
CERES Surface Validation Activity

August 3-28, 1998

Alias: BDRF Campaign - ARM SGP

Alias: CERES / ARM Radiation Experiment (CARE)



Langley Research Center / Atmospheric Sciences Division

October 21, 1998 5:45 pm

Scope

- ❑ Location: north central Oklahoma near the ARM CF site.
 - IGBP scene types: Cropland & Grassland
- ❑ Used a UH-1H helicopter to acquire airborne measurements.
 - 40 BRDF measurements over crops and grassland.
 - Albedo (Flux) flights: ARM CF and CERES footprint.
- ❑ Operated two radiometric surface stations.
 - Site 1 at the ARM SGP Central Facility.
 - Site 2 was central to the BRDF measurements.
 - 25 instruments in total.
- ❑ Coordination with PNL, GSFC, Landsat, CERES.



Instrumentation

Location	Instrument	FOV (degrees)	Class	Bandpass (nm)
Air/Surface	FieldSpec Spectral Radiometer	5,18,180	Spectral 1 nm res.	350-2500
Surface	Absolute Cavity Radiometer (ACR)	5.7	Broad	0-50000
Surface	Eppley Normal Incidence Pyrheliometer (NIP)	5.7	Broad	285-2800
Air/Surface	Eppley Precision Spectral Pyranometer (PSP)	180	Broad	285-2800
Air/Surface	Eppley Precision Infrared Radiometer (PIR)	180	Broad	3500-50000
Air	Heimann Pyrometer	6.3	Broad	9000-11000
Surface	Yankee MFRSR	180	Spectral (FWHM is 10 nm)	415, 500, 610, 665, 860, 940



Instrumentation Notes:

- ❑ Surface Meteorology (temperature, humidity, pressure, winds) at both sites.

- ❑ Additional Surface Instruments at Site 2 (field site).
 - MPL (523 nm).
 - All-Sky Camera (color video tape).
 - Radiosonde (temperature, dew point, pressure).

- ❑ Ground-based uplooking spectral radiometer is using a hemispherical FOV.
 - Run daily at Site 2.
 - Run at Site 1 for Albedo mapping flights.



Calibration Procedures (Air & Ground)

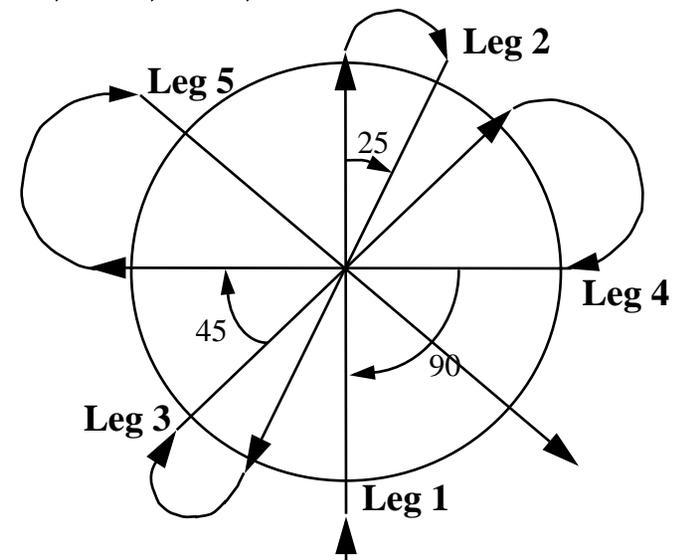
Instruments	Reference	Location
pyranometer	Forgan,B.W., 1996: A new method for calibrating reference and field pyranometers, Journal of Atmospheric and Oceanic Technology, 13 638 - 645.	LaRC
pyrgeometers	Philipona, R., C. Frohlich, CH. Betz, 1995: Characterization of pyrgeometers and the accuracy of atmospheric longwave measurements. Applied Optics, 34(9) 1598 - 1605.	Davos
cavity radiometers and pyrhemometers	Reda,I., T. Stoffel, J.Treadwell, 1997: NREL Pyrhemometer Comparisons, NPC1997. National Renewable Energy Laboratory, Golden, CO. Internal Document.	NREL; LaRC
spectral radiometers	Goddard 72 inch in integrating sphere	GSFC
photometry	classical Langley analyses	Mauna Loa, HI
micropulse lidars	John Reagan's Lab, Univ. of Arizona. U. of Arizona (optimization for boundary layer measurements)	LaRC
pyrometers	blackbody infrared calibrations	GSFC



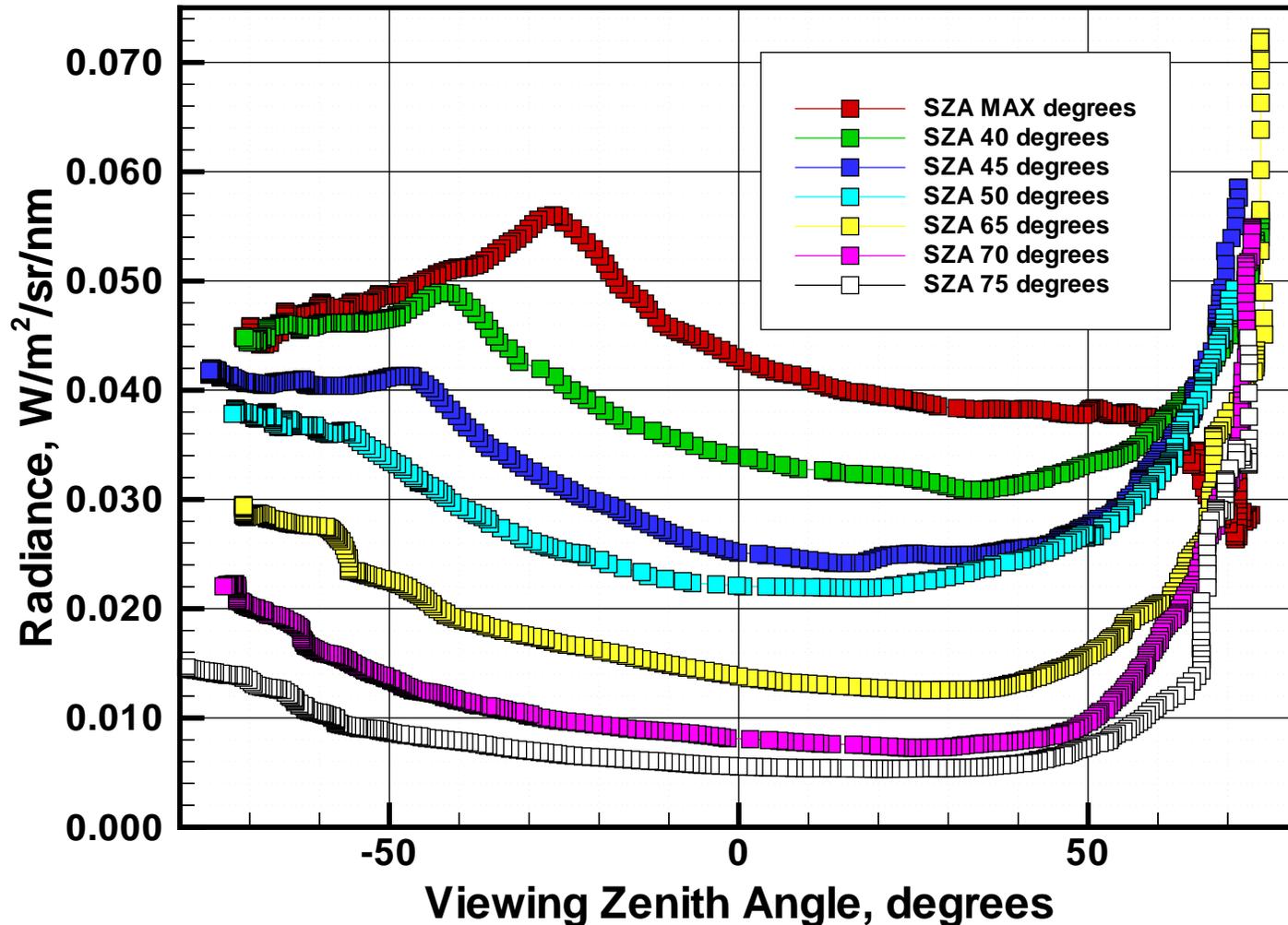
Helicopter Measurements

□ BRDF Measurements.

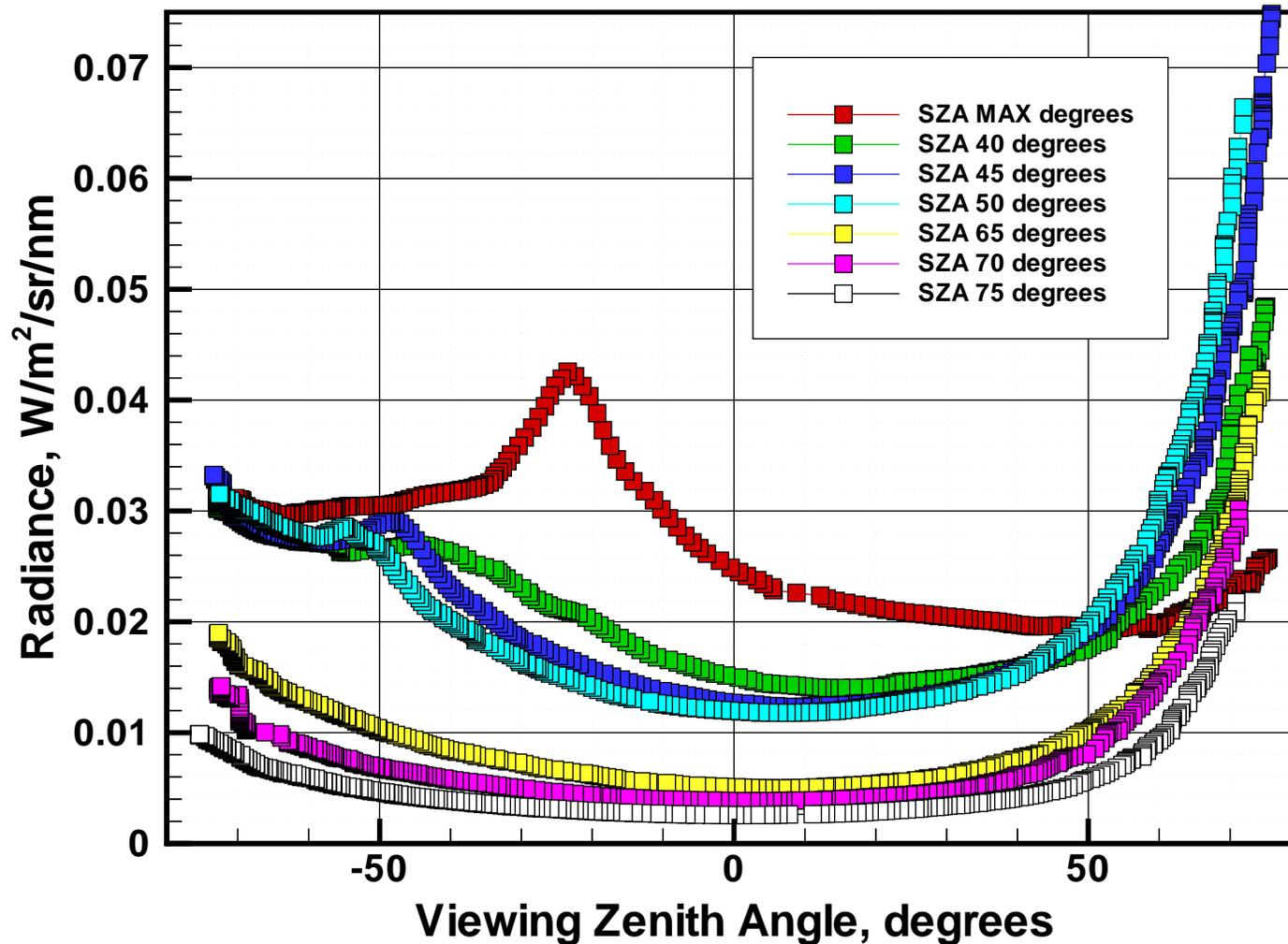
- Prioritized crops by percent land cover around the ARM CF.
- Priority (high-to-low): Wheat, pasture grass, milo, soybeans, and alfalfa. Grassland after all crops.
- Solar zenith angles [deg.]: 75, 70, 65, S, 50, 44, 40, & 25.
- +/- 75 degrees viewing angle for 5 azimuth angles.
- Narrow FOV.



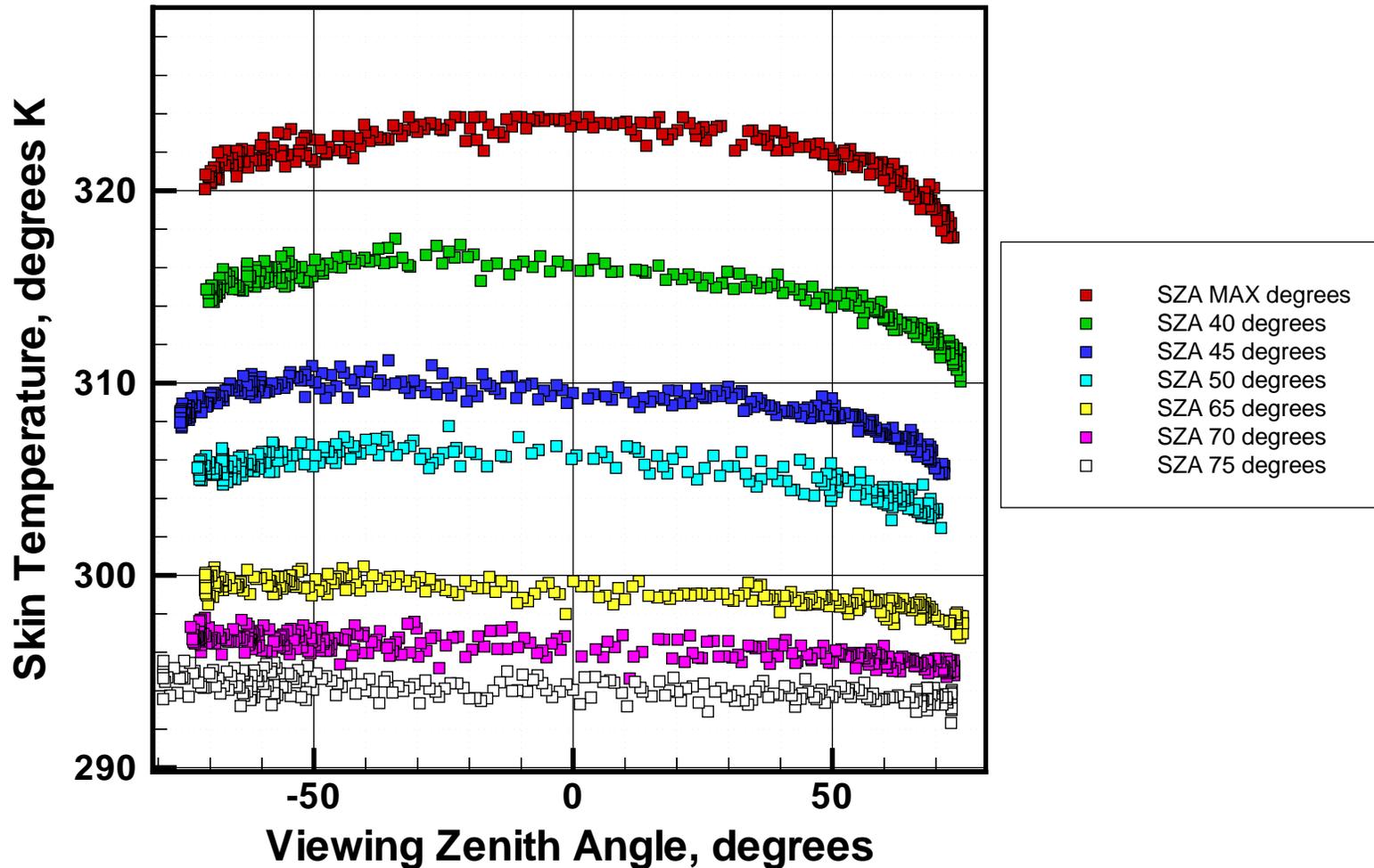
Spectral Radiometer 500 nm Principal Plane Data Fallow Wheat Scene Type / Dependency on SZA



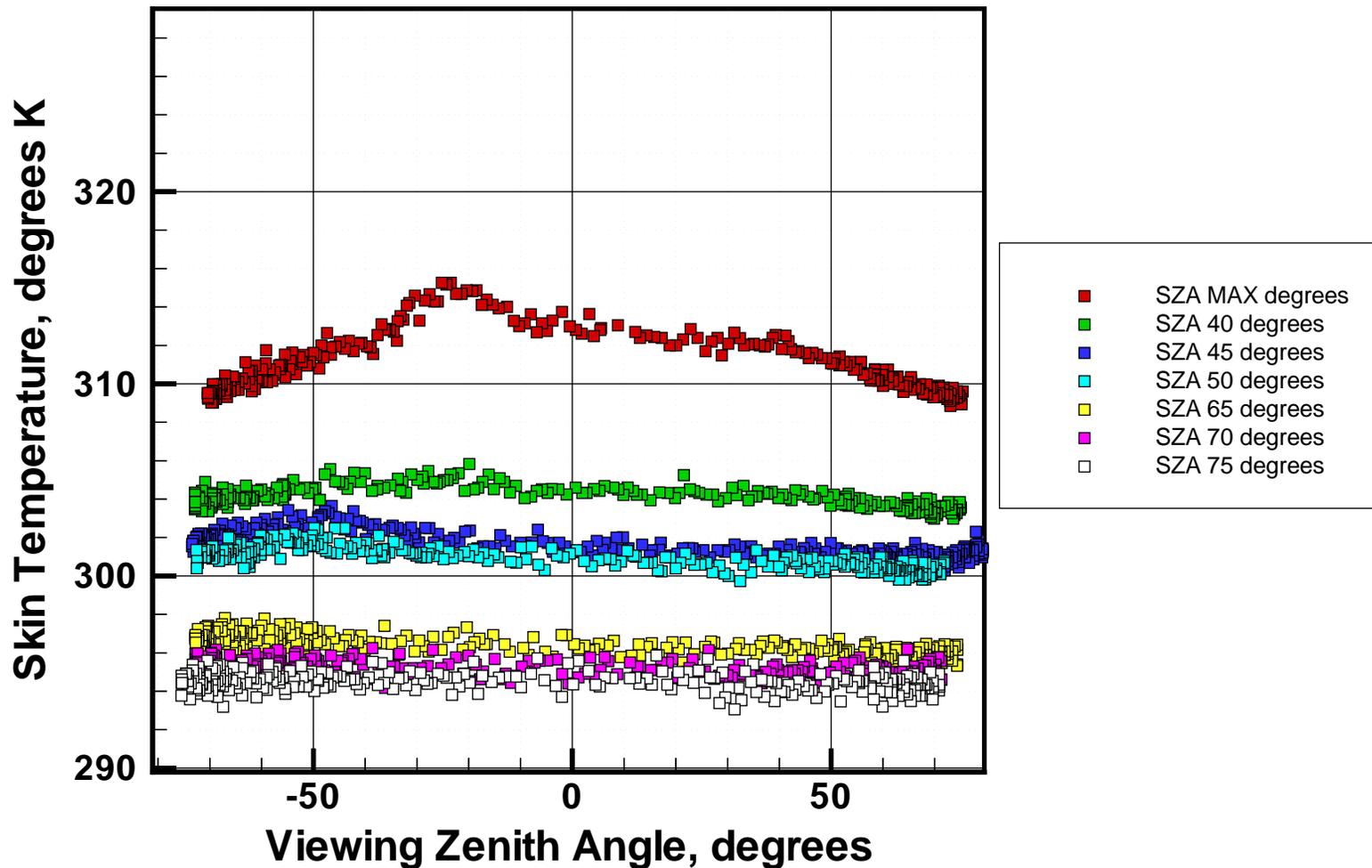
Spectral Radiometer 500 nm Principal Plane Data Milo Scene Type / Dependency on SZA



Heimann Pyrometer Principal Plane Data Fallow Wheat Scene Type / Dependency on SZA



Heimann Pyrometer Principal Plane Data Milo Scene Type / Dependency on SZA



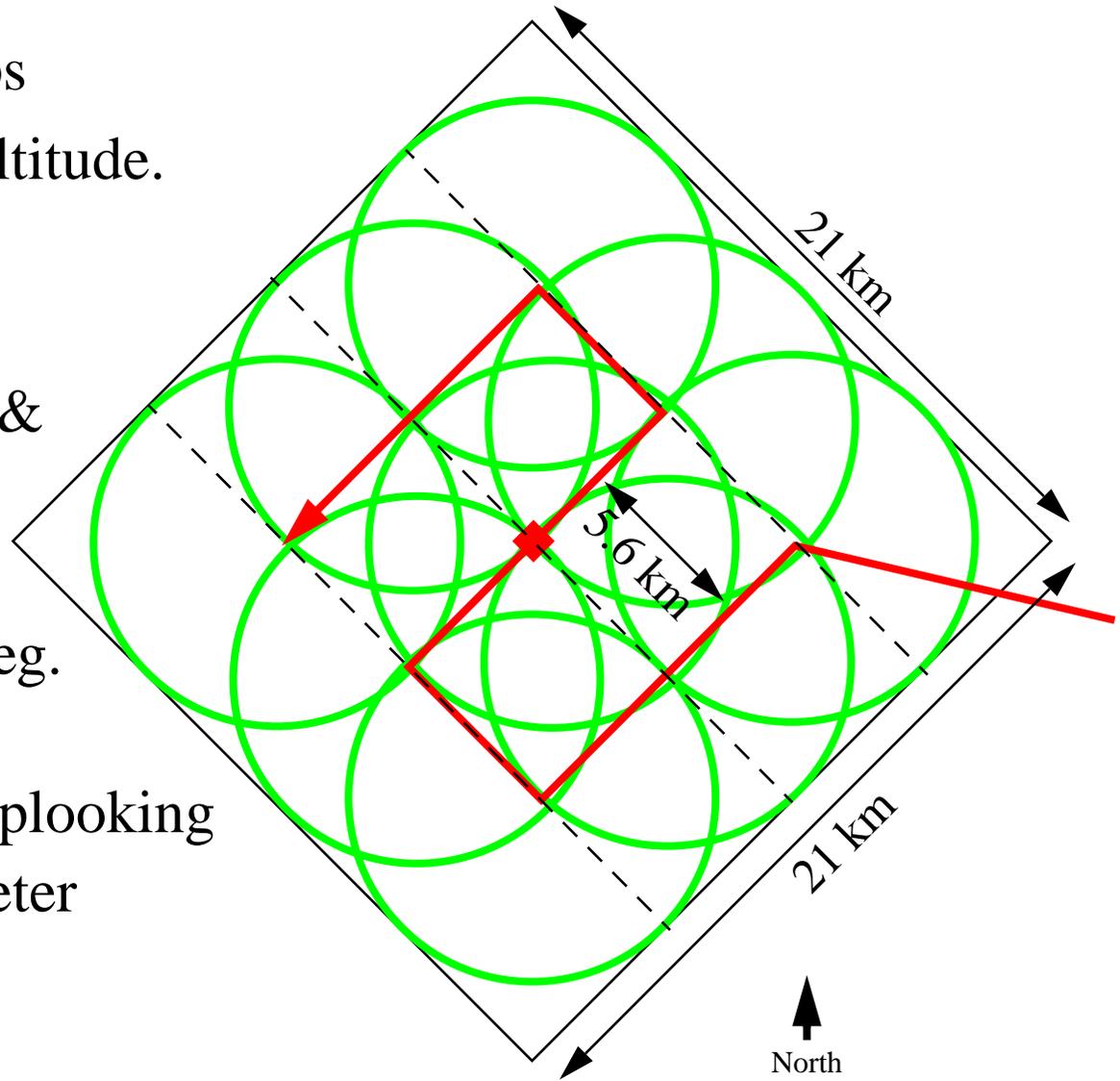
Helicopter Measurements

- ❑ Albedo (Flux) Mapping.
- ❑ 21x21 km box centered on ARM CF.
 - 5 completed; hourly from 0900-1300 local time.
 - Coincident gulfstream and CERES overpasses.
 - Gulfstream aircraft making aerosol profile measurements from 500 to 17,500 feet.
- ❑ 21x30 km box centered on a single CERES footprint.
 - Gulfstream aerosol profile available.
 - Mostly cropland; some cloud contamination.
 - 2-day delay in aircraft measurement after CERES footprint measurement.



Helicopter Measurements

- ☐ Albedo (Flux) Maps
 - 3000 ft. AGL Altitude.
 - Hemispherical Instruments
 - Fieldspec, PSP, & PIR.
 - Footprint size; assuming 160 deg. FOV is 10 km.
 - Ground-based uplooking spectral radiometer (hemispherical)



Helicopter Measurements

- ❑ Vertical descent.
 - Altitude range of 10,000 feet to 500 feet.
 - Using hemispherical FOV instruments.

- ❑ 1 descent centered at ARM CF site
 - Coincident with gulfstream aerosol profiling.

- ❑ 1 descent over a freshly plowed homogeneous field (3000 ft. max. alt.).

- ❑ 1 descent over the Grassland site.



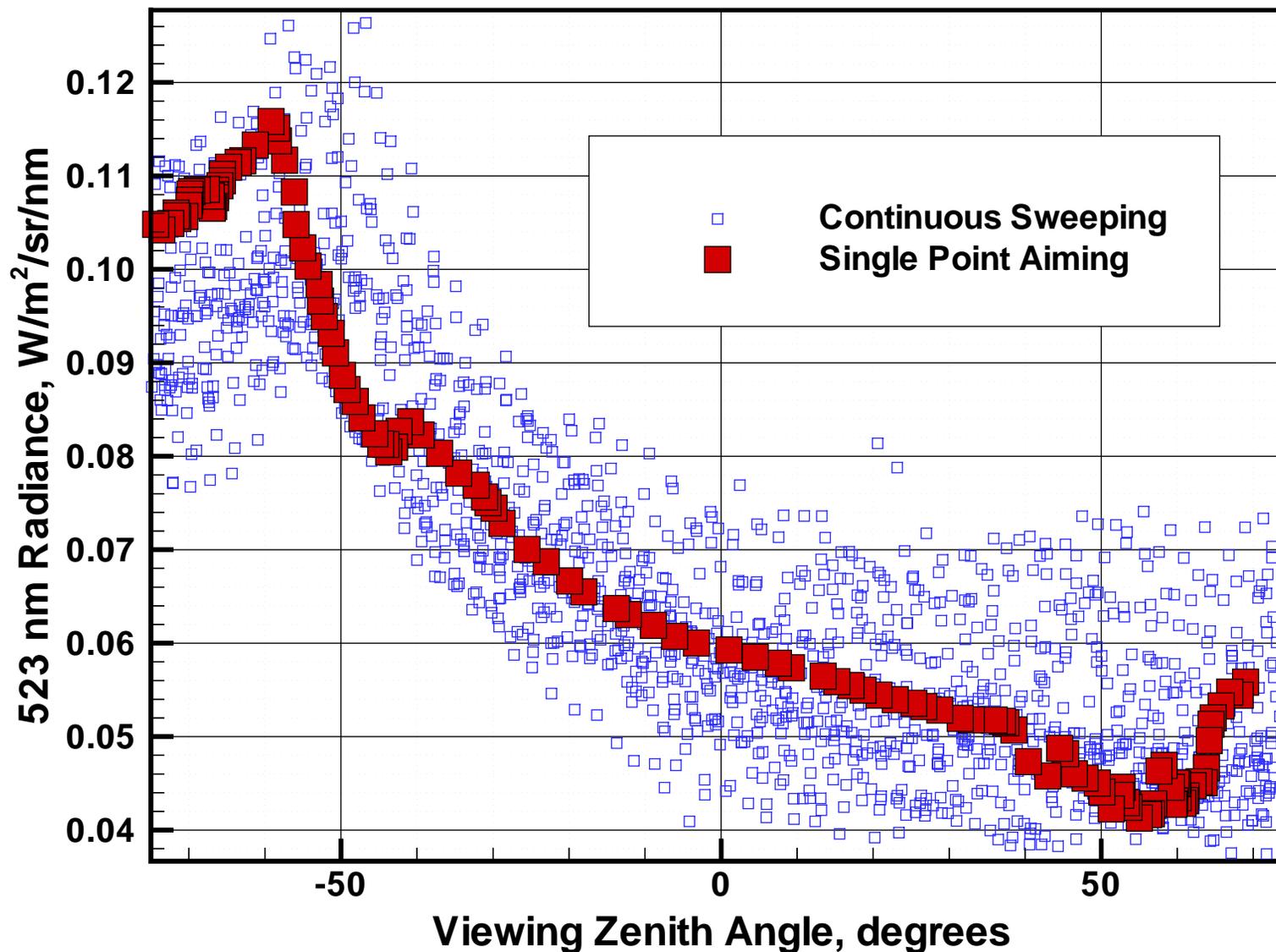
Helicopter Measurements

- ❑ Sweep scan.
 - Continuous 12 second scans in the solar principal plane.
 - Fly for several minutes and collect thousands of spectra.
 - Gaining statistical knowledge of viewing angle dependencies over a large spatial area.

- ❑ 4 principle plane sweep scans
 - 1 over the ARM CF and 1 over the grasslands.
 - 2 over a homogeneous stratiform cloud deck.



WSMR Desert Scene / Spectral Radiometer Data



Surface Measurements

- ❑ Coincident measurements at the ARM CF site for almost 4 weeks.
- ❑ Cropland field site located ~15 km east of the ARM CF.
 - MPL, all-sky camera, radiosonde, and surface meteorological data available.
 - Radiosonde launches prior to each helicopter flight.
 - 6 meter tower with a downlooking PSP and PIR.
- ❑ Characterization for the Crops.
 - 4-H Youth Volunteers made the random measurements.
 - Canopy height and spacing; humidity, temperature, soil moisture, and the GPS location of each sample.



Surface Measurements

☐ Grassland BSRN site.

- Located 50 km northeast of Ponca City, near Foraker.
- Did not include the MPL or all-sky camera.
- Radiosonde data available.



Data Availability

- ❑ Currently.
 - Data review in progress.
- ❑ Mid-September.
 - GIF images of all quicklook plots will be available.
- ❑ Late-September.
 - Raw data file access available.
- ❑ Mid-October.
 - Data placed within a database.
 - Interactive web access to the database.
 - Customized data files can be created.



Future Directions

- ❑ Complete Chesapeake Lighthouse Platform Installation.
- ❑ Modify our aircraft installation.
 - Fixed wing and smaller helicopter.
 - Multi-azimuth scanning system.
- ❑ Characterize IGBP scene types.
 - Multiple seasons.
- ❑ Return to ARM for other IOP's.

