



Date: November 14, 1991
 Julian Day: 318
 Experiment Day: 2

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

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Mission Objectives:

Cloud Physics and Remote Sensing

Mission Description:

In situ microphysical, thermodynamic and dynamic profiling of complex precipitating cirrus/alto cloud system in close coordination with ground-based 8.6 mm Doppler and 3 mm radars and ER-2 remote sensing observations.

Weather Synopsis:

Overcast conditions prevailed during the entire day. Rain started falling at about 7:30 am and continued until noon with intermittent drizzle for the rest of the day. Although the rain rates appeared light, large drops were observed during most of the event. Cloud base was about 1 km early but later lifted to about 2 km with underlying scattered scud clouds. Surface winds were steady from the SSW at about 20 knots. Temperatures were quite mild (60's). Remote sensing and in situ observations indicated a fairly continuous layer of clouds composed of droplets below 5 km and ice above. Cloud top lowered from 9.5 to about 8 km during the mission.

Synoptic Situation:

Coffeyville was located between a deepening trough in the far west and a ridge over the Mississippi Valley. Flow aloft was from the southwest (about 100 knots at 11 km) and more southerly at the lowest levels. Tropopause height was quite variable ranging from 11 km at Topeka to 14 km at Dodge City and Amarillo at 1200 UTC. The baroclinic leaf system seen the previous day over Montana in association with the polar jet stream had moved to NW Minnesota by during the morning. The subtropical jet stream was weakly developed and lay through southeastern Texas. This is a split flow regime. The remnants of the vortex cloud system in the southwest were now moving into western Texas. The lower troposphere was quite moist at low levels over New Mexico, Texas, Arkansas and Missouri. Rain showers moved progressively northeastward from the Texas-Oklahoma border to just south of the Kansas border during the early morning hours.

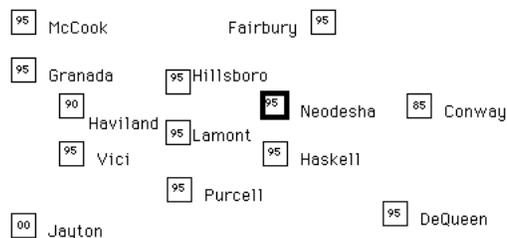
Aircraft	Depart	Land	Notes
NASA ER-2	8:05 CST	12:00 CST	On station at 1515 - 1700, data okay but some MAS channels need adjustment
NCAR King Air	7:30 CST	10:14 CST	No problems, good mission over Hub
NCAR Sabreliner			Flight scrubbed due to wet runway
UND Citation	7:40 CST	11:40 CST	Good flight, legs over hub

Satellite	Hub Overpass Time	Zenith Angle	Azimuth Angle	RAOB
NOAA-11	20:08:48	51.98	68.98	yes
	10:13:48	40.59	288.54	yes
NOAA-12	14:10:11	19.47	103.77	failed
	01:30:06	2.41	263.43	yes(-)

Rawinsonde Operations:(mode/status):

- Inner NWS stations (Type A): Routine @ 12 and 00 UTC
- Outer NWS stations (Type B): Routine @ 12 and 00 UTC
- Hub CLASS station: Satellite overpasses at 10, 20 and 01 UTC; 14 UTC
 - failed (replicator test). A second launch was mistakenly not made. 01 UTC
 - flight only reached 720 mb due to severe icing.
- Remote CLASS stations: Test flights at Muskogee and Iola at about 21 UTC
- Hub GSFC/WFF station: None
- CSU Parsons station: None

NWS Wind Profiler Status:



FIRE Profiler Status:

- CSU 405 MHz @ Parsons Continuous operation (no RASS)
- PSU 50 MHz @ Coffeyville Down due to technical problems
- NOAA 405 MHz @ Coffeyville Not operating (RASS only capability)

SPECTRE Operations:

Sporadic rain and poor weather. SPECTRE shut down for the day.

Aircrew/Mission Scientist Debrief Notes:

- **KING AIR, GOOD MISSION:**
Encountered a low layer of scud clouds at 600 m that were not noticed by surface observers or those watching remote sensing displays in operations center. Multiple cloud layers were found up to 3 km altitude with deeper cloud layers above. Large drops observed at 3.5 km altitude where a very distinct, continuous shallow layer of low depolarization was observed by ground-based NOAA radar in conjunction with a significant 'glitch' in the pattern of Doppler signal. Ice crystals were observed above about 6.5 km (-16C) on ascent. A cirrus cloud layer extended from about 8 to 9.5 km in general agreement with the radar observations. Sun dogs and other optical phenomena were observed on ascent. Generating cells were observed poking out of the top of the cirrus layer. Indications of droplets were found in one cell that was penetrated (29K'). Later, the layer became more homogeneous and then patchy as cloud top lowered. Radar returns gave the appearance of sheared fall streaks from 7.5 to 9.5 km early in the mission. King Air flew 30-35 km upwind-downwind legs from the Hub at 1K' intervals from 31K' to 28K' (9.5-8.5 km). Wind speeds were 90 knots! Crystals up to greater than a mm were observed at the lower levels. A spiral descent pattern was flown from 31K' to 6.8K' at about 150 fpm. Ice ended at 5.5 km. Cloud base was at about 2 km with scud clouds below.
- **UND CITATION:**
Citation worked above cirrus cloud top early in mission due to conflict with King Air. Air was very dry and clean (10 km). Observed a haze layer above - variously attributed to Pinitubu dust in stratosphere and/or a higher very thin cirrus layer. Citation later flew 30 mile (50 km) racetrack patterns along the wind (220deg.) from 31K' to 23K' (9.4-7.0 km) in 1K' steps coordinated pattern with ER-2 pattern. Ice then liquid encountered in layer from 23-26K' (-26C) associated with distinct cloud blob moving in from SW.
- **ER-2, GOOD FIRST MISSION:**
On station at 0845 to 1100 CST at 65K'. Flew north-south racetracks of 120 km in length.
- **OTHER:**
NOAA radar showed continued change in the cloud system. After aircraft had returned, thin clouds were observed at 2.5 and 5 km. The upper layer appeared to be supercooled and occasionally glaciated with fall streaks making it into the lower layer. Evening CLASS sounding failed due to strong icing at about the altitude of the lower layer.

Significant Hardware Problems:

- Hub CLASS RAOB failure at 1400 and 0100 UTC.
- U. Utah and U.Wisc lidars not operational (but wouldn't have been used anyway due to rain).
- NOAA 405 MHz profiler not operational.
- Sabreliner radiometric instruments not ready.

Highlights of FIRE Operations:

- A very interesting radar versus in situ versus ER-2 remote sensing comparison case for multilayered liquid phase, mixed phase and cirrus cloud observations. A number of interesting and/or puzzling features were observed by ground-based radar and in situ instruments.

Instrument Logs

Active Sensors

Active Sensor	UTC Hour																								Notes	
	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																										NOT OPERATIONAL
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	
Wisc HSR Lidar H																										SYSTEM TESTING-NO OPERATION
Wisc Vol Image Lidar																										NO OPERATIONS-RAIN
GSFC RAMAN Lidar H																										NO DATA COLLECTED
NOAA CO2 Lidar H		X																								RAIN ENDS OPERATIONS
NOAA Radar H	X	X	X	X	X	X	X	X	X																	
PSU Radar 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	LOST 1/2 HOUR AT 1330
PSU 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	
PSU 50 MHz Wind Prof 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	INTERMITTANT/TESTING
PSU/NOAA 50 MHz RASS H																										TECHNICAL PROBLEMS
NOAA 405 MHz RASS H																										NOT COLLECTING DATA
LaRC Lidar P																										NOT COLLECTING DATA
CSU Wind Prof/RASS P	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	WINDS ONLY
CSU Laser Ceilometer P	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	

Passive Sensors

Passive Sensor	UTC Hour																								Notes	
	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11		
NOAA μ -wave Radiometer H																										NO DATA COLLECTED
NOAA Sun Photometer H																										NO DATA COLLECTED
NOAA H20 Photometer H																										NO DATA COLLECTED
NOAA IR Flux Radiom. 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	
NOAA Dobson Ozone H																										NO DATA COLLECTED
NOAA Surface Ozone H																										NO DATA COLLECTED
NOAA Trace Gas H																										NO DATA COLLECTED
PSU μ -wave Radiometer H																										NEEDS ADJUSTMENT
PSU Sun Photometer H																										NO DATA COLLECTED
PSU Solar Flux Radiom. H	X	X	X	X	X	X	X	X	X	X	X															
PSU IR Flux Radiometers 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	
PSU Sky Video H																										NO DATA COLLECTED
Utah IR-Window Radiom. H																										NOT OPERATIONAL
Utah Sky Video H																										NOT OPERATIONAL
LaRC Video 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	NO DATA COLLECTED
AFGL Sky Imager 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	
Ames Radiometer H																										NOT OPERATIONAL
Denver Solar Radiom. H																										NO DATA COLLECTED
Denver IR-Spectrometers H																										NO DATA COLLECTED
GSFC IR-Spectrometer H																										NO DATA COLLECTED
Wisc. IR-Spectrometer H																										NO DATA COLLECTED
MRI Sun Photometer H																										NOT OPERATIONAL
MRI IR Radiometer H																										NOT OPERATIONAL
MRI Spectro-Radiom. H																										NOT OPERATIONAL
MRI Solar Flux Radiom. H																										NOT OPERATIONAL
GSFC Photometer H																										NOT OPERATIONAL
CSU Sun Photometer P																										NOT OPERATIONAL
CSU IR-Window Radiom. P																										NOT OPERATIONAL
CSU Solar Flux Radiom. P	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	
CSU IR Flux Radiometers P	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	
CSU IR-Spectrometer P																										NO DATA COLLECTED, RAIN
CSU Sky Video P								X	X	X	X	X	X													

[^ Top of Page](#)

Sondes and Surface Meteorology

Sondes + Sfc Met Sensor	UTC Hour																								Notes	
	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11		
NOAA Ozone Sonde H																										NONE
WFF Sonde H																										NONE
NCAR Cloud Ice Sonde H		X																								TEST LAUNCH HAD PROBLEMS
NCAR/CLASS Sonde H								X					X										X			14 FAILED. 01 ONLY REACHED 720 MB DUE TO SEVERE ICING.
NCAR PAMS 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	
NCAR/CLASS (remote)																										NONE
NCAR PAMS (remote)	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	IOLA DOWN UNTIL 20 UTC
CSU Sonde P																										NONE
CSU Sfc Meteor. P	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	
Type A NWS Sondes	X											X														
Type B NWS Sondes	X											X														
PSU Sfc Meteor 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	