

FIRE II Cirrus

Mission Summary



Date: November 26, 1991
Julian Day: 330
Experiment Day: 14

[Summary](#) | [Active Sensors](#) | [Passive Sensors](#) | [Sonde and Sfcmet](#)

Mission Scientist: David Starr
 Deputy Mission Scientist: None

Mission Objective:

Development and dissipation of cirrus cloud systems with observation of cloud microphysical, radiative and dynamical properties and structure.

Mission Description: Day #2 of Second Intensive Observing Period.

- **Large-scale:** Continued operation of the large scale rawinsonde network (6-hourly soundings) and inner network (3-hourly soundings) provided an excellent test data base for regional models as a number of distinct cirrus systems were observed over the western United States. A cirrus baroclinic leaf formed over Kansas-Nebraska and a massive ridge-crest cirrus system moved into the Pacific Northwest and Inter-Mountain West.
- **Water Vapor Mission:** Note pre-dawn King Air/Raman mission - see Day 13 summary.
- **Cirrus Missions:** A great day (late morning to early afternoon) for surface-based remote sensing of cirrus clouds over the Hub. Multiple (4) in situ profiling missions flown over the Hub in coordination with ER-2 over flight which sampled regions of cirrus formation and nearby clear areas. Our best candidate yet for a full multiple sensor, multiple scale case study!!

Weather Synopsis:

At sunrise, clear and cold conditions over southeast Kansas. Sondes and Raman lidar showed moist layers aloft. During the morning, surface temperatures warmed to the 40's as moderate to strong southerly breezes developed. Around noon, cirrus spissatus began to spread over the area. A halo was observed. By 2 p.m., a broken cirrus layer was evident from 8.5 to 9.5 km with increasing thickness. However, the lidar instruments also reported a mid-level cloud layer (6.5 km) at that time. Surface reports to the north and west reported clouds at multiple levels. By late afternoon, multi-layered cloud conditions, including a low level cloud deck, prevailed with continued strong southerly winds.

Synoptic Situation:

A trough over the central United States was responsible for the extensive cloud cover over the upper Great Plains. Low, middle and high clouds were observed. A low amplitude large scale ridge was located on the West Coast with an extensive ridge-crest cirrus system. The exit region of the cloud system reached into Colorado. Although upper level winds were generally northwesterly over the West, Topeka reported a shift to southwesterly at about noon with maximum wind speeds of 50 knots at the tropopause which occurred near the 10 km level. Dodge still showed northwesterly winds at that time. At 3 p.m., wind speeds increased to 65 knots at Topeka and to 115 knots at Dodge where the tropopause was now somewhat higher (11.5 km). Wind directions were about the same as at noon. In association with this dynamical feature, a nice baroclinic leaf feature developed over central Kansas and Iowa. The tail of this feature extended into western Oklahoma. Cirrus, middle level, and low level clouds occurred with this feature which was well-captured by the intensive rawinsonde network. Later, this feature evolved into a cyclone as it exited our region.

Aircraft	Depart	Land	Notes
NASA ER-2	9:00 CST		Good mission anchored to Hub over cirrus, HIS lost some data
NCAR Sabreliner	9:36 CST	11:53 CST	Good mission in cirrus near Wichita
UND Citation	10:29 CST	13:58 CST	Good profiling mission in cirrus over Hub, problems with 2D-C probe toward end
NCAR King Air	12:07 CST	15:31 CST	Good mission in cirrus near and over Hub
NCAR Sabreliner	13:42 CST	16:15 CST	Good mission in cirrus over Hub

Satellite	Hub Overpass Time	Zenith Angle	Azimuth Angle	RAOB
NOAA-11	21:11:30	28.28	258.90	3-hourly
	09:36:00	20.74	103.36	3-hourly
NOAA-12	15:02:17	51.74	289.95	3-hourly
	00:42:23	56.64	68.59	3-hourly

Rawinsonde Operations:

- Inner NWS stations (Type A): Intensive mode @ 12, 15, 18, 21, and 00 UTC
- Outer NWS stations (Type B): Intensive mode @ 12, 18, and 00 UTC
- Hub CLASS station: Intensive mode @ 15, 18, 21, and 00 UTC
 - no sounding at 12 UTC
- Remote CLASS stations: Intensive mode @ 12, 15, 18, 21, and 00 UTC
- Hub GSFC/WFF station: Launches @ 13 and 16UTC
- CSU Parsons station: Launches @ 15, 18, and 20 UTC

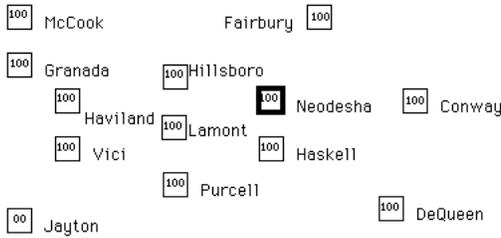
FIRE Profiler Status:

- CSU 405 MHz @ Parsons: Continuous operation



- PSU 50 MHz @ Coffeyville: Continuous operation, noisy
- NOAA 405 MHz @ Coffeyville: Not operational

NWS Wind Profiler Status



SPECTRE Operations:

Operations continued until mid-afternoon, when mid-level clouds blocked further operations. Denver solar spectrometer experiencing interference problems.

Aircrew/Mission Scientist Debrief Notes:

- **GENERAL:** Very good surface-based measurements during midday hours before low and middle level clouds moved in. Things got really good around noontime with almost all systems reporting good observations while Citation was visible overhead. The general increase in cirrus cloud began with a line of spreading spissatus followed by many small bands and patches some of which showed evidence of wave-like activity. A halo was observed and the Citation contrail was visible at times.
- **NCAR SABRELINER #1:** Flew step up/down pattern to east of Wichita (heading of WSW-ENE) beginning with a racetrack at cloud top (31K') and legs at 29, 28, 26 and below cloud base at 21 K'. A ramp up sounding was then made to 28K', followed by a racetrack and then a ramp down to below cloud base. The were described as very uniform looking - a very good radiation-microphysics case!
- **NASA ER-2:** Flew four complete E-W racetracks with upwind end over Hub -unfortunately this put most of the track over a clear region in western Missouri with thin cirrus over western end. Two shorter N-S racetracks were also flown with south end over the Hub. Instruments performed well except for a HIS data system failure about midway through the flight.
- **UND CITATION:** Flew long profiling mission over the Hub in coordination with the ER-2 mission and surface-based sensors. Flew 15-mile step up/down legs at 33, 32, 31,30, 29, 29, 30, 31, 32, 33, 34, 35, 34, 33, 32, 31, 30 and 29K' on heading of about 280deg/100deg. Cloud top was at about 34.2K' and the tropopause was at 34.5K'. The clouds got denser with time. Crossed own contrail a few times and was detected by CN counter. 2D-C probe failed about midway through flight (temperature problem?). Replicator was used throughout. Very good data.
- **NCAR KING AIR:** On take-off, a low (4-5K'), broken but increasing cloud layer was noted to the east and a middle level cloud was found at 20K'. The aircraft went northwest to the Emporia area to avoid ATC conflicts. Began profiling at 28 and 27K' but then returned to the Hub as cirrus were rapidly thickening there. Flew racetracks at 1K' intervals from 27 to 23K' and then step down at 23, 22, 21, and 20K' (out of cloud base) followed by a spiral descent from 26 to 18K'. Lots of bullet rosettes were observed as were large aggregates near cloud base. Very moist conditions were found above 400 mb level.
- **NCAR SABRELINER #2:** Very similar to the morning mission beginning with a racetrack above cloud top (31K') and legs at 29, 28, 27, 26 and 25K' (heading of WSW-ENE). A racetrack was then flown at 35.6K' followed by a leg at cloud top (~33K') where the altitude was frequently adjusted. Cirrus were again described as very uniform as in the morning flight in the Wichita area but unlike the intervening flights over the Hub. The cirrus were denser to the west.

Significant Hardware Problems:

- ER-2 HIS data system failure -lost last half of flight
- Citation 2D-C probe failed toward end of flight
- Hub CLASS failure - sondes not launched for water vapor comparison (operator fired!!)
- NOAA 405 MHz profiler not operational
- U.Wisc HSR lidar operating as dual-polarization lidar
- U. Utah lidar having background problems during daylight

Highlights of FIRE Operations:

- A tremendous end to the second IOP which captured the formation of a cirrus baroclinic leaf system over Kansas-Nebraska as well as a massive ridge-crest cirrus system moving into the Pacific Northwest and Inter-Mountain West.
- A tremendous end to the second IOP with a huge amount of in situ microphysical and radiative data and good coincident remote sensing observations in conjunction with the formation of a cirrus baroclinic leaf system.
- All lidar and radar systems collect a couple of hours of very good cirrus observations without low or middle clouds and with the in situ aircraft directly overhead (clearly visible).
- Another great morning for SPECTRE - clear skies evolving to cirrus.
- Very good ice replicator flight - beautiful images!

[^ Top of Page](#)

Instrument Logs

Active Sensor	Active Sensors												Notes													
	UTC Hour																									
	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11		
Utah Lidar H					X	X	X	X																		2-CHANNEL GREEN DATA
LaRC Laser Ceilometer H	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	

