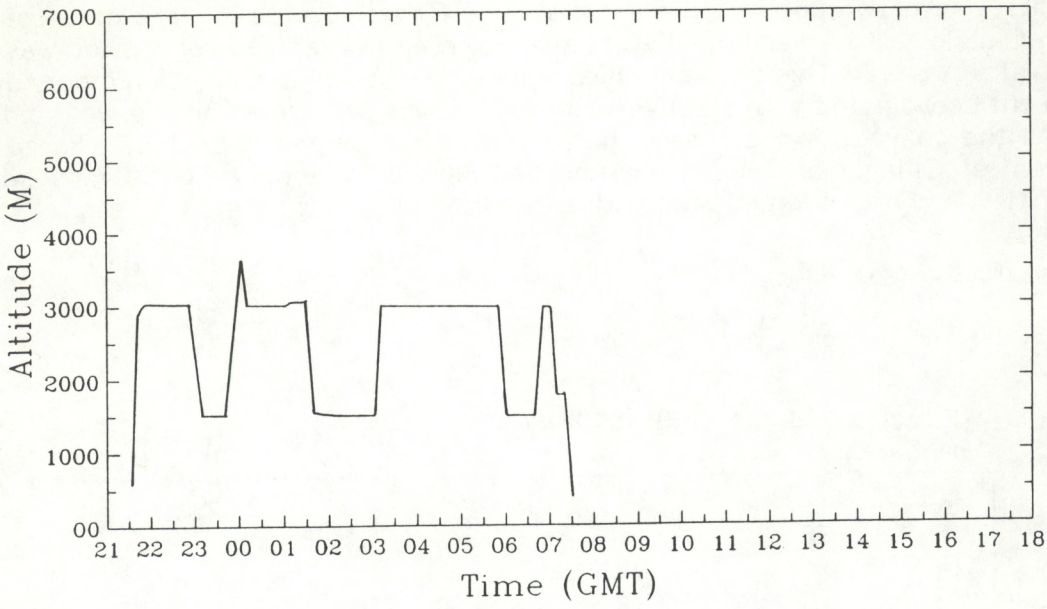
2-D KNOLLENBERG

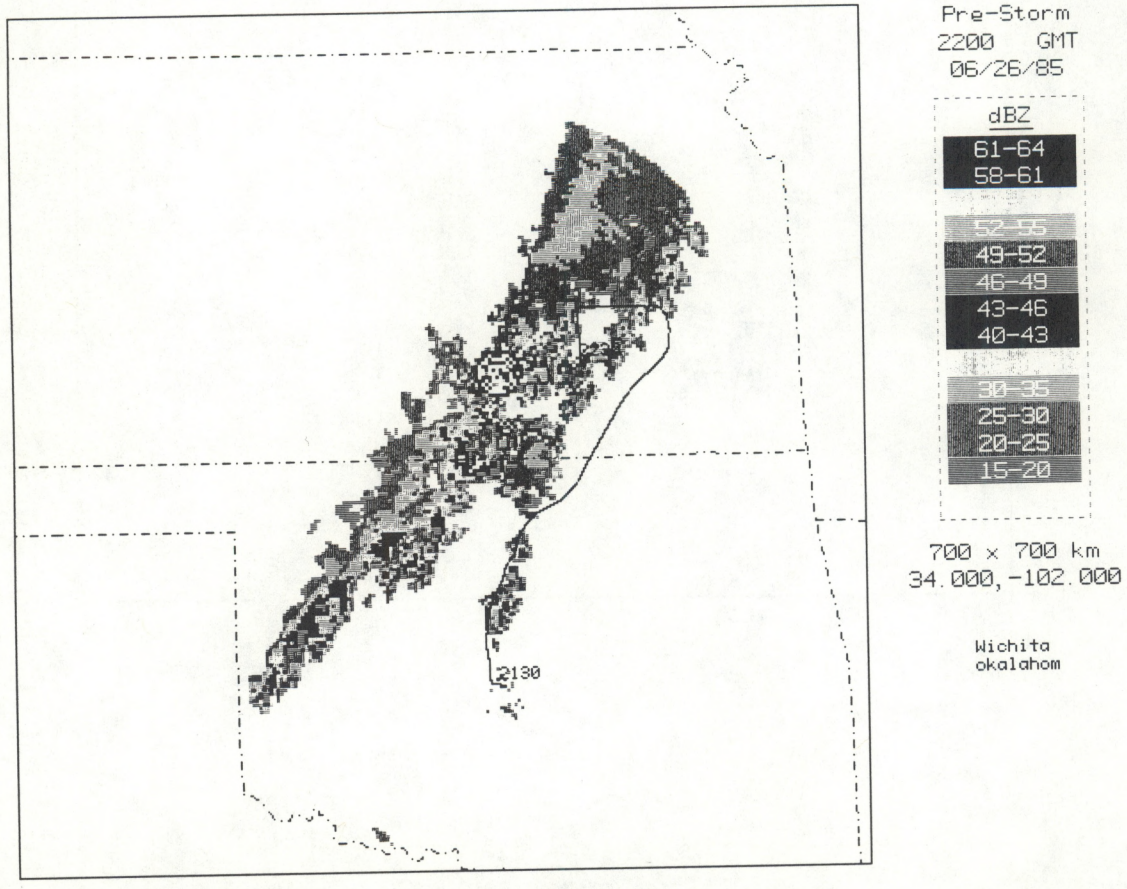
Tape Number	Time On (GMT)	Time Off (GMT)
1	0932	1059
2	1059	1224
3	1224	1311
4	1311	1324
5	1328	1354
6	1354	1411
7	1411	1422

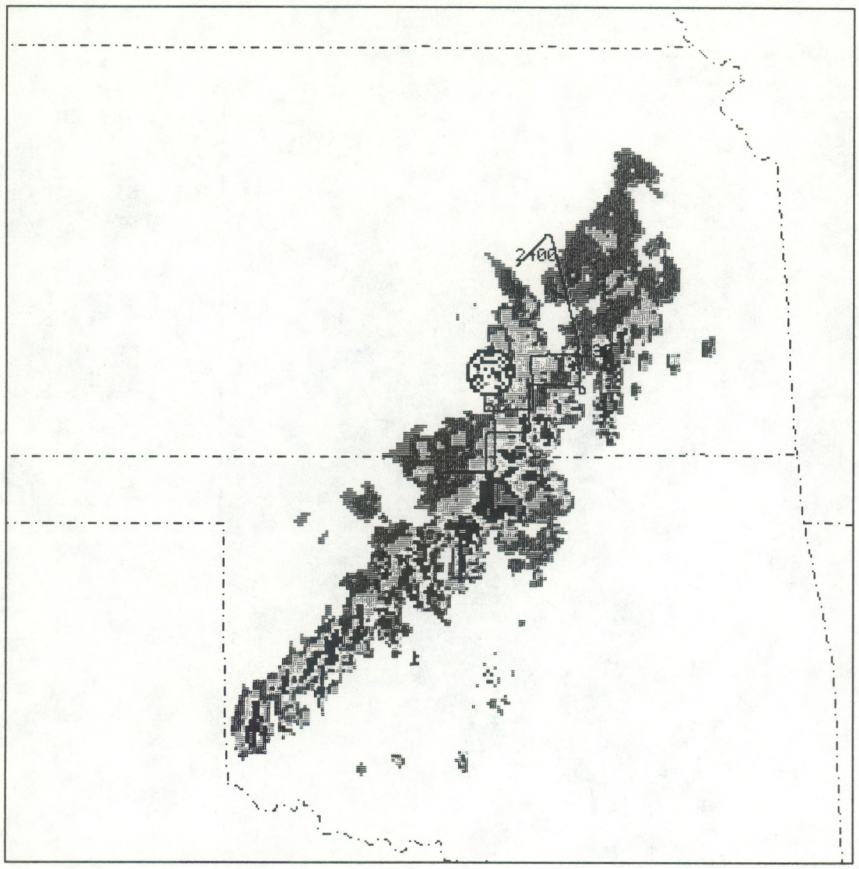
Mission # 15 NOAA-43
26-27 June 1985 (2128-0730 GMT)

There were two potential areas of study. Convective cells were developing from western Oklahoma to Amarillo, TX, and a large area of organized convection was present in central Kansas. The mission chosen was to set up a transition zone dynamics experiment coordinated with the CP-4 radar; this was performed on the west side of the line. As the convection increased, the pattern was enlarged to include a large part of north-central Oklahoma. After the line had passed Oklahoma City (0430 GMT), The aircraft flew a coordinated mission with the Norman Doppler radar.




7000
6000
5000
4000
3000
2000
1000
00
Altitude (M)
21 22 23 00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18
Time (GMT)


Pre-Storm
2200 GMT
06/26/85
dBZ
61-64
58-61
52-55
49-52
46-49
43-46
40-43
30-35
25-30
20-25
15-20
700 x 700 km
34.000,-102.000
2130
Wichita
okalahom

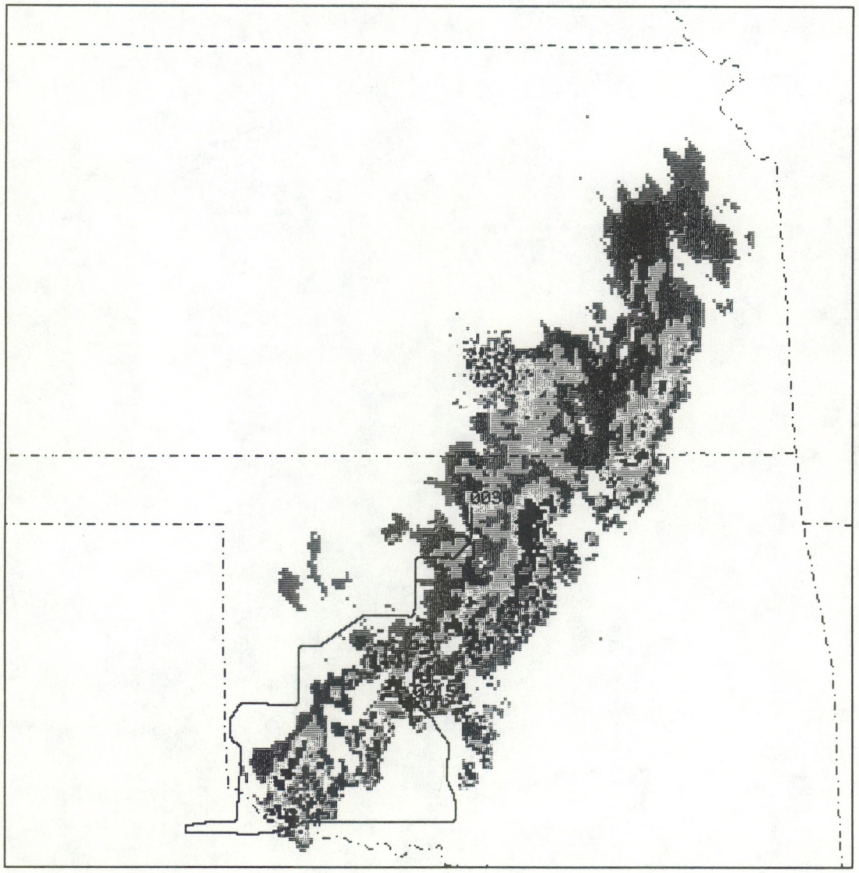


Pre-Storm
2330 GMT
06/26/85

dBZ
61-64
58-61
52-55
49-52
46-49
43-46
40-43
30-35
25-30
20-25
15-20

700 x 700 km
34.000,-102.000

Wichita
okalahom

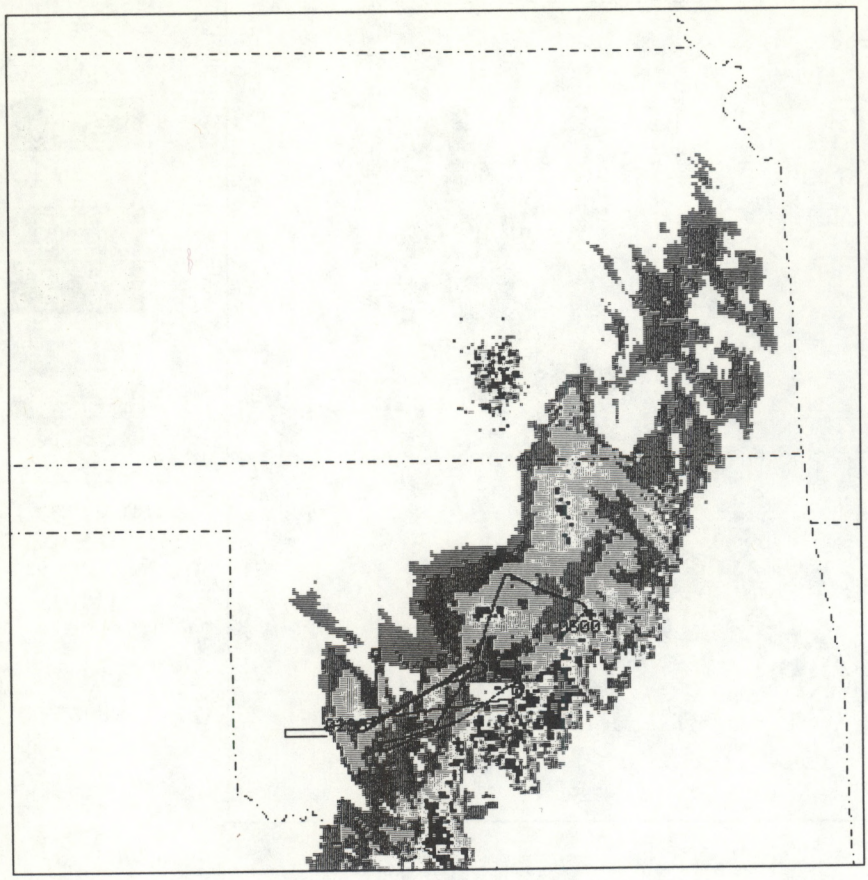


Pre-Storm
0134 GMT
06/27/85

dBZ
61-64
58-61
52-55
49-52
46-49
43-46
40-43
30-35
25-30
20-25
15-20

700 x 700 km
34.000,-102.000

Wichita
okalahom



Pre-Storm
0355 GMT
06/27/85

dBZ
61-64
58-61
52-55
49-52
46-49
43-46
40-43
30-35
25-30
20-25
15-20

700 x 700 km
34.000, -102.000

Wichita
okalahom

26 JUNE 1985
NOAA 43

LOWER FUSELAGE RADAR

Tape Number	Time On (GMT)	Time Off (GMT)
1	2135	2209
2	2209	2240
3	2240	2310
4	2310	2341
5	2341	0012
6	0012	0042
7	0042	0113
8	0113	0144
9	0144	0214
10	0214	0245
11	0245	0315
12	0315	0346
13	0346	0416
14	0416	0447
15	0447	0517
16	0517	0548
17	0548	0618
18	0618	0648
19	0648	0719

DOPPLER RADAR

Tape Number	Time On (GMT)	Time Off (GMT)
1	2151	2208
2	2211	2229
3	2232	2248
4	2251	2311
5	2313	2334
6	2336	2353
7	2356	0015
8	0017	0033
9	0037	0056
10	0059	0119
11	0121	0132
12	0134	0151
13	0209	0228
14	0230	0249
15	0251	0315
16	0317	0337
17	0339	0351
18	0353	0412
19	0415	0431
20	0433	0452
21	0454	0515
22	0517	0535
23	0537	0556
24	0558	0620
25	0625	0642
26	0644	0702
27	0704	0722

2-D KNOLLENBERG

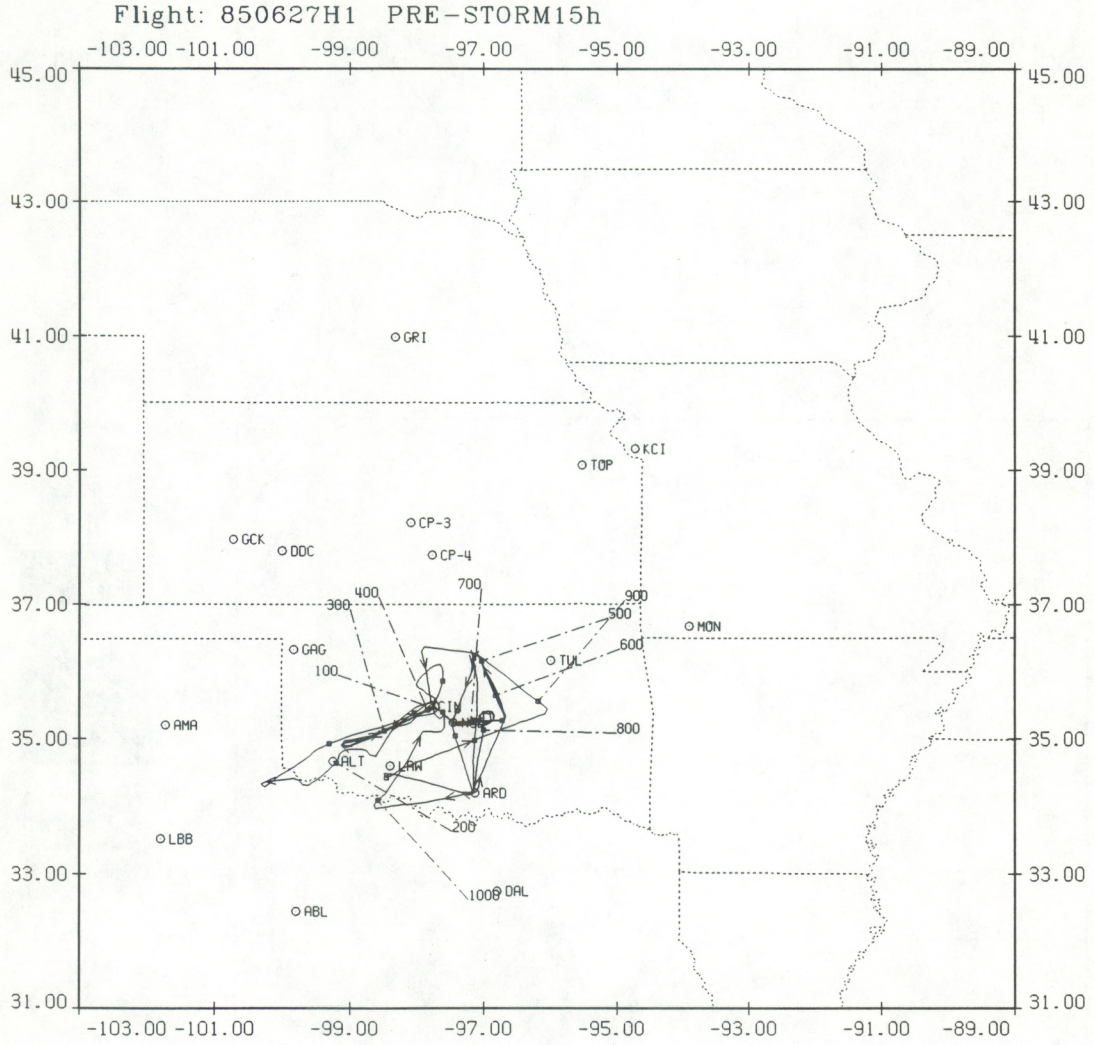
Tape Number	Time On (GMT)	Time Off (GMT)
1	2141	2223
2	2223	2228
3	2228	2240
4	2224	2246
5	2246	2256
6	2356	2307
7	2307	2332
8	2332	2356
9	2356	2442
10	2442	2455
11	2455	0115
12	0115	0130
13	0130	0217
14	0217	0249
15	0249	0300
16	0300	0312
17	0312	0319
18	0319	0325
19	0325	0332
20	0332	0336
21	0336	0343
22	0343	0353
23	0353	0402
24	0402	0407
25	0407	0414
26	0414	0423
27	0423	0431
28	0431	0439
29	0439	0450
30	0450	0456
31	0456	0501
32	0501	0509
33	0509	0514
34	0514	0520
35	0520	0530
36	0530	0536
37	0536	0541
38	0541	0547
39	0547	0553
40	0553	0602
41	0602	0607
42	0607	0613
43	0613	0618
44	0618	0626

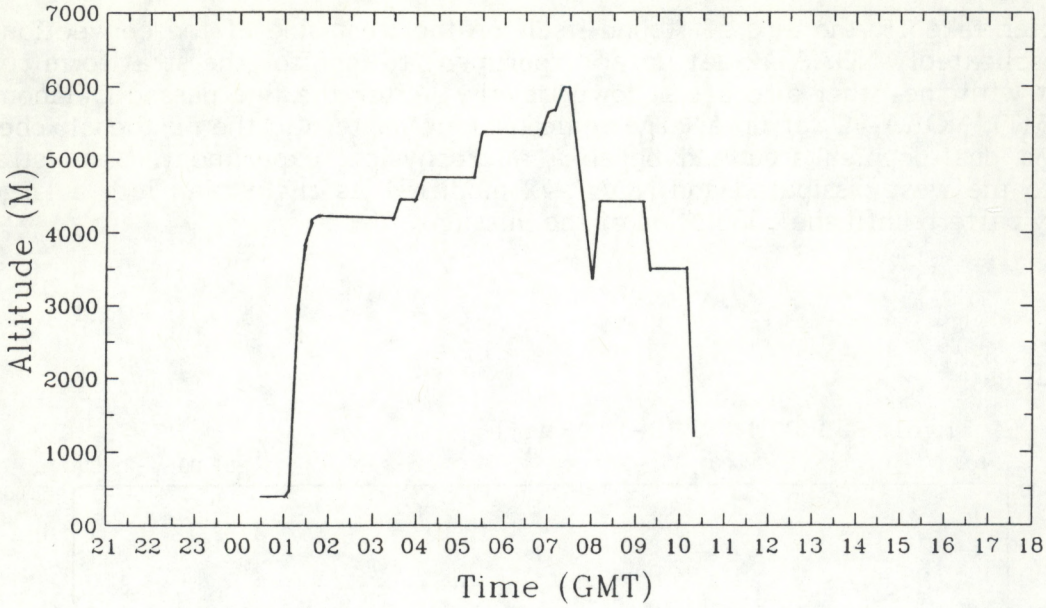
26 JUNE 1985
NOAA 43

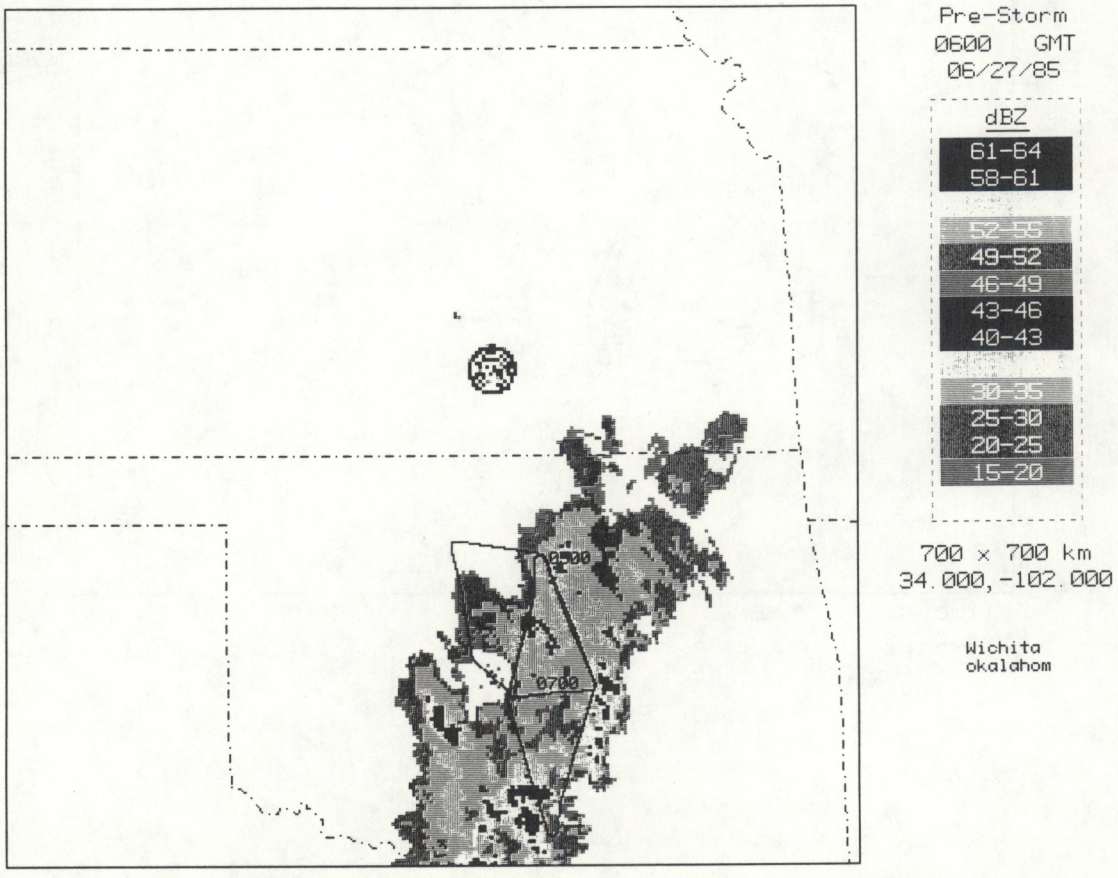
LOWER FUSELAGE RADAR			DOPPLER RADAR			2-D KNOLLENBERG		
Tape Number	Time On (GMT)	Time Off (GMT)	Tape Number	Time On (GMT)	Time Off (GMT)	Tape Number	Time On (GMT)	Time Off (GMT)
						45	0626	0634
						46	0634	0644
						47	0644	0651
						48	0651	0658
						49	0658	0703
						50	0703	0711
						51	0711	0718
						52	0718	0726

Mission # 15 NOAA-42
27 June 1985 (0108-1021 GMT)

After takeoff, the aircraft found itself on the west side of the convection as the line consolidated. NOAA-42 set up an experiment to monitor the stratiform region at 14000 ft with the other aircraft at lower levels. After the line passed Oklahoma City (0430 GMT), NOAA-42 set up a large scale triangle pattern in the northeast lobe of the Oklahoma dual-doppler area and began a microphysical experiment. The stratiform region to the west dissipated and NOAA-42 modified its flight plan into a large-scale butterfly pattern until the conclusion of the mission.




7000
6000
5000
4000
3000
2000
1000
00
Altitude (M)
21 22 23 00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18
Time (GMT)


Pre-Storm
0600 GMT
06/27/85
dBZ
61-64
58-61
52-55
49-52
46-49
43-46
40-43
30-35
25-30
20-25
15-20
700 x 700 km
34.000,-102.000
Wichita
okalahom
0600
0700

27 JUNE 1985
NOAA 42

LOWER FUSELAGE RADAR

Tape Number	Time On (GMT)	Time Off (GMT)
1	0117	0157
2	0158	0323
3	0223	0404
4	0404	0441
5	0441	0521
6	0521	0601
7	0601	0641
8	0641	0720
9	0720	0759
10	0759	0839
11	0839	0919
12	0919	0958
13	1010	1018

2-D KNOLLENBERG

Tape Number	Time On (GMT)	Time Off (GMT)
1	0112	0128
2	0128	0141
3	0141	0157
4	0157	0207
5	0207	0221
6	0221	0230
7	0230	0238
8	0238	0245
9	0245	0251
10	0251	0258
11	0258	0304
12	0304	0310
13	0310	0315
14	0315	0321
15	0321	0327
16	0327	0333
17	0333	0338
18	0338	0344
19	0344	0349
20	0349	0355
21	0355	0400
22	0400	0406
23	0406	0411
24	0411	0417
25	0417	0423
26	0423	0428
27	0428	0434
28	0434	0439
29	0439	0444
30	0444	0450
31	0450	0455
32	0455	0500
33	0500	0506
34	0506	0517
35	0517	0523
36	0523	0528
37	0530	0535
38	0535	0549
39	0549	0554
40	0554	0600
41	0600	0605
42	0605	0610
43	0610	0616
44	0616	0621

27 JUNE 1985
NOAA 42

LOWER FUSELAGE RADAR

Tape Number	Time On (GMT)	Time Off (GMT)

2-D KNOLLENBERG

Tape Number	Time On (GMT)	Time Off (GMT)
45	0621	0626
46	0626	0632
47	0632	0637
48	0637	0643
49	0643	0648
50	0648	0653
51	0653	0700
52	0700	0706
53	0706	0711
54	0711	0716
55	0716	0722
56	0722	0729
57	0729	0735
58	0735	0740
59	0740	0745
60	0745	0751
61	0751	0800
62	0800	0806
63	0806	0811
64	0811	0816
65	0816	0822
66	0822	0839
67	0839	0844
68	0844	0850
69	0850	0856
70	0856	0902
71	0902	0907
72	0907	0916
73	0916	0918
74	0918	0925
75	0925	0937
76	0937	0946
77	0946	0952

Appendix B

UNIVERSITY OF WYOMING

AIRCRAFT MISSION SUMMARY

UNIVERSITY OF WYOMING KING AIR
FLIGHT SUMMARY

May 4, 1985 (1955-2052 GMT)

Purpose of this flight was intercomparison with NOAA-43. Segment of flight devoted to formation flying (south to north leg) for time period 2009-2020 GMT, all at altitude 10,500 ft. After breaking formation, roughly over the Oklahoma-Kansas border, radio tests were conducted during a descent to about 3000 ft. The location of the formation flight leg was north of Oklahoma City, extending from about 80 km to 155 km. north of the Norman Doppler radar.

May 12-13, 1985 (0105-0413 GMT)

Flight devoted to inflow/outflow studies, concentrated in time period 0220-0400 GMT, in a 40 by 50 km area centered 60 km east and 5 km south of the Norman Doppler radar. NOAA-43 collected data on a pass by that location at about 0330 GMT. A tornado was sighted and reported near Edmond, Oklahoma shortly after takeoff (0116 GMT).

May 13, 1985 (0645-0917 GMT)

Flight devoted to stratiform precipitation studies, using horizontal passes (heading 040) at levels from -15C to +4C, roughly 3 to 5 miles behind a re-invigorated MCS that was probed in an earlier flight. NOAA-43 flew a box around the N2UW flight leg location, starting at about 0715 GMT. The horizontal pass locations lie approximately between the endpoints 190 km east, 100 km north and 230 km east, 150 km north of the Norman Doppler radar.

May 13, 1985 (2007-2355 GMT)

Flight had three segments: 1) Penetrations of inflow/outflow structure of vigorously developing cell at south end of line of thunderstorms in the vicinity of Gage, Oklahoma. First passes were under pedestal cloud structure before precipitation and echo developed. Location centered at 120 km west and 160 km north of Norman Doppler radar, starting at 2040 GMT 2) Second part of flight was penetrations of non-echo, vigorously growing cumulus tower at -5C level, for microphysics measurements. Updrafts measured up to 16 m/s. Penetrations centered at 85 km west and 175 km north of Norman Doppler radar, from 2155-2208 GMT. (Note: Last part of segment 1 flight and first part of

segment 2 flight, i.e., in/outflow and microphysics segments, missing from data due to mismounted in-flight data tape.) 3) Last part of flight focused on inflow/outflow studies within area of Doppler coverage by CP-3 and CP-4, centered at 75 km west and 280 km north of Norman Doppler radar, from 2220-2300 GMT. Interesting inflow structure, at narrow and shallow "wedge" over a weak outflow regime.

May 16-17, 1985 (2303-0130 GMT)

Purpose of flight was primarily training for new crew. Focus of flight was pointer descent in anvil/stratiform area of precipitation, with the figure-8 pattern centered roughly 315 km west and 15 km north of the Norman Doppler radar.

May 20, 1985 (1937-2228 GMT)

Flight devoted to inflow/outflow penetrations around several cells near CP-3 and CP-4 Doppler radars, generally in a 40 by 50 km box 330 km due north of the Norman Doppler radar. The inflow/outflow boundaries were easily identified in real time by shifts in wind direction, eventhough speeds were relatively light and did not change noticeably across the boundaries. Should have good mapping of multiple, converging, intersecting outflows. Time on station in the CP-3 and CP-4 dual Doppler area was 2035 to 2140 GMT.

May 21, 1985 (0418-0545 GMT)

Flight aimed at studying stratiform precipitation by pointer descent. The initial pointer position was approximately 285 degrees (true north) at 100 km from the Norman Doppler radar, using a descent rate of 200 fpm. The descent lasted from 0449 to about 0537 GMT, and ranged from about -18C to about 0C. The descent was terminated when we observed that most or all of the precipitation had evaporated before reaching the 0°C level. NOAA-43 flew legs at 10,000 ft to give airborne Doppler radar coverage of the N2UW descent.

May 27, 1985 (0500-0626 GMT)

Purpose of flight was to study stratiform precipitation by pointer descent on the north side of a line of convective cells. The convective line extended nearly due east from OKC at time of takeoff. PRE-STORM network became center of much MCS activity as night progressed, with several smaller systems eventually joined into one very large system. N2UW penetrated the stratiform area at 20,000 ft, well behind the active convection (40 to 50 km north of the main convection, in a broad area of NWS radar level-1 echo), and flew some 120 km eastward through uniform, high-concentration aggregate precipitation. The mission was aborted early for two reasons: 1) Complete failure to obtain good images with the PMS 2D-C probe, and 2) Continuous level of electrical activity (cloud-to-cloud lightning) close to the aircraft that was judged by both Sand and Kelly to be too intense for safe operation. Post-flight inspection of the aircraft indicated that no direct lightning strikes had been encountered. Future flights into stratiform areas of MCS's will attempt to penetrate at lower altitudes, to see if the electrical activity is reduced at levels closer to the melting zone.

May 29, 1985 (1741-2029 GMT)

Purpose of flight was to penetrate stratiform area of MCS located roughly east of Wichita (by flight time, earlier track of storm was across Nebraska before moving south into PRE-STORM network). We hoped that penetration of the stratiform area at lower altitudes than on 26 May would yield less electrical activity. To the contrary, we encountered at least as much cloud-to-cloud lightning in this case as in the previous case, from -16C level down to the melting level. The controlled pointer descent at a descent rate at 200 fpm (about 1 m/s) was flown from about -16C to about +7C, using a figure 8 pattern initially centered over Iola, Kansas. Some of the PMS probes experienced problems, but it appears on first look that a useful data set was collected. The flight definitely puts us at a decision point as far as future penetrations of MCS stratiform structures are concerned. Neither W. Sand nor R. Kelly feel that further, similar penetrations should be attempted with the King Air. The level of electrical activity, as cloud-to-cloud lightning above the melting layer and as cloud-to-ground lightning closer to the active convection zone, is simply too great to risk further penetrations of the type flown on 26 May and 29 May.

Appendix C

PRECP AIRCRAFT MISSION SUMMARY

BROOKHAVEN LABS QUEEN AIR
FLIGHT SUMMARY

June 1, 1985

The Queen Air (QA) made the ferry flight from Islip, Long Island to OKC, making refueling stops in Portsmouth, Ohio and Rolla, Missouri. Weather was clear all the way with the exception of a few thunderstorms encountered in the Tulsa area on the final leg to OKC. Operation of most equipment was satisfactory, with the exception of the ozone sensor and the relative humidity probe, which were clearly non-functional. Data were collected only for the first half of the ferry flight because of a shortage of blank recording tapes.

Data not available: O_3, relative humidity; no data at all second half of flight.

June 4, 1985 (1502-1757 GMT)

The QA made a midday flight in the vicinity of OKC for the purpose of testing all equipment at the onset of the PRE-STORM/PRECP measurement program. The flight was conducted largely in clear air, though some small fair-weather cumulus clouds were encountered. Three filter pack samples were taken, and one filter for metals analysis. No cloudwater samples were collected. The data acquisition system (DAS) failed to record, apparently because of the high ambient temperature. In addition, problems were experienced with the ozone, NO_x, and relative humidity instruments. The sulfate detector responded but drifted a great deal.

Data not available: DAS data, O_3, RH, $SO_4^=$.

June 5, 1985 (1424-1651 GMT)

The QA made a rainwater collection flight north and east of OKC. This flight was conducted in a steady rain which had begun the day before and which covered a broad area of Texas and Oklahoma. Rain was encountered throughout the flight, falling from a high cloud deck (cloud base >10k ft). Twelve rain samples were collected, three filter pack samples and one filter sample for metals analysis were taken. The data system and nearly all instrumentation on the QA worked perfectly, the exceptions being the RH sensor, which continued giving erroneous readings, and the NO channel of the NO_x detector, which had been improperly connected to the data system.

Data not available: RH, NO.

June 6, 1985 (2133-0000 GMT)

The flight on June 6 was very similar to that of the previous day. The QA flew east of OKC to collect rain samples below a high cloud layer in the Tulsa area. Most sampling was done along flight legs between Tulsa and Okmulgee, OK. Nine rain samples were collected, two filter packs and a metals filter were taken. Only minor problems were experienced: the RH sensor operated intermittently, the NO channel data connection had not yet been corrected and some drift was evident in the $SO_4^=$ detector. The data acquisition system operated properly.

Data not available: RH, NO.

June 8, 1985 (1745-1959 GMT)

A clear air intercomparison flight was performed with the QA and the other PRECP aircraft, the NOAA King Air (KA) and NCAR Sabreliner (SL), west of OKC. The data system failed because of the high temperatures on this day, which also resulted in considerable drift in the CO and $SO_2/SO_4^=$ response. The QA and the KA flew side-by-side at both 4k ft and 10k ft for intercomparison of data, however due to the data system failure the intercomparison is limited to chemical data. Two filter packs were taken on this flight. The RH sensor was not functional at all on this mission.

Data not available: DAS data; CO and $SO_2/SO_4^=$ during second half of flight.

June 10, 1985 (2059-2358 GMT)

The PRECP aircraft attempted a coordinated flight to sample around a convective cell. Convection was forecast SW of OKC, so the QA initially flew to the Hobart VOR. Weather in that area was clear, so the QA then returned east of OKC where a line of small cells had been sighted by the NCAR Sabreliner. However, those cells had dissipated by the time the QA arrived. The flight was continued as a clear air documentation flight, with filter packs taken at each of 3k, 6k, and 9k ft altitudes. The data system operated intermittently, apparently responding to temperature changes in the aircraft cabin. The RH sensor continued to give faulty readings, and was finally replaced after this flight. All other equipment operated properly. A metals analysis filter was taken.

Data not available: DAS data (intermittently).

June 13, 1985 (2000-2151 GMT)

The QA made a clear air chemical documentation flight flying south of OKC to Wichita Falls, Texas and back. All instrumentation worked properly on this flight. Two filter pack samples and a filter for metals analysis were taken.

Data not available: none.

June 15, 1985 (1029-1405 GMT)

The QA made an early morning flight to sample inflow air of thunderstorm cells in the Tulsa area. The entire flight was made under VFR conditions, with orientation of the flight track around the cells done visually. Two large cells were located in the Tulsa area, and were followed as far east as Fort Smith, Ark. The QA flew on the south side of these cells at various altitudes, sampling the inflow air for over an hour before the cells dissipated. Brief rain showers were encountered, but these were not of sufficient duration to allow collection of water samples. Three filter pack samples and a filter for metals were taken. The data system operated properly, as did all chemical instrumentation with the exception of the $SO_4^=$ detector.

Data not available: $SO_4^=$.

June 16, 1985 (2017-2348 GMT)

The QA made a clear air flight to characterize the inflow air to a frontal system expected to move through the OKC area overnight. The flight took place along east-west legs north of OKC. Weather was clear, sunny, and hot, T = 90° F. The data system operated properly for about the first half of the flight, then went off-line due to the cabin temperature. Drift was observed in the response of the CO and $SO_4^=$ detectors, also because of the heat, but all other equipment functioned well. Three filter pack samples and a metals filter were taken on this flight.

Data not available: DAS data (second half of flight), CO and $SO_4^=$ (partial loss).

June 17, 1985 (1227-1530 GMT)

A morning flight was conducted east of OKC for the purposes of sampling inflow air and precipitation in thunderstorms in the Tulsa area. Most of the flight consisted of sampling around and below a broken line of small cells oriented in a north-south direction south of Tulsa. Precipitation from these clouds was very spotty, only three rain samples were collected. One filter pack and metals filter were taken. The data system and all instruments operated properly. A problem in the aircraft research power supply occurred early in the flight, apparently resulting from a failure in the aircraft starboard alternator, and requiring complete shutdown of the sampling equipment for about one half hour. However, the alternator resumed proper operation, and power was restored for the remainder of the flight.

Data not available: all data 13:00 to 13:40.

June 20, 1985 (1952-2103 GMT)

The QA made a clear air test flight west of OKC in the afternoon. Weather was clear, warm, with winds gusty from the south. This flight had two purposes: to test the behavior of the port engine on the QA, and to make clear air documentary measurements. Although not designed as an intercomparison flight, this mission may allow some comparison of data with that from the KA, which also made a flight in the same area on this day. All instruments worked well, but the data acquisition system was again troubled by overheating during the second half of the flight. No filter samples were taken.

Data not available: DAS data (second half of flight).

June 22, 1985 (1020-1224 GMT)

An early morning flight was conducted on June 22 north and east of OKC for the purposes of sampling air and collecting rain associated with passage of a cold front through Oklahoma on this day. Considerable lightning activity was observed which prevented the QA from entering the areas of significant precipitation; as a result, no rain samples were collected. Two filter packs were sampled. All instruments functioned properly, with the exception of the data system, which showed intermittent error messages indicating recurrence of the overheating problem.

Data not available: DAS data (intermittent).

June 25, 1985 (2220-0000 GMT)

The QA flew a test and intercomparison flight with the KA on the afternoon of June 25. One purpose of this flight was to test the effectiveness of modifications of the data system in relieving the temperature-related failure of data collection. Weather was clear and warm, T = 90°F at takeoff. The actual intercomparison with the KA took place from 23:14 to 23:23. The $SO_4^=$ detector exhibited drifting response, but all other equipment on the QA worked properly, including the data system. One filter pack was sampled on this flight.

Data not available: none.

June 26, 1985 (2012-2200 GMT)

This flight was conducted northwest of OKC to sample inflow air and collect precipitation near thunderstorms associated with a front extending through western Kansas. Strong lightning activity forced the QA away from the precipitation area, and severe turbulence was encountered during the flight. All instruments and the data system worked properly throughout the flight. One filter pack sample was taken.

Data not available: none.

June 27, 1985 (0004-0110 GMT)

The purpose of the flight was to sample inflow air to thunderstorms present in northwest Oklahoma. Because the QA compass had been damaged by turbulence encountered on the previous flight, this flight was shortened by the requirement to fly only in daylight VFR conditions. All instruments including the data system functioned properly. One filter pack sample was taken.

Data not available: none.

June 28, 1985

The QA made the return ferry flight from OKC to Islip, with refueling stops in St. Louis, Mo. and Columbus, Ohio. No measurements were made on the first leg of the flight. Sampling was performed on the latter two legs, in conditions of rain and broken clouds. Several rain and cloudwater samples were collected, and four filter pack samples were taken all instruments including the data system worked properly.

Data not available: none.

NCAR SABRELINER
FLIGHT SUMMARY

June 5, 1985 (1803-2058 GMT)

High altitude flight from Oklahoma City to Wichita, Kans. and return. Flight levels 37K, 25K, 18K, 8K, and 3K feet.

Data not available: UV radiometer.

June 8, 1985 (1757-1850 GMT)

Aircraft intercomparison mission. Only 27 minutes of data collected. No data tape recorded.

Data not available: DAS tape, top total radiometer.

June 10, 1985 (1723-1955 GMT)

Flew mission to the west of OKC approximately 75 miles. Flight levels flown 37K, 25K, 18K, 8 K, and 3K feet.

Data not available: UV radiometer, top total radiometer.

June 10, 1985 (2108-2328 GMT)

Second flight flew west again to point 35°N, 100°W at 33K, 25K, and 18K feet.

Data not available: UV radiometer, top total radiometer.

June 13, 1985 (1705-1943 GMT)

Flew mission north of OKC to a point between Wichita and Salina, Kans. Sounding taken between 15000 to 3000 feet. Levels flown were 18K, 25K, 35K, 10K, and 3K feet.

Data not available: None.

June 15, 1985 (1107-1342 GMT)

MCS in the vicinity of Ft Smith, AK. Flew through anvil of storm at 33000 ft. Also flight levels at 25K, 19K, and 3K feet.

Data not available: None.

June 16, 1985 (2056-2347 GMT)

Flew to area south of Hays, Kans.; north-south tracks to the east of convective cells. Flight levels flown were 35K, under anvil at 25K, 37K just in anvil, and profiles from 19-3K feet.

Data not available: None.

June 17, 1985 (1256-1540 GMT)

Flew in the vicinity of Tulsa, OK at 23K, 31K, in cloud, then east of growing convective towers at 3K and 10.5K feet.

Data not available: None, tape gap (1403-1408).

June 17-18, 1985 (2200-0030 GMT)

Flew mission southeast of OKC in clouds forming along a cold front. Box pattern around clouds at 23K, 27K, 31K, and 29K feet, plus sounding from 17.5K to 3K feet.

Data not available: None.

June 18, 1985 (1750-2018 GMT)

Flew southeast out of OKC to vicinity of Texarkana at flight levels 27k, 23K, and 20K feet. Dallas-Ft Worth controller would not allow flight into anvil cloud. Profile taken from 17.5K to 3K feet.

Data not available: None.

June 20, 1985 (2005-2243 GMT)

Intercomparison flight with NOAA's P-3 to the west of OKC at flight levels 28K, 4.5K, 9.5K feet. A/C sounding from 3K to 17.5K feet.

Data not available: None.

June 22, 1985 (1715-1955 GMT)

Mission was to fly to Little Rock, Ark. in the stratiform region of a dissipating thunderstorm. Sounding taken between 17.5K-3K feet. Flight legs at 29K, 34K, and 26K feet.

Data not available: Grab sampling pump inoperative.

June 22-23, 1985 (2207-0015 GMT)

Flight to east of OKC. Sounding taken from 17.5K to 3K feet. Levels flown 23K and 35K feet, encountered tropopause fold.

Data not available: Grab sampling pump inoperative.

June 25, 1985

Convective cell too large for monitoring of outflows for any length of time. Flew at 31K, 27K, 24K, and 3K feet. Performed intercomparison with NOAA's King Air.

Data not available: None.

June 26, 1985 (1954-2229 GMT)

Flew to the northwest of OKC at 28K, 33K, and 31K feet.

Data not available: Aerosol filters.

June 27, 1985 (0006-0210 GMT)

Sampling a large meso-beta system west of OKC at 33K, 25K, and at 18K feet.

Data not available: Aerosol filters.

June 27, 1985 (1949-2208 GMT)

Mission was to collect ice from high, fair-weather cirrus clouds at 35K, 24K, and 21K feet.

Data not available: None.

NOAA AIR QUALITY DIVISION KING AIR
FLIGHT SUMMARY

June 5, 1985 (1534-1726 GMT)

Test flight #1. Data acquisition system (DAS) recording problems encountered during flight operations. When functioning, data OK and available.

Data not available: DAS intermittent, NO_x, O_3, sulfur, no filter packs or water samples, CO.

June 6, 1985 (2140-2340 GMT)

Test Flight #2. Continued DAS problems. Found and fixed at end of flight. VOR navigation malfunction, possibly need a new antenna. VFR flights only until further notice. Data rate entered incorrectly.

Data not available: VOR, DAS intermittent, sulfur, O_3, CO, NO_x, winds. No filter pack or water samples.

June 7, 1985 (2009-2100 GMT)

Test Flight #3. DAS working properly. No aircraft intercomparisons. Successful test flight.

Data not available: Sulfur, O_3, NO_x, no filter packs or water samples.

June 8, 1985 (1745-2024 GMT)

A good sampling flight. QueenAir and Sabreliner attempted coordinated intercomparison, but both had DAS problems. Some intercomparison in clear air was possible. Test run on filter pack but flow meter was broken. Winds are in error when Heading sticks.

Data not available: No filter packs or water samples.

June 10-11, 1985 (2132-0126 GMT)

Initially, flew to the west, then diverted east of Oklahoma City to sample dissipating Cb. Continued to west of OKC to measure inflow air into squall line which passed OKC near midnight. Mission coordinated with NCAR Sabreliner and Brookhaven QueenAir. Good mission. Four filter packs taken.

Data not available: Dew point temperature appears high, winds and a/c heading questionable.

June 15, 1985 (1101-1514 GMT)

Flight landed in Ft. Smith, AK then returned to OKC. Performed constant altitude flight patterns in residual meso-beta system. Found high FSSP and ASASP counts above 10000 ft level. Apparently, boundary layer air is reprocessed and moved upward. Still have problems with VOR navigation. Sulfur box malfunction. One filter pack taken.

Data not available: Error condition on CO, sulfur.

June 16-17, 1985 (2040-0039 GMT)

Flight legs sampled area to the southeast of an approaching meso-beta convective system.

Data not available: Overheated dew point temp. O_3 too hot after 2248. Sulfur operational below 15000 ft.

June 17, 1985 (2035-2330 GMT)

Boundary layer flight through inflow area of a weak MCS. No precipitation samples collected. One filter pack taken.

Data not available: Dew point temperature from 2119-2307.

June 18, 1985 (1750-1934 GMT)

Flew south then east of OKC. Attempted to collect precipitation samples but none available. One filter pack taken, then returned to OKC.

Data not available: Water samples. Dew point temperature intermittent.

June 21-22, 1985 (0452-0756 GMT)

Nocturnal squall line sampled. Flew in the vicinity of night-time jet between 3500-5000 ft. Aircraft cabin temperature very high. DAS may have recording problems. Some precipitation collected on the ground. Two filter packs taken.

Data not available: Dew point temperature inoperative.

June 25-26, 1985 (2306-0244 GMT)

Inflow flight in vicinity of meso-beta system. Collected one precipitation sample after the inflow study. Two filter packs taken.

Data not available: Dew point temperature inoperative.

June 26, 1985 (2042-2311 GMT)

Low-level flight to study inflow region of squall line. One filter pack taken.

Data not available: Dew point temperature.

June 27, 1985 (0042-0336 GMT)

Continuation of low-level flight in region of squall line inflow. This flight passed on backside of squall line before returning to OKC. Two filter packs taken.

Data not available: No water samples. No dew point temperature.

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