FIRE II Cirrus

Mission Summary

Date: November 24, 1991
Julian Day: 328
Experiment Day: 12

Summary | Active Sensors | Passive Sensors | Sonde and Sfcmet

Mission Scientist: David Starr
Deputy Mission Scientist: Steve Ackerman

Mission Objective:

- Cirrus formation and cloud radiative and microphysical properties
- Remote sensing of cirrus cloud properties

Mission Description:

There were two separate missions on this day.

- Local: Observations of cirrus cloud formation and interaction with a layer of supercooled altocumulus cloud. Two in situ aircraft missions were flown in conjunction with extensive surface-based remote sensing observations and upper air soundings. The cirrus system resembled a small scale ridge-crest cirrus system (~150 km) that formed to our west, moved over the Hub, and then dissipated.
- Gulf of Mexico: Remote sensing observations of cirrus clouds over altocumulus and stratocumulus clouds were made by the ER-2.

Weather Synopsis:

Clear skies and cold temperatures (upper teen's) prevailed over southeast Kansas on this Sunday morning. During the morning, some mid-level clouds were seen to the northeast. Clear skies and light northwest winds prevailed all day as temperatures struggled to reach 40deg F. Subvisual and contrail cirrus were first detected at about 3 p.m.. Cirrus cloudiness increased around sunset but middle and low level clouds soon followed.

Synoptic Situation:

The long wave trough moved eastward from the Mississippi Valley during the day. The ridge on the west coast flattened a bit but northwesterly flow still dominated the western half of the country. An extensive band of middle and low level clouds that stretched from eastern Montana into eastern Kansas. A well-defined ridge-crest cirrus system was located over Washington while a mesoscale ridge-crest system formed over northern Texas at about noon and slowly moved eastward along the Kansas-Oklahoma border. Convective activity increased significantly in the two tropical easterly waves to the southwest of Baja generating extensive cirrus shields.

Aircraft	Depart	Land	Notes
NASA ER-2	10:30 CST		Gulf mission. cirrus over altocumulus and stratocumulus.
NCAR Sabreliner	14:51 CST	16:47 CST	Cloud Physics mission, subvisual cirrus
NCAR King Air	17:00 CST	21:04 CST	Evening mission over the Hub
UND Citation			No flight

Satellite	Hub Overpass Time	Zenith Angle	Azimuth Angle	RAOB
NOAA-11	21:34:42	53.38	261.95	yes
	09:59:06	17.55	285.69	yes
NOAA-12	14:03:42	29.42	101.75	yes
	01:23:30	9.07	74.10	no

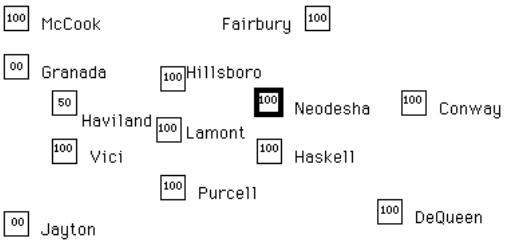
Rawinsonde Operations:

- Inner NWS stations (Type A): Enhanced mode @ 12, 18, and 00 UTC
- Outer NWS stations (Type B): Routine @ 12 and 00 UTC
- Hub CLASS station: Satellite overpass @ 14, 21, and 10 UTC
  - (no 01 UTC sounding)
- Enhanced mode @ 12, 18 and 00 UTC
  - (no 00 sounding)

Remote CLASS stations:

- Enhanced mode @ 12, 18 and 00 UTC
- Hub GSFC/WFF station: Launches @ 22, 23, 02, and 05 UTC
- CSU Parsons station: Launches @ 22, 00, and 01 UTC

NWS Wind Profiler Status:



FIRE Profiler Status:

CSU 405 MHz @ Parsons: Continuous operation (RASS during day)
PSU 50 MHz @ Coffeyville: Continuous operation
NOAA 405 MHz @ Coffeyville: Not operational

SPECTRE Operations:

Data collection for the period very successful with exceptionally clear sky conditions during the afternoon. Upper troposphere extremely dry yielding measured spectra that were very repeatable. Moistening conditions and cloud formation marked the evening as operations continued.

^ Top of Page.

Aircrew/Mission Scientist Debrief Notes:

- NCAR SABRELINER: An afternoon Sabreliner mission in good cirrus to our west near Wichita obtained microphysical observations of a very interesting cirrus system. Unfortunately, the CSU data system died and the only radiative data that were obtained were the broadband fluxes. Two and a half racetrack patterns were flown at altitudes from 29-31K' in a crosswind orientation (210deg./30deg.) across a series of distinct cirrus cloud bands where the region between the bands was described as very thin cirrus composed of very small particles (-50deg.C). The aircraft remained mostly in-cloud during the legs although the altitude was adjusted frequently. Turbulence was encountered within the main cloud bands which were described as relatively uniform and generally without fall streaks or cellular development. Note that this cloud system was associated with a short-term wind shift from NW to westerly (~60 knots @280deg.). A ramp sounding was made on return to the Hub.
- OTHER: Good observations were made by the surface-based remote sensing systems around sunset when the King Air took off for an evening mission. The CO2 lidar observed thin cloud layers at 3 and 7 km and cirrus from 8.5 to 9 km. The NOAA radar observed cirrus at 9.5 km. The VIL system made extensive observations showing development of precipitation fall streaks from high levels that fell through the thin middle level cloud deck and apparently dissipated it as a distinct entity.
- NCAR KING AIR: The flight initially went to the Bartlesville area to our southwest in northern Oklahoma. Some longish legs were flown at 27 and 28K'. As the cirrus system moved over the Hub, the aircraft returned to the hub where 20-mile racetracks were flown at altitudes of 27, 25, 23, 21, 19, and 17K' followed by a slow spiral descent from 27 to 10K'. Very large ice crystals and regions of high concentration (80 per liter) were encountered. Icing conditions were also occasionally observed.
- NASA ER-2: All sensors and data systems performed well (a first). Flight tracks were flown in the solar plane (4) and normal to it (4) over cirrus, cirrus overlying altocumulus and cirrus over stratocumulus. Some observations in clear areas were also made along the return to Houston. This was a good mission.

Significant Hardware Problems:

- Sabreliner Radiometer data system failure - no data.
- NOAA 405 MHz profiler not operational.
- PSU/NOAA 50 MHz wind profiler/RASS -status quo.
- U.Wisc HSR lidar operating as dual-polarization lidar.

Highlights of FIRE Operations:

- Excellent in situ microphysical observations of distinctly different cirrus cloud forms with one of the cases involving strong interaction with a supercooled midlevel cloud layer.
- Outstanding imagery from the U. Wisc. Volume Imaging Lidar graphically illustrating the cirrus-altocumulus interaction and its spatial and temporal variations.
- Very interesting Raman observations of evolving water vapor structure and cloud formation.
- Our second full-up case for surface remote sensors and our second nighttime case.
- Continued great performance from NOAA CO2 and radar groups and the Penn State team.
- A good ER-2 mission over a multilayered cloud system (cirrus, altocumulus and stratocumulus) over the Gulf of Mexico.
- Another exceptional SPECTRE day with very repeatable observations under clear sky conditions.

^ Top of Page.

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												X	X	X	X	X									2 CHANNEL VISIBLE
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																								POLARIZATION MODE ONLY
Wisc Vol Image Lidar												X	X	X	X									
GSFC RAMAN Lidar H												X	X	X	X	X	X							
NOAA CO2 Lidar H			X	X					X	X	X	X	X	X									X	
NOAA Radar H										X	X	X	X	X	X	X							X	
PSU Radar H										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	
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	SOME NOISE
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	SOME NOISE
NOAA 405 MHz RASS H																								NOT OPERATIONAL
LaRC Lidar P										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	RASS FROM 14 TO 02 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	X	X	

^ Top of Page.

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				X	X					X															
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						X																			
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										F															
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			X	X	X			X	X	X															
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	POWER OUTAGE 17-18 UTC
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	POWER OUTAGE 17-18 UTC
PSU Sky Video H											X	X													
Utah IR-Window Radiom. H											X	X	X	X	X	X									
Utah Sky Video H										X	X	X													
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	X	X	X	X	X	
Ames Radiometer H		X	X	X	X	X	X																		
Denver Solar Radiom. H							X	X	X	X	X														QUESTIONABLE DATA QUALITY
Denver IR-Spectrometers H							X	X	X	X	X	X	X	X											
GSFC IR-Spectrometer H						X	X	X	X	X	X	X		X	X	X	X	X							
Wisc. IR-Spectrometer H	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X						
MRI Sun Photometer H							X	X	X	X	X														
MRI IR Radiometer H							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														
GSFC Sun Photometer H																									
CSU Sun Photometer P						X	X	X	X	X	X	X													
CSU IR-Window Radiom.P							X	X	X	X	X	X	X	X	X										
CSU Solar Flux Radiom. P		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	
CSU IR-Spectrometer P											X	X	X	X	X										
CSU Sky Video P									X	X	X	X	X												
Ames Spectroradiometer H																									NO OBSERVATIONS
Ames 10 μm narrow fov H												X	X	X	X	X									

^ Top of Page.

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															X										
WFF Sonde H											X	X			X			X							
NCAR Cloud Ice Sonde H																									NO LAUNCHES
NCAR/CLASS Sonde																									12 UTC LAUNCHED AN HOUR EARLY, 00 AND 14 UTC

H			X				X														X		FILES NOT ON-LINE
NCAR PAMS H				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
NCAR/CLASS (remote)	X						X						X											SOME MISSING WINDS AT MUSKOGEE AND ARKANSAS CITY
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	IOLA HAD FROZEN WETBULB
CSU Sonde P											X		X	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	
Type A NWS Sondes	X						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	