FIRE II Cirrus
Mission Summary
THANKSGIVING DAY

Date: November 28, 1991
Julian Day: 332
Experiment Day: 16

Summary | Active Sensors | Passive Sensors | Sonde and Sfcmet

Mission Scientist: David Starr
Deputy Mission Scientist: None

Mission Objective:

Cirrus cloud microphysical and radiative properties

Mission Description:

Radiometric and microphysical observations were made of high level cirrus clouds associated with the flow of tropical upper level moisture from the southwest.

Weather Synopsis:

Thanksgiving day was warm and windy. Winds were southwesterly at 20 knots with frequent gusts to 30 knots. Early morning showers gave way to mostly cloudy skies with low level broken clouds and scattered to broken cirrus clouds.

Synoptic Situation:

An upper level short wave was diving into Nevada at 12 UTC while the preceding low amplitude ridge had moved to the Mississippi Valley. The cirrus associated with the ridge crest had now fully connected to a tropical source region as a solid stream of cirrus flowed from an easterly wave source region through the whole of the Baja Peninsula and over southern Arizona, New Mexico northern Texas, Oklahoma, Kansas and eastward into the ridge crest. The cloud system was not solid in appearance on the infrared imagery - strong development occurred over the mountain ranges in New Mexico and Colorado and stretched well downstream - even to Missouri. A developing low pressure system over the four corners area helped spawn an influx of low level clouds into the area on strong southerly flow.

Aircraft	Depart	Land	Notes
NASA ER-2			No flight
UND Citation	10:34 CST	15:18 CST	Good profiling mission over the Hub
NCAR Sabreliner	11:09 CST	13:30 CST	Good radiation mission to SW of Hub
NCAR King Air	11:54 CST	15:28 CST	Good cirrus profiling mission over Hub; also a good stratus data

Satellite	Hub Overpass Time	Zenith Angle	Azimuth Angle	RAOB
NOAA-11	20:48:23	9.27	73.74	yes
	09:12:54	49.00	99.47	no
NOAA-12	14:21:06	2.21	112.29	yes
	01:40:53	19.66	258.90	no

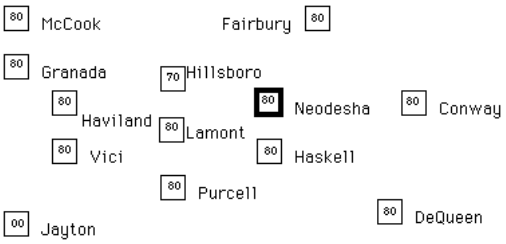
Rawinsonde Operations:

- Inner NWS stations (Type A): Routine @ 12 and 00 UTC
- Outer NWS stations (Type B): Routine @ 12 and 00 UTC
- Hub CLASS station: Satellite passes @ 14 and 21 UTC only, plus
  - 12 and 18 UTC launches
    and a special ice replicator flight at 17 UTC
- Remote CLASS stations: No launches
- Hub GSFC/WFF station: Launches @ 15, 18, and 21 UTC
- CSU Parsons station: Launch @ 20 UTC

FIRE Profiler Status:

- CSU 405 MHz @ Parsons: Continuous operation
- PSU 50 MHz @ Coffeyville: Continuous operation
- NOAA 405 MHz @ Coffeyville: Not operational

NWS Wind Profiler Status:



SPECTRE Operations:

Good observations of subtropical cirrus under non-optimal conditions as due to presence of broken stratus cloud layer during the morning and early afternoon.

Aircrew/Mission Scientist Debrief Notes:

- GENERAL: Despite the broken low cloud cover during much of the day, reasonably good observations were obtained by the surface-based remote sensing systems. NOAA CO2 reported cirrus from 9 to 11.5 km while NOAA radar showed tops to nearly 12 km between 7 and 9 a.m. CST. The VIL system came up before 10 a.m. and the HSRL came up as a dual-polarization system. An ice replicator sounding obtained an outstanding profile of changing crystal sizes and habits through the cloud layer.
- UND CITATION: Observed low cloud layer between 3.2 and 6K' on climb out. The base of the cirrus was initially observed at 27.7K' (-35deg.C) to the west of the Hub and at 34K' over the Hub. An attempt was made to confirm a hypothesis that there were cirrus or subvisual cirrus above the tropopause - this was a double tropopause situation where the intervening air was presumed to be upper tropospheric subtropical air. Cloud top was observed at 36K' below the lower tropopause at 37.7K'. No indication of subvisual cirrus or cirrus was found at 39K' (no noticeable change CNN and a flat FSSP trace). Step up/down legs were then flow along the wind (250deg./70deg.), at altitudes of 37.7, 36, 35, 34, 33, 32, 31, 31, 33, 35, 43, 33, 31 and 33K'. Again nothing was found at 43K'. Cirrus were described as lots of bands and patches. No cells were noticed and no optical phenomena were observed. A few patches of light turbulence were encountered. 2D-C probe did not operate during most of the flight. However, the replicator was on for almost all the flight.
- NCAR SABRELINER: Racetrack legs (~100 miles in length) were flown from the Hub toward Ponca City at 31K' and at 29 and 28K' in the base of a very diffuse cirrus cloud layer. A ramp up was made to 33K'. Cloud albedo was estimated at 30-40 0n the densest portion of the cloud near Ponca City where the lower level clouds were not visible when at 33K'. Data is judged very good!
- NCAR KING AIR: Data was obtained in the stratus cloud layer in conjunction with surface-based radar and CO2 lidar observations. A very narrow droplet spectra was found during a single data leg at the 4.5K' level. Cloud base was 3.7K' and cloud top was at 6K'. The cirrus portion of the mission consisted of legs at 28, 29, 30 and 31K' followed by a spiral descent to 27K', legs at 27, 28, 29, 30, 31K', and another spiral descent to 27K'. Cirrus were described being organized in patches and bands with some bands extending down to 27 or 28K'. Few large crystals were noticed. Bullet rosettes were not apparent as mostly columns or irregular particles dominated. Some rounding of particle edges was noted. Generating cells were seen at 31K' (-41deg.C) where the habits were more distinguishable.

Significant Hardware Problems:

- Citation 2D-C probe failed.
- NOAA 405 MHz profiler not operational.
- U.Wisc HSR lidar operating as dual-polarization lidar.

Highlights of FIRE Operations:

- This was a very successful mission and a nice way to spend Thanksgiving.
- A good quantity of in situ cirrus observations, including a real good ice replicator sounding, were made in conjunction with surface-based remote sensing observations under fairly difficult conditions. Cirrus moisture may have been of fairly recent tropical origin.
- No subvisual cirrus were found in a situation where they were hypothesized to exist.
- A great Thanksgiving dinner and the best of company.

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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																									NO OBSERVATIONS
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	
Wisc HSR Lidar H				X	X	X	X	X	X	X	X	X													POLARIZATION MODE ONLY
Wisc Vol Image Lidar				X	X		X	X	X	X															SPOTTY COVERAGE DUE TO CLOUDS
GSFC RAMAN Lidar H																									NO OBSERVATIONS
NOAA CO2 Lidar H		X	X	X			X	X	X	X	X	X													
NOAA Radar H				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
PSU Radar H	X	X	X	X	X	X	X	X	X	X	X	X													
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	INTERMITTENT DATA DROPOUTS
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	
PSU/NOAA 50 MHz RASS 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	SOME DATA LOSS DUE TO HIGH WINDS
NOAA 405 MHz RASS H																									NOT OPERATIONAL

LaRC Lidar P				X	X		X	X	X	X	X	X	X												
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	RASS FROM 19 TO 22 UTC
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	

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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	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 Sun Photometer H																									NO OBSERVATIONS
NOAA H20 Photometer	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 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	
NOAA Dobson Ozone H																									NO OBSERVATIONS
NOAA Surface Ozone 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	
NOAA Trace Gas H							CF																		
PSU μ-wave Radiometer 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	
PSU Sun Photometer H																									NOT OPERATIONAL
PSU Solar 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	
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	
PSU Sky Video H	X	X	X	X	X	X	X	X	X	X	X	X													
Utah IR-Window Radiom. H																									NO OBSERVATIONS
Utah Sky Video H																									NO OBSERVATIONS
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	
AFGL Sky Imager H	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X								
Ames Radiometer H																									NO OBSERVATIONS
Denver Solar Radiom. H																									NOT OPERATIONAL
Denver IR-Spectrometers H																									NOT OPERATIONAL
GSFC IR-Spectrometer H			X	X	X																				
Wisc. IR-Spectrometer H			X	X	X	X	X	X	X	X	X	X													
MRI Sun Photometer H																									NO OBSERVATIONS
MRI IR Radiometer 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	
MRI Spectro-Radiom. H																									NO OBSERVATIONS
MRI Solar Flux Radiom. H	X	X	X	X	X	X	X	X	X	X	X														
GSFC Sun Photometer H																									NO OBSERVATIONS
CSU Sun Photometer P							X	X	X	X	X														
CSU IR-Window Radiom. P							X	X	X	X	X														
CSU Solar Flux Radiom. P			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	
CSU IR-Spectrometer P							X	X	X	X	X														
CSU Sky Video P				X	X	X	X	X	X																
Ames Spectroradiometer H																									NO OBSERVATIONS
Ames 10 μm narrow fov H																									NO OBSERVATIONS
CISRO/WPL/PSU IR W. Rad	X	X	X	X	X	X	X	X	X	X	X	X													NO OBSERVATIONS

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Sonde and Surface Meterology

Sonde + 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																									NO LAUNCHES
WFF Sonde H				X			X			X															
NCAR Cloud Ice Sonde H					X																				
NCAR/CLASS Sonde H	X		X							X															
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	
NCAR/CLASS (remote)																									NO LAUNCHES
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	IOLA DOWN FROM 13 UTC
CSU Sonde P								X																	
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	
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	