CALMIT Field Program

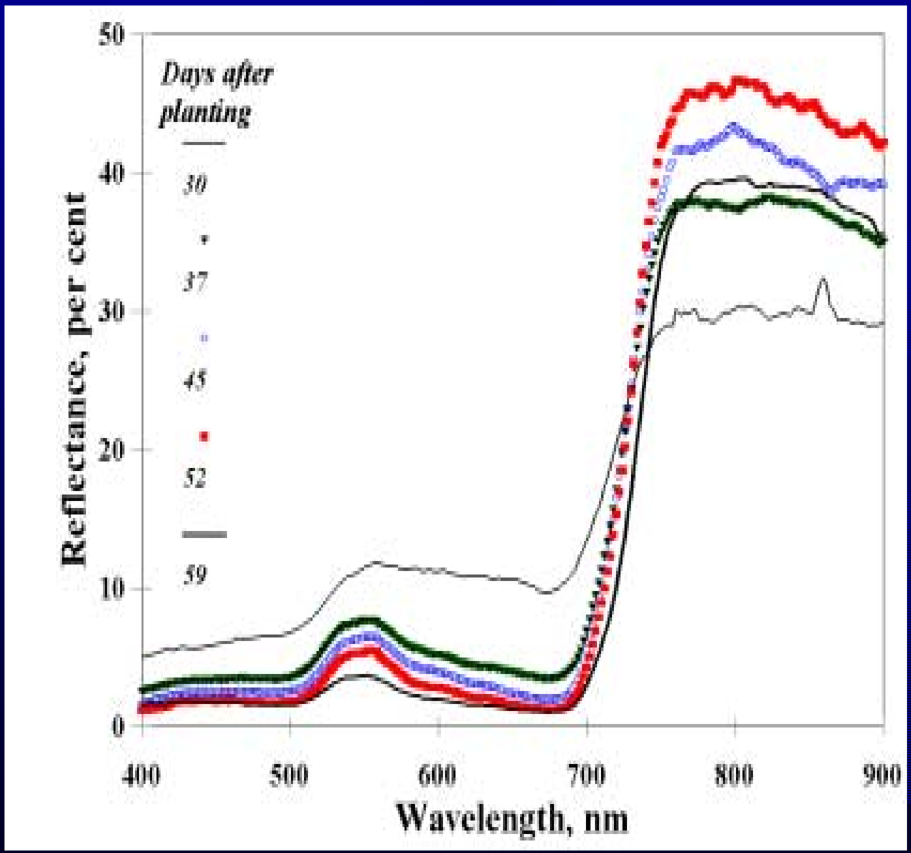
Center for Advanced Land Management Information Technologies (*CALMIT*)

University of Nebraska – Lincoln

Field Program: Three Areas

- Agriculture
- Surface Waters
- Coastal / Marine

1) Agriculture



Biophysical Measurements:

- *Vegetation Fraction*
- *Leaf Area*
- *Pigment Type and Density*
- *Leaf-Water Content*
- *Primary Productivity / Biomass*
- *Absorbed Photosynthetically Active Radiation*

CALMIT Field Facility

Note aircraft-calibration targets
on concrete strip (above)

"Goliath"

Goliath Specifications

- All terrain (tracked wheels)
- Boom height = 10.5m (with full rotation)
- Boom length = 3.8m stowed; 12m extended
- Platform height = approx. 2m
- Platform width = 2.6 x 3m
- Passengers = driver + 4
- Wheel spacing for standard 76.2 cm (30-inch) rows

Goliath is Mobile

Spectroradiometers Available on Goliath

- Dual Spectron SE-590's
- Dual Ocean Optics USB-2000's
- ASD-FR

Spectroradiometers
Spectron SE-590 (2)

256 channels; 365-1114 nm

Spectroradiometers
ASD Field Spec - FR (2)

Spectroradiometers
Ocean Optics USB2000 (4)

2048 Channels, 350-1000 nm

Dual systems allow simultaneous capture of downwelling (sky) irradiance and upwelling (target) radiance

Dual Fibers Facilitate Data Collection Under Rapidly Changing Illumination Conditions

Other Sensors on Goliath

- Canon digital-video camera
- Linear Laboratories infrared thermometer
- P-band Radar Scatterometer

Vegetation Fraction: Digital Camera

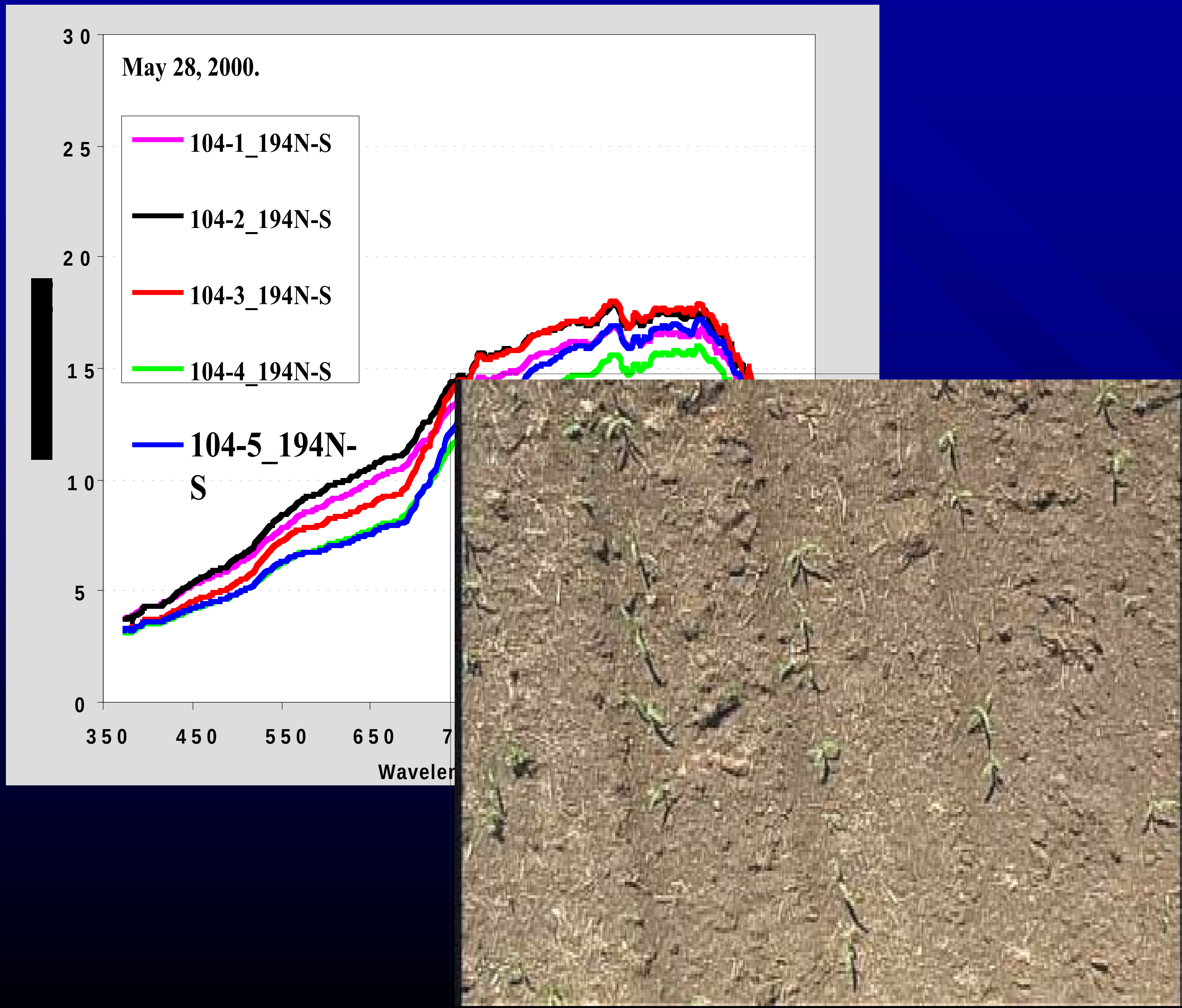
V8 (19 June)

V12 (6 July)

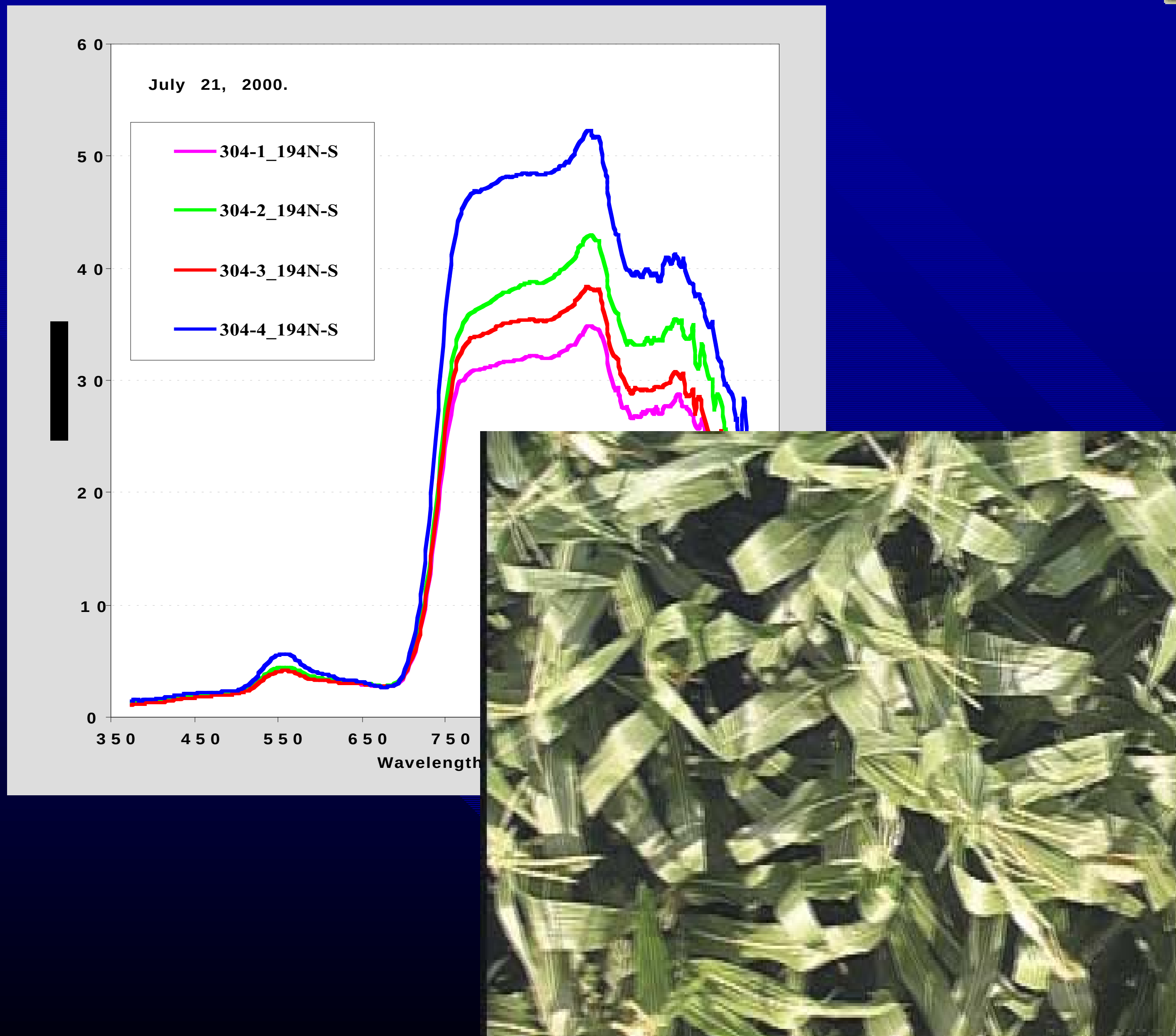
R2 (28 July)

R5 (20 August)

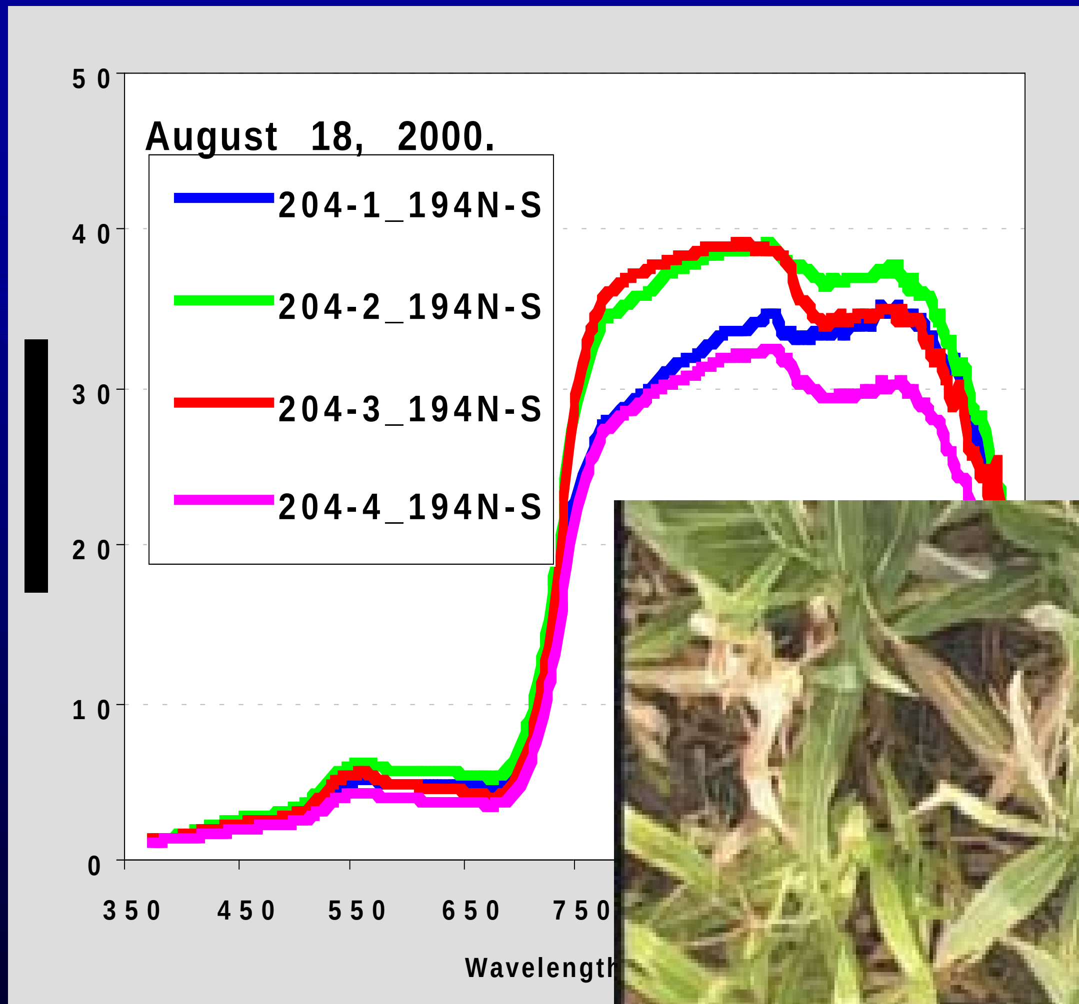
Early Season



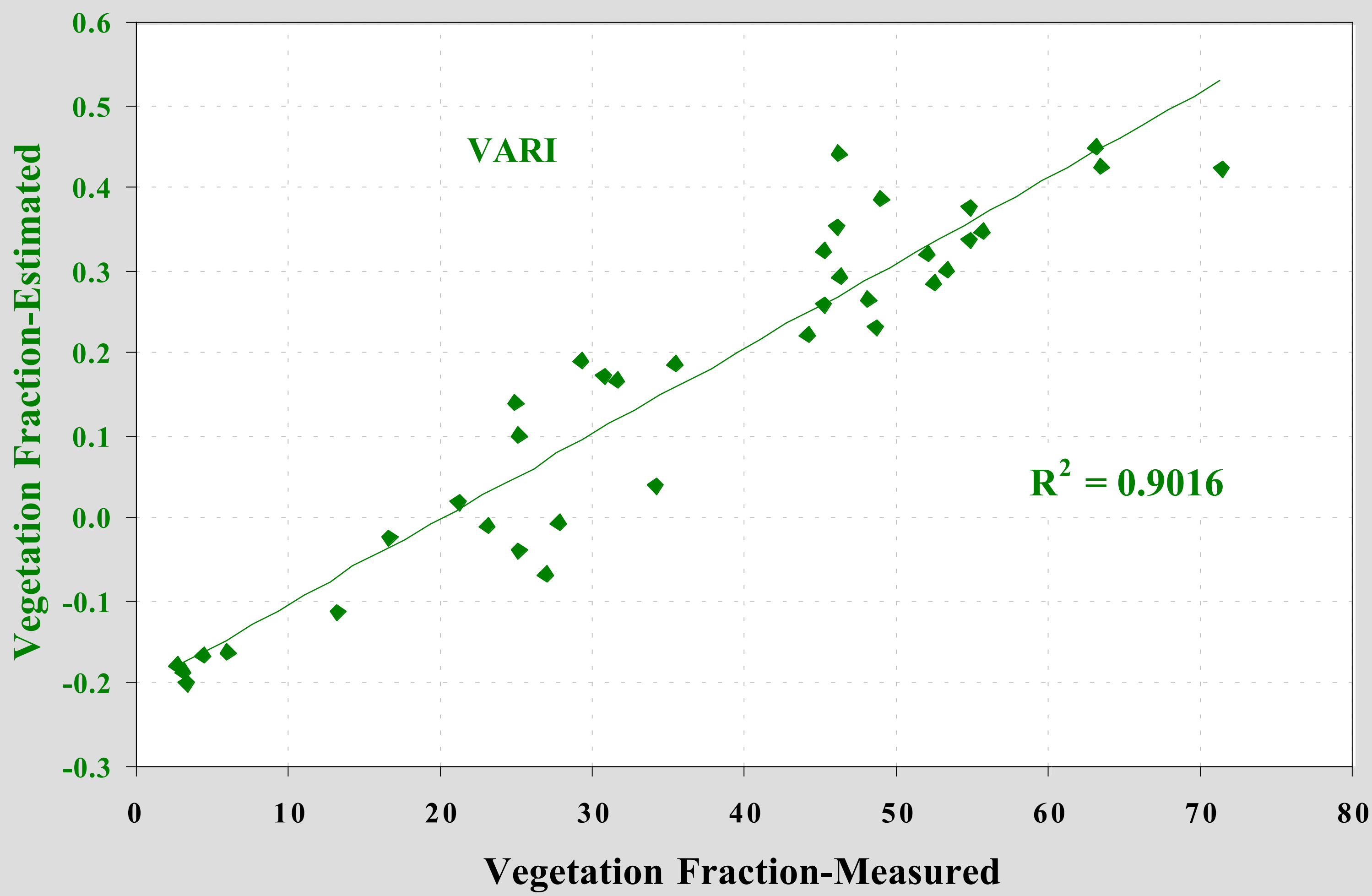
Mid-Season


July 21, 2000.
304-1_194N-S
304-2_194N-S
304-3_194N-S
304-4_194N-S
0
10
20
30
40
50
60
350
450
550
650
750
Wavelength

Late Season


August 18, 2000.
204-1_194N-S
204-2_194N-S
204-3_194N-S
204-4_194N-S
50
40
30
20
10
0
350
450
550
650
750

Estimating Vegetation Fraction



Other Systems on Goliath

- Real-time DGPS
- Wireless Internet

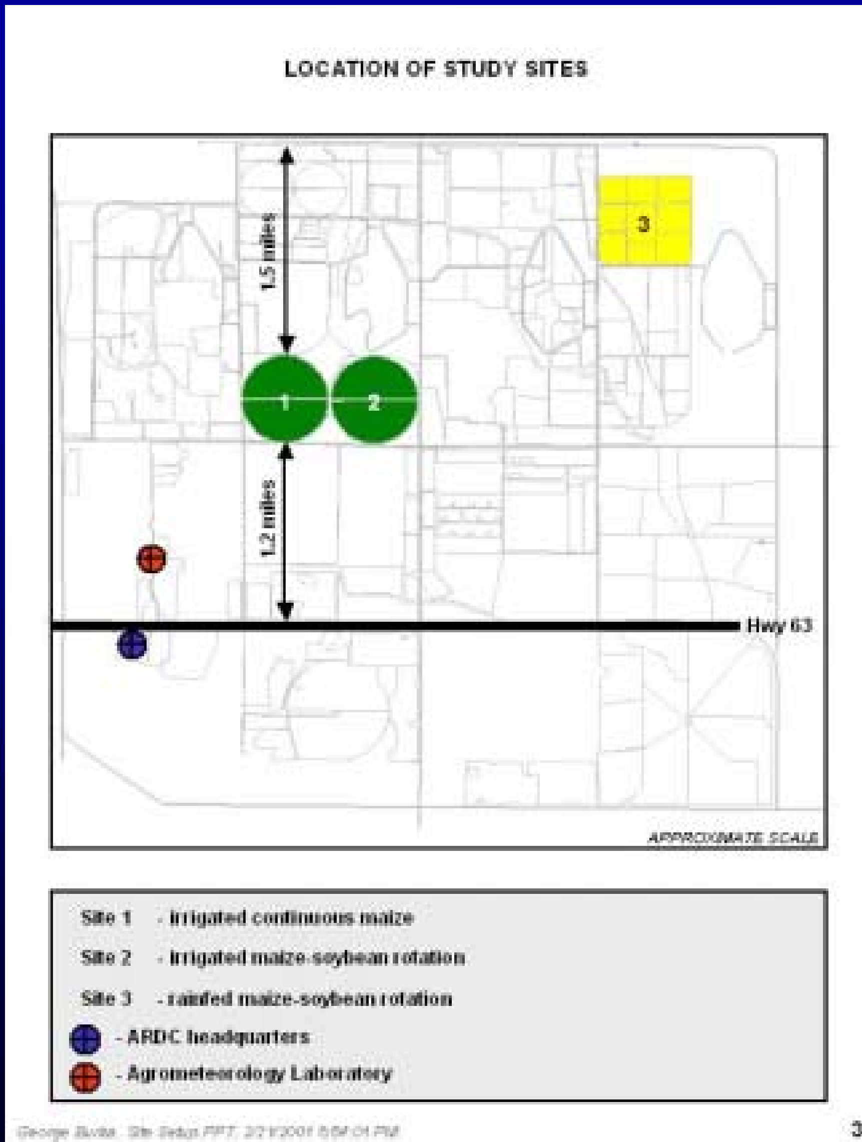
Other Field Instruments

UniSpec

256 Channels, 300-1100 nm

Leaf Clip

Operates with internal light source

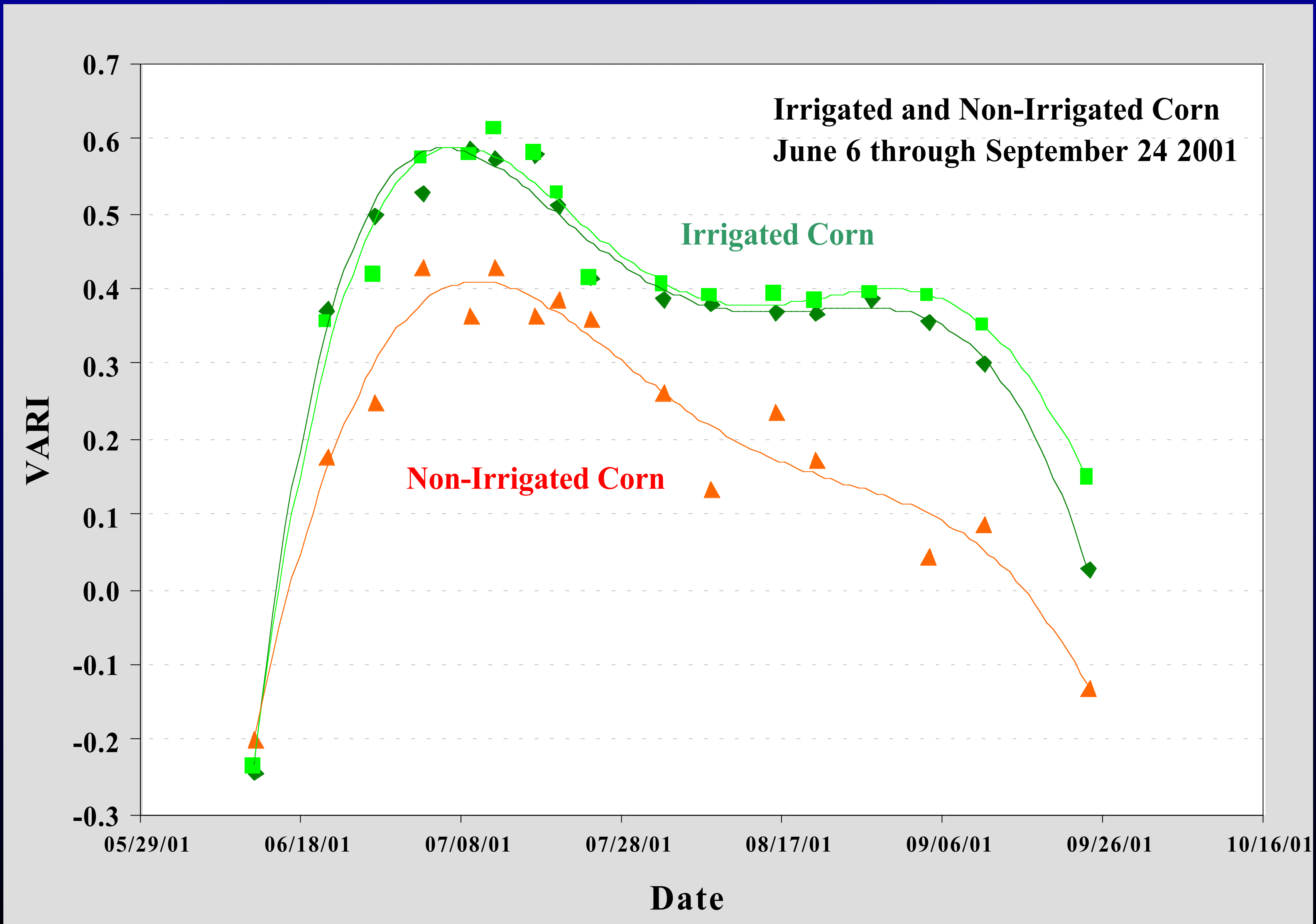


University of Nebraska ***Carbon Sequestration Program***

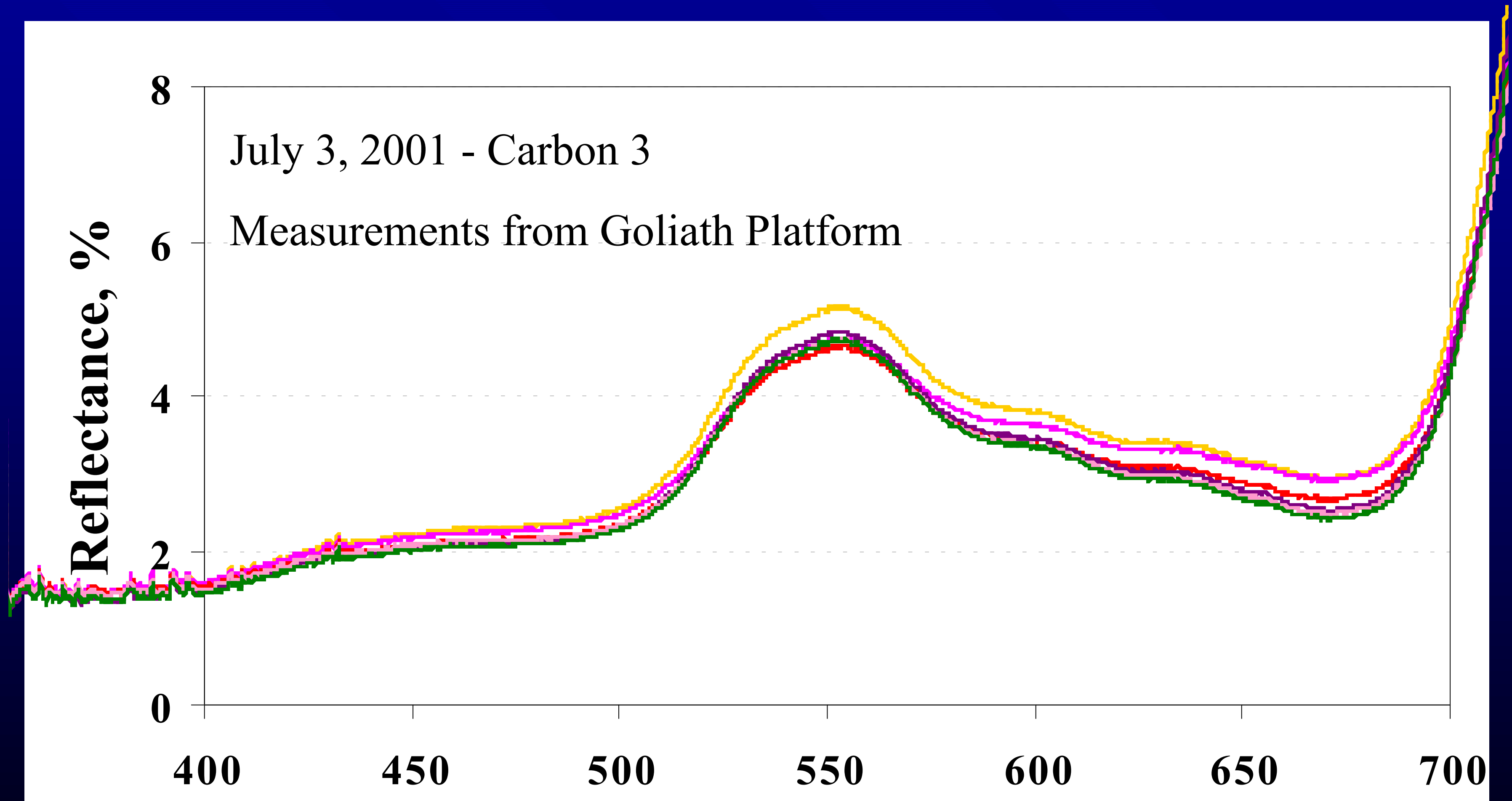
Project Study Teams:

- Micrometeorological
  (CO_2 and H_2O Vapor Fluxes)
- Soil Water Balance
- Soil C
- Plant C Assimilation
- NO_2 and CH_4 Flux
- Leaf Level Remote Sensing
- Canopy Level Remote Sensing
- Technology Design & Adoption

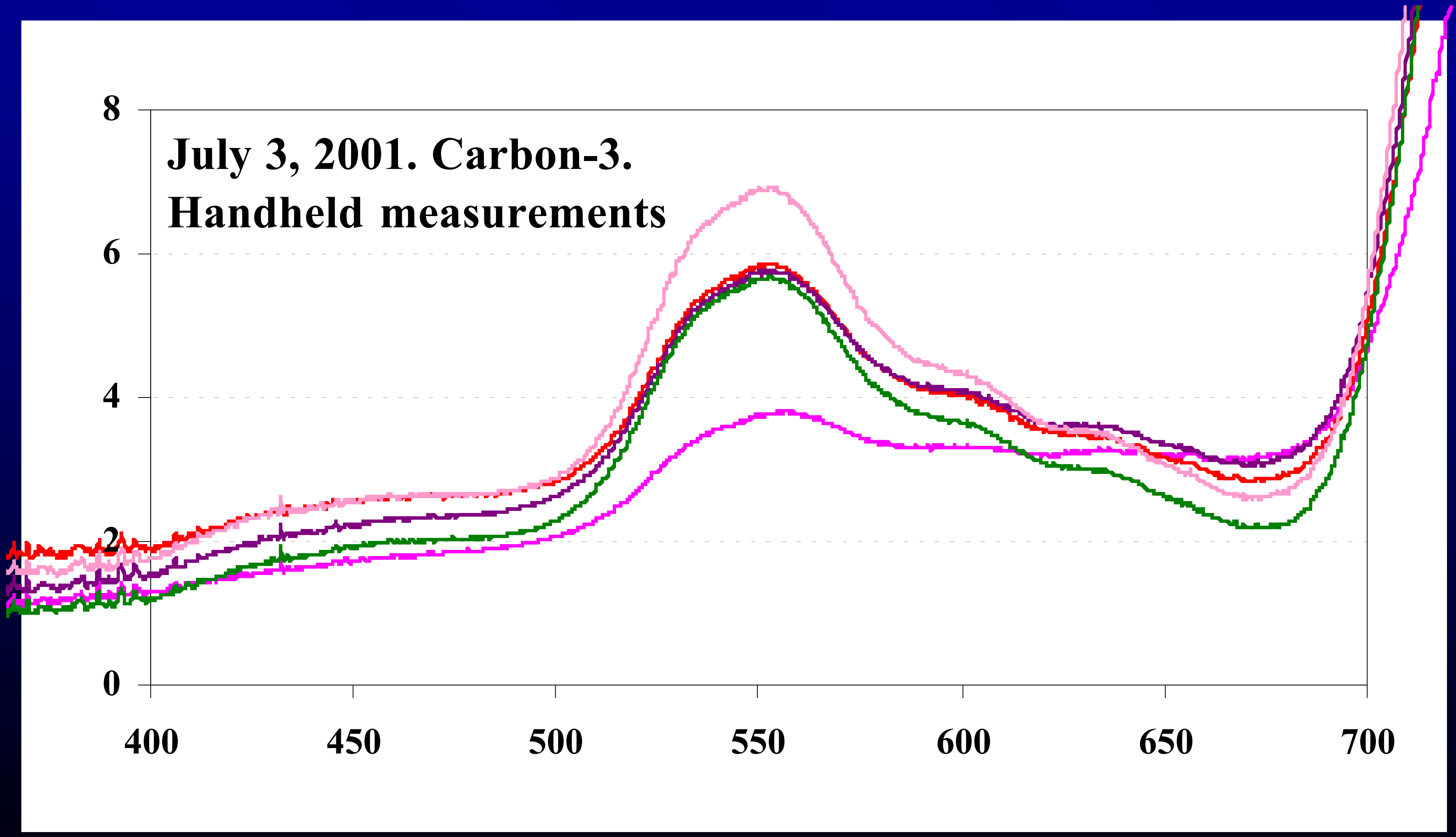
Seasonal VARI



Why Use Goliath?

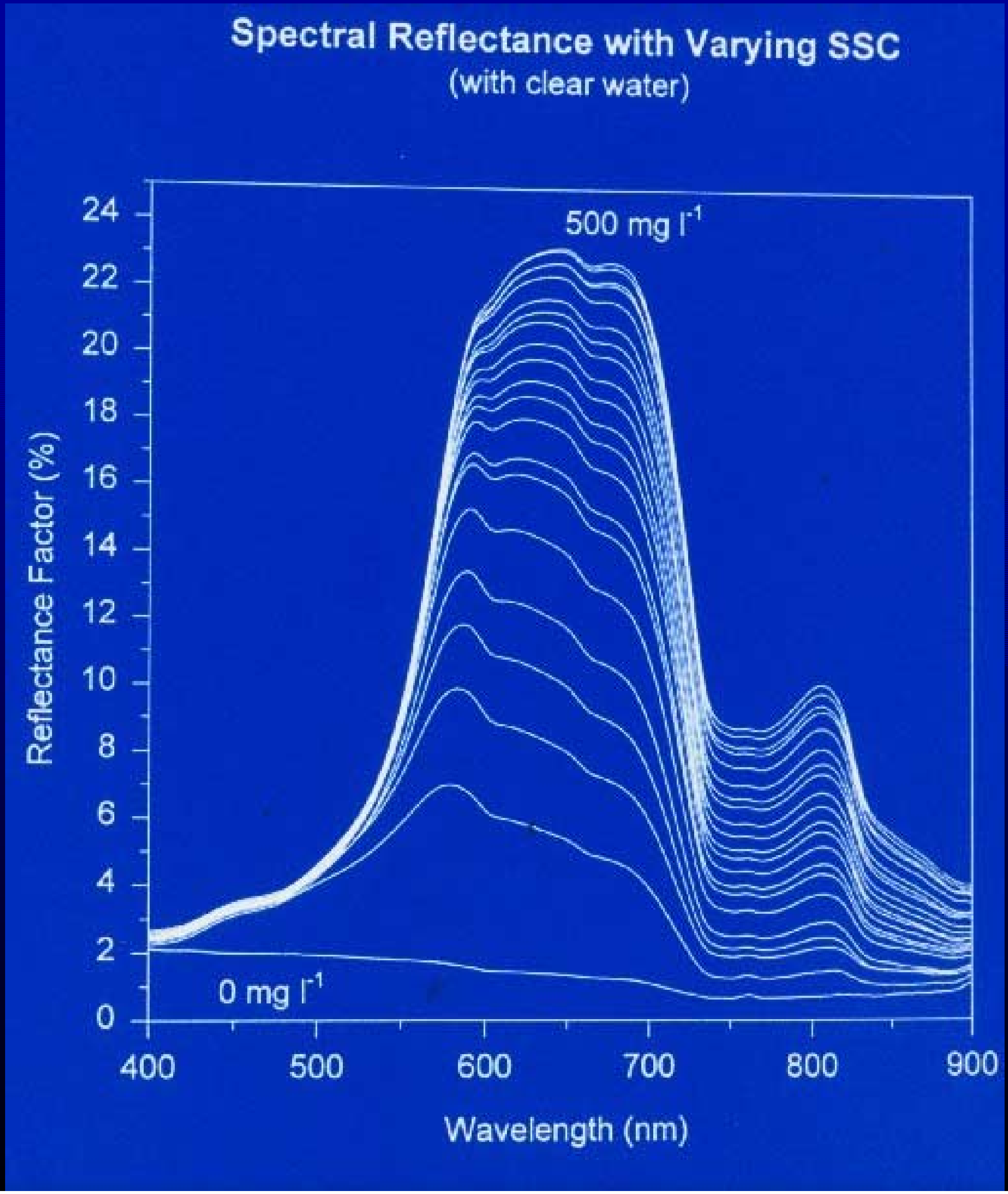


Why Use Goliath?



“Hercules” (2003 Field Season)

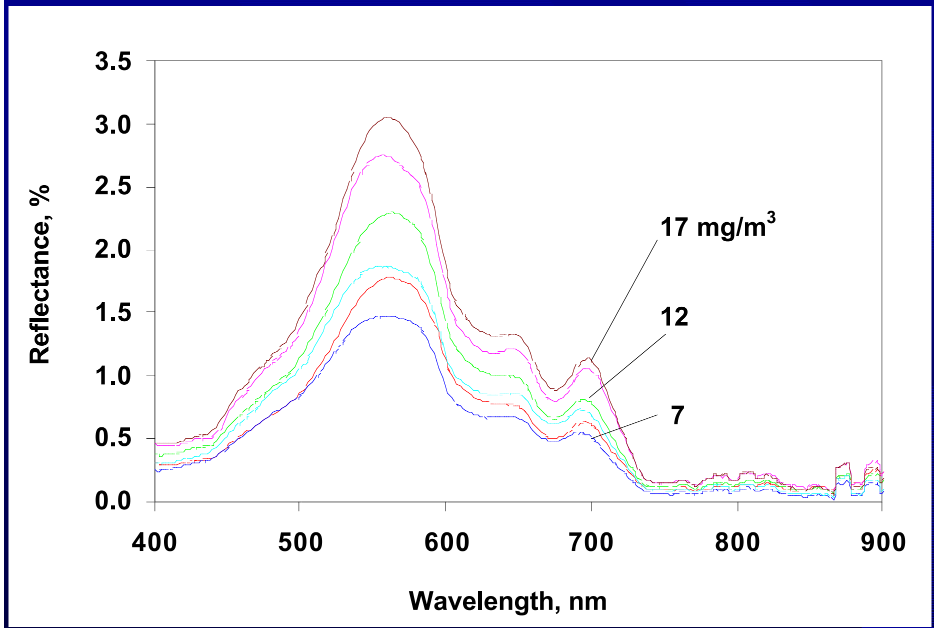
2) Surface Waters: Mesocosms


Spectral Reflectance with Varying SSC
(with clear water)
500 mg l-1
0 mg l-1
Reflectance Factor (%)
Wavelength (nm)
0
2
4
6
8
10
12
14
16
18
20
22
24
400
500
600
700
800
900

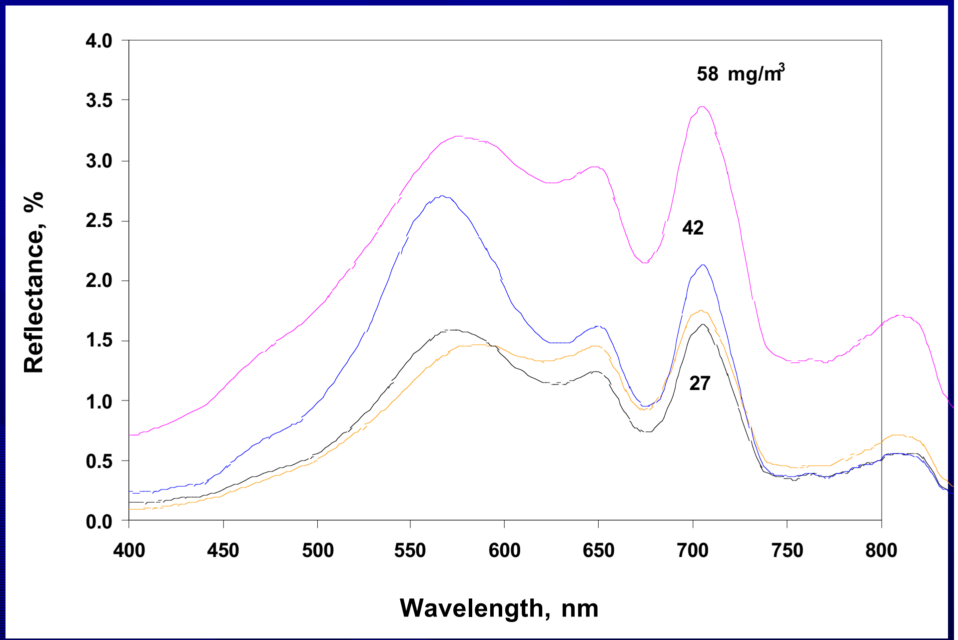
Surface Waters: Macrocosms

Underwater Light Fields

Okoboji Lakes (20 Sep 01)



West Okoboji

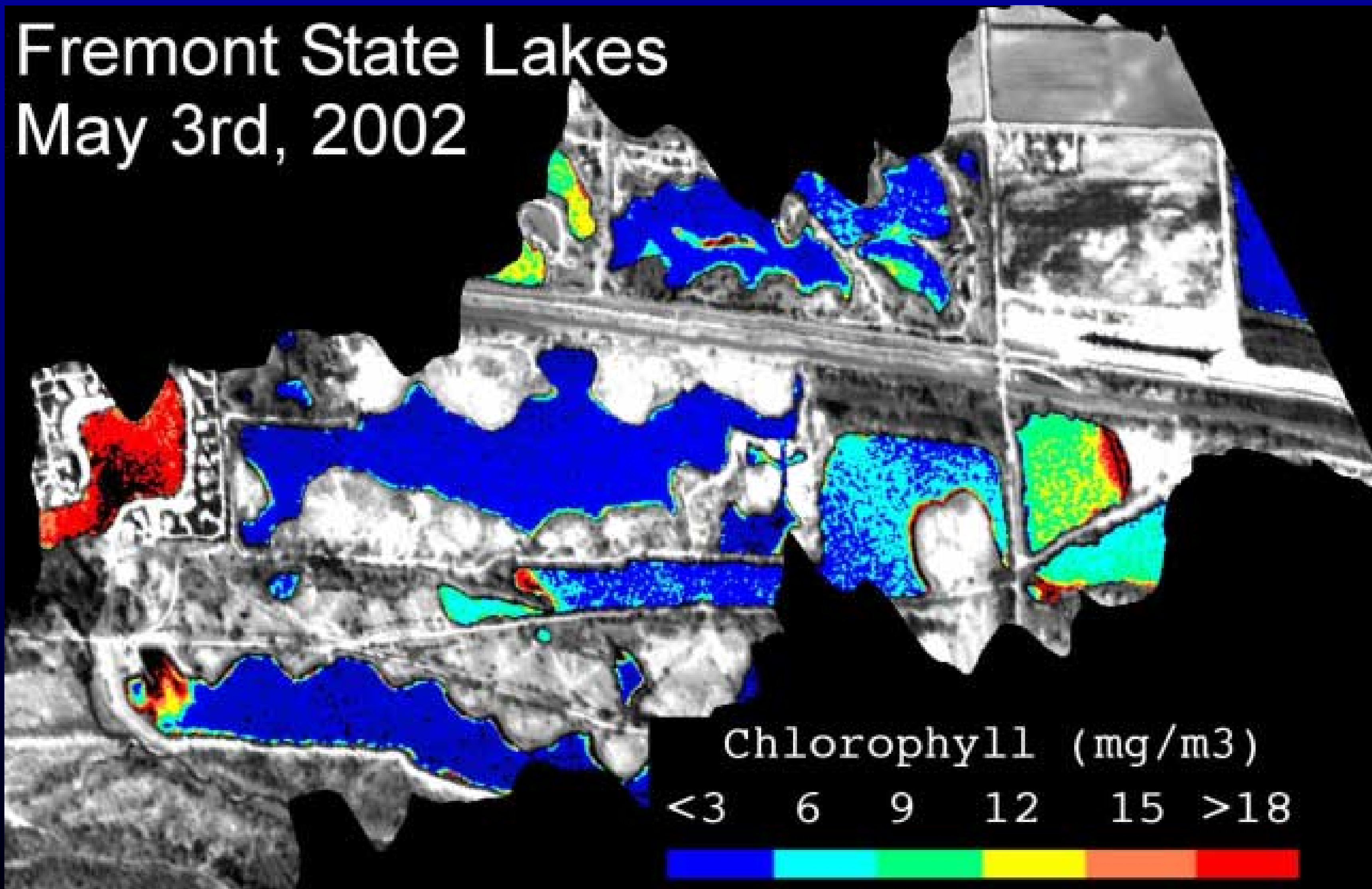


East Okoboji

Examples of Ancillary Data

- Sechi Disk
- Pigments
  - » Chlorophyll
  - » Carotenoids
  - » Phycocyanin
- Phytoplankton Densities
- Turbidity
- Non-Organic Solids

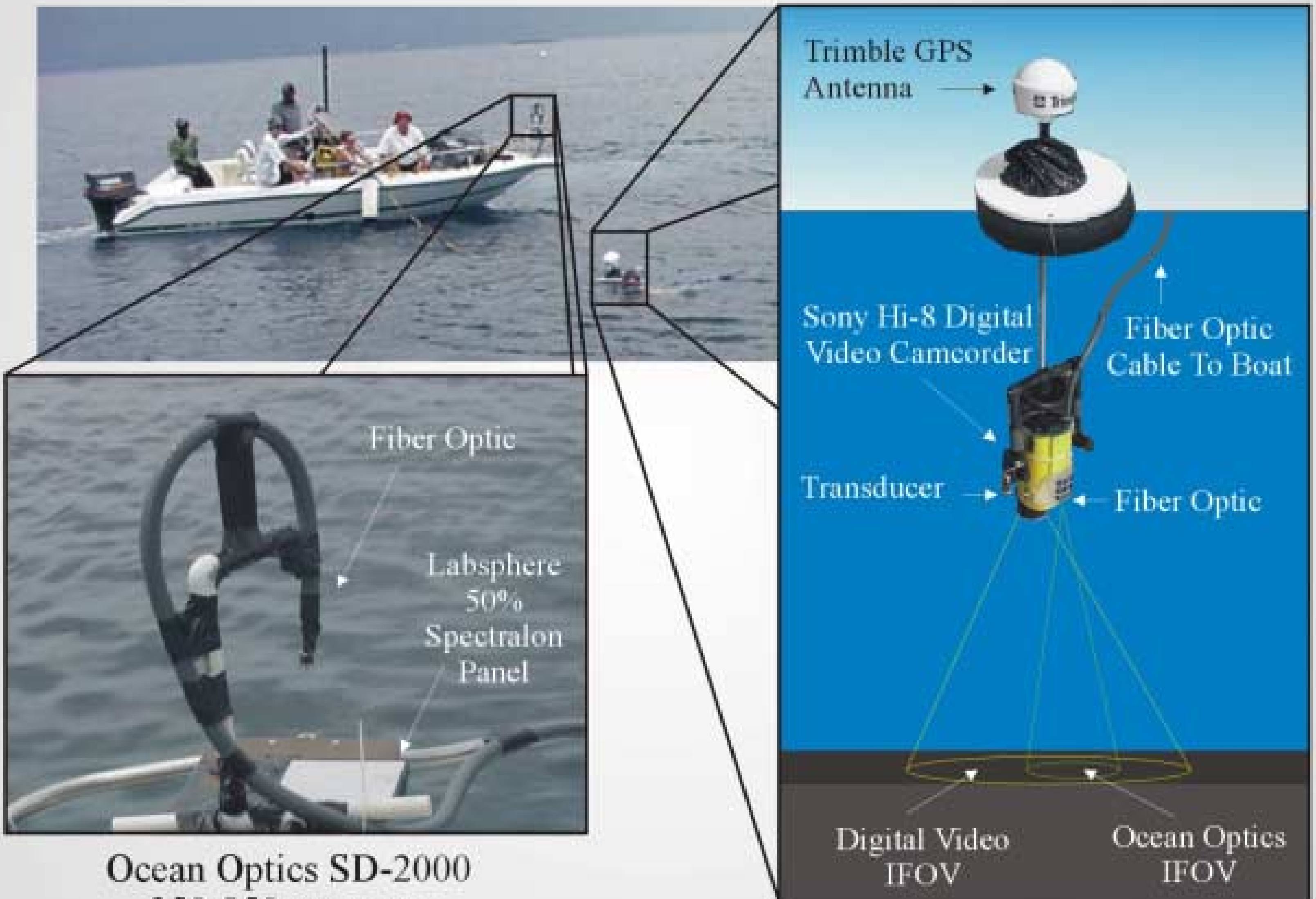
Classified AISA Image



Coastal / Marine

Roatan Island, Honduras

The "Bob" Technology

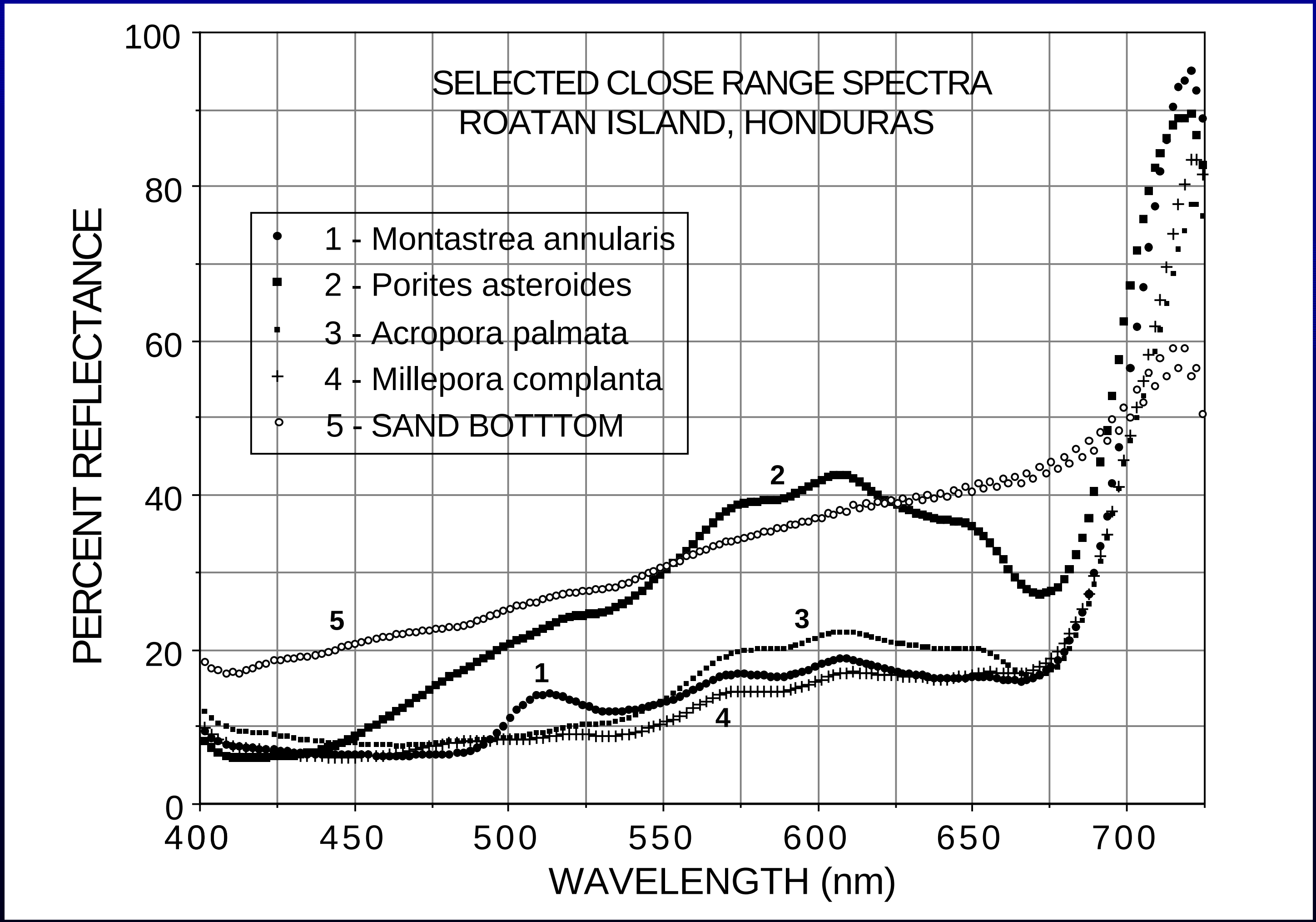


Ocean Optics SD-2000
350-850nm range

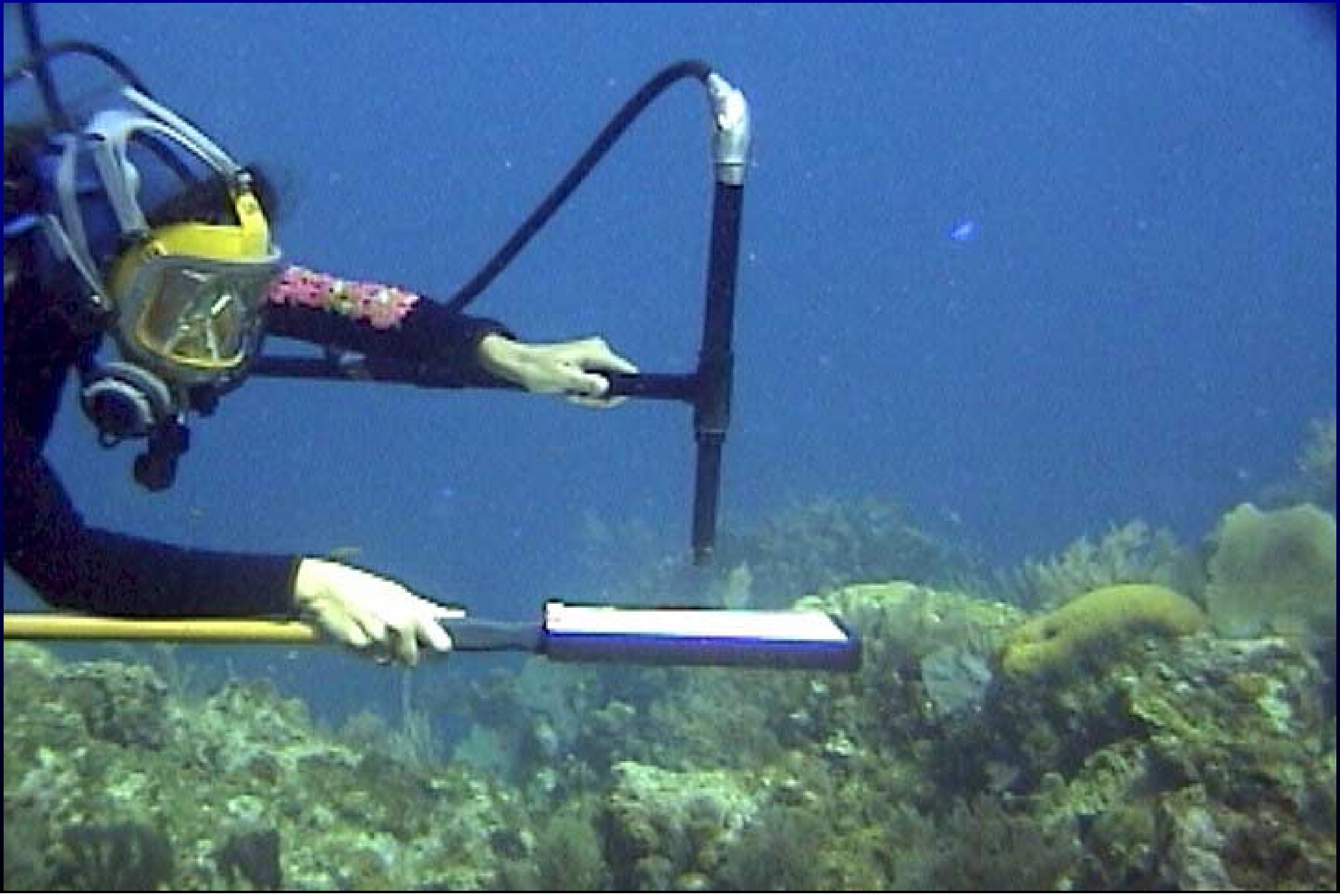
Remote Sensing of Corals

Video of Coral Features Scanned

Coral Spectra



Traditional Calibration



Dual Fibers

Collecting spectra on a coral reef: Roatan Island, Honduras (March, 2002)

Using Dual Spectoradiometers for Hyperspectral Data Collection

Land

Lakes

Underwater

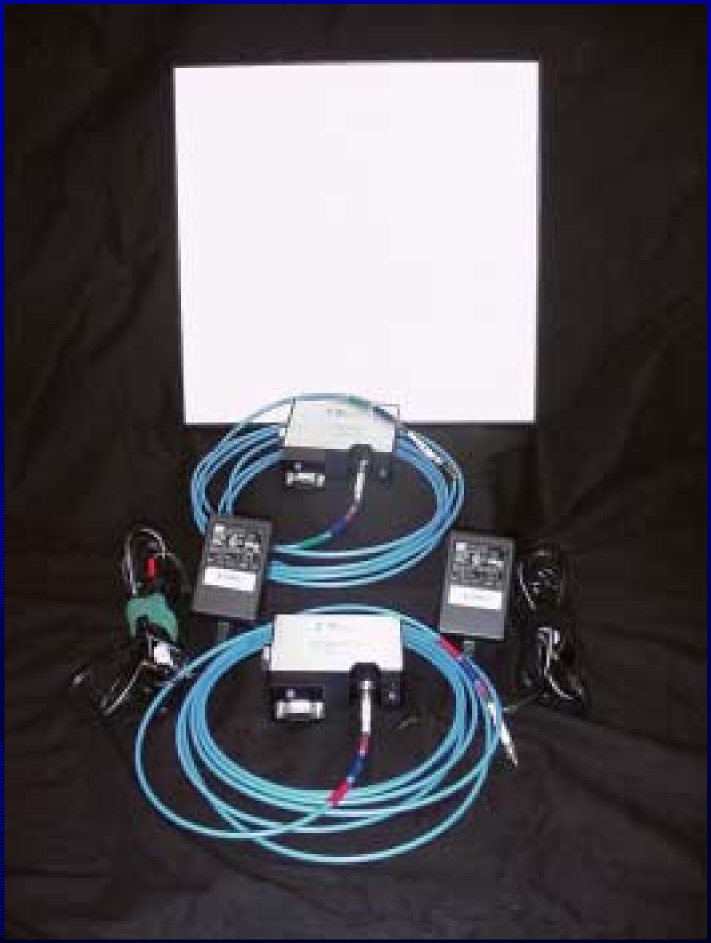
Advantage

Allows for data collection under most irradiance conditions

Method is not valid if the irradiance changes during the scan time of the instruments (Usually 5 to 20 sec)

Hardware Requirements

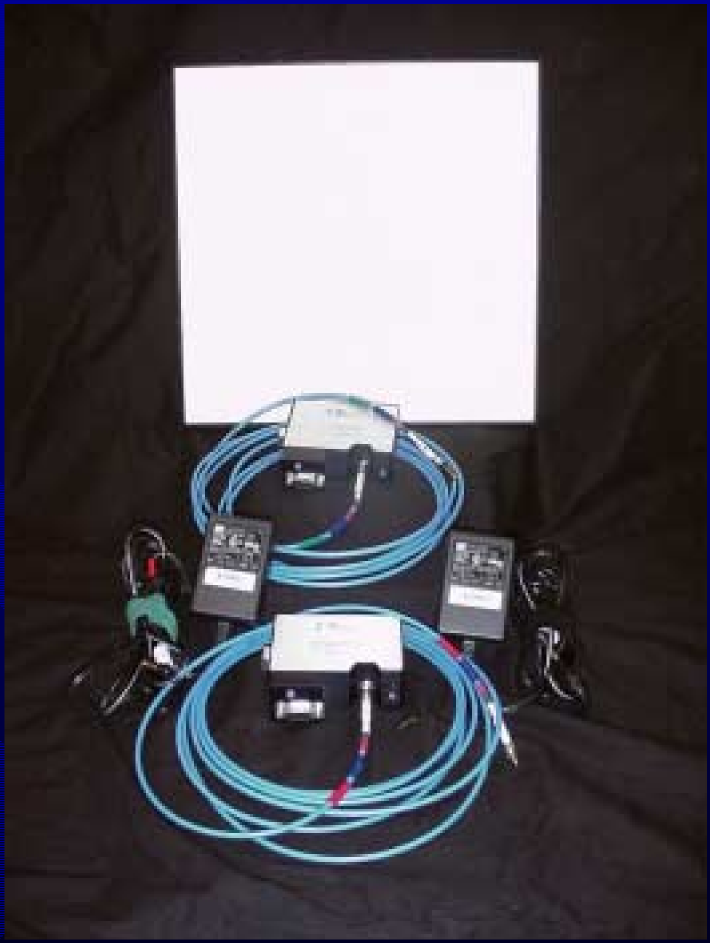
Two similar spectroradiometers



Hardware Requirements

Two similar spectroradiometers

Hemispherical cosine corrected optic

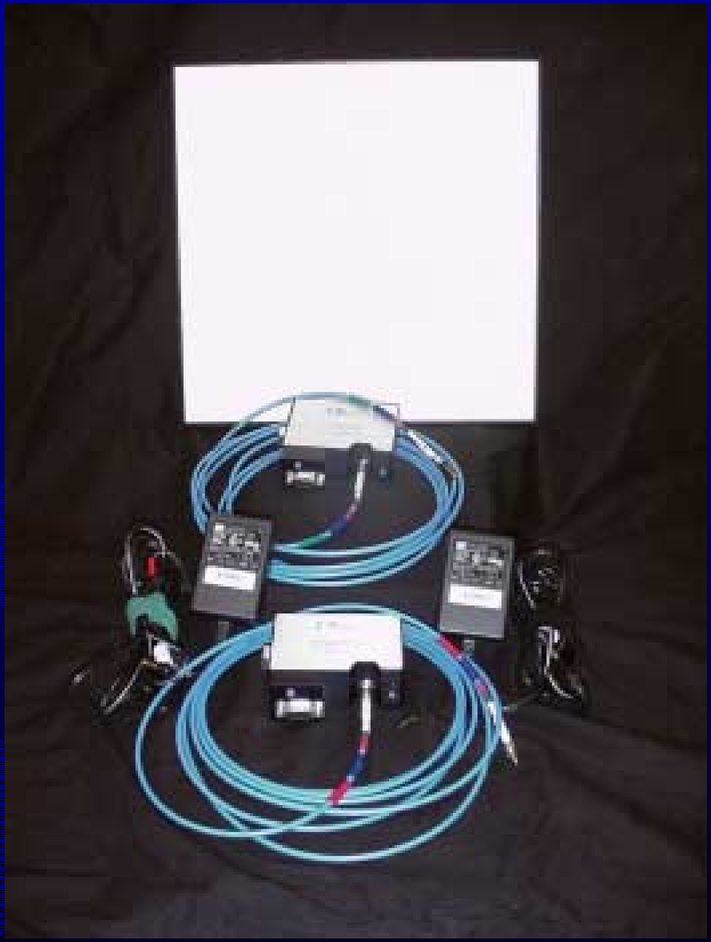


Hardware Requirements

Two similar spectroradiometers

Hemispherical cosine corrected optic

Cables, power supplies, fibers, etc.



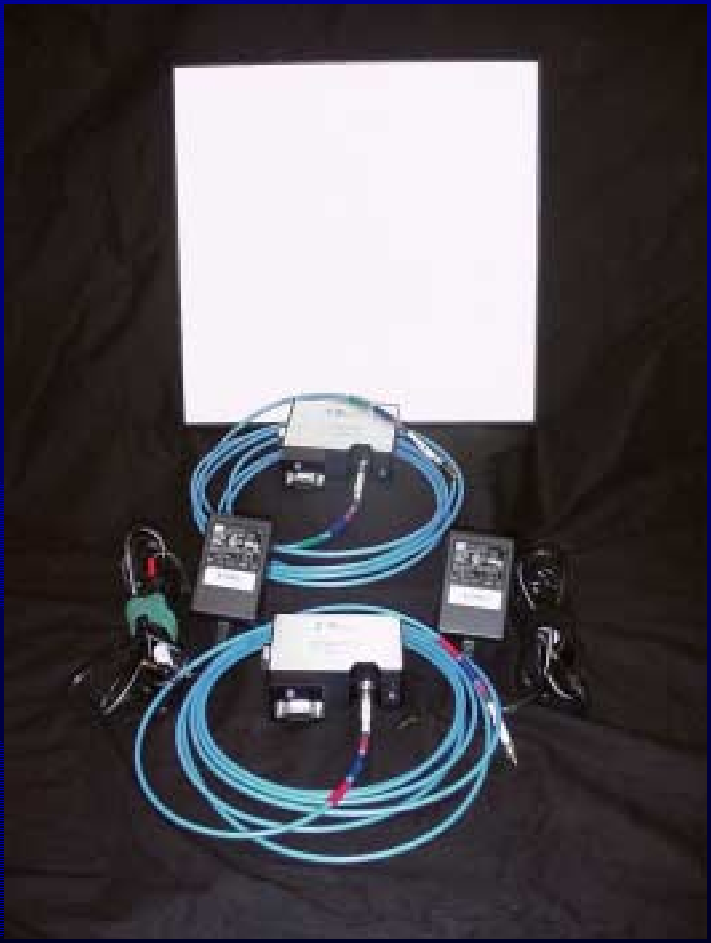
Hardware Requirements

Two similar spectroradiometers

Hemispherical cosine corrected optic

Cables, power supplies, fibers, etc.

Calibrated reflectance standard



Additional Requirements

Computer

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Computer

Spectral calibration of instruments

Additional Requirements

Computer

Spectral calibration of instruments

Software for acquisition & processing

Additional Requirements

Computer

Spectral calibration of instruments

Software for acquisition & processing

Radiometric calibration optional
- Not necessary for reflectance
- Needed for radiance/irradiance

Method

Near simultaneous data acquisition from both instruments

- Downwelling and upwelling radiation
- Instruments have different integration times

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Spectral channels of downwelling instrument interpolated
To match channels of upwelling instrument

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Method

Near simultaneous data acquisition from both instruments

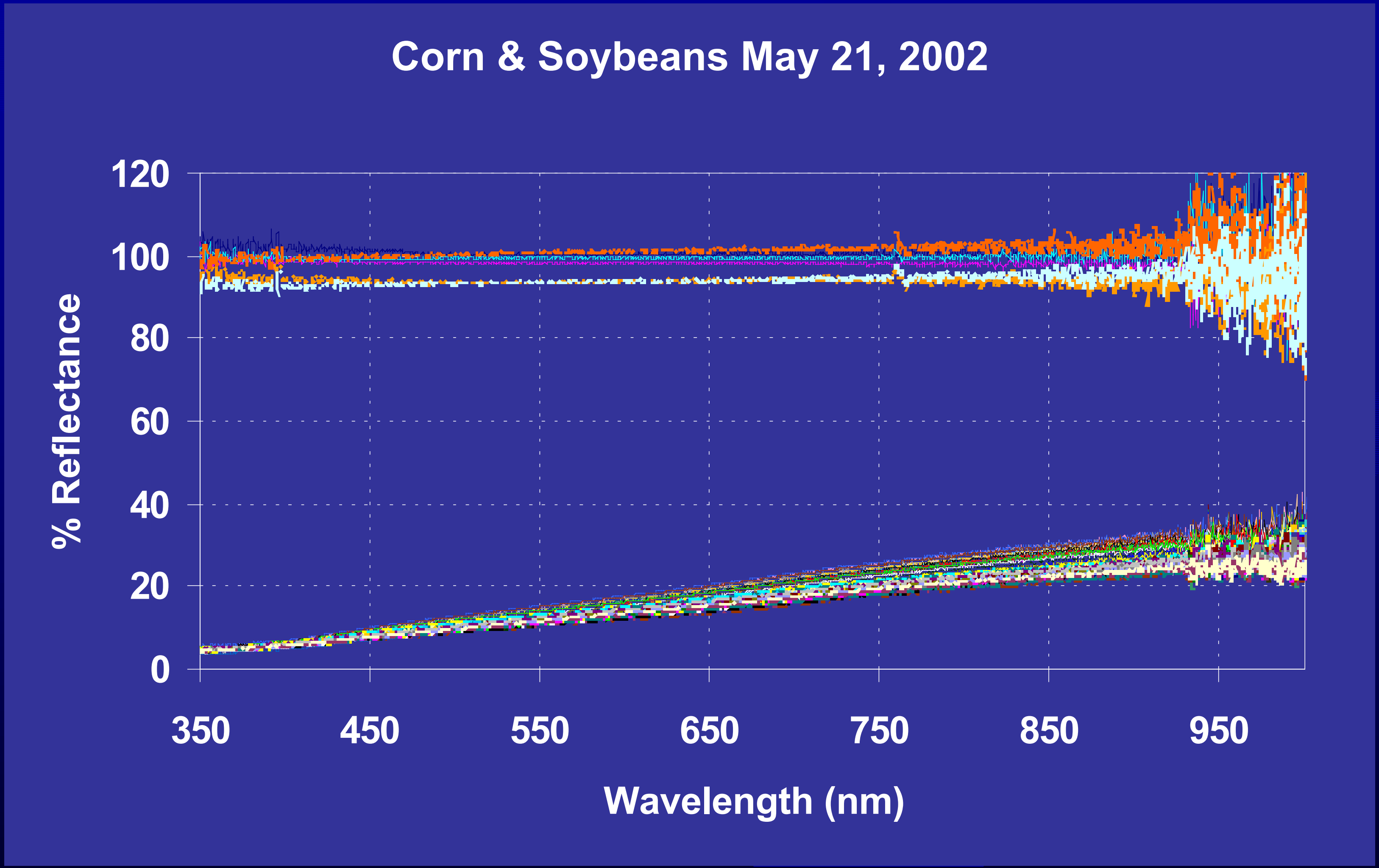
- Downwelling and upwelling radiation
- Instruments have different integration times

Spectral channels of downwelling instrument interpolated
To match channels of upwelling instrument

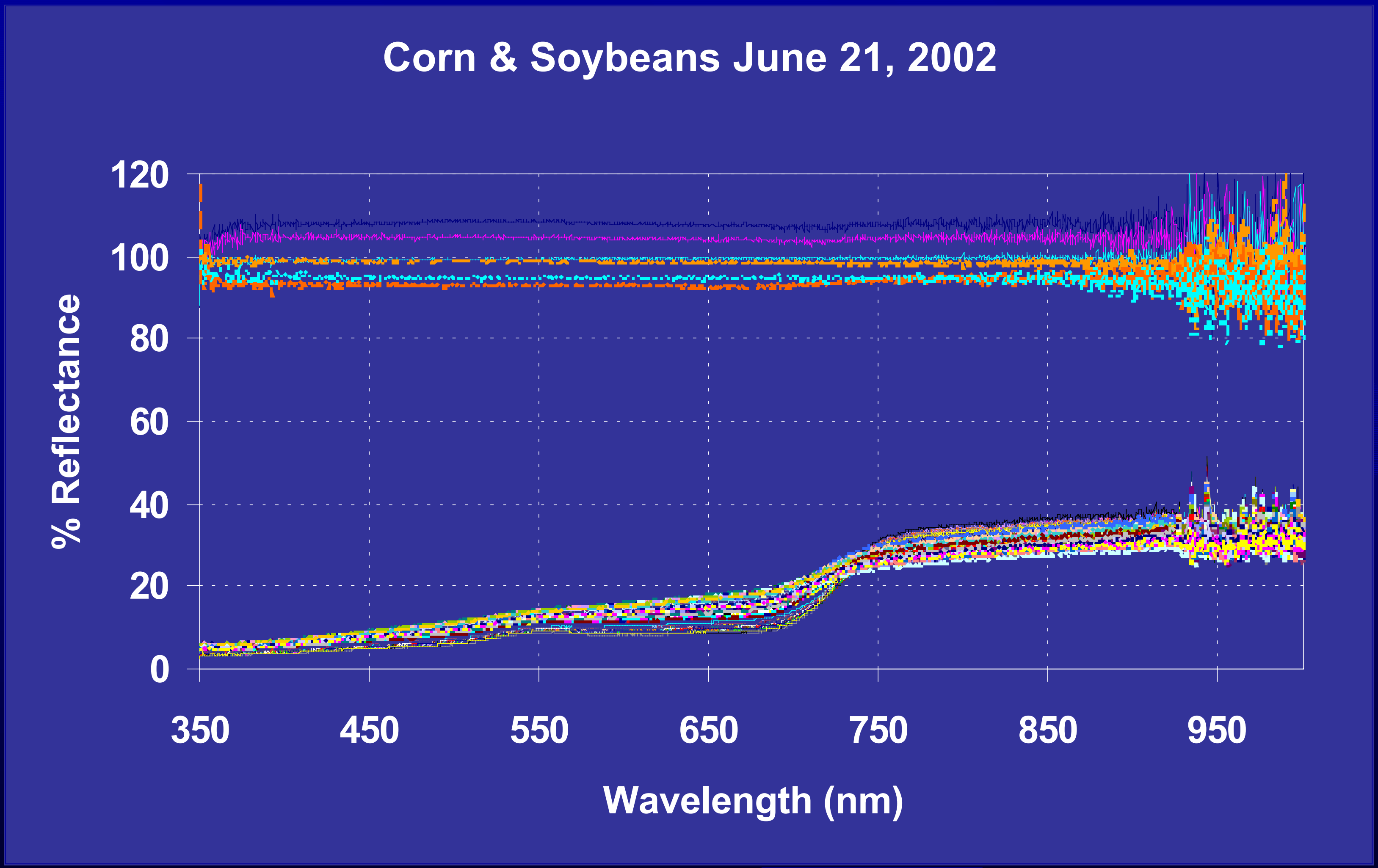
Ratio of upwelling divided by downwelling is calculated

Use scans of calibration panel to correct all other scans

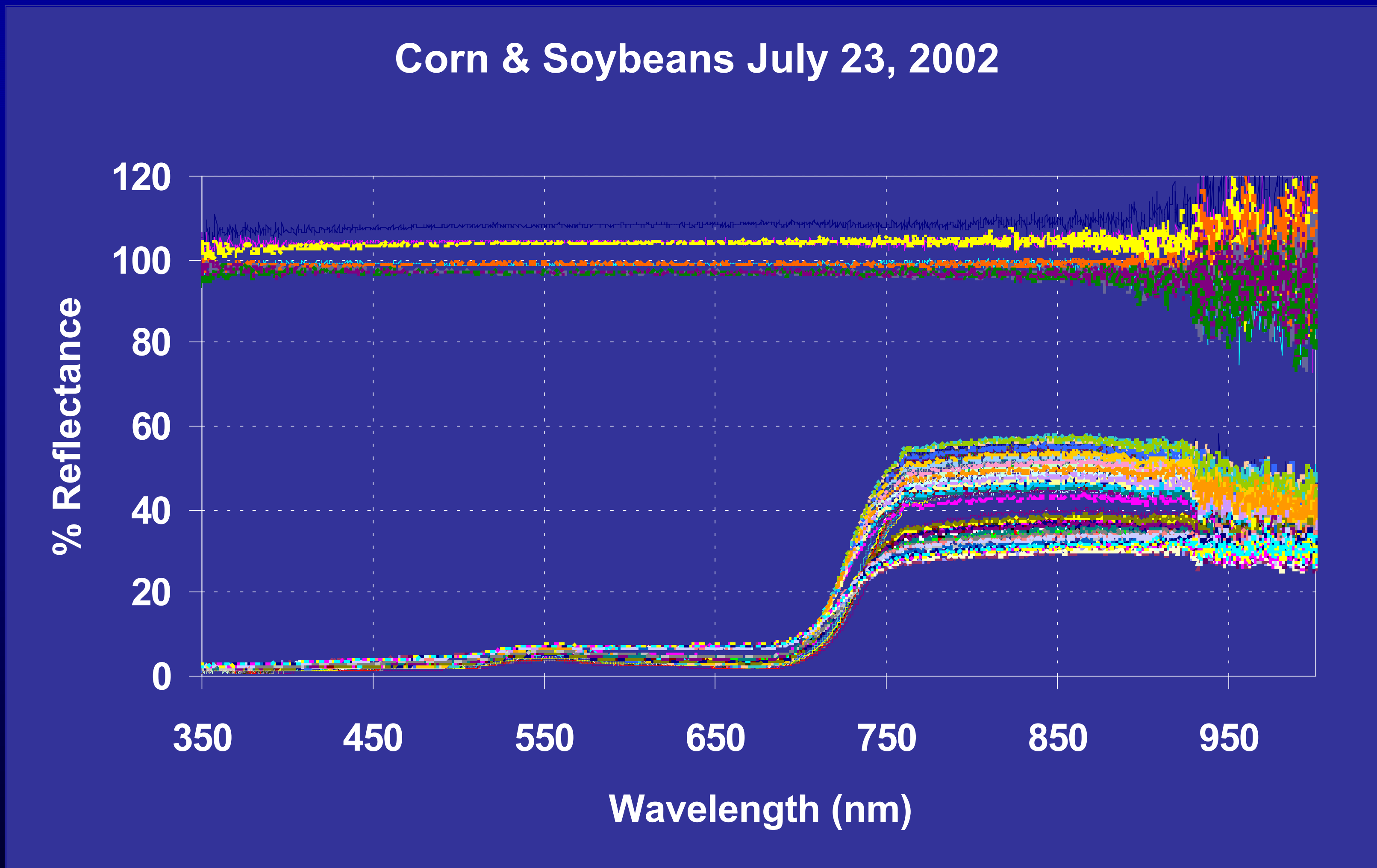
- Panel reflectance is known
- A correction factor (CF) is calculated for each channel
- CF applied to upwelling/downwelling ratio of each scan



Allows calibration scans to be compared



Correction factors calculated for each channel based on the median value of the calibration scans for that channel

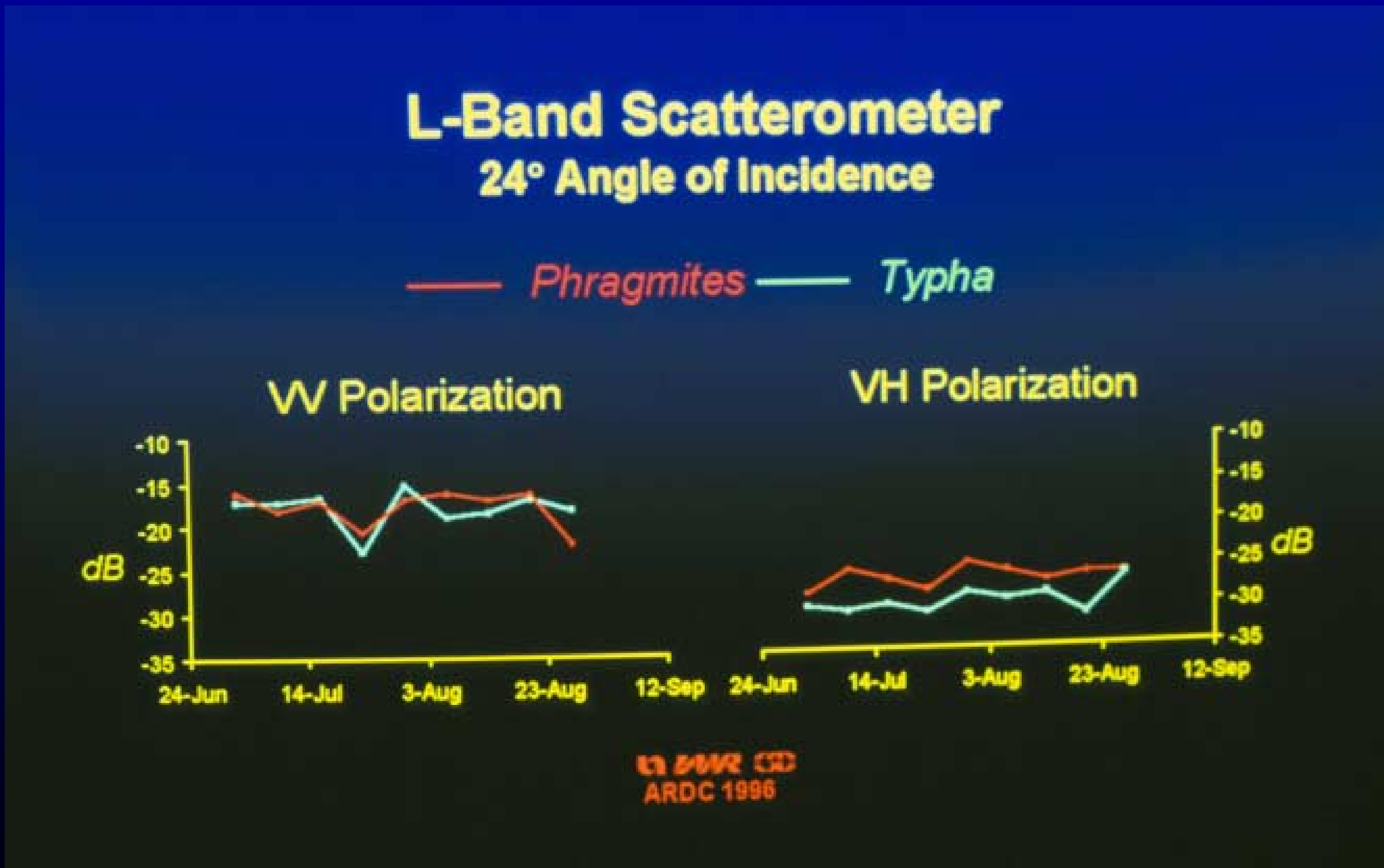


Correction factors applied to all scans

UNL Field-Radar System (EE Dept.)

Radar Measurements of Wetlands

Radar in the Field: Wetlands



Field Program: One Part of System

CALMIT

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www.calmit.unl.edu/calmit.html